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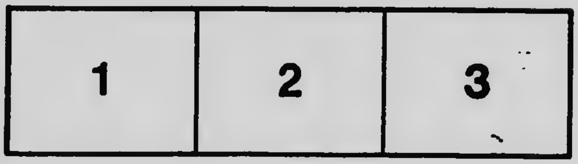
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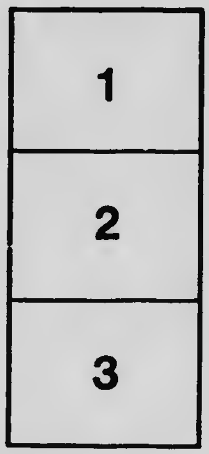
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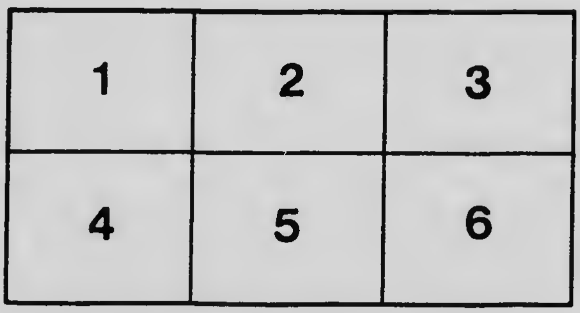
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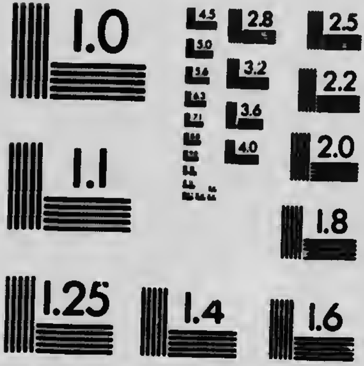


BULLETIN 172.] May '09 [M... ...

A REVISED EDITION OF No. 143.

Ontario Department of Agriculture.

ONTARIO AGRICULTURAL COLLEGE.

DAIRY SCHOOL BULLETIN.

INTRODUCTION.

By H. H. Dean, B.S.A., Professor of Dairy Husbandry.

This bulletin has been prepared by the Dairy School Staff in connection with the Ontario Agricultural College. Two new branches have been added, viz., Soft Cheesemaking, and Boilers, Engines, and Piping.

There is a growing demand for soft cheese in Canada, and we have added this as a branch of our Dairy Department of the College. Mr. F. G. Rice, who has charge of this work, is a graduate of the Midland Agricultural and Dairy College, Kingston, Derby, England. Mr. Geo. Travis, who has been one of the Dairy Instructors employed in Western Ontario during the summer for several years, has given the practical instructions regarding boilers, engines, piping, soldering, etc., to the Dairy Classes for the last two years.

Messrs. M. Robertson and Fred Dean are the summer Creamery Instructors, who are now connected with the Dairy School in winter. Mr. G. R. Taylor has charge of the Milk and Cream Testing, Mr. A. McKay is Chief Instructor in Cheesemaking, and Mr. C. H. Ralph is Assistant Cheese Instructor.

Dairy Farmer. Many dairy farmers grow discouraged during a season of low prices and sell their cows. This is a great mistake. No branch of agriculture is so stable and so remunerative as dairying during a series of years. A year of low prices is usually followed by one of high prices. The cow is undoubtedly the best paying animal on the farm if she is fed and handled properly. However, in order to make a cow pay it is necessary that her owner shall possess certain qualifications. The most important of all is that he shall have a real liking for the cows, not only because of the money which they earn, but he must like them simply because they are cows. A person who really likes cows will take pleasure in feeding and looking after them. To him it is not drudgery. This person will always treat cows kindly and considerately. There will always be a bond of sympathy between the owner and the cow. Each will strive to do the best possible for the other.

The owner of cows must study their habits, likes, and dislikes. He must feed them liberally and make them as comfortable as possible.

Unless he or she is prepared to be a student of cows, success is not probable. To the dairy farmer we should say, know your cows *individually*. This can be best done by weighing the milk from each cow daily, once a week, on two consecutive days each month, or even once a month. Samples for testing should also be taken on the day or days for weighing in order to know the percentage of fat in the milk. This, together with a close observation of the feed consumed by a cow, will enable a dairy farmer to determine whether or not his cows are making a profit. It will also enable him to intelligently weed the poorer cows.

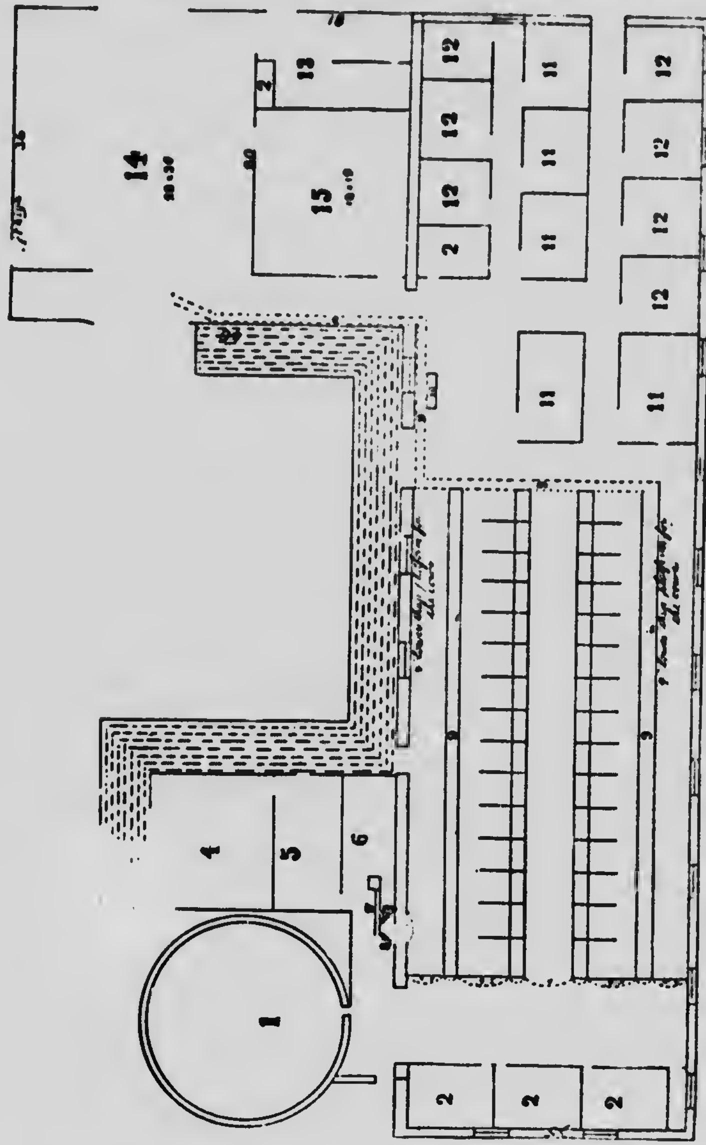
Dairy Cows may be purchased or they may be bred. Frequently good cows may be bought at reasonable prices, but generally speaking they must be reared by the dairy farmer. For the dairyman who cannot afford to keep pure-bred cows, it is desirable to select grade or native cows and breed these to a pure-bred male belonging to one of the dairy breeds. Great attention should be paid to the sire, as milking quality in the female depends more on the sire than on the dam. Dairy farmers do not sufficiently realize the importance of this point. Excellent dairy cows may be secured at small cost by using a dairy sire belonging to a dairy breed and a dairy family. In this way a herd of ordinary or inferior breeding may soon be transformed into a herd of good milkers. The fundamental mistake made by many breeders of dairy cows is in the use of inferior or what are commonly called "scrub" sires. The patrons of every cheese factory and creamery ought to have the use of a pure-bred bull at nominal cost. It would pay the factories to adopt some co-operative plan to secure this result.

Calves and heifers for the dairy should be kept in a thrifty condition but not too fat. They should commence milking when about two and one-half years old. At the end of the second lactation period and during all future years they should produce not less than 6,000 lbs. milk or 250 lbs. butter yearly. This may be taken as a minimum standard of production for profitable dairy cows. Stated another way, they should earn from $25 to $100 per cow each year, above the cost of feed.

Dairy Stable. The chief requirements in a dairy stable are that it shall be light, clean, and healthful. The first is got by having plenty of clean windows, the second by having cement floors, with stalls of proper length and a gutter or drop behind the cows, and the last by having the stable well ventilated, and whitewashed at least once a year. Mangers are not necessary in a modern cow stable.

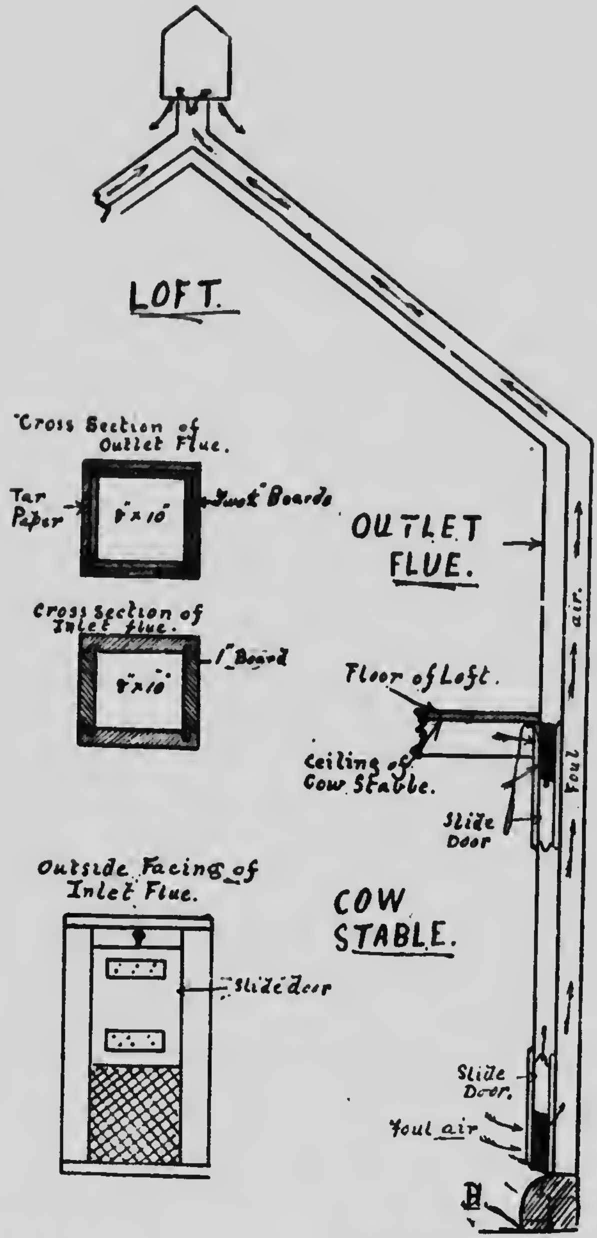
Conditions vary so much on different farms that it is difficult to give a plan suitable for all farms. The accompanying illustrations will show the arrangements in the dairy stable of the College, and on the whole it is quite satisfactory. The feed bins are located at one end of the stable and the box stalls, eleven in number, at the other. There is room for thirty cows to be tied up. A large room above the stable holds the hay and straw. This is not the most sanitary arrangement, but it is convenient.

The King system of ventilating is the one adopted in the dairy stable and it is quite satisfactory. There are six inlets and eight outlets. The

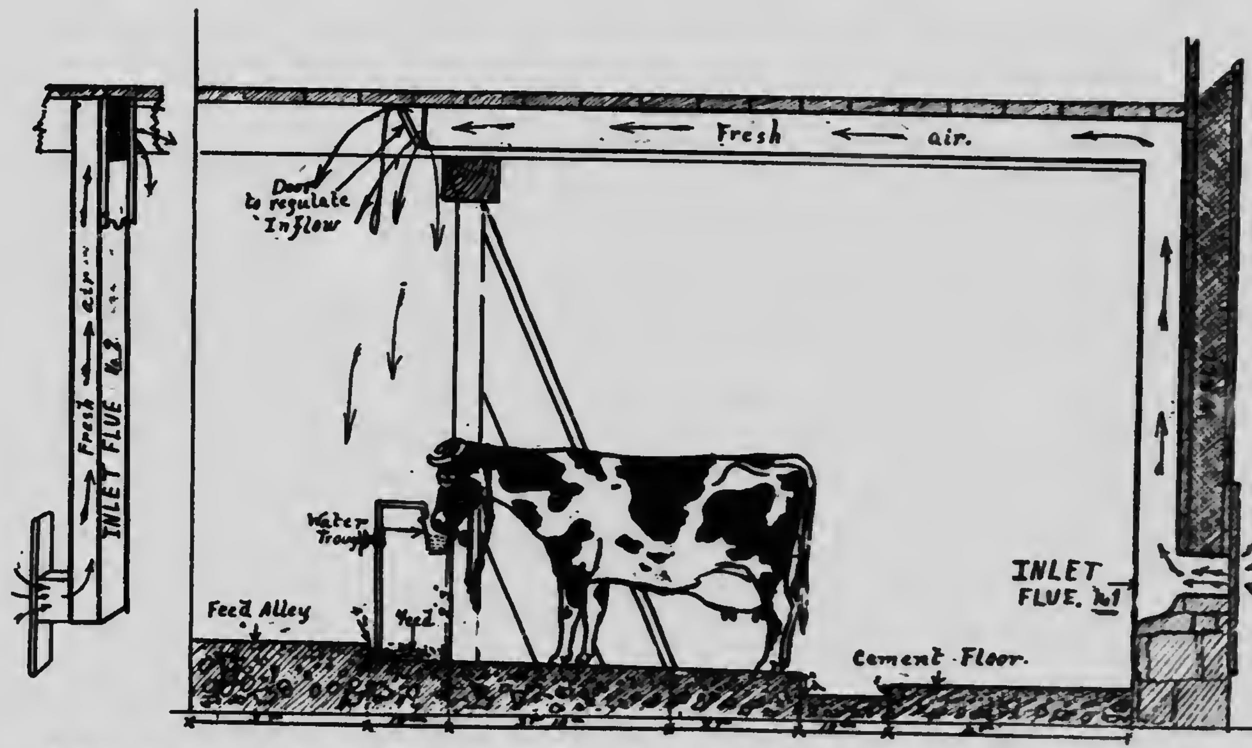


Ground plan of Dairy Barn, O.A.C., Guelph.
1, silo; 2, feed bins; 4, 5, 6 and 15, storage rooms; 9, gutter behind cows; 11 and 12, box stalls; 13, horse stalls; 14, manure shed.

cost of putting in the ventilation was $136, including the cost of galvanized iron ventilators, of which there are four connected with the eight outlets from the stable.



