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Agricultural Experiment Station

CIRCULAR No. 234

OPERATION OF THE CREAM RECEIVING STATION

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By N. W. HEPBURN AND H. A. RUEHE



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OPERATION OF THE CREAM RECEIVING STATION

BY N. W. HEPBURN, ASSOCIATE CHIEF IN DAIRY MANUFACTURES, AND
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The hand-separator method of producing cream for butter-making has brought with it many problems difficult of solution; and among these problems there is perhaps none more important or more worthy of careful consideration than that of the method of securing cream from the farm and getting it to the manufacturing plant. The manufacturers of butter have been driven to a great variety of methods in the securing of cream, but at the present time there is probably no system more prevalent in Illinois than that of gathering cream thru cream receiving stations.

The centralizer system is comparatively new and has necessarily called into the ranks of the creamery industry many untrained workers. It is for this aggregation of men, working in a new field, that some facts concerning the operation of a cream station are here given.

Every creamery today is consciously or unconsciously an organization composed of a purchasing department, a manufacturing department, and a selling department, and it is obvious that the cream station is a definite part of the purchasing end of such an organization. It is important, therefore, that a buying station take on, as rapidly as possible, the policy of the company which it represents, with the idea of becoming a permanent factor in that organization. A station representing one plant today and another tomorrow cannot hope to become successful for itself; neither can it become a factor in building up the creamery industry.

THE OPERATOR'S DUTIES

The primary function of the operator of a receiving station is to buy cream, and it is obvious that our best cream buyers are those who have made it their business to become generally informed on the subject of dairying and dairy manufacturing problems, for immediately upon its establishment a good cream-gathering plant becomes a dairy service station.

In the centralized system of handling cream, the station operator occupies a place of vital importance. 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 the cream on the other. This phase of station opera-

tion must necessarily appeal to every operator who in any measure realizes the importance of his task.

EQUIPMENT

Cream is a delicate food product capable of absorbing undesirable flavors and odors. It is important, therefore, that the buying room and its surroundings be clean and free from objectionable odors and flavors. For the convenience of the operator, the room should be light and airy, and for the moral effect on the cream producer the room should present a clean, attractive appearance.

ABUNDANCE OF HOT WATER

An abundance of hot water is absolutely necessary to the successful operation of a receiving station. One of the most common methods of securing hot water in our Illinois cream stations is by means of the oil stove. A suitable vessel for heating water and washing cans on the oil stove is shown in Fig. 1.

Another successful method of providing hot water, where city water pressure is available, is the coil heating stove attached to a range boiler of thirty to forty gallons capacity. This method has the merit of furnishing an abundance of hot water and at the same time is less expensive both in original cost and in operation than is a boiler.

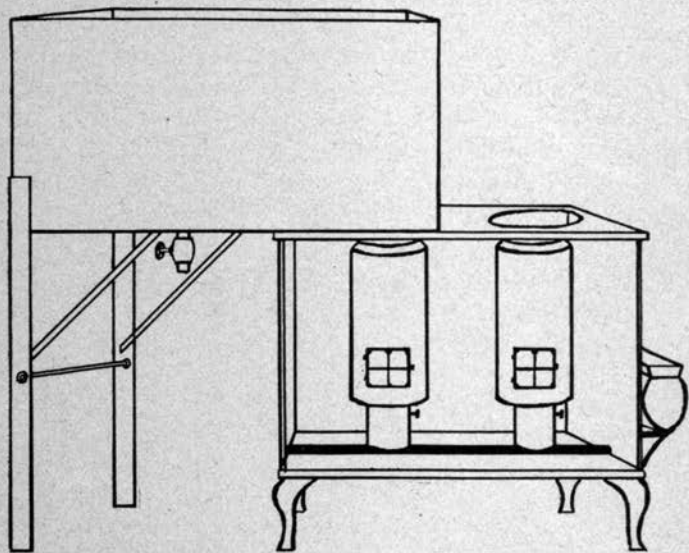


FIG. 1.—A COMBINATION WASH SINK AND KEROSENE STOVE AS A MEANS OF FURNISHING HOT WATER FOR CAN WASHING

In the larger stations, a No. 3 steam boiler is often used to furnish both hot water and steam.

BUYING SCALES

The scales for weighing cream are preferably of the platform type, accurate and sensitive enough to easily read half-pounds.

In handling such scales, several precautions must be exercised. Scales for this purpose are necessarily used in a room in which the air is charged with moisture, which condition sooner or later will cause parts to corrode, rendering the scales sluggish. The following precautions in handling scales will obviate some of the serious trouble which comes to the station operator thru errors in weighing:

1. Wipe the beam and weights daily.
2. Examine the scale at the beginning of each day's operation to make sure that it is in balance.
3. At least once each month take the platform off and rub the knife edges carefully with a piece of fine emery cloth or sand paper, cleaning all working parts and putting the scale into active order.
4. Keep the platform dry.
5. Set the scale level on a solid foundation.

