Bulletin 163 July, 1910

The Agricultural Experiment Station

OF THE

Colorado Agricultural College

FARM BUTTER MAKING

BY

H. M. BAINER

PUBLISHED BY THE EXPERIMENT STATION
FORT COLLINS, COLORADO
1910

The Agricultural Experiment Station

FORT COLLINS, COLORADO

THE STATE BOARD OF AGRICULTURE

		Term Expires
HON. B. F. ROCKAFELLOW,	Canon City,	1911
HON. E. H. GRUBB,	Carbondale,	1911
HON. R. W. CORWIN,	Pueblo,	1913
HON. A. A. EDWARDS, *President*,	Fort Collins,	1913
HON. F. E. BROOKS,	Colorado Springs,	1915
HON. J. L. BRUSH,	Greeley,	1915
HON. J. C. BELL,	Montrose,	1917
HON. E. M. AMMONS,	Littleton,	1917
GOVERNOR JOHN F. SHAFROTH PRESIDENT CHAS. A. LORY	*Ex-Officio.*	

L. M. TAYLOR, SECRETARY — G. A. WEBB, TREASURER

EXECUTIVE COMMITTEE IN CHARGE.

A. A. EDWARDS *Chairman.*

J. L. BRUSH, — E. M. AMMONS

STATION STAFF

C. P. GILLETTE, M. S., *Director*, - - - - - - ENTOMOLOGIST
L. G. CARPENTER, M. S., - - - - - IRRIGATION ENGINEER
W. P. HEADDEN, A. M., PH. D., - - - - - - - CHEMIST
G. H. GLOVER, M. S., D. V. M., - - - - - - VETERINARIAN
ALVIN KEYSER, A. M. - - - - - - - - - AGRONOMIST
W. G. SACKETT, B. S., - - - - - - - - BACTERIOLOGIST
J. O. WILLIAMS, B. S. A., *U. S. Expert in Charge* - HORSE BREEDING
E. R. BENNETT, B. S., - - - - - - - - HORTICULTURIST
B. O. LONGYEAR, B. S., - - - - - ASSISTANT HORTICULTURIST
H. M. BAINER, M. S., - - - - DAIRYING AND FARM MACHINERY
G. E. MORTON, M. L., B. S. A., - - - - FEEDING INVESTIGATIONS
R. E. TRIMBLE, B. S., - - - ASSISTANT IRRIGATION ENGINEER
P. K. BLINN, B. S., ROCKY FORD - - FIELD AGENT, ARKANSAS VALLEY
F. C. ALFORD, M. S., - - - - - - - - ASSISTANT CHEMIST
EARL DOUGLASS, M. S., - - - - - ASSISTANT CHEMIST
S. ARTHUR JOHNSON, M. S., - - - - ASSISTANT ENTOMOLOGIST
B. F. KAUPP, M. S., D. V. S., - - - - - - - PATHOLOGIST
MIRIAM A. PALMER, M. A., - - - - - - - DELINEATOR
L. C. BRAGG, - - - - - - - - - ASS'T IN ENTOMOLOGY
GEORGE P. WELDON, B. S., GRAND JUNCTION. - FIELD ENTOMOLOGIST
R. S. HERRICK, B. S., DELTA, - - - - FIELD HORTICULTURIST
C. L. FITCH, - - - - - - - - - POTATO INVESTIGATIONS
W. E. VAPLON, - - - - - - - - - - - POULTRY
J. E. PAYNE, M. S., - - - - - - FIELD AGENT, PLAINS
J. W. ADAMS, B. S., CHEYENNE WELLS, - SUP'T PLAINS SUB-STATION
D. H. MATHIAS, B. S., - - - - ASS'T IRRIGATION INVESTIGATIONS
J. C. SUMMERS, B. S., - - - - - - - - ASSISTANT CHEMIST

FARM BUTTER MAKING

By H. M. BAINER

Looking at farm butter making from a business standpoint, every farmer or dairyman who keeps cows for the butter product, desires to make as much and as good butter as possible. There are many factors which are likely to produce a second or third grade of butter, these must all be taken care of as they come. The majority of dairymen are beginning to realize that good butter is made only from good cream. The churned butter cannot be better than the cream from which it is made. This bulletin is written with the idea of giving general information or directions for making a better grade of farm or ranch butter.