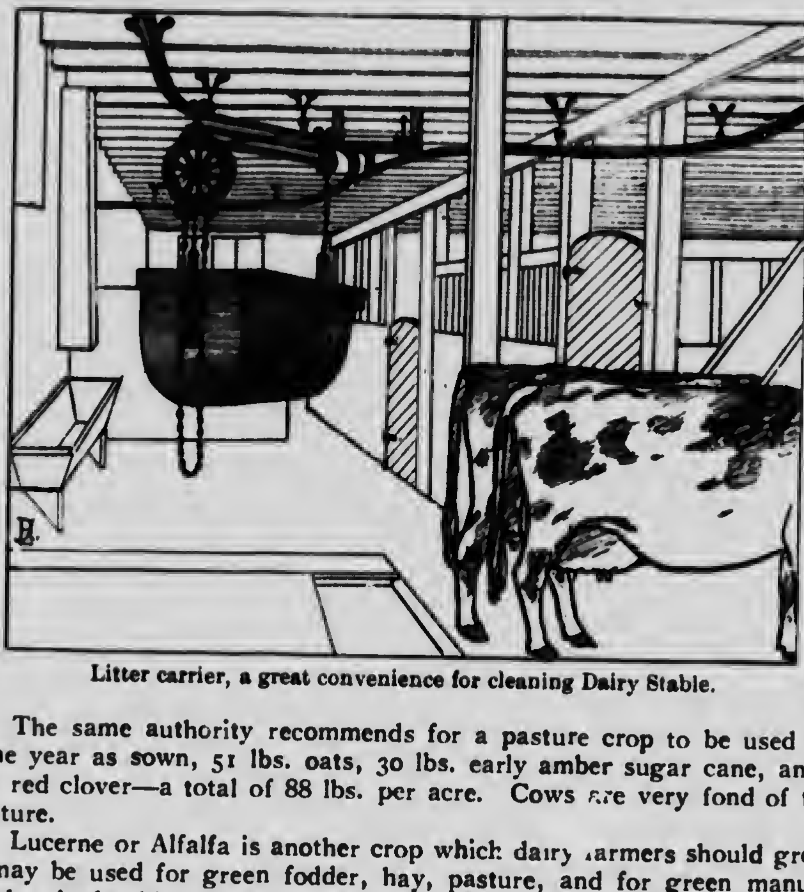
Plan showing outlet for foul air. There are eight of these in the stable—four on each side. One from each side enters a ventilator at roof.



Cross section of stable showing one-half the feeding alley, place for feeding, water trough, stall, gutter, passage behind the cows and inlets of fresh air. There are six of these inlets, one-half of which open at the ceiling behind the cows and one-half in the centre of the stable.

FEEDING THE COW. The natural food of the cow is grass, and nothing is equal to good pasture for cows. In order to secure good pasture on cultivated land it is advisable to give more attention to the method of, and mixture used for, seeding. A very good combination of grasses and clovers, where a rotation of crops is practised, is the following: 4 lbs. timothy, 5 lbs. orchard grass, 7 lbs. red clover, and 2 lbs. alsike clover, making 18 lbs. of seed per acre.

On fields which may be allowed to remain in pasture for several years, the following mixture is recommended by Prof. Zavitz: 4 lbs. orchard grass, 4 lbs. meadow fescue, 3 lbs. tall oat-grass, 2 lbs. timothy, 2 lbs. meadow foxtail, 5 lbs. lucerne clover, 2 lbs. alsike, and 2 lbs. white clover, making 24 lbs. of seed per acre.



Litter carrier, a great convenience for cleaning Dairy Stable.

The same authority recommends for a pasture crop to be used the same year as sown, 51 lbs. oats, 30 lbs. early amber sugar cane, and 7 lbs. red clover—a total of 88 lbs. per acre. Cows are very fond of this mixture.

Lucerne or Alfalfa is another crop which dairy farmers should grow. It may be used for green fodder, hay, pasture, and for green manure. For hay it should be cut when less than one-third in bloom. It is claimed that a ton of lucerne hay is equal to a ton of bran for milk production. This crop should receive more attention on dairy farms. About 18 lbs.

of seed per acre should be sown on well-drained land in the spring, with or without a crop. It should not be pastured or cut the *first* year. It will give two or three cuttings each year after it is established.

To supplement pastures, green peas and oats, or summer silage are often necessary. These help to maintain the milk flow at a time when the shrinkage would otherwise be considerable. From two to four pounds of meal per cow each day will often pay when the prices of dairy produce are good. This meal may consist of bran and oats, or either of them alone.

For winter feeding, corn silage is undoubtedly the cheapest bulky food at the disposal of dairymen. However, corn silage alone is not sufficient for milking cows. They also need some clover hay, roots, and meal. When dry, it pays to feed the cows a moderate amount of meal, as it seems to be a recognized principle that the time to renew a cow is when she is not milking. Too many put their cows on short rations when they are not milking, thus violating the foregoing principle, and the results are not satisfactory. It pays to feed a good cow well when dry. With heavy milkers there is danger of losing the cows through "milk fever," but modern methods of treating this disease make it comparatively harmless, and there is very much less risk now than formerly. Under ordinary conditions the best plan with heavy milkers in high flesh is to not milk the cow any more than is required for the calf for the first two or three days. If the cow is attacked, the "air treatment" is simple and effective.

On the one hand many cow feeders fail to give their animals sufficient to maintain a proper milk flow, while on the other, some feeders give more meal than the cows can profitably assimilate. Experiments indicate that cows in full flow of milk should receive about eight pounds of meal daily, together with all the roughage which they can consume. An increase to twelve pounds of meal daily in most cases means an added cost for the milk and butter out of proportion to the increased yield.

The winter feed at the dairy barn of the College is prepared as follows: The hay is cut and mixed with the corn silage and pulped mangels for several hours before feeding. This roughage is given at two feeds, and on it is placed the meal for each cow at the time of feeding. The meal usually consists of bran, oats and oilmeal. A feed of long hay is given once a day in addition to the regular feed.

Our standard ration consists of about

40 lbs. corn silage,	4 lbs. wheat bran,
10 lbs. clover hay,	3 lbs. ground oats,
30 lbs. mangels,	1 lb. oil meal.

The following table is based on Bulletin 154 from Cornell Station:

DIGESTIVE NUTRIENTS IN ONE POUND OF SOME COMMON FEEDING STUFFS.

Kind of Food.	Total dry matter.	Pounds of digestible nutrients.			Nutritive Ratio
		Protein.	Carbo-hydrates. + (fat x 2.25).	Total.	
Green fodder corn, 1 lb.............	0.20	0.010	0.125	0.135	1:12.5
" peas and oats, "	0.16	0.018	0.076	0.094	1:4.2
" red clover, "	0.29	0.029	0.164	0.193	1:5.6
" alfalfa clover, "	0.28	0.039	0·138	0.177	1:3.5
Corn silage, "	0.21	0.009	0.129	0.138	1:14.3
Potatoes, "	0 21	0.009	0.165	0.174	1:18.3
Mangels, "	0.09	0.011	0.056	0.067	1:5.1
Sugar Beets, "	0.13	0.011	0.104	0 115	1:9.4
Carrots, "	0.11	0.008	0 082	0.090	1:10.3
Turnips, "	0.10	0.010	0.077	0.087	1:7.7
Timothy hay, "	0.87	0.028	0.465	0.493	1:16.6
Mixed hay, "	0.87	0.062	0.460	0.522	1:7.4
Red clover hay, "	0.85	0.068	0.396	0.464	1:5.8
Alfalfa hay, "	0.92	0.110	0.423	0.533	1:3.8
Corn fodder, "	0.58	0.025	0.373	0.398	1:14.9
Corn stover, "	0.60	0.017	0.340	0.357	1:19.9
Pea straw, "	0.86	0.043	0.341	0.384	1:7.9
Wheat straw, "	0.90	0.004	0.372	0.376	1:93
Oat straw "	0.91	0.012	0.404	0.416	1:33.6
Corn, (grain) "	0.89	0.079	0.764	0.843	1:9.7
Wheat, " "	0.90	0.102	0.730	0.832	1:7.2
Rye, " "	0.88	0.099	0.700	0.499	1:7.1
Barley, " "	0.89	0.087	0.692	0.779	1:7.9
Oats, " "	0.89	0.092	0.568	0.660	1:6.2
Buckwheat, " "	0.87	0.077	0.533	0.610	1:6.9
Peas, " "	0.90	0.168	0.534	0.702	1:3.2
Corn and cob meal, "	0.85	0.044	0.665	0.709	1:15.1
Wheat bran, "	0.88	0.122	0.453	0.575	1:3.7
Wheat middlings, "	0.88	0.128	0 607	0.735	1:4.7
Low grade flour, "	0.88	0 082	0.647	0.729	1:7.9
Gluten feed, "	0.92	0.194	0.633	0.827	1:3.3
Gluten meal, "	0.92	0.258	0.656	0.914	1:2.5
Linseed meal (new process) 1 lb.. ...	0.90	0.282	0.464	0.746	1:1.6
Cotton seed meal, "	0.92	0.372	0.444	0.816	1:1.2
Sugar beet pulp, "	0.10	0.006	0.073	0.079	1:12
Apple pomace, "	0.233	0.011	0.164	0 175	1:14.9
Skim-milk (separator), "	0.094	0.029	0.059	0.088	1:2
Buttermilk, "	0.10	0.039	0.065	0.104	1:1.7

To find the pounds of nutrients in any given number of pounds of any feeding-stuff multiply the weight of nutrients in one pound as given in the table, by the pounds fodder, meal, etc., which you expect to feed.

By referring to the preceding table we find that our ration contains digestible material as follows :

Feeding Stuffs.	Total dry matter.	Pounds of digestible nutrients.			Nutritive ratio.
		Protein.	Carbo-hydrates. + (fat x 2 25.)	Total.	
Corn silage, 40 lbs.	8.40	0.360	5.160	5.520	....
Clover hay, 10 "	8.50	0.680	3.960	4.640	....
Mangels, 30 "	2.70	0.330	1.680	2.010	....
Bran, 4 "	3.52	0.488	1.812	2.300	....
Oats, 3 "	2.67	0.276	1.704	1.980	....
Oil Cake, 1 lb.	0.90	0.282	0.464	0.746	....
	26.69	2.416	14.780	17.196	1:6.1
Wisconsin standard	24.5	2.20	14.900	17.100	1:6.8
German "	24.0	2.50	13.400	15.900	1:5.4

By comparing it with the Wisconsin and German standards, we find that it contains more dry matter than is called for by either, more protein than is asked for in the Wisconsin and less than the German, more carbonaceous material than the German and slightly less than in the Wisconsin, the total digestible material is greater than in the German and about the same as the Wisconsin, while its nutritive ratio is between the two standards, but conforming more nearly to that of Wisconsin.

By using the table as directed any farmer can readily find out the amount of digestible material in his ration and compare it with the standards given. If he finds that the ration is too low in protein or muscle-forming material, then bran, oil-meal, gluten meal, peas or clover hay should be added to the ration, and if necessary some of the more carbonaceous foods such as silage, may be reduced. However, silage, roots, beet pulp, etc., give succulency to the ration which is very important in the economical production of winter milk.

FACTORY FLOORS. Substitute, as soon as possible, a cement floor for the wooden floor now in the factory. Grade the ground to a slant of one inch in six feet to a central gutter, then pack the earth firmly and cover with four to six inches of gravel. Pound the gravel solidly. Mix sand and gravel with good cement in the proportion of four or five to one, and lay the grouting about four inches thick on the firm gravel. Finish with one inch of screened sharp sand and the very best brand of cement mixed in the proportion of two to one for the finishing coat. Have the surface smooth so that pools of water will not lie on the floor. The gutter should have a fall of one inch in six to eight feet, to an outlet, and should be made specially solid and even on the side and bottom. Employ a skilled workman to lay the floor, and use none but the very best material.

Place a "bell-trap" at the outlet from the gutter. Use sewer tile with cemented joints in underground drains near the factory, to prevent sewage soaking into the well. The sewage may be disposed of by means of a filter-bed or by the sub-earth system. Do not allow it to accumulate about the factory.

PAYING PATRONS. Milk is valuable for buttermaking in proportion to the fat which it contains, and the pounds of fat delivered in the milk or cream should form the basis of dividing proceeds among patrons of the creameries.

As butter consists of fat, together with about 16 per cent. of water, salt, and curdy matter, there will always be more butter than the fat contained in the milk or cream. This excess of butter over fat constitutes what is known as the "overrun." The "overrun" in whole milk creameries varies from 12 to 16 per cent., *i.e.*, 100 lbs. fat in the milk makes from 112 to 116 pounds of butter, and this "overrun" belongs to the patrons, unless otherwise understood. It is unwise for creamery managers to take the "overrun" as part payment for manufacturing.

In cream-gathering creameries the overrun usually varies from 12 to 20 per cent.

For calculating the yield of butter from fat in the milk, adding one-sixth to the fat is near enough for practical purposes.

Cheese is made largely from two constituents in the milk, viz., fat and casein; therefore, the method of dividing proceeds among the patrons of cheese factories is more complicated than for creameries. Three systems are now in use among factorymen:

1. Paying according to the weight of milk delivered regardless of its quality.

The principle of this plan is that it assumes all milk to be of equal value per 100 pounds for cheesemaking. It rests on a false assumption, is unjust, and it tends to promote dishonesty. Factorymen and honest patrons who complain that some of the milk is skimmed and watered by dishonest patrons, deserve little sympathy, because a remedy is within the reach of all at a very small cost. The milk of all patrons should be tested regularly, and be paid for according to its value for cheesemaking.