A scale handled in this fashion will retain its sensitiveness and do accurate weighing for an almost indefinite period.

TESTING APPARATUS

Testing Bottles.—There are two general types of cream testing bottles sold for commercial use. Those which give the percentage of fat directly when 18 grams of cream are used and those which give the percentage of fat directly when 9 grams of cream are used. The latter bottle is in more common use in Illinois cream receiving stations.

Bottles which give readings directly for any other unit than 18 grams of cream are marked as shown in Fig. 2.

The Acid Measure.—The acid measure is a guide to the amount of acid to use and furnishes a convenient means of transferring the acid to the test bottle when only a limited number of tests are to be made. The 9-cc. measure is used for 9 grams of cream, but the actual amount of acid necessary may vary considerably. The color of the mixture after the acid is added and mixed is the best guide as to the proper amount of acid to use.

Acid.—Commercial sulfuric acid, specific gravity 1.82-1.83, is used in making the cream test. The acid loses strength when exposed to

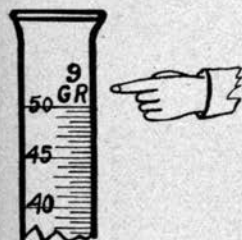


Fig. 2.—Marking on Neck Shows Capacity of Bottle

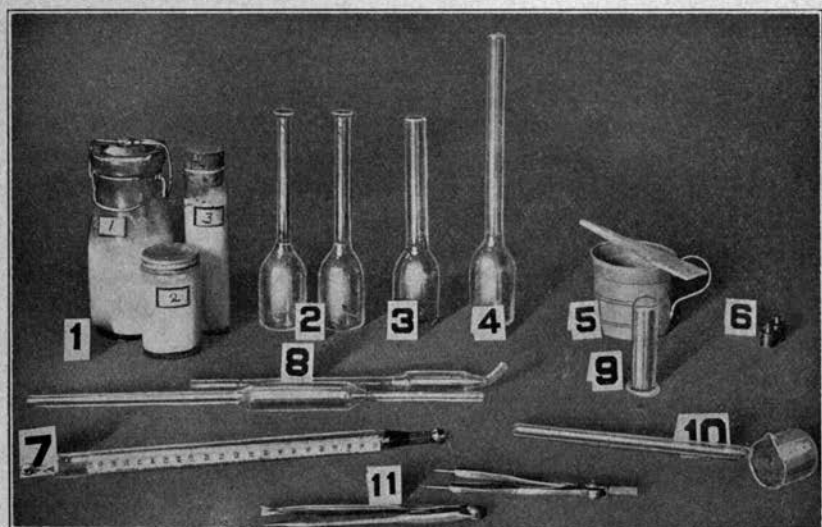


FIG. 3.—TESTING APPARATUS

(1) Three different styles of sample bottles. (2) Nine-gram 50-percent cream-test bottles. (3) Eighteen-gram 50-percent 6-inch cream-test bottle. (4) Eighteen-gram 50-percent 9-inch cream-test bottle. (5) Mixing cup and spatula. (6) Nine-gram weight. Eighteen-gram weight. (7) Thermometer. (8) Two styles of cream pipettes. (9) Acid measure. (10) Acid dipper. (11) Two styles of dividers for reading the test.

the air and should therefore be kept in a bottle tightly corked with a rubber or glass stopper.

The temperature of the acid will have some effect on the test; therefore, to secure uniform results it is desirable to keep the acid bottle where it will have a temperature of about 70° F.

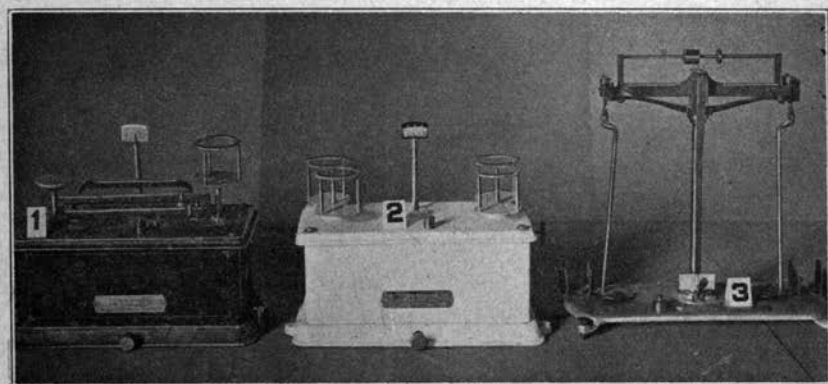


FIG. 4.—COMMON TYPES OF CREAM-TEST SCALES USED IN ILLINOIS RECEIVING STATIONS

Pipette.—For transferring the cream from the sample bottle to the test bottle a pipette is often used. Two styles of pipettes are shown in Fig. 3.