THE DAIRY.

It is generally understood that the kitchen is not a good room in which to ripen and churn the cream.

A good clean cellar, which is well drained, properly lighted

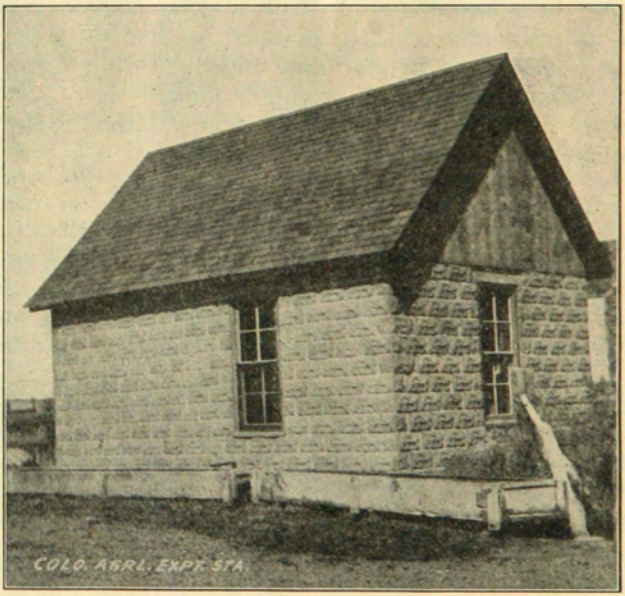

Fig 1—Cement Block Dairy.

and well ventilated is far superior to the kitchen. A separate room, next to the kitchen, with an outside as well as an inside entrance is desirable, if used for dairy work only. There are very few farmers or small dairymen who feel able to construct a separate dairy, although it is desirable.

Such a building can be easily and cheaply constructed of solid concrete walls or cement blocks, as shown in Fig. 1. Any farmer who understands handling cement and can make good forms or molds for construction can make a good solid wall concrete dairy very cheaply. The walls can be made of solid concrete, 4 to 6 inches thick and plastered on the inside with a cement plaster. An excellent wall can be made out of a mixture of 1 part Portland cement, 3 parts sand and 3 parts of gravel, plastered on the inside with a mixture of 1 part cement to 2 parts of sand. The mixture should be placed in the forms in a very wet or sloppy condition. Old barbed wire, or wire of any kind, placed in the walls as they are being constructed, will strengthen them very much, especially at the corners. The floor in the dairy room should be constructed out of concrete, with a cement surface.

The separate dairy should be located so that it is handy to both the house and the barn, so that hot and cold water can be easily secured, and so that it can be well drained. It is advisable to place it near the well so that cold water can be easily secured for cooling the milk or cream. It is a good plan to arrange the dairy so that all water which is pumped for live stock has to pass through a cement tank in the dairy and out through an overflow pipe into the watering trough or supply tank.

Usually a building 10x12 feet, clear on the inside, will be large enough for the average farm dairy.

CLEANLINESS A NECESSITY.

If good butter is to be produced, the milk and cream must be properly handled. The milk cannot be produced under unsanitary conditions and at the same time furnish the raw material for a good quality of butter. The reasons for a poor grade of butter are more frequently found before the milk has been skimmed than after.