2. Paying according to the weight of the fat delivered in the milk, the same as at creameries.

The principle of this system is that it assumes all milk to be valuable for cheesemaking in proportion to the fat which it contains. The system is manifestly more just and equitable than the first named, and is to be commended in preference to "pooling" by weight of milk. The chief weakness of the plan is that the yield of cheese is not in direct proportion to the fat contained in the milk; therefore, it gives an undue advantage to the patrons sending milk containing a high percentage of fat.

3. Paying according to the fat and casein in the milk, the casein being represented by the factoi 2, added to the percentage of fat.

The principle of this system is that it assumes milk to be valuable for cheesemaking in proportion to the fat and casein contained in it, and it further assumes that the percentage of fat + 2 represents the available fat and curdy compounds in milk for cheesemaking.

The application of the third system is very simple. To illustrate: the tests for fat of patrons' milk are 3.0, 3.5, 3.8 and 4.0. The percentage of fat and casein are $3 + 2 = 5.0$; $3.5 + 2 = 5.5$; $3.8 + 2 = 5.8$; and $4 + 2 = 6.0$. The pounds of fat and casein are calculated by multiplying the pounds of milk delivered by the percentage of fat and casein. Thus, if the first patron had 1,500 lbs. milk he would be credited with $1,500 \times 5 \div 100 = 75$ pounds of fat and casein. If the second delivered 2,000 pounds milk he would be credited with $2,000 \times 5.5 \div 100$, or 110 pounds of fat and casein, and so on with all the others. The value of one pound of fat and casein is ascertained by dividing the net proceeds of the sale of cheese by the total pounds of fat and casein delivered.

The following table gives a summary of the results obtained during five years' experiments, in which 250 experiments were made with nearly 200,000 pounds of milk, which contained percentages of fat varying from 2.7 to 5.5.

Av. p.c. fat in milk.	Lbs. cheese made per 100 lbs. milk.	Lbs. cheese made per 1 lb. fat in milk.	Lbs. cheese made per lb. fat and casein or p.c. fat + 2.	Lbs. loss of fat and casein in whey.		Per cent. lost in curing in four weeks.	Average score	
				Per 1,000 lbs. milk.	Per 100 lbs. cured cheee		Flavor max. 35.	Total max. 100.
2.87	8.75	3.04	1.79	2.71	3.09	4.26	30.4	89.9
3.22	9.03	2.80	1.72	2.75	3.15	4.43	30.2	89.4
3.83	10.02	2.61	1.71	3.34	3.21	4.10	30.8	90.3
4.23	10.67	2.53	1.71	3.21	3.02	4.05	31.0	90.4
4.74	11.44	2.41	1.69	3.64*	3.18*	3.07	31.0	89.8
5.21	12.13	2.32	1.68	3.40*	2.80*	3.53	31.5	91.6

* Fat only. Casein not determined.

Amounts of money (cheese 8c per pound) credited by three sys
and also value of cheese.

Average p.c. fat in milk.	Weight of milk—1,000 lbs. milk.	Weight fat in 1,000 lbs. milk.	Weight of fat and casein in 1,000 lbs. milk, or fat plus 2.	Value che made from lbs. milk
	$ c.	$ c.	$ c	$ c.
2.87	8 27	5 91	6 69	7 00
3.22	8 27	6 63	7 18	7 22
3.83	8 27	7 89	8 02	8 02
4.23	8 27	8 71	8 56	8 54
4.74	8 27	9 76	9 27	9 15
5.21	8 27	10 73	9 91	9 70

"Our five years' experiments prove that this third system con
nearest to the actual value of the cheese produced, though it still pla
a slight premium on the milk-fat. It encourages the production of go
milk, and at the same time does not discourage the majority of patro
who have average milk, and who are apt to envy those whose cows gi
a small amount of rich milk, and who draw a large share of the procee
of cheese-sales, when the money is divided on the basis of the fat only
—O.A.C. Report, 1898, p. 52.

The Hart Casein Test has proven satisfactory, and enables us
obtain the percentage of casein in milk, but it does not change the pri
ciple of this third method.

Skim-milk and Whey. The value of skim-milk for young calves an
pigs is much increased by feeding it sweet. The whole milk creame
should heat all skim-milk to 185 degrees, before it leaves the creamery
Sweet skim-milk is probably worth 15 to 20 cents per 100 pounds.
has also about the same value for grown pigs when sour, if fed alon
with meal.

Buttermilk has about the same value as sour skim-milk, if it doe
not contain too much water. When selling buttermilk in bulk at th
creamery a convenient way is to value it at so much per ton of butter
From $5 to $8 per ton of butter is a fair price.

Experiments made at the Ontario Agricultural College showed tha
100 pounds of whey were equal to 14 pounds of meal in the productio
of bacon. Both skim-milk and whey had a marked influence in the pro-
duction of *firm* bacon. When selling whey in bulk at the factory, it is
usually valued at from five to ten dollars per ton of cheese.

The by-products of cheesemaking and buttermaking are valuable
factors in adding to the wealth of dairymen by means of feeding bacon
hogs and young cattle for beef and the dairy.

All these by-products ought to be pasteurized at the factory before returning them to the farm. Whey heated to 160° F. for one hour in the whey tank will likely destroy the germs which produce tuberculosis in hogs and other animals. All cheese factories ought to pasteurize the whey. It improves the feeding quality, lessens danger of spreading disease, and reduces danger from bad flavors in milk and cheese, as most of the organisms causing these flavors are killed by heating. The cost of pasteurizing the whey has been estimated at 50 cents to one dollar per ton of cheese.

THE ALKALINE SOLUTION: ITS PREPARATION AND USE.

BY R. HARCOURT, B.S.A., PROFESSOR OF CHEMISTRY.

CAUSES OF ACIDITY IN MILK. The development of acid is caused by the breaking down of milk sugar into lactic acid, through the influence of certain acid-forming ferments in the milk. But even sweet milk, immediately after it is drawn from the udder, will have an acid reaction with certain indicators. This acidity is not due to lactic acid nor any free acid in the milk, but to the acid nature of the ash constituents, possibly also to the carbonic acid gas it contains, and to the acid nature of the casein. When phenolphthalein is used as an indicator, freshly drawn milk will generally show as much as .10 per cent. of acid and immediately after exposure to the atmosphere, lactic acid germs commence breaking down the milk sugar. At a temperature of 70° to 90° F., these germs multiply at an enormous rate, consequently lactic acid will develop very rapidly in milk during a warm or sultry day or night. Cooling retards the action, but even at a temperature of 40° to 50° F. they will multiply and considerable lactic acid will be formed. Milk intended for cheesemaking should not contain more than .20 per cent. acid when delivered at the factory; whereas it does not usually smell or taste sour until it contains .30 to .35 per cent. A further development of acid will cause the milk to curdle, or, in other words, will produce coagulation of the casein. There is, however, a limit to the development of acid; for, after a certain point, the germs which break down the milk sugar are destroyed by the acid they produce, and there is no further increase in acidity.

In many ways a knowledge of the acid contents of milk or its products is of value. In most cases, a determination of the percentage of acid in the milk when delivered at the factory will indicate the care the milk has received previous to that time. The acid test may be of value in selecting milk best adapted for pasteurization, or for retail trade, or manufacture of high-grade products. At the present time, however, the chief uses made of the alkaline solution in dairy work are to determine the acid in cream intended for churning, and the acid in milk and whey in the various steps in the process of the manufacture of cheese. Both in ripening cream and in cheesemaking, acid is developed, and the alkaline solution is now frequently used to measure the amount of acid present and thus control the work.

HOW TO MEASURE THE ACIDITY. The measurement of the amount of acid or alkali in a solution depends upon the fact that it always takes a definite quantity of alkali to neutralize a definite quantity of acid. Thus, for instance, it always takes a definite quantity of caustic soda to neutralize a definite quantity of lactic acid, sulphuric acid, or any other acid. If, then, we know the strength of a given caustic soda solution and measure the amount of it used to render a definite amount of milk or cream neither acid nor alkaline, but neutral, we can figure the amount of acid in the sample taken. To make such a determination we require the following:

1st. A standard solution of caustic soda, usually made of the strength known as .111 normal.

2nd. An indicator—some chemical which, added to the milk, indicates by change of color when enough of the alkaline solution has been added to render the milk neutral. Phenolphthalein is the one most commonly used for this purpose. It is made by dissolving 10 grams of phenolphthalein in 300 c.c. of 80 per cent. alcohol.

3rd. A burette, graduated to 1-10 of a cubic centimeter, in which to measure the amount of solution used.

4th. A pipette, to measure the milk or cream.

5th. A glass or porcelain cup, and a stirring rod. A complete outfit suitable for use in butter and cheese factories may now be procured from almost any of the dairy supply firms.

For the information of those who want to make their own alkaline solution or who may wish to check the strength of a solution on hand, the following directions are given:

PREPARATION OF SOLUTIONS. The caustic soda solution may be prepared by a druggist or one who has a delicate balance at hand by carefully weighing out 4.4 grams of pure sodium hydroxide and dissolving in one litre (1,000 c.c.) of water. But impurities in the sodium hydroxide and lack of delicate enough balance make this method unreliable.

The most accurate way of preparing this solution is by standardizing it against an acid diluted to the same strength as the alkaline solution wanted. As it requires an experienced chemist to prepare this acid of the strength required, it is important that it be got from a reliable source.

Having on hand, then, a .1·1 normal solution of acid, the object is to make a solution of the alkali, 1 c.c. of which will exactly neutralize 1 c.c. of the acid. For this purpose, dissolve 5 grams sodium hydroxide (NaOH) in one litre of water. If the soda contains much carbonate, it must be removed by adding a little of a solution of barium hydroxide, boiling, and filtering off the precipitated carbonates. The relative strength of the acid and alkali solution is next determined. This is done as follows:

Rinse out a clean burette two or three times with the acid solution, and then fill it with the same. Note the exact point at which the surface of the liquid stands in the burette; measure out 10 c.c. of the alkaline solution, and deliver into a clean beaker, glass or porcelain cup. Dilute with about 50 c.c. of water, add three or four drops of the phenolphthalein indicator, and then stirring all the time, let the acid from the burrette drop slowly into the alkaline solution, until the color first produced by the indicator is just destroyed. This is the neutral point. Now, again note the exact point at which the surface of the liquid stands in the burette. The difference between the two readings is the amount of acid required to neutralize the 10 c.c. of alkali. If care be taken in coming to the neutral point slowly, it will be seen that one drop finally destroys the last of the light pink color. This work should be repeated until accuracy is assured. The following is an example of results:

1st. 10 c.c. of alkali required 11.5 c.c. of acid for neutralization.
2nd. 10 c.c. of alkali required 11.45 c.c. of acid for neutralization.
3rd. 10 c.c. of alkali required 11.5 c.c. of acid for neutralization.

In this case, we would accept 10 to 11.5 as the relative strength of the two solutions. The alkali is, therefore, the stronger, and must be diluted. If 1.5 c.c. of water be added to 10 c.c. of the alkali solution, 1 c.c. of the alkali ought exactly to neutralize 1 c.c. of the acid. Therefore, for every 10 c.c. of the alkali solution add 1.5 c.c. of water. Measure out the amount of the solution and pour into a clean dry bottle. Calculate the amount of water required to dilute the alkali to the proper strength, and add it to the contents of the bottle. Mix well, and test correctness of work by proving that 10 c.c. of the one solution will exactly neutralize 10 c.c. of the other. If it does this, the solution is correct.

TESTING THE ACIDITY OF MILK OR CREAM. By means of a pipette (a 10 c.c. is a convenient size) measure out a definite quantity of the milk or cream to be tested and deliver into a beaker or cup. If distilled or rain water is handy rinse out a pipette once, and add the rinsings to the sample. Dilute with 50 c.c. of water, and add three or four drops of the indicator. Now, having the alkaline solution in the burette, carefully note the point at which the surface of the liquid stands in the burette and then cautiously let it drop into the cream or milk being tested. Keep the sample well stirred while adding the alkali. The acid in the sample will gradually be neutralized by the alkali added until at last a uniform pink color appears, which will slowly fade away. The most delicate point is the first change to the uniform pink color, which the sample shows when the acid contained therein has been just neutralized. Because of the influence of carbonic acid of the atmosphere the pink color is not permanent unless a slight excess of alkali solution has been added. The operator should not, therefore, be led to believe by the disappearance of the color after a short time, that the neutral point has not been reached. Having decided on the neutral point, again read the burette at the surface of the liquid, and the difference between this reading and the first is the amount of alkali solution used to neutralize the acid in the sample taken.

The calculation of the per cent. of acid is simple. The alkaline solution used is of such a strength that when a 10 c.c. pipette is used, the number of cubic centimeters of alkaline solution required to neutralize the acid in the milk or cream has simply to be multiplied by 0.1. Thus, if 5.6 cubic centimeters of the alkali be used then $5.6 \times 0.1 = .56$ per cent. acid.

To insure accuracy the utmost care and cleanliness must be observed in every detail of the work. All water used with the milk or cream or in making the alkaline solution should be either distilled or pure rain water. The burette and pipette, after being washed, must be rinsed out two or three times with the solution they are intended to measure.

The knowledge the operator may gain from such tests will not only make it possible for him to turn out more uniform products, but it will also enable him to act with confidence and more intelligently to pursue the work he may have on hand.

MILK AND CREAM TESTING.

By Geo. R. Taylor.

Milk varies considerably in composition, therefore, it is necessary to test it. The chief constituents are fat, casein, sugar, albumen, mineral matter, ash, and a large percentage of water.

Of these constituents the fat is the most variable, and, by some, is considered to be the most valuable. In fact, the fat is often used as an index to the commercial value of milk. This shows the importance of having a test for fat which is simple, reliable and accurate, also the necessity of knowledge and ability on the part of the operator to successfully conduct the test.

The Babcock test has been in use for several years, and has proved beyond doubt its reliability as a practical test, not only for determining the amount of fat in milk and cream but also for detecting the extent of losses in skim-milk, buttermilk and whey due to faulty methods of manufacturing. The test is also of great value to the milk producer in assisting him to determine the value of individual cows in his herd, and when used in conjunction with the lactometer it assists in detecting some of the common adulterations in milk, such as watering and skimming.

