near 45° Fahr. as is practicable. It is advantageous to have a supply of ice for use in the water.

4. When an abundan' supply of cold water from a flowing spring is not available, the cooling power of fresh cold water may be applied economically by conveying it in a pipe to the bottom of the tank or creamer, and allowing the warmed water to run off from the top. If the water be scarce, the overflow may be carried into a watering trough for the live stock of the farm.

5. It is advantageous to set the milk as soon as practicable after it is drawn from the cows.

In a test with deep-setting pails, it was found that the quantity of butter fat not recovered in the cream, and consequently left in the skim milk, was 11.48 per cent greater when the setting of the milk in ice water was delayed one hour, than it was set immediately after it was drawn.

6. There was not much difference in the percentage of butter-fat recovered into the cream, due to the temperature at which the milk was set, when between 88° and 98° Fahr The loss of butter fat unrecovered from the skim milk was 2.53 per cent greater when set at 78° than when set at 98° Fahr.

7. The milk should be left undisturbed for about 22 hours. The quantity of butter fat not recovered into the cream was 8 per cent greater when the milk was set for only 11 hours than when it was set for 22 hours, in deep setting pails in ice water.

8. With ordinary milk, there is no gain from adding water "to thin it" when it is set. There was practically no difference in the percentages of butter fat not recovered into the cream when, (1) 25 per cent of water at 160° Fahr. added to the milk (2) 25 per cent of water at 60° Fahr added to the milk, and (3) no water added to the milk, were the differences of treatment in the setting of milk, in deep setting pails in ice water.

CREAMING MILK FROM COWS CALVED MORE THAN SIX MONTHS

9. The milk from cows which have been milking more than six months does not yield its cream so readily as the milk from cows more recently calved.

During the cold weather of autumn and winter, by the setting of milk (in deep-setting pails, in cold water, at a temperature of 38° to 40° Fahr., for 22 hours) from cows which had been milking for periods of from 6 to 12 months, about 33 per cent of the total quantity of butter fat in the milk was left in the skim-milk.

Where the milk of one fresh-calved cow was added to the milk of eight cows which had been milking for periods exceeding 6½ months each, and the milk set as stated above, about 1¼ per cent of the total quantity of butter-fat in the milk was left in the skim milk.

When the milk of cows, which had been milking for periods of less than 6 months each, was set as stated above, from 7 to 15 per cent of the total quantity of butter-fat in the milk was left in the skim-milk.

During the autumn and winter when the milk from cows which had been milking for periods of more than 6 months each was set in shallow pans for 22 hours, from 5 to 15 per cent of the total quantity of butter-fat in the milk was left in the skim milk.

By the use of the centrifugal cream separator all the butter-fat in the milk, except about 3 per cent of the total quantity, may be recovered into the cream, from the milk of cows at all stages of lactation and during all seasons of the year.

SEPARATING CREAM BY THE CENTRIFUGAL METHOD.

10. The milk for the separator should be carefully strained and heated to a temperature of 80° or 85° Fahr. If it be used at a lower temperature, the cream is apt to become thick and clotted in the separator. Cold milk has a greater density than milk at a higher temperature; the higher the temperature up to 85° Fahr., the greater the efficiency of the separation of cream, all other conditions being equal.

11. Particular care should be exercised to prevent the use of any bitter milk. If any appreciable quantity of bitter milk be mixed with the general supply, the result will be a yield of butter which is likely to be more or less bitter in flavour. In very bad cases, the butter may become quite oily. These are both serious defects.

12. Where the heating and cooling conveniences are rather limited, the milk may be separated at a temperature of 80° Fahr.; but in those cases, the inflow of milk should be lessened and be regulated according to the percentage of butter-fat which is discovered to be left in the skim milk. That should not exceed one-tenth of one per cent. The Babcock milk tester should be used every day to check the percentage of fat in the skim milk and in the buttermilk. For the testing of the skim milk, the sample should be composed of small quantities taken from the outflow of the separator at different times.

13 The efficiency of the separation of the cream depends largely upon the skill and management of the operator, although there are differences in the capacity and construction of the different centrifugal machines. The thoroughness of the separation of the fat into the cream depends mainly upon (1) the speed at which the separator is run (2) the temperature of the milk, and (3) the quantity of milk run through per hour. The operator should study carefully the instructions which are issued by the manufacturer or agent of the separator which he uses It is desirable that the separator be run at its maximum speed, and that it be not exceeded. The separator should be set exactly level, and it should be kept so Where belt machines are used, the belts should not be intensely tight; and in setting up the machines and calculating the speed between the engine and the separator bowl, from 3 to 5 per cent should be allowed for slippage of belts

14 When the quantity of cream to be separated can be regulated by a set-screw in the bowl, it should be set to allow from 14 to 16 per cent of the quantity of average milk to flow through the cream outlet. A good rule is to take off cream which contains from 20 to 25 per cent of butter-fat, or cream which contains about one pound of butter to from 3½ to 5 pounds of cream. The set screw inside the machines should be loosened occasionally, to prevent it from becoming immovably set.

THE RIPENING OF THE CREAM.

15. The cream from the centrifugal separator should be cooled quickly after it is received from the machine.

16. The cream from the setting method should be kept cold and sweet until the quantity intended for one churning has been gathered.