Cream Scales.—The two general types of scales now in use in the cream station are those of the torsion type and those of the agate-bearing type.

It should be remembered that the cream scale is the most delicate piece of apparatus the station man has to deal with and must be used with great care. Disorders of the cream scale usually come about as a result of exposure to dirt or from rough handling. A scale properly handled will last for years.

To secure the best results the scale should be set level on a solid foundation. To remove the effect of the jarring of floors, which often causes errors in weighing the cream sample, there is considerable advantage in fastening the shelf which supports the cream scale to the wall. Fig. 5 illustrates how a scale box may be fastened to the wall, serving as a shelf and as a protection to the scale when not in use.

Testing Weights.—The small weights used in testing cream are either of the 9-gram or 18-gram type. Each type is plainly marked. It sometimes happens that these weights are inaccurate. When in doubt on this point, the operator should have his weight checked up either by the field man or the central office. The weights should always be kept free from dirt and grease, as any accumulation will make them too heavy, and inaccurate testing will result.

Cream Stirrers.—The cream stirrer should be of the perforated bowl type with a good, heavy handle strong enough to serve in stirring the very thick cream which is sometimes received.

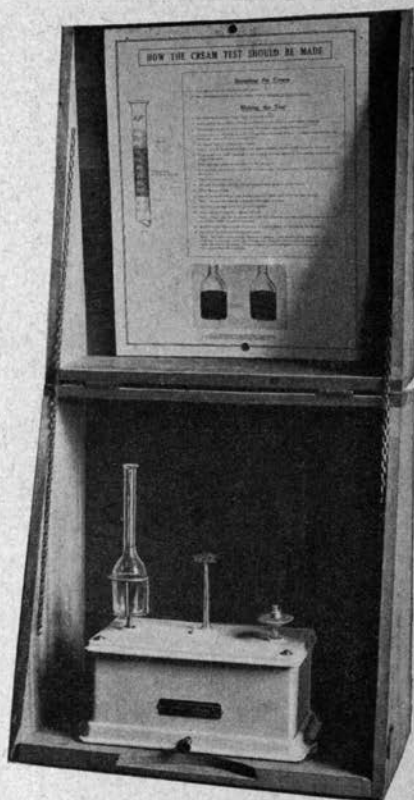


FIG. 5.—SCALE BOX USED AS A SHELF AND AS A PROTECTION TO THE SCALE

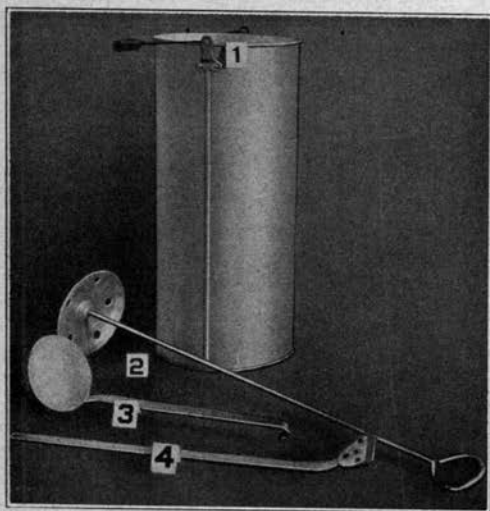


FIG. 6.—SAMPLING APPARATUS

(1) Can used as a receptacle for dipper and stirrer. (2) Cream stirrer. (3) Sample dipper. (4) Spatula for scraping cream from covers, neck, and shoulder of the can.

MAKING THE CREAM TEST

Since the butter manufacturer is primarily interested in the amount of butter which can be made from a given quantity of cream, the butter-fat basis is logically used as a buying basis for cream; and one of the important duties of the station operator is to make the determination called the cream test. Strict observance of the following steps is absolutely necessary for an accurate determination of butter fat:

SAMPLING

Prior to the sampling of the cream, the cans must necessarily be arranged in some systematic order. A good plan is to make a list of the patrons and assign a number to each, the cans being lined up in the same order. Details for this procedure are not here given because they necessarily differ with the plan and organization represented in buying cream and with the quantity of cream received.

Rubber Mop and Drip-Saver.—To remove the last of the cream that adheres to the inside of the can, a small rubber mop illustrated in Fig. 6 may be used. Finally the can should be rinsed with about a quart of hot water to remove the last of the cream. The rinsings should be kept in a can and shipped separately, as they usually go into second-grade butter.

Where steam is available, a drip-saver may be arranged by building a metal drip shelf over a steam jet (see Fig. 7).

For the daily operation, a cream setting can will be found a convenient receptacle for the sample dipper and stirrer (see Fig. 6).