The cows should be kept in a healthy condition. The stable should be well lighted, properly drained and thoroughly ventilated. The milker should remember that milk takes on odors very readily and that undesirable bacteria and filth which are allowed to get into it during the milking period, even in apparently small quantities are likely to spoil the product. Some of the greatest sources of contamination are the cows, the milker, the stable, the flies, the pails, strainer, and the stable air. The dark, unventilated, damp stable is the home of disease and germs. On the other hand, plenty of sunlight and fresh air is conducive to health and sure death to most germs. Everything that falls into the milk, flies, hair, particles of dirt, etc., carries with it thousands of bacteria, the majority of these being detrimental. Every possible precaution should be exercised to keep the milk clean and pure. All dirt should be

brushed from the cow before starting to milk and it is often advisable to wipe the udder with a damp cloth. The milker should be clean. The cows should not be fed before milking as it will raise a dust which will help carry bacteria into the milk. The milk should not be allowed to stand in the stable any longer than is absolutely necessary, it should be removed to the dairy room as soon as possible and there strained for the creaming process.

Poor feed, such as musty hay, damaged grain, rotten silage, fermented feeds, etc., will give the milk and butter a bad flavor. Again, certain weeds in the pasture, such as wild onions, ragweeds, etc., will produce bad flavors. Poor water for the cows also has its effect.

THE DAIRY UTENSILS.

All pails and cans should be made of a good grade of tin. They should be made of pressed tin or should have the seams smoothly soldered over, so there will be no places for dirt to lodge. Galvanized and wooden pails are not advisable. The tinware should not be allowed to rust and, above all, it should not be used for any other purpose.

All dairy utensils, including pails, cans, separators, churns, etc., should be thoroughly washed every time after using. They should be first washed or rinsed in cold or luke warm water, not hot, as it will cook the milk onto the tin. After rinsing, wash them in hot water, then thoroughly scald with boiling water or steam and place in the direct rays of the sun. It is not advisable to dry them with a cloth, as they will remain cleaner, if scalded and allowed to drain in the sunlight. Do not use laundry soap in washing the dairy utensils but rather a good washing powder or sal-soda which contains no grease.

SKIMMING THE MILK.

There are two general systems of separating the cream from the skim milk: The centrifugal or hand separator method and the gravity or setting method. The gravity method being again divided into three divisions; namely, deep setting, shallow pan and water dilution. Taking these all together there are four general methods.

Briefly summarized we give the following statements concerning each method:

Hand Separator.—This method is, by far, the best. The relative skimming efficiency of the hand separator and gravity systems as determined by experiments at the Purdue Agricultural Experiment Station showing the per cent. of butter fat in the skim milk are as follows:

Hand separator .02%.

Deep setting .17%, 8½ times the hand separator.

Shallow pan .44%, 22 times the hand separator.
Water dilution .68%, 34 times the hand separator.

Not only does the hand separator secure practically all of the butter fat, but it delivers the skim milk in a sweet, warm and undiluted condition ready to be fed to the calves or pigs. Fewer dairy utensils are needed, as the milk is separated as soon as it comes from the cow and the skim milk is fed at once.

Less work is required to handle the milk in this method than in others.

The cream delivered from the separator is of uniform richness with much of the fibrous and foreign matter removed. About 50%

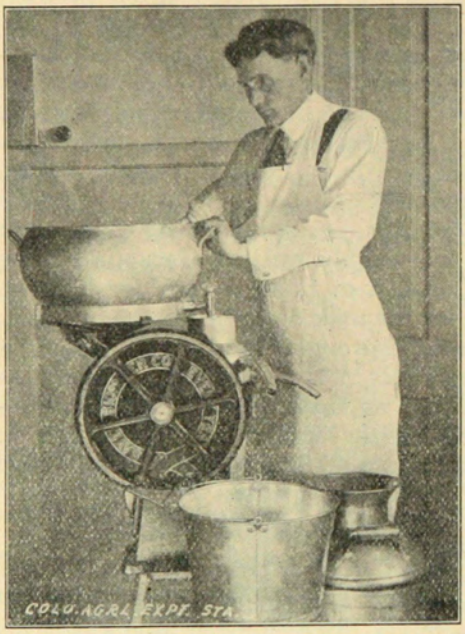

Fig. 2—Hand Separator Ready for Skimming.

of the total number of germs found in the milk are thrown out by the separator into the bowl slime.