The details connected with a determination of fat by the Babcock test are briefly as follows :—

1. Thoroughly mix the milk by pouring from one vessel to another. When a thick cream has formed on top it will be necessary to warm the sample slightly by placing in warm water before mixing. If the sample is not properly mixed a representative sample cannot be obtained and the test is of no value.

2. By means of a 17.6 c.c. (cubic centimeter) pipette, measure approximately 18 grams of milk at a temperature of from 60 to 70 degrees F., into a milk test bottle.

3. Add to this 17.5 c.c. of commercial Sulphuric Acid having a specific gravity 1.82 to 1.83, then mix the milk and acid thoroughly by giving the bottles a gentle rotary motion. The acid should be at a temperature of 60 to 70 degrees F.

4. Place the bottles in the tester, making sure that the bottles in the machine are properly balanced, and turn for five minutes at full speed, which will vary from 700 to 1,200 revolutions per minute according to the diameter of the test—800 revolutions per minute for an eighteen inch diameter machine.

5. Add hot water at a temperature of not less than 140 degrees F. to float the fat into the neck of the bottle. Water at a temperature of 160 degrees F. will give better results with hand testers when working in a cool room.

6. Turn the tester again for two minutes at full speed.

7. Place the samples in water at a temperature of 140 degrees F. for several minutes before taking the readings.

Notes.

1. Always make sure that the pipettes and test bottles are clean before using.

2. Be very careful to measure the exact amount of milk for a test. A 17.6 c.c. pipette will deliver about 17.5 c.c. of milk. This measurement of milk of average quality will weight about 18 grams.

3. A partially churned sample of milk may be prepared for sampling by heating it to about 110 degrees F. and pouring it from one vessel to another to mix it thoroughly. When it is thus prepared, take a sample as quickly as possible, and cool to about 60 degrees F. before adding the acid.

4. In sampling frozen milk it is necessary that both the liquid and the frozen part be warmed and mixed thoroughly. The unfrozen part is richer in fat and solids than the frozen.

5. A sample of milk that has soured and thickened may be prepared for sampling by adding a small amount of some alkali to neutralize the lactic acid, and cause the curd to redissolve. A small amount of powered concentrated lye is very suitable. Add just a small amount of lye at a time, and pour the milk from one vessel to another, to mix the lye with the milk, which causes the casein to become dissolvel.

6. The amount of acid used must be varied to suit its strength. The right amount is being used when the fat presents a bright golden appearance. Acid that is much too strong or too weak should be discarded, as satisfactory results cannot be obtained from its use. Acid a little weak is to be preferred to very strong acid. Carboys or bottles con-

taining acid should be kept well corked, to prevent the contents becc
ing weakened by absorbing moisture from the atmosphere.

7. Avoid pouring the acid directly on the milk. The test bot
should be held at an angle so as to cause the acid to follow the side
the bottle and go directly underneath the milk. After the addition
the acid to the test bottle the milk and acid should be in two disti
layers without any charred matter between them. A thorough mixi
by means of a gentle rotary motion should be given at once.

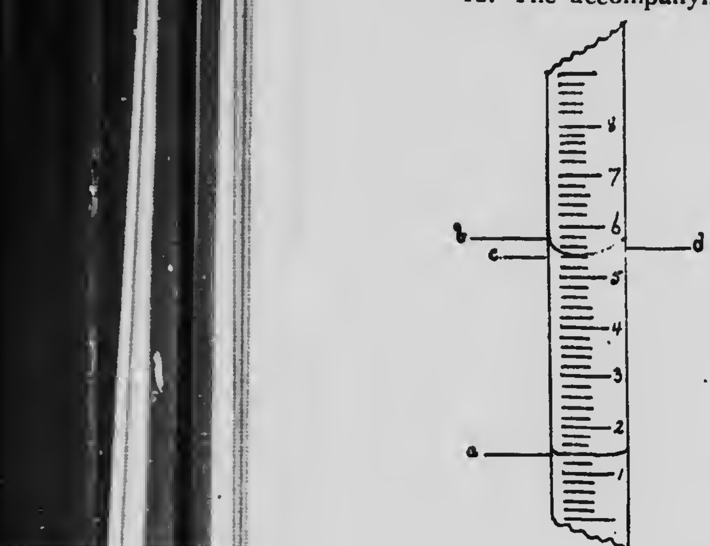
8. If using hand testers in a room at a low temperature, it may
necessary to keep sufficient hot water in the machines to maintain
temperature of 140 degrees F. in the test bottles.

9. The wa er added to the test bottles should be soft or distilled.
hard water is used, add a little sulphuric acid (half an acid measure,
a little more to a gallon of water) to soften it; this will prevent fo
above the fat.

10. If there are several readings to take, *always* set the samples
hot water (140 degrees F.) extending to the *top of the fat* before re
ing.

11. It is well to use a pair of dividers or compasses for measuri
the column of fat. The points of the dividers should be placed at t
upper and lower limits of the fat column; then if one point of the divide
be placed at the zero mark of the scale, the division at which the ot
point touches will show the percentage of fat in the sample tested.

12. The accompanying illustration will show the correct method
reading milk tests when the fat is at
temperature of 140 degrees F.



The reading should be taken from
to *b*, not to *c* or *d*.

13. Burnt or cloudy readings may
caused by:—

(1) The use of too much or too stro
acid.

(2) Allowing the acid to fall directly
the milk.

(3) Having the milk or acid at too hi
a temperature.

(4) Allowing a sample to stand too lo
after adding the acid, before mixing t
milk and acid.

14. Light colored readings and floati
particles of curd are usually due to:—

(1) The use of too little or too we
acid.

(2) Ha   'he milk or acid at too low a temperature.

(3) Insufficient shaking of the bottles to unite the milk and ac
thoroughly.

(4) Lack of required speed or time in whirling.

15. A convenient method of testing the accuracy of the graduation is to test the same milk in the different test bottles. A bottle that differs by more than .2 in its reading from the rest should be discarded. As the capacity of the part of the neck over which the scale extends should be 2 c.c., the accuracy of the scale may be tested by filling the bottle to the zero mark with water. Remove any drops which may have adhered to the inside of the neck, with a piece of absorbent paper; then add 2 c.c. of water by means of a properly graduated pipette or burette. If the scale is correct the water will extend to the 10 per cent. mark.

16. Pipettes and acid measures may also be tested by measuring water from a graduated burette.

17. Care and exactness with regard to every detail are absolutely necessary in order to obtain reliable results in milk-testing.

Composite Samples.

This method of sampling milk is employed in cheese factories and creameries where milk is paid for in proportion to the amount of fat delivered instead of in proportion to the weight of milk. The object of the composite sample is to obtain an average test of several lots of milk without involving the great amount of work which would be required to test each lot separately. A small sample is taken from the daily deliveries of each patron's milk and is placed in a bottle which contains a small amount of some kind of preservative. Several kinds of preservative are used for this purpose, but among the most common are Bichromate of Potash and Corrosive Sublimate; the latter is sometimes sold in tablets. Bichromate of potash is a good preservative if samples are not required to be kept longer than ten days or two weeks, but for longer periods it does not appear to be strong enough to give good results. On the other hand corrosive sublimate, which is a very violent poison, will preserve milk for a much longer period, but it is somewhat dangerous to use it alone, as it does not give any color to indicate that the milk contains poison. An excellent preservative can be made by mixing bichromate of potash and corrosive sublimate in the proportions of seven parts of the former to one of the latter. From what can be taken on a five cent piece to what can be taken on a ten cent piece will usually be found sufficient to preserve a pint sample from two weeks to one month. The amount of preservative required will depend on, the weather, the size of the sample and the length of time it is to be kept. At the end of this sampling period, which may be two weeks or one month, depending on various conditions, the sample may be tested with the Babcock test, and if all the work of sampling and testing has been carefully done the test should give the average percentage of fat in the different lots of milk which the sample represents.

Notes on Composite Sampling and Testing.

1. Pint bottles with close fitting stoppers are convenient for holdin composite samples.

2. The bottles should be kept closely stoppered to prevent evapor tion or absorption of moisture, also to prevent any foreign substanc getting into the sample.

3. Paste a plainly written label on each patron's jar, and give it least two coatings of shellac to prevent it from washing off when clear ing the bottles. Numbering may also be done by roughening a portio of the neck of the bottle with a file or whet-stone, then write the patron' number on with a lead pencil.

4. Add the preservative to the sample bottles before any milk put in. It may be necessary to put in a little more later if the sampl shows indication of spoiling. Too much preservative makes it difficul to dissolve the casein of the milk with sulphuric acid when testing, an also has a tendency to give burnt readings.

5. The sample for the composite jar should be taken after the mil is poured into the weigh can. For this purpose an ounce or half ounc dipper is often used. A tube or milk "thief," or a drip from the con ductor pipe are also satisfactory means of sampling. It is difficult t accurately sample frozen milk, and patrons should be warned agains sending milk in that condition.

6. Give the jar a gentle rotary motion each time a fresh sample i added, to mix the cream that has risen and the fresh sample with th part containing the preservative. Avoid shaking the jar as that has tendency to churn the contents.

7. It is sometimes necessary to place the samples in a cool plac each day when through using them.

8. To prepare composite samples for testing, place the bottle i warm water and bring the temperature of the sample to about 110 degree F. to loosen the cream from the sides of the bottle and cause it to mi more readily with the rest of the sample. Mix well by pouring fron one vessel to another before sampling. If a sample is slightly curdle it may be brought into solution by the addition of a small amount o powdered alkali before heating. When the samples have been put i the Babcock test bottles, they should be cooled to at least 60 degree before adding the acid. Paying strict attention to this point will usuall prevent burnt readings. Sulphuric acid appears to act more strongly o samples containing preservative; therefore it is advisable to add slightl less acid than for normal milk. When difficulty is experienced wit burnt readings it is recommended to add the hot water to the samples a two different times, filling to the neck of the bottle the first time, an whirling for one minute, and then adding to about the 3 per cent. mar

the second time and turning for another minute. Best results in testing will be obtained by adopting certain temperature for each step of the work and always adhering to these.

9. Cost of Acid for Testing Composite Samples. In a gallon of sulphuric acid there is sufficient for about 260 tests. Estimating the value of the acid at 3½c. a pound, the cost of the acid for a single test would be about one-quarter of a cent.

10. To find the correct average test of a can of milk, which is composed of the milk given by several cows, find the total pounds of fat and the total pounds of milk, multiply the pounds of fat by one hundred and divide by the pounds of milk. There is often a considerable difference between the correct average test as determined in this way and the average test got by adding the tests together and dividing by the number of cows.

Cream Testing.

The fat content of cream can be determined quite as quickly and as accurately, by means of the Babcock test, as the fat in milk. For this reason the Babcock test has largely displaced the slow and more laborious method of the Oil Test, in cream-gathering creameries.

For testing cream, special bottles, with graduated necks, large enough to contain 30, 40, or 50 per cent. of the weight of the sample in cream fat are used. The graduations on the bottle should be so arranged that readings to one-half of one per cent. can be made easily.

The proper sampling of cream is a very important part of the work. The same weight namely, 18 grams are required for a test. But since cream has a much less specific gravity than milk, due to the large amount of fat it contains, which is the lightest part of the sample, a 17.6 c.c. pipette will not deliver 18 grams into the bottle. Cream testing from 25 to 30 per cent. fat has a specific gravity similar to that of water. Therefore a pipette graduated to hold 18 c.c. is recommended for sampling such cream. Very rich cream, ripe or gassy cream, and cream fresh from a separator, can be more accurately tested by weighing the samples by means of a fine balance or special cream scale.

Sour samples which contain lumps of curd may be prepared for testing by adding a little powdered alkali to the sample, and heating to 120 degrees F. When samples of viscous cream are taken with a pipette the results will be more accurate if a little water be used to rinse the pipette and the rinsings allowed to go into the test bottle.

No definite measurements of sulphuric acid can be given for testing cream as some samples seem to require more than others in order to give satisfactory results, but as a rule, slightly less acid is required for cream than for milk. A good guide as to the quantity of acid to use is obtained by noting the color of the mixture of cream and acid whe they have been thoroughly mixed. It should be a dark chocolate colo but not black. It is good practice to use a small quantity of acid firs and if the mixture does not turn sufficiently dark a little more may b added.

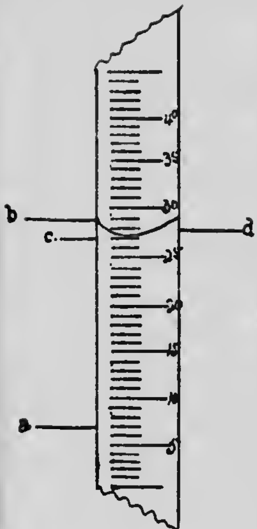
When a cream test is completed in the ordinary way, as indicate for testing milk, satisfactory results are not always obtained. Som times the fat appears in the neck of the bottle quite black or burnt, ind cating too strong action of the acid. At other times the fat appears ver light or cloudy indicating an insufficient action of the acid. The latte condition is usually associated with tests of rich cream, and the result are very unreliable as the comparison of the results of a few tests wi show :—

Cloudy.	Correct.	Cloudy.	Correct.	Cloudy.	Correct.
Per cent. fat.	Per cent fat.	Per cent. fat.	Per cent. fat.	Per cent. fat.	Per cent. fat
42	39.5	46	39	40.5	36.5
40	38	41.5	39	37.5	35
43	38	43.5	40	38	36
42.5	32.5	44.5	40	44	38

These conditions can easily be prevented and clear readings of fa may always be obtained in making a cream test by following either c two methods :

1. After the cream has been carefully measured into the bottle, small amount, about one-third of a pipette of water, is added, and mixe with the cream before the acid is added. When 18 c.c. of cream is use fc - the test this rinsing of the pipette serves a double purpose, helpin to make the test more accurate by causing all of the cream to b delivered into the bottle, and assisting in making a clear reading. Car must be taken that too much water is not added or a thorough mixtur of the cream and acid cannot be obtained, and a test with light, curd material at the bottom of the fat will be the result.

2. It has been found by experiment that very satisfactory result may be obtained by adding the hot water to the cream test as soon a the cream and acid are thoroughly mixed, and whirling the tester onl once, from five to six minutes. This method has an advantage over th other in that it does not require so much time to complete a test, as th tester does not have to be stopped to allow hot water to be added. Mor accurate readings may also be obtained, as the meniscus of the fat more clearly defined.