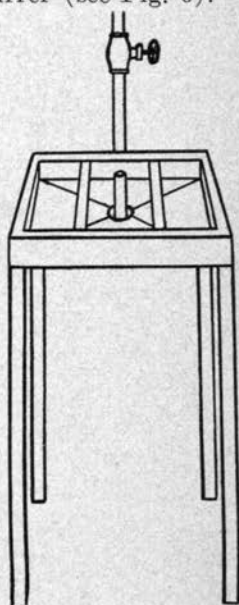


Fig. 7.—A Homemade Drip-Saver with Steam Connection

Preparing the Cans of Cream for Sampling.—This is a most important step in the butter-fat determination. There is a tendency for the richer cream to rise to the top, for lumps to form in the souring of the cream, and there is likely to be a considerable amount of heavy cream sticking to the sides of the can. All this means that the percentage of fat in the cream in one part of the can when it is received may be very different from that in another part. The object



FIG. 8.—SAMPLING CREAM

The cream should be thoroly mixed before the sample is taken, so that the sample will be truly representative of the entire can of cream.

of thoroly mixing the cream before the sample is taken is to cause every portion of it to be alike in fat content, so that any sample taken out will be the same in fat content as any other sample. To accomplish this, stir the cream thoroly, giving it a vigorous boiling motion. By means of the stirrer, scrape the sides and shoulder of the can, making sure that these scrappings are thoroly mixed with the other portions of the cream. The necessity for time and patience in this operation cannot be overemphasized.

Heavy and Frozen Cream.—Patrons should be discouraged from bringing in cream so rich in butter fat and heavy in body that it cannot be stirred. The handling of such cream must necessarily result in a loss to both the producer and the manufacturer. When frozen cream or cream of this heavy type is received, in limited quantities, the only adequate method of sampling is to first warm it up thoroly to a point where it can be stirred. Even at this point the melted cream is much more difficult to sample properly than cream which has never been frozen. The warming may be accomplished by allowing the can of cream to stand in a warm room for several hours, or more rapidly by setting the can in a vessel of hot water. The practice of taking a spoonful of cream from the top of the can of heavy or frozen cream must be condemned. *Sampling is the most difficult and most important step in making the test.* Time and care spent on this point will relieve the station operator of an undue amount of trouble in the remainder of the test operations.

Taking out the Sample.—After mixing is completed, take out a small sample with the sample dipper, pouring it into the sample bottle.

PREPARING THE SAMPLE FOR TESTING

If testing several samples, keep them in the rotation in which they were received. Preserve this order thruout the testing process. First set the bottles containing the samples in a pan of warm water, allowing them to remain until they are from 80° to 100° F. As soon as the cream is warm, proceed to mix the samples by pouring them back and forth from the bottle to a sampling cup several times until the cream appears well mixed and free from lumps. If samples are to be kept any length of time before testing, they should be tightly corked to prevent evaporation.

WEIGHING THE SAMPLE

The cream scales should be balanced on a level, solid shelf fastened securely to the wall away from drafts of air. Under station conditions the best practice is usually to weigh one sample at a time, in which case proceed as follows:

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 weight on the right-hand pan. Then by means of the pipette transfer enough of the thoroly-mixed cream to the test bottle to bring it again into balance.

If a number of samples are being tested, it is usually best to weigh them all before proceeding with the next step in the testing.

(NOTE.—When bottles are placed on or removed from the scale, the scale should always be locked. In fact all manipulations of the pans should be accomplished thru the locking device and not by touching the pans. A scale should never be moved from one place to another without first securely locking it.)

ADDING THE ACID

If 9 grams of cream are used, add about 9 cc. of sulfuric acid, or enough to turn the sample to a chocolate brown within a few seconds. By holding the test bottle in a slanting position and slowly

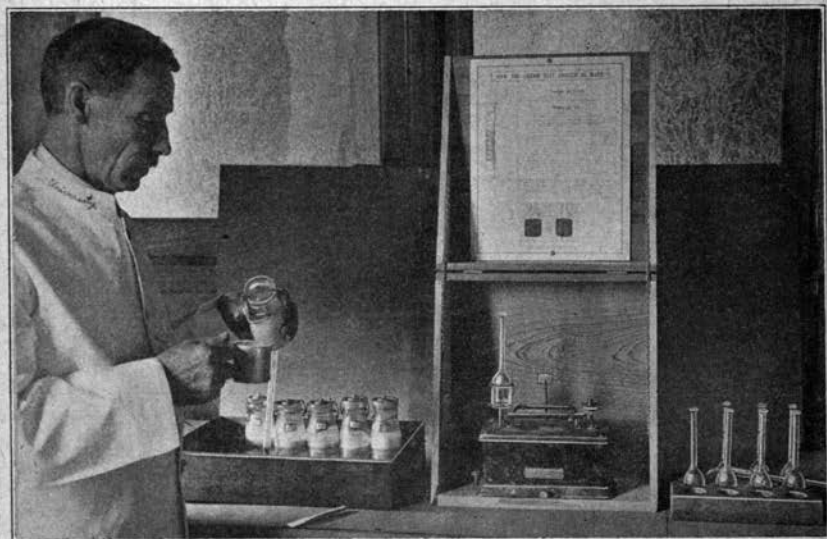


FIG. 9.—PREPARING THE SAMPLE FOR TESTING

Pour the sample from the cup to the sample bottle several times until the cream is of a uniform consistency.

rotating it, the acid can be added in such a way that it will flow down the side of the neck and wash any cream sticking to the neck down into the bottle.