The milk has had less chance to absorp bad flavors and odors from standing around and the cream is produced in excellent condition. By using the hand separator, there is a gain in the quality as well as the quantity of butter obtained.

Deep Setting.—In this method, the warm milk is strained into a can, usually of the shot gun type, which is tall and of small diameter. This is set into a tub or trough and is surrounded with cold water. The milk is usually allowed to set for 24 hours, at

the end of which time the skim milk is drawn off through a faucet at the bottom, leaving the cream in the bottom of the can. Often the can is not provided with a faucet and the cream is removed from the surface with a saucer or hand skimmer. Generally, the deep setting system produces a better grade of cream than either the shallow pan or water dilution systems. The cream is usually removed in a sweet condition, less surface is exposed to the drying action of the air and the skim milk is in better condition for feeding, although it is cold and sometimes sour. The cream is not of uniform richness and is often not rich enough to churn well.

Shallow Pan.—The milk is strained into pans or crocks and is set in a cool place to cream out. It is sometimes set in cold water. It requires about 36 hours setting and is then skimmed from the surface. Usually the cream and skim milk is sour. The cream is not of uniform richness, and is often leathery and of a poor quality.

Water Dilution.—The milk is strained into a special can and is usually diluted with equal parts of cold water. It is set for 12 hours and then skimmed by drawing off through a faucet at the bottom. This method is poorest of all. Often as high as one-fourth of all the butter fat is lost. The skim milk is very poor. The calf has to drink two gallons to get one gallon of milk. The cream is thin, it has a watery flavor and is often very much contaminated with the impurities of the water.

The water dilution separator must be considered as a failure.

The farmer who handles the milk from 10 cows which produce 80,000 pounds of milk per year, should not lose over 30 pounds of butter fat in hand separator skim milk. By good use of the gravity methods he would lose from 275 to 600 pounds of butter fat in the skim milk. To be sure this is not all lost, especially when fed to calves or hogs, but the same food element can be much more cheaply supplied, in corn, kafir, or milo.

SELECTING THE SEPARATOR.

There are many makes of good separators now found on the market which are sold as cheaply as many of the poorer makes.

Select a "Standard" machine, one that has a good recommendation and is known to be durable and reliable. Buy a well known machine, one that is guaranteed in construction, material and clean skimming.

Size of Separator.—Hand separators may be procured in sizes varying in capacity from 150 pounds of milk per hour (18 gallons), to 1,200 pounds per hour (144 gallons). The prices vary from about $35.00 for the smaller size to $165.00 for the larger size.

Select a separator with a capacity of not less than 50 pounds per hour for each cow milked. A 10-cow herd would then require

a 500 pound capacity machine and an 18-cow herd a 900 pound capacity one. Don't make the mistake of getting a machine that is too small, as it will take too much time to skim the milk.

COLLECTING THE CHURNING.

Cream should be churned at least twice a week during cold weather and three times a week during warm weather. The frequency of churning will depend largely upon the conditions under which the cream is collected and kept. Enough has been said to show that the kitchen is not the proper place in which to collect and keep cream, although it may be necessary, at times, to take it there for ripening.

As soon as the milk has been skimmed, the cream should be cooled by setting it in a cold place or by running cold water around it. It should be kept in as nearly sweet condition as possible until enough has been gathered for churning. After thoroughly cooling each skimming of cream, it can be added to the previous skimming. In no case should warm cream be added to cold cream, both should be equally cold and then they may be put together and thoroughly mixed. Every time a new skimming of cream is added to that already gathered it should be thoroughly stirred into the cream below. None of the cream should be allowed to stick to the sides of the cream can or jar above the surface.

Do not add fresh cream to a batch of older gathered cream later than twelve or sixteen hours before churning, as it will not ripen or churn uniformly.