Cream tests should be read at a temperature of 140 degrees, and the fat measured to the bottom of the meniscus.

Errors due to expansion of fat amounting to one-half to one per cent. of fat, often exist when tests are read immediately after whirling in a steam tester.

The accompanying illustration shows the correct method of reading cream tests. Readings should be taken from *a* to *c* and not to *b* or *d*. ......

Composite samples of cream are made and cared for similar to those for whole milk, but the taking of samples for the composite bottles requires to be done with much greater care and accuracy. Owing to various and unavoidable causes, the weights and tests of the individual patron's cream varies considerably from day to day. Therefore it is necessary that the cream be carefully mixed and a sample be taken in proportion to the weight of each delivery.

Where cream haulers do all of the sampling it is somewhat difficult to carry out this principle, unless they are supplied with some special sampling instrument. It is suggested that a pipette graduated into small spaces, and nearly enclosed in a tin case to prevent breaking, be used for this purpose. The hauler would then receive instructions to take a space of cream for each pound or some definite number of pounds of each delivery.

Some creameries relieve the haulers entirely of the responsibility of taking proportionate samples, and only ask that they take a representative sample, then the proportionate sample is taken from this when it arrives at the creamery.

That the taking of proportionate samples is an important point is indicated by the fact that many large creameries in the United States have discarded the composite cream sample entirely, and are making tests of each individual delivery of cream, because they were unable to get reliable and satisfactory results from its use.

Cream samples are often sour when added to the composite bottles, and are more difficult to keep in nice condition than milk samples. For this reason it is advisable to use a stronger preservative, and a mixture composed of three parts of bichromate of potash and one of corrosive sublimate is recommended.

Composite cream samples should be carefully prepared for testing by heating to 120 degrees F. before sampling. If the samples are curdled a small amount of powdered alkali may be added to the bottle before heating.

When samples are in good condition and test over 30 per cent. fat, more accurate results may be obtained by weighing the test, and if creamery men insist on having a richer cream, it is only fair they should take the extra time and care required to weigh the tests.

The following results show a comparison of weighed and measur
tests from monthly composite samples :—

Measured.	Weighed.	Measured.	Weighed.
Per cent.	Per cent. fat.	Per cent. fat.	Per cent. fat.
17.5	18	29	29
18.5	19	29	29
20.5	20.5	29.5	29.5
21	21	29.5	29.5
22	22.5	29.5	30.5
24.5	24.5	30.5	31
27.5	27.5	33.5	34
28	29	34	35
28.5	29	36.5	37.5
37	38	41	42.5

The Oil Test.

This means of ascertaining the butter value of cream is st
employed in a few sections. It is simply a churning process.

The cream collector is supplied with a pail 12 inches in diamet
in which the depth of the cream supplied by the patrons should be car
fully measured. After thoroughly mixing the cream the collector shoul
take a representative sample, filling the test tubes carefully to the mar
which should be five inches from the bottom.

To Make an Oil Test. Upon arrival at the creamery, set th
samples in a warm place, as over the boiler, and leave over night
ripen thoroughly. They will not churn properly unless well ripened.

The next morning, place the samples in water at a temperature
about 90 degrees F., and as soon as the cream will flow freely fro
one end of the tube to the other, place in the oil test churn and beg
churning. Should the cream at any time cool and thicken, place th
samples in warm water to liquefy the cream again. Continue churnin
until there is evidence of a clear separation of the fat, then place th
samples in hot water, at a temperature of from 160 to 170 degrees, f
from fifteen to twenty minutes.

If the separation be complete, the fat will be clear and yellow, an
there will be three distinct columns with sharp lines of division betwee
them, viz., a column of clear fat on top, one of whey next, and one
curdy matter at the bottom. If there be not a clear separation, cool
about 90 degrees, churn again and proceed as before.

To Take a Reading. There is a chart prepared for the purpos
Place the bottle in an upright position on the "base line" of the char
move it along until, when looking by the right side of the bottle, th

top of the column of fat comes even with the uppermost slanting line on the chart. Next still looking by the right side of the bottle, observe the line to which the bottom of the fat comes; the number on this line gives the reading.

A small rule made specially for this purpose is more convenient than a chart. This, however, will give a correct reading only when the test-tubes have been filled precisely to the mark. The chart consists of a sliding scale, and gives the proportion of oil regardless of the depth of cream taken or the diameter of the test-tubes.

Sometimes the fat, though clear, is somewhat open. In such cases, or when the fat is not clear, allow the samples to become cold, and then place in water at a temperature of about 120 degrees F. before taking a reading. About 120 degrees F. is a very suitable temperature at which to take readings.

MEANING OF THE READING. Cream that gives a reading of 100 in the oil test will make one pound of butter for every inch of such cream in a cream pail 12 inches in diameter; cream testing 120 will make 1.2 pounds of butter per inch. To find the pounds of butter, multiply the number of inches by the reading and divide by 100.

THEORY OF THE TEST. A standard or creamery inch is one inch of cream (in a 12 inch pail) testing 100.

One inch, therefore, contains 113 cubic inches. One pound of butter contains about 25 cubic inches of butter oil, which is 22 per cent. of 113. Therefore, any cream which will yield 22 per cent. of its volume in butter oil will yield one pound of butter per inch. Tubes filled to the depth of five inches with cream which gives 1.1 inches of butter oil will yield one pound per inch, as 1.1 is 22 per cent. of 5.

A reading of 100 by the oil test would, therefore, theoretically, be equal to 22 per cent. of fat.

SKIM-MILK, BUTTERMILK AND WHEY.

As the percentage of fat in skim-milk buttermilk and whey is usually very small, the best method of testing these is by the use of the double neck test bottle. There are several different kinds of double-neck bottles in use, but those having the two necks joined together, and extending perpendicularly from the center of the bottle, seem to give best results, as they are much stronger and less liable to give burnt readings.

17.6 c.c. of skim-milk, buttermilk, or whey are taken into a test bottle and the test is completed in the usual way. Very fine readings can be taken, as a small amount of fat can be made to extend over a long space in the small neck. Considerable difference of opinion exists amongst authorities on milk testing with regard to the correct method of reading the double-neck bottle; but chemical analyses indicate that the addition of .05 to the Babcock reading would give the most accurate results.

The fat column in the small neck can be raised or lowered slightly to assist in getting accurate readings by pressing the finger gently on the top of either neck.

It is recommended to use a little more than 17.5 c.c. of acid in testing skim-milk; also to turn the tester a few revolutions faster per minute, and whirl for a longer time. Whey does not contain such a large per centage of solids as milk, and usually about 10 c.c. of acid are sufficient to cause a clean separation of fat.

The whole-milk bottle is not suitable for testing skim-milk, butter-milk, or whey, as it is almost impossible to make an accurate reading of such a small amount of fat when it is extended over a broad surface. However, the milk test bottle might be used to indicate whether or not much fat is being lost.

Testing Cheese for Fat.

1. Obtain a representative sample by cutting a slice from the outside to the centre of the cheese, or by taking plugs from different parts.
2. Cut the sample as finely as possible and weigh 5 grams into a milk-test bottle or 9 grams into a cream bottle.
3. Add sufficient warm water at a temperature of 120 degrees F., to make about 18 grams in the bottle.
4. Keep the sample warm and mix occasionally, until the cheese and water form an emulsion.
5. Measure 17.5 c.c. of acid. Add a little at a time and continue mixing until the curd is all dissolved.
6. Sometimes, slightly more than 17.5 c.c. of acid are required for a test. Sufficient has been used when the mixture turns a dark chocolate color.
7. The hot water may be added before whirling in the tester.
8. To find the per cent. fat., multiply the reading by 18 and divide by the number of grams used. For example: 5 grams give a reading of 8.5, the percentage of fat in the cheese $= \frac{8.5 \times 18}{5} = 30.6$.

The Lactometer and the Detection of Adulterations in Milk.

The lactometer is an instrument used to determine the *specific gravity* of milk. The term specific gravity means the weight of a certain volume of any substance compared with the weight of the same volume of pure water at a standard temperature.

There are different kinds of lactometers, but the Quevenne is the most suitable for milk-testing. By means of it we can determine rapidly the relative weights of milk and water.

The Quevenne lactometer is standardized at a temperature of 60° F.; if the milk to be tested varies from this, corrections may be made according to the following rule: For each degree in temperature *above* 60, add .1 ($\frac{1}{10}$) to the lactometer reading, and for each degree *below* 60, subtract .1 ($\frac{1}{10}$) from the lactometer reading. This rule is practically correct, if the temperature is kept within a range of from 50° to 70° F. It can be readily recalled when we remember that the density of milk *increases* with a *reduction* of temperature and decreases with a rise in temperature. The scale on the lactometer is graduated from 15 to 40, and indicates a specific gravity of from 1.015 to 1.040.

Note. The correct lactometer reading (or L.R. at 60° F.) + 1,000 ÷ 1,000 indicates the specific gravity.

The lactometer reading of whole milk usually ranges from 29 to 34, although it may fall as low as 27, or go as high as 35. The lactometer reading of skim-milk varies from 33 to 38. The reading should be taken soon after placing the instrument in the milk; if cream be allowed to rise on the milk, the reading will be too high, as the bulb of the lactometer will be floating in partially skimmed milk. Milk should be cooled and allowed to stand some time (one to three hours) after being milked before taking the lactometer reading. Otherwise the readings will be too low.

The composition of milk is about as follows:

Fat	3.6	per cent.		
Casein	2.5	"	8.9	solids not fat.
Albumen	.7	"		
Sugar	5.0	"		
Ash	.7	"		
Water	87.5	"		
	100.00			

It is the solids not fat in milk that cause its specific gravity to exceed that of water and consequently its lactometer reading to be greater, as the percentage of solids not fat increase.

A number of different rules have been prepared for the calculation of milk solids when the lactometer reading and the percentage of fat are known. Of these, the following has been quite generally adopted. To find the per cent. of solids not fat in a sample of milk, add two-tenths of the per cent. of fat to one-quarter of the lactometer reading; and to find the per cent. of total solids add one and two-tenths times the per cent of fat to one-quarter of the lactometer reading.

The following rule also is sufficiently accurate for practical purposes and has simplicity to recommend it. To determine the per cent. solids not fat, add the lactometer reading at 60 degrees and the per cent. of fat together and divide by four (4). Example: L.R. = 32, Fat 4% $\frac{32+4}{4}$ = 9% S.N.F.

Adulterations.

By the use of the Babcock test in conjunction with the lactometer, we are enabled to determine both the nature and the extent of an adulteration.

The percentage of fat in milk varies and can also be influenced by skimming, therefore the lactometer alone is of little use in determining adulterations. The solids-not-fat are fairly constant and thus afford a means of detecting adulterations.

Watered Milk. To find the per cent. of pure milk in a watered sample, multiply the per cent. S.N.F. in it by 100 and divide by the per cent. S.N.F. in the pure milk. This subtracted from 100 will give the per cent. of extraneous water in the watered sample. To take an example:

The per cent. of solids-not-fat in a sample of pure milk is 9; but after being watered the per cent. of solids-not-fat in the watered sample is 7.2. Find the per cent. of pure milk in the watered sample.

Per cent. of pure milk in watered sample, $\frac{7.2+100}{9}$ = 80 per cent.

Per cent. of extraneous water = 100 − 80 = 20 per cent.

Note. When a sample of pure milk cannot be obtained, use 8.5 in the early part of the season, and 9 in the later part, for the per cent. S.N.F. in pure milk.

The per cent. of *water added to the pure milk* may be estimated as follows: The per cent. S.N.F. in a pure sample, multiplied by 100, divided by the per cent. S.N.F. in the watered sample, less 100. The above may be worked out as follows:

$\frac{9 \times 100-100}{7.2}$ equals 25 per cent. water added, or

To 80 lbs. pure milk, 20 lbs. water were added, then to
1 lb. pure milk, $\frac{20}{80}$ lbs. water were added.
To 100 lbs. pure milk, $\frac{20}{80} \times \frac{100}{1}$ lbs. water were added,
equals 25 lbs. water added to 100 lbs. milk, or 25 per cent.

Notes.

1. Have the temperature of the milk uniform throughout, and as near 60° F. as possible when taking a lactometer reading.

2. Always mix the milk well before taking a lactometer reading.

3. Do not have milk on the upper part of the stem of the lactometer when reading, as this weighs the lactometer down and causes the reading to be too low.

4. Have the lactometer free from the side of the vessel, and perfectly still when taking a reading.

5. A high lactometer reading accompanied by a low per cent. of fat indicates skimming, *e.g.*, L. equals 34, F. equals 2.4.

6. A low lactometer reading accompanied by a low per cent. of fat is indicative of watering, *e.g.*, L. equals 22, F. equals 2.4.

7. A normal lactometer reading with a very low per cent. of fat indicates both watering and skimming. Also, if the lactometer reading of a sample of milk be low, yet not so low accordingly as the per cent. of fat, this is indicative of both watering and skimming. Both of the following indicate watering and skimming; L. equals 31, F. equals 2; L. equals 26, F. equals 1.8.

The Hart Casein Tester.

This is a simple test for determining the casein content of milk. The test has been introduced by Dr. E. B. Hart, of the Wisconsin Experiment Station, and its development and use is likely to prove of considerable value to the cheese branch of the dairy industry. No more ability or skill is required to make a casein test than is necessary in making a Babcock test for fat and the test can be completed in a few minutes.

The principles involved in this method as outlined by Dr. Hart are:

1. The construction of a special bottle with a graduated scale whereby the percentage of casein can be read when a definite volume of milk is used for a test.

2. The precipitation of the casein by dilute acetic acid.

3. The agitation of the precipitate with chloroform to dissolve the fat.

4. The application of a definite centrifugal force in order to mass the casein into a pellet.

5. Reading the per cent. of casein.

The details connected with a determination of casein are briefly as follows:—

1. Measure 2 c.c. of chloroform into the test bottle.

2. Add to this 20 c.c. of a .25 per cent. solution of acetic acid at a temperature of 70 degrees F.

3. Measure accurately 5 c.c. of sweet milk at a temperature of 70 degrees.

4. Place the thumb over the opening of the bottle, turn the bottle over by rotating the hand and shake the contents vigorously for fifteen to twenty seconds.