As soon as the acid is added, shake the sample thoroly until the acid has completed its action on the solids not fat in the cream, which will be shown by the mixture turning to a chocolate-brown color.

ADDING THE WATER

In commercial practice water is usually added up to the base of the neck of the test bottle as soon as the acid has acted upon the cream sufficiently. Then the sample is whirled. Water for this purpose should be clean, and where a hand tester is used the water should be hot; otherwise, lukewarm water may be used.

WHIRLING IN THE TESTER

Place the bottle in the tester in such a manner that the load will be balanced, and run the machine at the speed indicated by the manu-

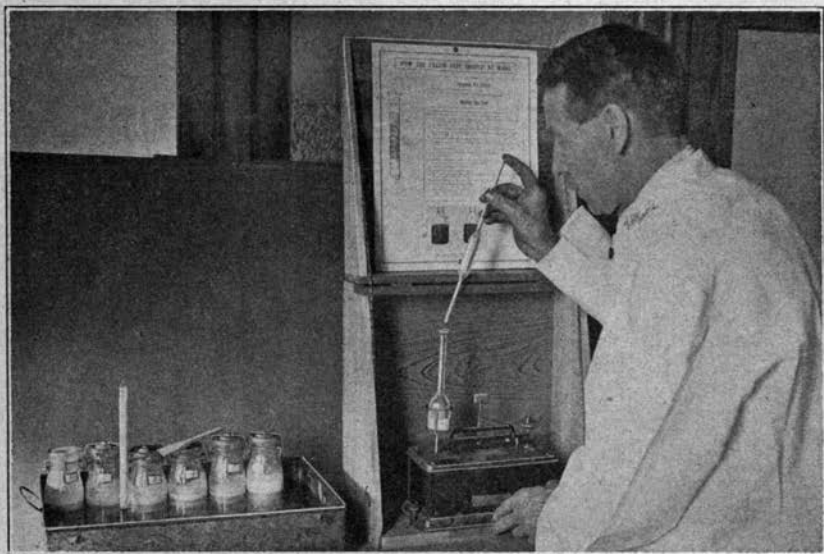


FIG. 10.—WEIGHING THE SAMPLE

Under station conditions the best practice is usually to weigh one sample at a time.

manufacturer for five minutes. Next allow the machine to stop gradually and add enough warm water to bring all the fat up within the gradu-

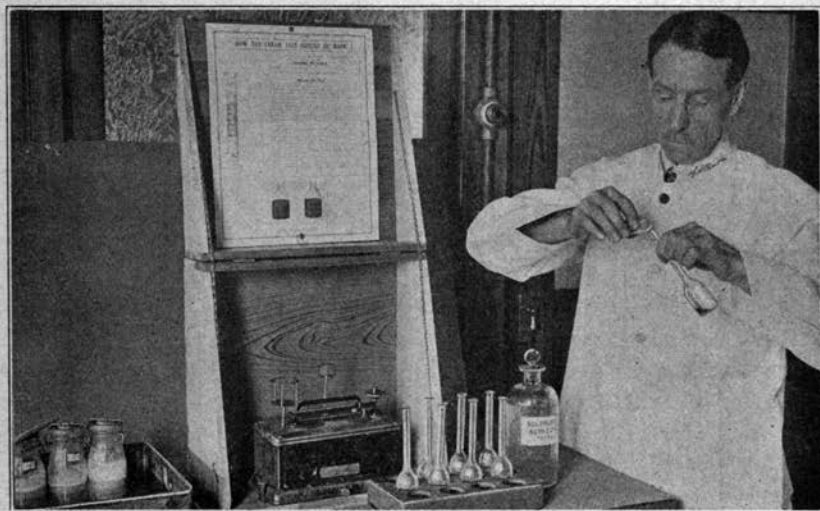


FIG. 11.—ADDING THE ACID

Hold the test bottle in a slanting position so that the acid in flowing down the side of the neck will wash any cream with it.