17. The temperature of the cream, when set to be ripened, may vary from 65 to 80 degrees Fahr. according to the season; the higher temperature is used during the late fall and winter.

18. The temperature at which the cream is set for ripening should be maintained about six hours, during which time it may be stirred occasionally. After that, it should be left undisturbed until ripe for churning. No close cover over the cream vat need be used. A clean canvas cover is sufficient. Care should be taken to purify the canvas or other cover frequently.

19. "Fermentation starter" is the designation applied to the portion of fermented or sour milk, buttermilk or cream, which is added to the cream to ripen it for churning. The ripening of the cream consists of the development of the ferment or ferments which are added to it, or which got into it from the atmosphere, from contact with vessels or utensils, or from other sources.

20. It is quite important that every butter-maker should have on hand a fermentation starter of pure clean flavour, and of a uniform smooth consistency.

21. The following is the way in which a culture of lactic ferment was made at the Central Experimental Farm dairy, from which "fermentation starters" were prepared.—

A quantity of about two quarts of skim milk was heated to 205° Fahr. The temperature was maintained at that point for ten minutes after which, and while exposed to the atmosphere of the butter-making room, it was cooled to 80° Fahr. It was left in a closed glass-stoppered bottle at the ordinary temperature of the dairy-room, from 60° to 70° Fahr. for five days. It was then found to be coagulated and to possess a mild pure lactic-acid flavour, which became more distinct after it had been kept in cold water at a temperature of 40° Fahr. for three days. That was the culture. The flavour of it was such as was characteristic of cream from which fine flavoured butter had always been obtained; and "fermentation starters" for the ripening of cream were prepared from it.

22. A "fermentation starter" may be prepared from skim milk which is pure, sweet and free from taint. It should be heated to 150° Fahr. and left at that temperature for ten minutes. It may then be cooled to a temperature of 80° Fahr., when a portion of the culture, as described above, at the rate of ten per cent of the quantity of the skim milk should be added to it. That becomes the "fermentation starter."

23. The "fermentation starter" should be left to ripen at a temperature not exceeding 80° Fahr. for 20 hours. When the flavour and odour are distinctly acid, it should be placed in cold water at a temperature of 40° Fahr. in order to arrest a further development of the ferment.

24. The bacteria cultures for the making of "fermentation starters" may now be obtained also in the market from firms who deal in dairy supplies.

25. Where no undesirable flavour exists and no difficulty has been experienced in churning, some buttermilk of pure, nice flavour may be used as a "fermentation starter" for the cream. If at any time the flavour of the butter seems to deteriorate from that method, a new "fermentation starter" should be secured, as described in paragraphs 21 and 22.

26. The "fermentation starter" may be added to the cream at the rate of from five to ten per cent of the quantity of cream.

In any case where the cream has become somewhat tainted, if the taint be of fermentation origin, a larger quantity than usual of the fermentation starter should be added. This may in a great measure check the development of the taint and leave the particular fermentation of the starter which is added, to be the prevailing one in the cream and butter.

27. If for any reason it is desired to churn the cream while sweet, the churning should be commenced at a temperature of five to eight degrees colder than for the churning of sour cream. In all our examinations, the butter from sweet cream has been rated from two to three points lower in valuable commercial flavour than butter from a portion of the same cream which had been ripened or soured.

28. Although it is usually not desirable that turnips should be fed to milking cows, when they are fed, the odour and flavour may be prevented from appearing in the butter.

In a trial which was made from the milk of cows which were being fed the excessive quantity of 90 pounds of turnips per head per day, the odour and flavour of turnips was not perceptible in the butter which was made after the following treatment was given to the cream:

The cream was heated at 150° Fahr. and stirred at that temperature for ten minutes while it was still sweet. It was afterwards cooled, ripened and churned in the usual way. A portion of the cream from the milk of the same cows was ripened and churned in the usual way without being heated above 68° Fahr.

The butter obtained from the cream which was not heated above 68° Fahr. had a distinct odour and flavour of turnips; while the butter obtained from the cream which was heated to 150° Fahr. was excellent in odour, flavour and grain, and was without any perceptible odour or flavour of turnips.

From the cream heated to 150° Fahr. before being ripened for churning, eight-enths of one pound less of milk was required to yield each pound of butter, than from the cream from a portion of the same milk which was not heated above 68° Fahr.

29. It has not been found advantageous to thin the cream by adding a quantity of water to it before it is churned or before it is ripened. Quantities of water were added to cream at the different rates of 10, 20, 25 and 30 per cent of water added; and the conclusions were that (1) the churning was slightly less efficient in the recovery of the butter fat, (2) the quantity of marketable butter obtained per 100 pounds of milk was ounce less, (3) the butter was not so firm or solid in the grain, and (4) the churning period at an equal temperature was longer by from one minute to thirty minutes, when water was added to the cream than when cream was churned without the addition of water.

CHURNING.

30. The preferable degree of ripeness in the cream will be indicated by the following points,—a mild, pleasant acid taste, a uniformly thick consistency, and a glossy appearance, somewhat like white oil paint. If not at the exact temperature desired for churning, it should be cooled or warmed to that point, which may range from 54° to 58° Fahr. according to the season. It should be strained into the churn and the churn should not be filled to more than two-fifths of its capacity.