A refrigerator is a poor place in which to keep cream which is being collected for a churning. In the first place, it is usually used for keeping a little of everything and a mixture of odors are found in it, which will flavor the butter and at the same time give it a characteristic refrigerator aroma. Again, the refrigerator does not contain enough pure air for cream. About as good a method as any, is to place the cream can in a tank of cold water and give it plenty of pure fresh air. Keep the cream as cold as your well water until within about 12 hours of churning time when it may have to be warmed somewhat for ripening.

RIPENING THE CREAM.

In order to ripen cream, the temperature must be made favorable to the development of the lactic acid bacteria (those that produce the lactic acid or sour the cream). This temperature is usually somewhat above 60° F. The object of ripening or souring the cream is to produce the flavor and aroma in the the butter, to make the cream churn easier and to improve the keeping qualities of the butter. The process of ripening largely controls the quality of the butter, therefore it must be considered as the most important step in farm butter making.

Cream that has been gathered by the gravity methods, instead of the hand separator will need but very little ripening, and will usually not need a starter as it will be sour enough by the time a churning has been collected. It must be frequently stirred, however, during the gathering period to insure its ripening uniformly throughout.

Separator cream, properly collected and cared for will in most cases be practically sweet at the time when enough has been gathered for a churning.

Under creamery conditions, in order to quickly ripen cream and to be sure that the right kind of bacteria are in it, what is known as a starter is added. This starter is nothing more than milk which has been properly soured and kept in good condition and is added to the sweet cream in small quantity. This not only adds the right kind of bacteria for souring the cream but also gives the butter maker control of the fermentation process and he is able to make a uniform grade of butter out of several batches of cream.

Under farm conditions, where the milk is under the control of the butter maker from the beginning, starters are seldom necessary. In fact, to keep a good starter under farm conditions of churning two and three times a week, is a difficult proposition. For farm conditions, the starter cannot be generally recommended, although there may be times when they are necessary. For example, it may be necessary in winter months to add a starter in order to hurry up the ripening process, or to head off the action of numerous undesirable bacteria.

The starter may be good skim milk or whole milk which has been soured under favorable conditions, or it may be ripened cream or butter milk from the previous churning. The starter must be kept in a cool place after it has been properly soured, until used. It should not be allowed to get old or stale, or it will be worse than none. One quart of starter thoroughly mixed with six or eight gallons of cream which has been warmed to from 65° to 75° F. should cause it to properly ripen in 12 hours.

As soon as the cream has become properly ripened, it should be cooled to the churning temperature. The farm butter maker must judge the degree of ripeness by the taste, aroma and appearance. Too sour cream makes a strong flavored butter with poor keeping qualities, in fact, it produces a poorer butter than cream that is not sour enough.

THE CHURNING PROCESS.

The Churn.—One of the best types of farm churns is that with no inside fixtures, such as the barrel churn. Those churns with inside fixtures, agitate the cream in a different way and have more

of a tendency to spoil the grain of the butter, they are also harder to keep clean.

At present, there are several churns on the market that are guaranteed to get the butter out of the cream in from three to eight minutes, these must be considered as frauds. They always spoil the grain of the butter and at the same time partly emulsify or mix the butter fat and milk in such a way as to make them inseparable, thus producing a salvy or grainless butter of very poor keeping quality.

For dairies, making 75 pounds or more of butter per week, there is no doubt but that the small combined churn and worker

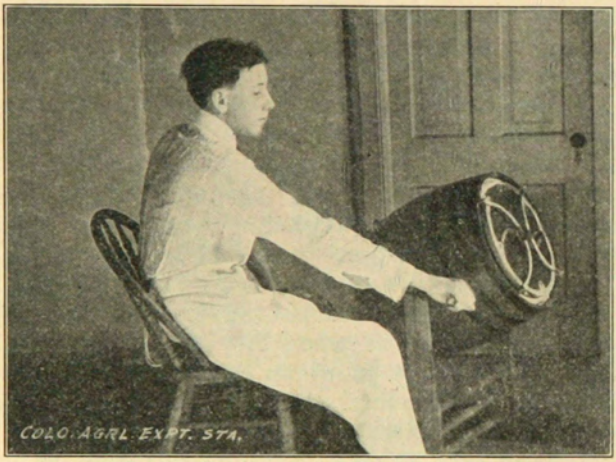

Fig. 3—Churning with Barrel Churn.

will prove more satisfactory than the churn and worker separate. The combined churn and worker is used altogether in creamery practice.