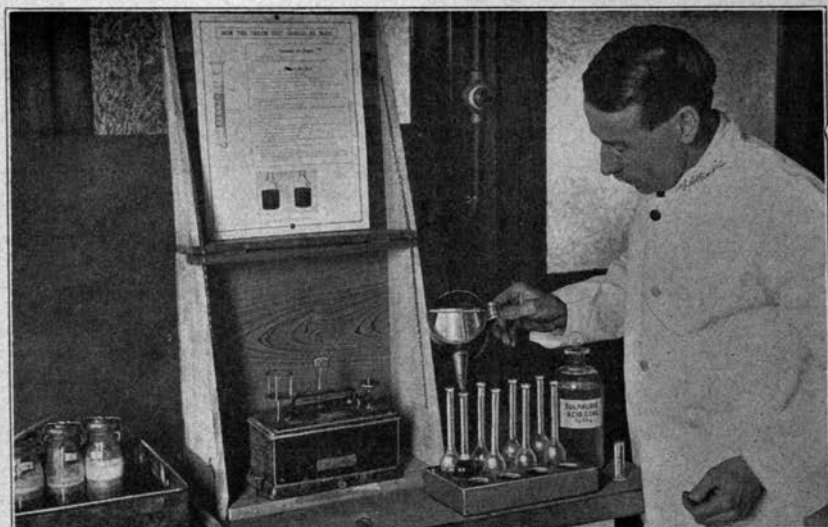


FIG. 12.—ADDING WATER

As soon as the acid has acted on the cream sufficiently, water is added up to the base of the neck of the test bottle.

ated portion of the neck. Then whirl the machine for three minutes.

Temperature in the Tester.—To insure good results in testing, the temperature in the tester should be sufficiently high for a complete separation of the fat. In steam machines this feature is usually cared for by the exhaust steam. In the hand machine, however, the question of temperature is often overlooked. The best results with the hand machines, especially in the winter, are secured by partially filling the bowl of the machine with boiling water before the test is made.

TEMPERING THE FAT COLUMN

Cream bottles read accurately only when the temperature of the fat column is between 130° and 140° F. Therefore, to insure correct results, the fat column should be tempered before reading. This may be accomplished by allowing the bottles to stand for five to ten minutes in a vessel of water at 130° to 140° F. The water should come up to the top of the fat column. The test bottles should be removed from the bath one by one as they are read.

The tempering of the fat column is especially necessary where a steam tester is not used.

ADDING GLYMOL

While the fat is being tempered, add a few drops of colored mineral oil (called Glymol, or "red reader") to the top of the fat column to destroy the upper curve of meniscus. Glymol should be added

carefully drop by drop so that it will run down the bottle neck and not mix with the butter fat.

MEASURING THE FAT COLUMN

The fat column is most easily measured by a pair of dividers. The length of the fat column is determined by the dividers, after which the lower leg of the dividers is placed at zero and the top leg will stand at the proper reading. After taking the reading, it is well to check the results by remeasuring the fat column to see that no error has been introduced by the accidental opening or closing of the dividers. In reading, the operator should hold the neck of the bottle in a vertical position, and the point where the reading is being taken should be on a level with his eye, as shown in Fig. 13.

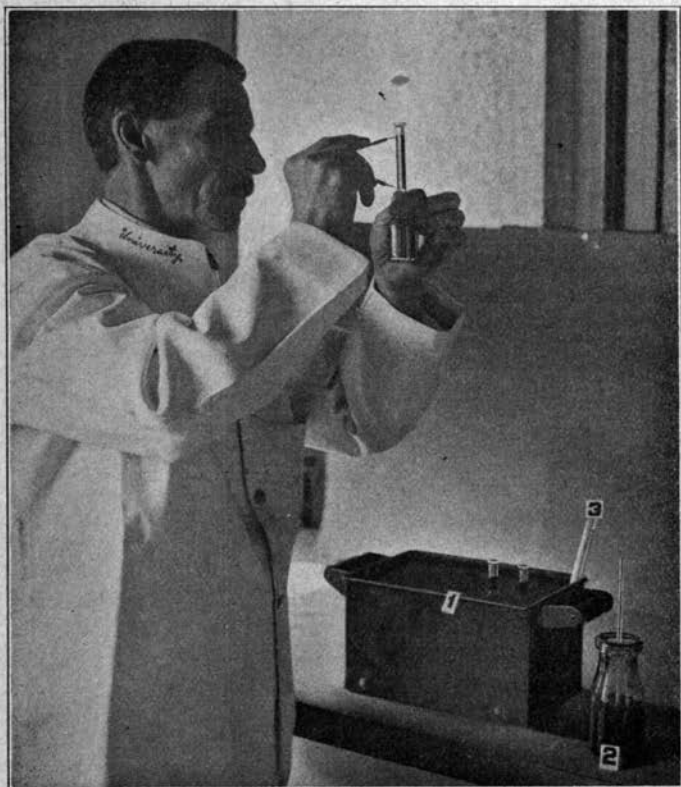


FIG. 13.—TEMPERING THE FAT COLUMN AND READING THE TEST

(1) Bottle bath. (2) Glymol. (3) Thermometer, registering the temperature of the water, 130°-140° Fahrenheit. Note position of the test bottle and the dividers.