5. Place the tests in the centrifuge and whirl for 7½ to 8 minutes at a speed of 2,000 revolutions per minute for a 15 inch diameter machine.

6. After whirling, allow the tests to remain for ten minutes to allow the pellets to relax slightly, before taking the readings.

Notes on the Casein Test.

1. Use only the best quality of chloroform.

2. See that the temperature of the milk and acid are as nearly 70 degrees F. as possible.

3. Use a watch to take the time in shaking the test and do not mix more than 20 seconds.

4. Make sure that the speed of the tester is correct. It is advisat to use a metronome for this purpose when the whirling is done by hanc power.

5. Curdled samples of milk cannot be tested for casein.

6. Composite samples preserved with bichromate of potash for fron three to four days can be tested more or less satisfactorily, but sample containing other preservative and those with bichromate of potash whicl are kept for a longer time, do not appear to give reliable results. There fore, the test will need to be improved in this particular before it wi be suitable for factory conditions.

7. A comparison of the results of the Casein Test with those c chemical analysis, conducted at the Ontario Agricultural College durin the summer of 1908, shows the casein test to be quite accurate. Th average percentage of fat in 22 samples of sweet milk was 3.72. Th average percentage of casein in these samples as determined by the Ha method was 2.395, and by chemical analysis 2.415—a dlfference of on .02 per cent.

CHEESE-MAKING.

By Alex. McKay and C. H. Ralph.

Care of Milk.

Milk is the raw material from which the cheese or butter mak manufactures a valuable and concentrated food product. It is a peris able article and very susceptible to contamination; it should be suppli only from cows in good health, furnished with an abundance of who some food, pure water and having free access to salt at all times. Co giving milk should not be allowed to eat turnips, rape, foul, wee musty or decayed food, or anything that will impart an objectiona flavor to the products, as injury to the milk from any cause results i positive loss to the producer. It is very important that there be no d or bad odors in the stable at the time of milking. Before commencing milk, the udder and flank of the cow should be brushed or wiped with damp cloth to remove loose hairs or fine particles of dust or filth these are usually laden with undesirable germs. The milker should clean, kind and sympathetic and free from any contagious diseases.

only tin pails, being careful to see that all seams are well soldered so as to facilitate cleaning. Wash and scald thoroughly all utensils used in handling milk. First rinse them with water, then wash well with water at a temperature of about 120° F., and then scald or steam. Do not wipe with a cloth, but place to drain where they will get plenty of sunlight and pure air. Use a brush in preference to a cloth for washing tinware. If these few simple rules are followed we should be able to produce milk in a fairly clean condition, and clean milk means milk with a comparatively low bacterial content. But, be as careful as we may, we find that we are unable to produce milk which is free from germ life, so the next step is to employ means of keeping this life in check. The only practicable way is to reduce the temperature so as to make unfavorable conditions for its development. The simplest and most effective way of doing this is to provide a tank large enough to contain cans that will hold at least two milkings. Before commencing to milk, this tank should be filled with cold water into which the empty cans are placed, and as each cow is milked the milk should be strain. . into the cans. By handling the milk in this way the cooling is practically done as soon as the milking is completed. The milk should be covered up as soon as possible to prevent contamination from the surrounding atmosphere, and sufficient cold water added to the tank to reduce the temperature of the milk to at least 65° F. and for keeping it at that temperature over night. If keeping milk over Sunday cool to 55° F. and hold at that temperature. This tank may be so arranged that all the water pumped for watering stock may be run through it before it reaches the stock-watering trough thereby saving the labor of pumping this extra amount of water. Ice is almost a necessity for keeping Saturday night's or Sunday's milk. The warm milk should in no case be mixed with that already cooled. Where possible send to the factory in separate cans. If this is not done, the morning's milk should be cooled before mixing with the evening's milk. The whole secret of keeping milk in good condition is to be found in cleanliness and low temperature and under no conditions should chemicals be used for preserving milk.

The Curd Test.

Provide tin or porcelain cups sufficient in number to test the milk of at least the number of patrons supplying milk to the factory. A convonient size is two inches in diameter and three inches deep. Each cup should be plainly numbered. Provide a box of tin or galvanized iron with a neat fitting cover, large enough to hold the cups. For convenience; this box should have both water and steam connections. In taking the samples for making the tests place the number of the cup opposite the patron's name from whose milk the sample was taken. Place them in the box already described, adding water to the depth of the milk in the cups. Raise the temperature of the samples to 86° F.

Set the samples by using one dram of a dilute rennet solution made a strength of one part rennet to twenty-four of water. Stir in the re net with a knife having a solid metal handle being careful to sterili the knife between the stirring of each sample so as not to contamina one sample with flavors from another. When firm enough, cut with t same knife using the same precautions to sterilize between the cutti of each sample. Raise the temperature gradually to 98° F. and han the sample as nearly like the milk and curd in the vat as possible. looking for "bitter" flavors and the milk is in a sweet condition, it m be advisable to add a few drops of culture to the samples before settin as this flavor is rarely detected without acid. This test is particula valuable in detecting flavors which develop in the curd but cannot detected in the milk. It is also valuable for convincing patrons who m doubt that the flavor of their milk is as bad as represented by the chee maker, as it is possible to have them see and smell the curd made fr each patron's milk as delivered at the factory.

The Preparation and use of a Culture.

A culture for cheese-making is now looked upon as a necessi therefore the need of full and exact knowledge of the proper method preparing and using cultures. First provide suitable cans of good t which are well soldered, and about twenty inches deep and eight inches diameter. It is better to have a duplicate set, as this gives a better opp tunity for keeping them in good condition. When the milk is in sm lots it can be more readily heated and cooled than if kept in larger qua tities. For convenience in heating and cooling, a special box lar enough to hold the cans containing the culture for one day's use shou be provided. This should have cold water and steam connections. T cans may be left in this box so as not to be influenced by the outsi temperature. In starting a culture it is advisable to use a commerc or pure culture. These may be obtained from the Bacteriologi department of the College or from any of the dairy supply houses.

Special temperatures are required for the first propagation of the Commercial Cultures.

Empty the mother culture into a quart of pasteurized milk cooled a temperature of 75° to 80° F. and allow to stand until coagulation tak place.

It is advisable to propagate commercial cultures at least two or thr times before using them.

Better results may be obtained by using the milk from the sa source each day, as we are more likely to get a uniform flavor and acidi from day to day by so doing.

After selecting the milk for culture, heat to a temperature of 18 F., then cool rapidly to a temperature of 60° F. To this milk add enou of the culture already prepared to develop an acidity of not more th .7 at the time the culture is required for use.

If the culture is to be kept more than 24 hours it is advisable to set accordingly by using a lower temperature and using less of the mother culture. Aim to produce the same acidity from day to day.

Before using, remove one or two inches of the milk from the surface of the can, as this is more liable to contamination from outside sources. Break up the remainder by stirring well in the can.

At this time take out a small quantity to propagate the culture for the next day. A glass sealer should be provided for this purpose.

The indications of a good culture are as follows: The whole mass is firmly coagulated, no liquid is found on top, it has a mild acid flavor, pleasant to the taste and smell.

A culture may be used to advantage when the milk is maturing slowly or when it is tainted or gassy; one half of one per cent. is the greatest quantity that should be used, and this only when the milk is known to be in a sweet condition.

Milk should be set slightly sweeter when culture is used.

With gassy milk its use is especially beneficial.

Culture with bad flavor or with too high an acidity should not be used.

A wire handled dipper is preferable for stirring milk for cultures.

All utensils must be thoroughly cleaned and sterilized after each time of using.

Co-operation between Maker and Patrons.

That there has been a marked improvement in the milk delivered to the factory for cheese-making is quite apparent from the improved quality of the cheese produced, but there is still room for more co-operation between the maker and his patrons; first by the maker keeping his factory and its surroundings in a better condition as to cleanliness and sanitation thereby making it a more attractive place, which the farmer can look at with pride instead of disgust; secondly by returning the bye-product, whey, in better condition. This latter can be accomplished only by the pasteurization of the whey and the proper cleaning of the tank. It is useless heating the whey unless it is all removed each day and the tank thoroughly washed.

We cannot advise any particular method of heating as this must be varied according to the conditions at the factory, but the heating should commence as soon as the first whey is run into the tank. This should be done for two reasons:—first, to take advantage of the temperature the whey is already at; and second, to prevent the further development of acidity.

The whey should be heated to at least 150° F. in order to obtain the best results. Care should be taken not to exceed 160° F. as heating above this temperature will cause the whey to become slimy.

Milk for Cheese-making.

To obtain the best results, :s necessary to have the milk deliv at the factory clean, sweet, of good flavor, and we would stro advise cheese-makers to re ail milk which is not in a fit condition the manufacture of fir.- ass cheese. The maker who receives other than of this kind is acting dishonestly towards his better pat who are furnishing a first-class quality of milk.

Testing for Ripeness.

This may be done with the acidimeter or the rennet test;— results may be obtained by the use of either test.

No efinite degree of acidity can be given as a rule to go by. proper rule is to set at the acidity that will give the best results lat the process or will allow the curd to remain in the whey until prop "firmed," which will usually take from 2½ to 3 hours from the tim setting to the time of dipping the curd with the right amount of developed. This will be found to be slightly less than the acidity o. milk at setting as shown by the acidimeter.

If using the acidimeter and making colored cheese, the ac should be ascertained before adding the color to the milk, as it is difficult to detect the neutral point with the color added.

Another point to note carefully when using the acidimeter is the e of the presence of rain water in the milk. When the milk is dilu less milk is taken in the sample, and will show a less degree of ac than is contained in the milk to the extent of the percentage of dilu thereby misleading the operator.

If color is used it should be thoroughly mixed with the milk be the rennet is added, using one to one-and-one-half ounces of colo thousand pounds of milk. Add color in amount as the market require.

When making early spring cheese it is usually necessary to r a quick-curing cheese in order to reach an early market.

To make this class of cheese it is advisable to use a large qua of rennet and a small quantity of salt, as this hastens the ripening cess and overcomes the tendency of milk at this time to make a dry, cheese due to the low per cent. of butter-fat in the milk and the tend of this class of milk to develop acid rapidly. Heat the milk to 86 and stir slowly while heating. When the desired acidity is obtai add the rennet, using four to five ounces per thousand pounds of mil sufficient to coagulate the milk firm enough for cutting in fifteen or tw minutes.

Commence to cut early, using the horizontal knife first, cu slowly lengthwise of the vat.

Then with the perpendicular knife cut crosswise and afterwards lengthwise of the vat. We would advise strongly the use of the ¼-inch wire knife as this leaves the curd in better condition for the moisture to escape with the least possible loss in the whey, as the cubes are smaller, and more uniform and are not so easily broken as the larger ones.

Commence stirring at once with agitators or the McPherson rake. Stir carefully for ten or fifteen minutes, then see that the curd is free from the sides of the vat before applying heat. This loosening of the curd from the sides of the vat can be done at this stage with less loss than if done immediately after cutting, as the curd has become somewhat firmer and does not break up so readily. Curds should be handled carefully and in such a manner that the cubes will not be broken, nor allowed to mat together. Rough handling or breaking of the curd causes a serious loss to both quality and quantity.

Heat to a temperature of 98° F. in 1½ hours from the time of setting. We formerly advised taking the agitators out soon after heating was completed with the idea that we were able to firm the curd better with the small rake, but since the introduction of the ¼-inch knife, we have found that we get better results, with less labor, by allowing the agitators to run for a longer time.

We still advise removing part of the whey so as to guard against the danger of a rapid development of acid at the time of dipping, as the curd can be removed more quickly with a small amount of whey. This can be accomplished by removing one of the paddles until the whey is reduced; then replace the paddle and allow the agitators to do the stirring, as they do it more gently and with less danger of harming the curd. There is nothing gained by harsh treatment of the curd, as such treatment will allow the moisture to escape only in so far as it breaks the curd. It is much better to allow the curd to firm by natural agencies, namely, acid development, heat, and rennet action. Acid usually develops very rapidly in the spring, therefore it is necessary to be prepared to remove the whey quickly when sufficient acid has been developed, which may be from .165 to .19 per cent. as shown by the acidimeter. Curds at this stage should be nice and firm (not hard or harsh), and be kept in a loose, open condition in the sink a sufficient length of time to allow the free moisture to escape, as the moisture can be removed at this stage with very much less loss than it can later on. Leave the curd about 8 inches deep in the curd sink. When it is well matted, cut into strips 6 to 8 inches wide and turn upside down, and in about fifteen minutes turn again, piling two deep. Continue turning every fifteen minutes until the curd is ready to mill. When the curd is well matted and flaky and shows .7 to .8 per cent. of acid it should be milled, and well stirred afterwards. The stirring should be repeated often enough to prevent the curd matting until ready to salt. This will be when the curd has mellowed down nicely and shows 1 to 1.2 per cent. of acid. Stir and air the curd well before adding the salt, as this improves the texture and flavor of the cheese. Salt at the rate of $1\frac{1}{2}$ to 2 pounds of salt to lbs. of milk. It is important that the temperature of the curd dipping to milling should not go below 94° F. After milling, allo curd to cool gradually tc about 85° F. when ready to salt. Put to at a temperature of 82° to 84° F. Weigh the curd into the hoop, ti the press gradually and leave the cheese 45 minutes before taking dress. When dressing, use plenty of clean hot water and what are monly called "skirts." These cloths help to make a good rind c cheese, keep them clean, and cause the cheese to come out of the more readily. Turn all the cheese in the hoops every morning, and no cheese to be taken to the curing-room that do not present a neat appearance.

Summer Cheese.

In making summer cheese one ounce of color to one thousand p of milk is usually sufficient, but this may be varied according requirements of the market. Use from 3 to $3\frac{1}{2}$ ounces of rennet e per thousand pounds of milk, or sufficient to coagulate the mi cutting in 25 to 30 minutes. If this limit is exceeded we have too a loss in the whey. The cutting and firming of the curd is the sa given for spring cheese.