A common error is made in securing churns that are too small. The churn should never be filled more than half full of cream and one-third full is better.

Temperature.—Every butter maker should secure a good dairy thermometer and then use it. One of the main causes for having to churn from one to several hours, is that the cream is not at the right temperature. With a temperature of from 52° to 60° F., butter should be produced in from 25 to 40 minutes, providing the other conditions are right.

After the cream has been ripened it should be cooled to the churning temperature and then held at that temperature from one to three hours before churning.

Churning.—The churn should be first scalded and then thoroughly cooled with cold water.

It is very important that all cream be strained into the churn. This will remove all clots and particles or curd and there will be less danger of white specks in the butter. It is not uncommon to find flies, solid impurities, etc., in the cream, even if handled with the best of care.

Do not fill the churn much over one-third full, but rather give the cream room for agitation, which helps to insure quick churning. Turn the churn just fast enough to give the cream the greatest amount of agitation. In case a barrel churn is used, turn it so the cream has time to fall from one end of the churn to the other, with a distinct thud.

Coloring.—In order to make a uniformly colored butter for the entire year, some color must necessarily be used. Very little will be required during the spring and summer months when the cows are getting green feed. During the fall and winter months more color will be required. No harm is done by moderately coloring butter with a good standard color, of which there are several brands on the market. Colored butter can be sold for a

Fig. 4—Taking Washed Butter from the Churn in Granular Condition.

very much better price than that not colored. White butter is not nearly so appetizing and good in appearance as that which contains color.

The color should be added to the cream in the churn before starting to churn.

When to Stop Churning.—The old practice of churning until all the butter has gathered in one body in the butter milk cannot be considered a good one. In this way too much butter milk is mixed into the butter which cannot be worked out or washed out, this not

only gives the butter a poor flavor but poor keeping qualities as well.

The butter should be gathered until the granules become about the size of a grain of wheat. Then draw off the butter milk through a strainer and wash the butter. If the butter is gathered in larger grains or chunks it will be found harder to properly salt, and at the

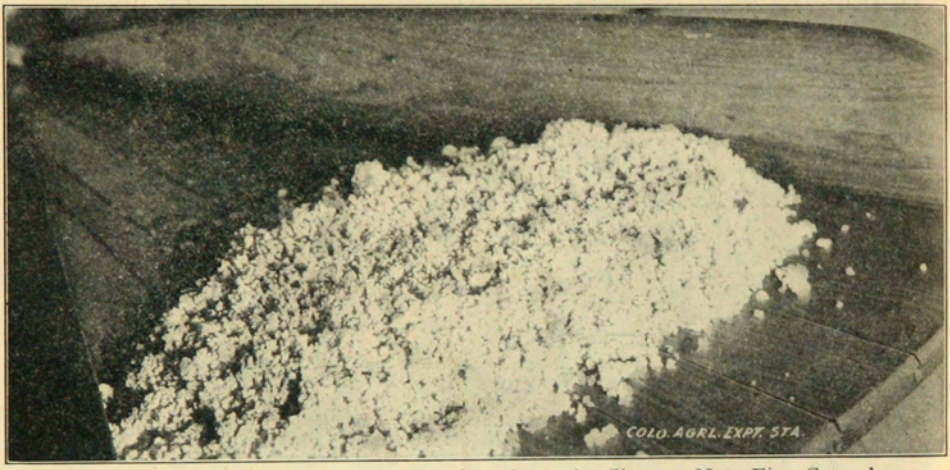

Fig. 5 – Butter on Table Worker just from the Churn. Note Fine Granular Condition.

same time there will be more danger of mottled or spotted butter. It is generally understood that an uneven distribution of salt is largely responsible for mottled butter.