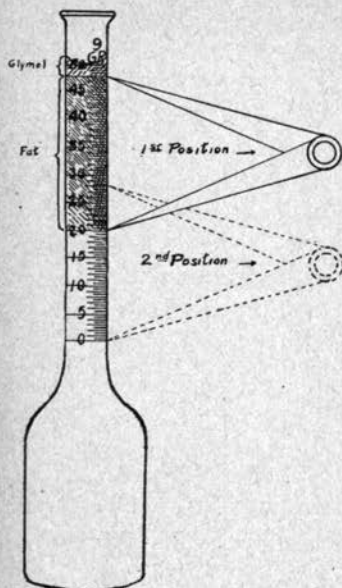


Fig. 14.—Method of Using the Dividers in Reading the Cream Test

tation on this day is 45 cents; then $\$.45 \times 15.99 = \7.19 , the value of the can of cream.

CALCULATING THE RESULT

The reading thus obtained represents the percentage of fat in the cream. The weight of the cream multiplied by this figure, pointing off two decimal places, represents the pounds of fat in a given quantity of cream. The pounds of fat multiplied by the price per pound paid at the station will give the total amount due on a given shipment of cream.

As an example, suppose Mr. A. delivers a five-gallon can of cream in which the net weight is 39 pounds. The station operator finds that the test of this cream is 41 percent. Then $39 \times .41 = 15.99$, the number of pounds of butter fat contained in this cream.

The amount due the patron will be found by multiplying the quoted price per pound of fat by the number of pounds of butter fat. Suppose the quotation on this day is 45 cents;

DEFECTIVE TESTS

When a finished sample is taken from the tester, the fat column should be translucent and have an amber-yellow color without any foreign material either at the top or the bottom of the column.

It is impossible in this circular to discuss fully all the causes of defective tests, but the following outline is offered as suggesting those that are more common:

Columns too dark

1. Temperature of cream or acid too high
2. Too much acid
3. Too strong acid
4. Water not added soon enough

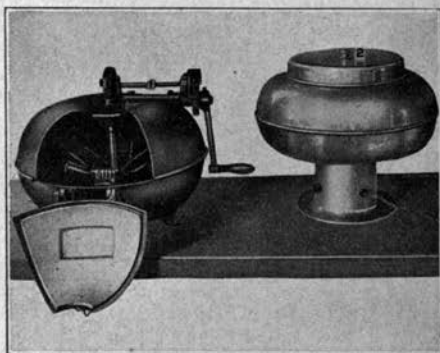


FIG. 15.—TWO TYPES OF TESTER
Hand tester at the left; electric tester at the right.

Columns too light

1. Cream too cold
2. Acid too cold
3. Too little acid
4. Acid too weak
5. Water added too soon
6. Low temperature of tester
7. Insufficient whirling

Dark foreign matter at bottom of fat column

1. Acid too strong
2. Too much acid
3. Acid or cream too warm
4. Water not added soon enough
5. Acid and sample not mixed immediately after the acid is all added
6. Dirty water

CARE OF GLASSWARE

Frequently one cause of inaccurate results in testing is the fact that test bottles have not been washed free from fat before they are used. A dirty bottle may increase the test from $\frac{1}{2}$ to 5 percent. The following method of handling glassware will yield satisfactory results:

Empty the bottles as soon as the tests are read; that is, before the fat has had time to solidify in the neck. Then wash the bottles immediately. The tempering bath may be used for this purpose. Fill the bath about two-thirds full of water just warm enough to be used comfortably; add two tablespoonfuls of some good washing powder or soap chips. Take as many bottles as can be held conveniently in one hand, immersing them in the bath and allowing them to partially fill with the alkaline water. Shake thoroly and discard the first rinsings into the drain; after which the bottles may be placed in the bath and washed one by one with a bottle brush. After all the bottles have been washed, fill the bath with warm, clean water, with no washing powder, and rinse the glassware thoroly.

Bottles handled in this way will never be a source of trouble. **CLEAN BOTTLES ARE ONE OF THE MARKS OF A CAREFUL WORKMAN.**

POOR CREAM WILL NOT MAKE GOOD BUTTER

There seems to be a misconception among cream producers and even among station operators regarding the quality of cream necessary to produce good butter. Even with our improved systems of manufacturing, poor cream will not make good butter and no class of individuals is in a better position to exert influence on the cream producer in this respect than is the station operator.