It may be necessary to raise the coo'-ing temperature slightly h as we may be dealing with milk of a different composition fron used in the spring. The acidity should be allowed to develop tc a point that is found from day to day to give the best results working of the curd later in the process, aiming to have the curc good body, well matted and in a flaky condition when ready to mi this time it should have an acidity of .7 to .8 in about two hours the time of dipping. The curd should be well stirred after milling if cut crosswise of the grain, the stirring may be done better anc much less labor. Curd should be well matured, stirred, aired thorc and cooled to a temperature of 85° F. before salting. Use from 2 pounds of salt on the curd from one thousand pounds of milk.

Fall Cheese.

When making fall cheese it is a mistake to use too much cult to ripen the milk too much, giving the cheese the appearance of been made from over-ripe milk, which is very objectionable i cheese; rather use a smaller amount of culture, not more tha quarter of one per cent., and add it to the milk when there is a quantity in the vat, as it starts a gradual fermentation which con all through the process. Always heat the milk to at least the te ture of the culture before the culture is added. Set slightly sweete usual, as we are able to work closer to the "sweet line" all th through, owing to the fact that we receive the milk in a better con

Gassy Milk.

The presence of gas in the milk retards the development of acid, and as acid is necessary in the manufacture of cheese we should make the condition as favorable for its development as possible without injury to the body of the curd. To do this, use ¼ to ½ per cent. of good culture, as by so doing we introduce into the milk an abundance of the lactic acid bacteria which will, under favorable conditions, overcome the gas producing bacteria.

The next step is to ripen the milk slightly more than usual before setting. When cutting, aim to have the cubes as even in size as possible. Allow the acid to develop slightly farther before applying the heat, stir carefully, and heat slowly, aiming to have the curd in normal condition at dipping. Use the same temperature for cooking and the same acid for dipping as with a normal curd. A gassy curd does not require so much stirring as a normal curd, because the moisture leaves it more readily. Mill as soon as the curd is well matted and the acidity has developed to .8 to .85 per cent. About half way between milling and salting commence piling the curd. Allow it to stand 15 or 20 minutes then spread it out, stir and pile again. Continue to do this until the curd feels mellow. Give plenty of fresh air before salting. Use a normal amount of salt and put to press at a temperature of about 80° F., if possible.

Over-ripe Milk.

What is over-ripe milk? It is milk with one of the agents used in cheese-making out of proportion; or milk with the lactic acid developed in too great a degree in order to obtain the very best results in converting the milk into cheese. What are the agents used in separating the solids from the moisture or water content of the milk? They are rennet, heat, and acid development, together with the cutting of the curd to get it into a convenient condition for the escape of the moisture. The heat should not be applied until enough milk is in sight to fill the vat. Why? Because as we raise the temperature, we make more favorable conditions for the development of acid. Heat as quickly as possible to 82° or 83° F. and after testing for acidity set at this temperature. Why? Because, first, 82° is less favorable for acid development than 86° F., and the time for heating to 86° is saved; and what is more important, you are able to get the rennet in sooner and a larger quantity of it, thereby getting the acid under control more quickly; if not under control, it is difficult to get it to work in conjunction with the other agents which contract and expel moisture from the curd. In handling over-ripe milk we think it is always advisable to use more rennet—at least one ounce more, per thousand pounds of milk, for several reasons: first, that it may coagulate the milk more quickly; second, it gives a firmer curd more quickly, and renders the curd less liable to be broken when handling it, thereby saving to a great extent the great loss which usually is sustained from making over-ripe milk into cheese. It also helps to break down the caseous matter in the cheese, giving it a better texture. Commence cutting the curd early and cut rapidly so as to keep pace with the rapid firming of the curd. If this is not done the curd will get into a condition which makes it very hard to cut properly. Use the ¼-inch knife rather than cut the curd four times, as it leaves the curd more uniform and in better condition than when it is chopped finely. Heat quickly, and if necessary, raise the temperature two or three degrees higher than for normal milk.

Here is where a great many cheese-makers make a mistake, by stopping the stirring and running off part of the whey when the curd is quite soft; while the whey is running off, the curd is matting, then they go at it with the little rake and break it all up, thereby liberating a lot of the milk solids, giving them a high acid reaction in the whey, and the result is, they have a sweet curd and a sweet cheese. Just stop and think for a minute which is likely to do the more effectual work, you with a rake, or the acid development in conjunction with the heat and rennet action? The natural tendency for this kind of curd is to run together, so the best way is to keep it stirred in all the whey until it firms up a little. Hard raking does not firm the curd, except in so far as it breaks the cubes. If agitators are used, the curd can be kept apart and the whey lowered quite soon enough without resorting to this rough handling. One can readily see that if the whey be lowered quite close to the curd while it is in a soft condition that it will be quite difficult to keep it from matting; and while you are keeping it apart with a small rake, you are breaking it up, causing a loss, and also causing rough texture in the cheese. It is always advisable to have the whey run down shortly before the dipping point is reached to avoid being caught with too much acid. When the curd is in a soft condition it is advisable to dip with slightly less acid and to keep it in a loose open condition in the curd sinks until all the surplus moisture is drained from the curd. If the curd is still a little weak, mill slightly earlier than usual. If not, treat as a normal curd. Mature the curd well before salting.

Ripening or Curing Cheese.

The ripening or curing of cheese is one of the most important points in the process, as no matter how well a cheese is made, if the curing is not properly done the quality cannot he the finest. Therefore it is necessary to provide a room where the temperature can be controlled at all times. It is important some means be provided to control the moisture in the room so as to prevent the growth of mold which occurs where too much moisture is present. An excessive shrinkage takes place if there is too little moisture in the room. Proper temperature and moisture may be obtained by building an ice chamber in connection with the curing room and having a free circulation of air over the ice. This cools the air and causes a deposit of the moisture on the ice. In putting the cheese in the curing-room, place them straight and even on the shelves and turn them every morning except Sunday. Keep the room well swept and looking clean and tidy. Use good strong cheese-boxes, have them dry, and of such a size as to fit the cheese nicely.

Weigh carefully, and stencil the weights neatly on the boxes. Load the cheese on clean wagons, and provide canvas covers to protect them from rain and heat while on the way to the station.

SEPARATORS AND THE SEPARATION OF MILK.

R. W. Stratton.

In dealing with this subject, general directions only can be given. Space will not permit giving detailed directions for the different makes of separators. A book of directions is furnished with each new separator sent out, and the specific instructions contained therein should be strictly followed unless you know of something better, which you have proven to be so by practice, not theory. Separators may be divided into two classes—the steam or turbine, and the belt separator.

Turbine Separator.

In setting it up, a solid foundation should be provided. It does not matter how solid a wooden floor is, it will vibrate more or less from the running of a churn or other machinery. With a stone, brick, or cement foundation a separator is independent of any vibration from other machinery and will run much better, and for a longer time. If setting the separator on a cement floor probably the most permanent method of fastening it down is as follows: First m[illegible] exact location for the holes. With a square draw a line through t[illegible]e where the holes should be, then drill the cement to the desired de[illegible] to 7 inches). To do this a common cold-chisel may be used providing the bit is wide enough for the body of the chisel, though a pointed chisel for this purpose is preferable. The dust may be removed from the hole while drilling by a small bellows, or blowing through a small rubber or glass tube. Have the bolt head somewhat rounded and place the bolt in the hole with the threaded end up, making sure to have it perpendicular and in line, and the necessary height above the floor, then pour melted lead in the hole around the bolt. If a method is desired whereby the bolts can be removed from the floor, drill hole[illegible]s above, plug with wood, bore with a bit at least ¼ of an inch smaller than the lag screws used and fasten down with lag screws. Another method whereby separators may be changed without drilling new holes is to drill the holes in the cement nearer to the centre than any separator will be likely to require, fasten a 2 inch by 4 inch piece of wood to the floor and bolt the separator to it.

In putting down a cement floor to be used for separators, it is well to have a pier built about two inches higher than the floor and about the size of the separator base. This tends to prevent dirt from lodging under the separator when scrubbing the floor.

If a stone or brick pier (bricks are neatest) has to be built, the nature of the soil will determine the depth to excavate, and the size of the frame or base of the separator will determine the length and breadth. The exact specifications are given in the book of instructions furnished with the separator.

Place the separator in position, being careful to have the separator frame perfectly level every way. Determine this by placing the spirit level upon the planed top of the frame.

The pipe to convey the steam to the separator may be the same size as the fittings of the separator, provided the distance from the boiler is not over twenty-five feet. When the distance is more than this, the size of the pipe should be one-quarter inch larger for every twenty-five feet of piping, to overcome the effects of friction and condensation of steam.

Exhaust pipes are usually made of galvanized iron, and should never be reduced in size at any point smaller than the outlet on the separator, and should be put up as straight as possible to convey the steam from the separator. It may be carried out at the side of the building. In either case, a piece extending upwards should be put up to cause a draught. Placing the exhaust pipe out through the roof is preferable when the surroundings will permit it. Have the pipe long enough to be higher than any part of the roof, in order that the draught may not be interfered with by change of wind. A drain pipe must be provided in any case at the lowest point on the pipe, to allow water to escape readily. If this should be in the making-room, a trap to prevent annoyance from escaping steam may be put on the drain pipe.

Belt Separator.

The directions given for the foundation of a turbine will apply to this. First place the intermediate or jack in position. This should be at an angle of at least 45 degrees in front or behind the driving shaft. Level it by placing a level perpendicularly on the planed rim of the separator pulley of the intermediate. Be sure to have the shaft of the intermediate parallel with the driving shaft.

The pulley provided for the driving shaft should be of sufficient width to allow the belt to be shifted from the tight to the loose pulley of the intermediate, and of the proper size to give the exact speed required.

Next place the frame of the separator in position. Level it in all directions by placing the level on the planed top of the frame. Line the separator with the intermediate, so that looking from the intermediate the right hand edge of the small pulley of the separator is in line with the right side of the large pulley of the intermediate, having the vertical centre line of the spindle level with the underside of the intermediate pulley.

The separator bowl should revolve to the right, or with the sun, the same as the hands on a watch. The intermediate should run from the separator, so as to place the draw belt on the upper side of the intermediate pulley, with a view to remove some of the weight of the bowl from the foot-step bearing when the separator is running. If an idler or belt-tightener is used, always place it on the "return" side of the belt—*never* on the "draw" side.

Do not use the belt tightener any more than is absolutely necessary, as it shortens the life of the belt very materially. It would be an improvement if the intermediate could be adjusted to suit the stretching of the separator belt.

Wipe all the bearings well with a cloth, to remove all grit and dust. A little coal oil upon the cloth will be found helpful where any coating of dried oil is met with. See that all oil tubes are clear and free to feed oil. Wash the bowl and all parts that the milk comes in contact with. If everything has been properly attended to as directed it is ready to start. If a turbine, turn on steam very gradually to allow the water to get out of the steam pipes, when the required amount of steam may be turned on. When speed has been reached, start the feed of milk.

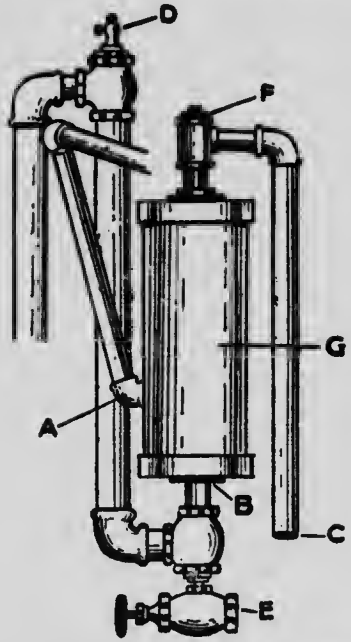
If a belt machine, and only one in use, put all belts in position, and start the engine slowly, allowing the speed to increase gradually. If more than one separator is used, it is better to start the engine at full speed, then shift the belt from the loose to the tight pulley after starting the separator by pulling the belt with the hand until the bowl has attained some speed. Then shift the belt from the loose pulley part way on to the tight pulley, moving it at intervals until on full. From 6 to 10 minutes should be required to get up speed. Full speed is ascertained by means of speed indicators. A 100 notch wheel should be counted for one minute, and a 50 notch wheel for one-half a minute, in order to know the number of hundred revolutions the bowl is revolving per minute. After speed has been reached, the milk should be turned on full speed, until both cream and skim-milk flow from the respective spouts; then it should be closed off until the cream is of the desired thickness. The cream should be the guide in operating the separator.

The cream left in the bowl when all the whole milk has been put through should be forced out with warm water. From one to two pails will be needed for this purpose. Shut off the feed-tap for a few seconds when about half the quantity has gone through; then turn it on again, allowing the remainder to complete the operation. Pure warm water is preferable to skim-milk, as it is nearer the specific gravity of the cream, and consequently displaces it more readily.

Allow the bowl to stop of its own accord after the power has been removed; never apply any brake or friction to the intermediate. Remove the solid matter found at the extreme outside of the bowl and burn it at once. Clean out all milk tubes with the spiral provided; wash with tepid water thoroughly; scald with steam or boiling water; then place on a draining rack where the bowl and its parts may dry. Never close the bowl when wet inside, as it will cause it to rust. Leave it open when not in use so it will be thoroughly dry.

In ordering the parts for the separator always specify exactly what is wanted by the use of the proper name and number of the same. This can be found by consulting the book of instructions furnished with all machines. A duplicate set of the delicate or wearing parts of any machine should be kept on hand for emergencies.

Milk fresh and warm from the cow is in the best possible condition for a perfect separation. The difference in specific gravity between the



SKIM-MILK OR WHEY PASTEURIZER USING EXHAUST STEAM.

A. Milk inlet 1¼" pipe. B. Exhaust steam inlet 2" pipe. C. Overflow 2". D. Small valve on exhaust steam pipe to prevent suction of skim-milk back into steam pipe. E. Valve to drain heater F. Plug which may be removed in order to see if heater is filling with material from skim-milk. G. Heater 6" diameter, 18" long with caps screwed on each end.

fat and other portions of the milk is then greatest, and it is also more fluid, as there is no development of lactic acid, nor chemical changes due to its exposure to the air. At the creamery, it is not met with in this favorable condition; consequently it is necessary to produce artificially as many of the favorable conditions as possible to get the best results. When milk is received at a temperature below 85° it should be heated to from 90 to 100°

A tempering vat should be elevated at a suitable height to allow the milk to flow into the separator; and it should contain enough milk to employ the separator for at least four minutes. If large bodies of milk are heated to the desired temperature in a vat before separating, acid develops too rapidly and clogging of the separator bowl is likely to follow. Should any accident happen whereby the separator is stopped, the milk would likely develop acid enough to thicken, when it could not be separated.