Washing the Butter.—After thoroughly drawing off the butter milk, the butter should be washed in good clean and pure well or spring water. Under good churning conditions, the temperature of the wash water should be about the same as the butter milk. If the butter comes too soft, use water that is colder and if it is too hard, use water slightly warmer.

Pour the wash water into the churn over the butter and turn the churn but four or five quick revolutions. Then draw off the first wash water and put on the second and turn churn as before. If the butter is hard enough after the second washing, draw off the water at once and the butter is ready for salting.

Salting and Working.—If the butter has to be salted and worked outside of the churn, it should be taken out in the granular condition and the salt should be added before it has been worked at all. Nothing but a good grade of dairy salt should be used. As a general rule, about one ounce of salt is added for each pound of the granular butter. The salt should be worked through the

butter with a ladle or some good type of worker and not with the hands.

The best way to work butter outside of the combined churn is by use of the small table worker. Next to this, is the butter bowl and ladle.

Fig 6 —Working Butter in Butter Bowl.

One working, at the time of salting, is usually sufficient, providing the butter is hard enough when removed from the churn and providing, also, that it is worked in a cool place. If the butter

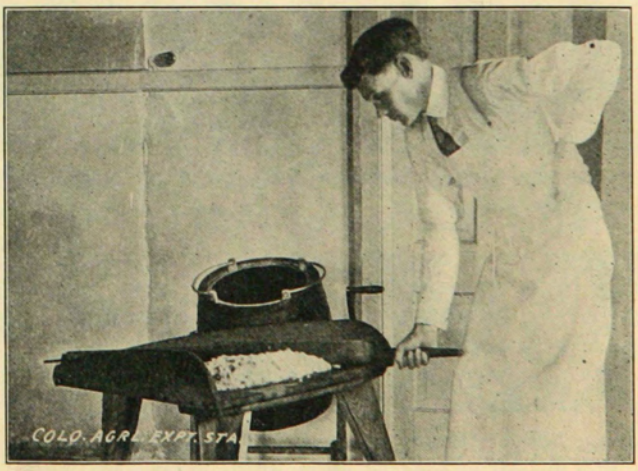

Fig. 7—Working Butter on Table Worker, a Better Method than with Butter Bowl.

becomes too soft before the process of working is completed, it can be set away in a clean, cool place for a short time, until it gets hard enough to finish.

The butter maker will have to judge by taste, distribution of salt, and general appearance, when the butter has been worked enough. Butter has usually been worked enough when the salt is evenly distributed and when the water has been sufficiently removed so that the butter will bend without breaking, when rolled. Too much working will spoil the grain of the butter and make it salvy; while leaving too much water in it will tend to spoil its keeping qualities.

Printing.—Butter should be packed or printed as soon as it has been worked sufficiently, after which it should be put in a cool place until taken to the market.

The appearance of the package, as well as the way the butter is printed or packed, has a great deal to do with the selling price.