The following suggestions to the producer will be helpful in securing from him a better grade of cream:

1. Keep the cows clean.
2. Use covered milk pails.
3. Milk with dry hands.

4. Remove all milk from the barn immediately and separate it at once.
5. Set the separator so that it will skim cream that will test from 35 to 45 percent—35 to 40 percent in winter and up to 45 percent in summer.
6. Wash, scald, and dry the separator and all utensils immediately after using. The separator bowl may be dried in a warm oven, tho the oven should not be so warm that it will melt the tin on the bowl parts. Setting utensils in the sun is a good practice, as the sunshine acts as a germicide.
7. Keep all utensils and separator parts dry when not in use.
8. Cool the cream immediately after skimming by setting the can in cold, running water. Construct a cooling tank so that the cream will be cooled with the water that is used to fill the stock tank.
9. Never mix warm cream with cold cream. Cool the cream before mixing it with previous skimmings.
10. Do not allow the cream to freeze in cold weather.
11. Stir the cream at least twice a day; this will keep it smooth and free from lumps. Do not use a wooden paddle for a stirrer, as it is insanitary.
12. Deliver cream frequently, at least twice a week in winter and three times a week in warm weather.

Directions for the care of cream are found in Circular 190 of the Illinois Experiment Station, which may be had for the asking. The spreading of such information among cream producers will be of material assistance in improving the quality of cream. **SOUR CREAM DOES NOT TEST MORE THAN SWEET CREAM.**

SHORTAGE

One of the great obstacles in the station method of securing cream is the wide difference that often occurs between the total amount of butter fat which is paid for by the station on a given day and the amount of butter fat found in the sum total of the day's shipment from the station. This discrepancy is called shortage. It should be pointed out that this so-called shortage does not, for the most part, represent an actual loss in butter fat, but is usually the result of the sum of a number of small errors in weighing and testing each farmer's cream, together with the loss occasioned by careless handling. Shortage can be largely overcome by strict adherence to the following rules:

1. Use extreme care in weighing each can of cream, being careful to watch the break in the scales.
2. Use care in preparing the can of cream for sampling.
3. Rinse the cans properly and save all drippings and rinsings and ship them to the manufacturing plant in a separate can.
4. Use clean glassware and utensils.
5. Test and read the result accurately.
6. Use extreme care in recording and calculating these results.

As a concrete example of the financial loss due to shortage, suppose that a buying station is paying 45 cents per pound for butter fat. The station then pays \$45 for 100 pounds of fat which it is supposed to have received. Assuming, however, that the station short-

age is 5 percent, the creamery will receive only 95 pounds of fat costing \$45. One pound of fat will then have cost the creamery 47.36 cents or 2.36 cents more than the price quoted, a practice which, if persisted in, will work toward the ultimate ruin of any organization.

CHECKING SHORTAGE

Under certain conditions it may be of some satisfaction to the station operator to check up his daily operations for himself. It is obvious that if, for instance, cream is shipped out from the station daily, the total butter fat in the shipment should equal the total butter fat purchased on that day. To test this out, first, carefully weigh the cream in the shipping can; second, stir each can thoroly and take a sample and test it. The sum total of butter fat in all cans should be equal to the total pounds of butter fat purchased on that day. It is of course understood that the "day" for this purpose will date from one shipment to the next, which is largely determined by the train schedules where the station is located.

Such procedure is on the same principle that a banker considers it good business to balance his books at the end of each day's business.

WASHING THE CANS

It is customary in many plants receiving dairy products to wash the cans before they are returned to the farmer. This custom has extended to the cream station and may prove to be an important element in securing a better grade of cream. First, the moral effect of a clean station with clean cans and utensils is of itself beneficial; and second, the facilities at the station for washing and sterilizing the cans should be far superior to those on the average farm. The following suggestions are offered for handling of cans under these conditions:

1. Use water liberally.
2. First rinse each can with lukewarm water.
3. Wash in a sink two-thirds full and containing some good washing powder. Do not use common soap.
4. Rinse the can thoroly with warm water. If steam is available, invert the can over a steam jet for at least 30 seconds.
5. Set the can inverted in a drying rack to dry. Remember that drying is quite as important as washing in making cans a fit receptacle for dairy products.

SHIPPING CANS

Empty cans should be hauled from the depot immediately upon their arrival. On reaching the station, the covers should be removed and the cans inverted on a rack. Cans deserve more attention than they have received in the past, as they form an important part of

the creamery industry, and the station man can do much toward their conservation.

The following books contain information which will be helpful to the field superintendent, as well as the station operator:

MODERN METHODS OF TESTING MILK AND MILK PRODUCTS. By Van Slyke.

TESTING MILK AND ITS PRODUCTS. By Farrington & Woll.

THE BOOK OF BUTTER. By E. S. Guthrie.

DAIRY CATTLE FEEDING AND MANAGEMENT. By Larson & Putney.

DAIRY CATTLE AND MILK PRODUCTION. By C. H. Eckles.

These books may be obtained by writing to the Secretary of the Illinois Butter Manufacturers Improvement Association, Kimball Building, Chicago, Illinois.