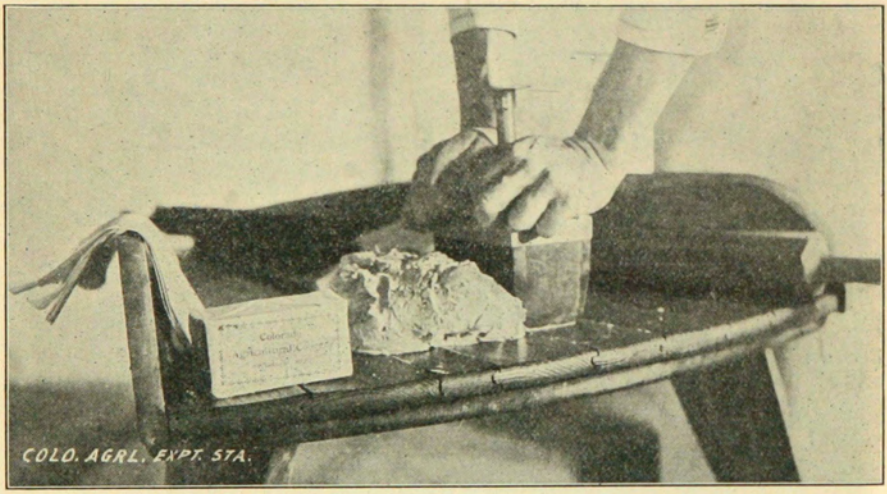

Fig. 8—Printing Worked Butter in 1-lb. Bricks. Note Parchment Paper Wrapper.

The country roll must be considered a thing of the past. The one pound brick print which stamps the name or brand of the maker in the surface of the butter is one of the most popular types of package. Instead of this, it may be better to put up the plain pound print and wrap it with a printed parchment paper which shows the name of the maker and the brand or quality on the outside.

WHY DO I HAVE TO CHURN SO LONG?

1.—The cream should be churned at a temperature of 52° to 60° F. depending on the time of year and the room temperature.

In winter this temperature may run from 57° to 60°, especially if the room in which the churning is done is cool. In summer the temperature should be somewhat cooler, 52° to 57°, especially if the room is warm. If the cream is too cold, it will foam and expand, and sometimes the churn will get too full. When this takes place little can be done, except to allow the cream to stand for sometime, or to warm it gradually four or five degrees before starting to churn again. There is less danger of the cream foaming in revolving churns, such as the barrel churn, than there is with the dash churn, or almost any other class of churns.

2.—The cream may be too old. It should be churned at least twice per week, even in winter.

3.—The cream may not be perfectly ripened. (See "Ripening the Cream").

4.—The individual cows of the dairy may have been milked for a long period without new cows having been added to the herd. The butter fat globules become smaller as the period of lactation advances. The smaller the fat globules become, the longer it is necessary to churn.

5.—When cows are taken off grass and fed dry feed, it often has the effect of making it necessary to churn longer. This may be overcome, somewhat, by feeding succulent feeds, such as silage and roots.

6.—Often the butter will collect in the churn in very fine grains, and further churning seems to do but very little good. Under these conditions, the butter can usually be made to gather by diluting the cream with a small amount of water at the churning temperature. It may also be overcome by adding a handful of salt to the cream in the churn. The solution of the salt affects the viscosity of the cream in such a way as to hasten the formation of butter fat globules.

SUMMARY.

Good butter can be made from good cream only.

The kitchen is not a good room in which to ripen and churn the cream.

The dairy should be arranged so that all water which is pumped for live stock has to pass through a cement tank and out through an overflow pipe into the watering trough or supply tank.

The cows should be kept and milked under sanitary conditions.

The milk should not be allowed to stand in the stable longer than is absolutely necessary.

Poor feed, weeds, and poor water will give the milk and butter a bad flavor.

Of the different methods of skimming milk, the hand separa-

tor is best; deep setting, second; shallow pan method, third, and water dilution, fourth.

Do not add warm cream to cold cream. Keep the cream thoroughly stirred, especially while it is being ripened.

The process of ripening, largely controls the quality of the butter, therefore it must be considered as the most important step in farm butter making

The barrel churn is a very good farm churn.

From 25 to 40 minutes is about the proper length of time to churn.

Strain all cream into the churn.

To properly color butter, add the coloring to the cream in the churn just before starting to churn.

Stop churning when the butter fat granules become the size of a grain of wheat.

It pays to wash the butter.

Too much working will spoil the grain of the butter and make it salvy; while leaving too much water in it will tend to spoil its keeping qualities.

The good butter maker will place his name and brand on his product.