While it is doubtless true that better butter can be made by pasteurizing the whole milk before separating, still the improvement is not enough to compensate for the extra labor required in cleaning the separator and utensils. There is also the fact that the separator bowl will need to be retinned often if separating pasteurized milk.

The plan followed at the Dairy department at the present time is to heat the milk to about 95° F. before separating. The cream is delivered from the separator into the pasteurizer and heated to 180° to 185° F. The skim-milk is elevated by a pump and just before entering the tank it passes through a heater in which exhaust steam from the engine is used for pasteurizing the skim-milk. The cut will show how this heater may be made. A union should be put in the steam pipe somewhere near the heater, as the heater will need to be taken apart at intervals to be cleaned. This can best be done by burning in the furnace. The amount of milk, and the temperature to which it is heated will determine how often it should be cleaned. Usually it will run from six to eight weeks without requiring to be cleaned.

A great saving in fuel can be made by utilizing the exhaust steam from the engine. At the Dairy department the pipes are so arranged that the exhaust steam can be used for heating the whole milk before separating, heating water, pasteurizing the skim-milk, and heating the building.

Two other labor and trouble saving devices are in use at the dairy which are worthy of special mention. One is a skim-milk weigher which after several years' use we would find it very difficult to get along without. The other is an Ideal hoist for elevating milk at the intake. Having the driveway graded so that no lifting of the can is required is the best plan, but where this cannot be accomplished, the Ideal hoist would seem to be a very satisfactory means of elevating the milk.

Pulleys and Belting. The following rules for finding the size of pulleys and the required length of belting will be found useful in fitting up a creamery or in placing additional machinery.

To find the diameter of a driven pulley, multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions the driven pulley should go. The result will be the diameter of the driven pulley.

Example. Diameter of pulley on the engine, 40 inches; speed of engine, 160 revolutions; speed of main shaft, 200 revolutions: $40 \times 160 \div 200 = 32$, which is the diameter in inches required for the driven pulley.

To find the required size of a driving pulley, multiply the diameter of the driven pulley by the number of revolutions it should make, and divide the product by the revolutions of the driver.

Example. Diameter of the pulley on intermediate is 4 inches, which is required to run 900 revolutions per minute; revolutions of shaft, 200: $4 \times 900 \div 200 = 18$, which is the diameter in inches of the pulley required to drive the intermediate at proper speed.

To find the length of belt for any two pulleys, add the diameter of the two pulleys together, divide this sum by 2, and multiply the quotient by $3\frac{1}{4}$. Add the product to twice the distance between the centres of shafting, and the result will be the required length of belt.

Example. Two pulleys are 8 and 24 inches in diameter, and 8 feet is the distance between the centres of the shafting. $8 + 24 = 32$, $32 \div 2 = 16$, $16 \times 3\frac{1}{4} = 52$ inches = 4 feet 4 inches, and 4 feet 4 inches + 16 (twice the distance between the centres of the shafting) = 20 feet 4 inches, which is the length of belt required.

CREAMERY BUTTER-MAKING.

By Fred Dean.

Under present conditions, a very large percentage of cream used for butter-making is separated from the milk on farms, and a certain amount of responsibility is thereby shifted from the butter-maker at the creamery to the creamery patron, in producing a first-class flavored butter. The patron not only produces milk, but also manufactures cream for the creamery. It is evident that no improvement can be made in the quality of creamery butter, until some improvement is made in the care of milk and cream on the farm, and in the condition of the cream when delivered at the creamery. Poor cream is not due wholly to the lack of knowledge on the part of the patron, but more often it is due to habitual carelessness, and to not realizing his responsibility in the production of a better quality of cream and butter.

The value of cream is lessened if it becomes tainted from any cause or source, and the greater the taint the less value it has as a food product. Thus, the best of care should be given it from, and at, the time it is milked until delivered at the creamery. "Cleanliness and cold" are the two essential points in having a pure milk and cream supply. This means clean stables, clean and pure food and water, clean cows, a clean milker, clean utensils for storing the milk and cream in, a pure atmosphere and plenty of cold water and ice.

Care of Utensils.

If the stables and cows are kept clean, and milking is done in a cleanly manner, it is also necessary to see that all pails are rinsed with cold, or luke warm water as soon as they are emptied. If the milk is allowed to dry on the pails it makes them much more difficult to wash, and bacteria will soon begin their evil work. The practice of a good many patrons is to use the same water for washing the numerous pails and separator devices, pouring it from one dish to another, or washing them all in one vessel, so that the last of the utensils washed are so laden with grease and bacteria, that it would be better if they had not been washed at all. Cloths are used a great deal for washing and wiping, but if patrons would get accustomed to the brush for washing, and scalding water to do the drying, a great improvement would be made in keeping the utensils in better condition. Nothing is more beneficial in keeping utensils sweet and clean than using a good washing powder in the washing water; then steam or scald, and expose for an hour or two in the sun, or near the stove in the winter.

Care of Separators and Cream.

Lack of care of the separator and in separating the milk, as well as not properly caring for the cream afterwards, is one of the patron's weaknesses. A good many of the separators are used and cared for much the same as the ordinary farm machinery, which soon leaves them unfit for the use they were intended for. They must be oiled regularly, and turned the full speed, or higher, as indicated on the handle, to do good work.

The cream should not have less than 25 lbs. of fat in every 100 lbs. of cream, and if it does, it is a sure indication of a poor make of separator, a careless operator, or an unintelligent farmer, as no up-to-date farmer of the present day has any excuse for depriving his stock of many pounds of valuable skim-milk, which he does when sending a thin cream. A cream testing between 30 and 35% fat will give the best satisfaction to the patron and buttermaker. After the patron has run the milk through the separator, he should see that the separator is washed at once, and after each skimming. If this is not done, it will be impossible to furnish good wholesome cream to the creamery. The separator should be placed in a dry, clean building, and have a box or half barrel handy for putting the vessel containing the cream in. Fill this box with cold water and ice, and leave the vessel there until the cream hauler calls for the cream. The cream should be given an occasional stir, and fresh or warm cream should not be added to the cooled cream until all is about the same temperature. If every patron would store one ton of ice for every cow that he milks, it would return him more interest on money invested than any other investment he could make. He should do this for his own interest, and the interests of his neighbor, the buttermaker, and for the reputation of our creamery butter. It is to the advantage of the patrons to see that cream is delivered to the creamery three times per week in hot weather, and that all fat so delivered is accounted for by the buttermaker.

Buildings and Equipment.

The finest quality of cream cannot be made into a high grade butter in surroundings which are unsanitary, and with machinery and utensils which are poorly adapted to the work and difficult to keep clean. Some of our creameries are poorly located, poorly built, not well lighted or ventilated, having walls, ceilings and floors not kept any too clean, and with drainage and water supply not so good as they might be. A large majority of them have been adding improvements and making additions—the old box churn and mason worker have been superseded by the latest combined churns; wooden floors have been torn out and replaced by cement. There are two essentials in all creameries, but which are found in few: first, a pasteurizing outfit, which if properly operated will mean a better and more uniform article, a better demand, and a higher price for our butter both on the home and foreign markets. The second requisite is good refrigerators. Some are not properly insulated, but the greatest trouble is getting the makers to keep them supplied with sufficient ice. Butter should not be stored in the majority of them over one week when kept at their best, yet often we find it stored two, three, and four weeks at temperatures from 45° to 60° F. This often spoils an article that was good when first made. Cleanliness of the surroundings and inside of a creamery are essential to thoroughness and a uniform quality of the buttermaker's work.

The Butter-Maker.

The art of making creamery butter has of late years been followed by too many men who have not had sufficient training and experience before starting to manage a creamery and make the butter. The makers who expect their duties to be inside the four walls of a creamery, in using a thermometer, a pair of scales, ladle, etc., according to a set of fixed rules, will never make a success for themselves or their creamery. Proprietors and co-operative companies owning creameries, will not make a success of their creameries, if they continue to engage incompetent makers because they are cheap, or make butter themselves without the necessary experience, knowledge and training. The best makers are quitting the business because they do not receive satisfactory wages, while the poorer and inefficient maker is receiving too much though working for half the wage offered to a good man. The unsuccessful and closed creameries to-day can be traced to bad management of inexperienced, lazy, careless and indifferent makers, poor haulers paid too much for what they did and the way they did it, and the acceptance of poor and bad cream. The buttermaker's efficiency is gauged by his ability to make good butter, his tact in handling cream haulers and patrons, and his ability to transact ordinary business, as well as having a knowledge of the technical side of the creamery business in general.

Receiving the Cream.

No set rule can be given in making a first-class article. If the cream has been received in good condition, and had good care while on the farm, a few given rules will help to guide the maker in some of the most important steps.

The first step is to see that all conductors, pipes, etc., that the cream comes in contact with are free from dirt, dried cream and yellow matter. Where the cream is received in individual cans (which gives the most satisfactory results) the maker should inspect, sample and weigh the cream himself and not leave it to the helper. Where cream is gathered in tanks and large cans, poorer results are obtained, as inspection, sampling and weighing is carried on by men who too often are not competent, and lose many dollars for companies, proprietors, and patrons by their carelessless. Where the hauler does the sampling, etc., it would be money well spent to engage the best man obtainable, irrespective of first cost. It is necessary that the maker should weigh and sample all cream from haulers who do the weighing and sampling at the farm in order to check weights and samples received from them. Cream should not be received that is over-ripe, or tainted from any cause, and makers should insist on having a cream testing between 28 and 30 per cent. fat.

Pasteurization.

Pasteurization is recognized as a useful agent in the production of a better and more healthful product, and will go a long way towards eradicating many of the evils now complained of. It should be the aim of every maker to pasteurize all cream as soon as received. This will check the development of further acid, destroy the more injurious germs, will give an even and uniform quality each day, as well as greatly improve the keeping quality of the butter. The temperature for heating should never be below 170° nor more than 185° F., and should be followed by cooling at once to between 50° and 60° F., by running the cream over a cooler. If the water cooler will not lower the temperature sufficiently, plenty of ice and water should be stored around the vat to hold it at the desired temperature. Give the cream frequent stirrings. If water is scarce, the same water can be used over and over again by letting the waste water run back into a tank under the cooler. Ice is put in this tank and the water forced through the cooler by a rotary pump. The adding of ice directly to the cream is a bad practice. It does not cool the fat globules uniformly, thins the cream, gives a tallowy flavor to the butter, and imparts an impure flavor from the ice. The ice should be run through a crusher, or be broken very small and placed in the jacket of the cream vat, before the cream arrives. This cools the vat and the cream cools more quickly with the use of less ice. The stirring should be done often in order to give the cream a uniform temperature and acidity. A good cream or skim-milk culture produces a more uniform and better quality of butter.

If sour cream is received in the morning it is a good practice to churn the same day in the late afternoon, providing the cream has been thoroughly cooled for five or six hours. This prevents the development of further acid and requires less ice and labor. Experiments have shown that the sooner the bulk of cream received at the creameries is manufactured into better the better is the quality of butter.

Churning and Washing.

The temperature and time of churning depend upon numerous conditions. The churn should not be filled much over half full, and the revolutions per minute of the Success and Simplex churns should be between 18 and 20. A good many of the churns run too slowly, taking a much longer time for churning than is necessary, and also compels churning at too high a temperature. A very high, or very low temperature is not conducive to good results. A temperature between 50° and 56° F., will give best results, and covers nearly all conditions of rich and poor cream, seasons of the year, period of lactation, etc.

The length of time for churning should not be more than 45 minutes, nor less than 30 minutes from the time the churn is started until the buttermilk is ready to be drawn off. If churning is done too quickly, the fat globules will likely be soft and over-churned, there will be an extra loss of fat in the buttermilk, and the butter will have poor body. On the other hand, if too long time be taken, power is wasted, there is an excessive loss of fat in the buttermilk, and the granules are small, round and hard to gather owing to the low temperature or thin cream. The butter should be left in good condition for working—not too hard, nor too soft, and the temperature of the washing water such that it will maintain these conditions. The buttermilk, when ready to be drawn off, should show a perfect separation of the fat globules from the milk serum; a small amount of froth is noticeable on top of the butter and the sight glasses are clean. The granules should be about the size of wheat—uniform and angular in shape, not round. If granules are hard to gather and round, draw off part of the milk serum (buttermilk), add some warm water and then finish churning. The water for washing should be as cold as possible at first to expel the milk serum that may adhere to the granules. Allow the first washing to pass through the churn without revolving, until it comes out clear, then close the tap and add enough water to float the butter. If there is plenty of good water and the cream is not of good flavor, this water should be let off, and water added again at a higher temperature, say, 2° to 4° higher than the buttermilk, and about the same in amount as there was cream. Revolve the churn with the fast gear, 12 to 20 revolutions, depending on the size of granules when the buttermilk was drawn off, but give sufficient revolutions to increase the size of the granules to that of corn or beans.

Salting and Working.

As soon as the water has drained, and while the butter is still moist, add a good brand of Butter Salt. (Do not use the common, coarse, cheap kind which adversely affects both grain and flavor.) Apply from 3 to 5 per cent. salt, depending on the market, and whether or not preservatives are used. Do not use over ½ of 1 per cent. preservative, and mix this thoroughly with the salt before applying it to the butter. The salt should be sifted on at the rate of about one-third of the total at one time. Give the churn one-half a revolution after each application. Next adjust the rolls and work at intervals, if the butter is very moist, to allow the escape of the surplus moisture. If the butter is in good condition it may be worked continuously for 12 to 16 revolutions, depending upon the temperature of the butter and that of the surroundings. It should be free from holes and surplus moisture, when cut and pressed with the ladle. The butter trier should be used every few days to see the condition of the previously worked butter. It is claimed by buyers that more objection is made to mottles in butter than to that which has been over-worked. The mottles are mostly caused by the variations and extreme changes in churning and washing temperatures; not expelling all of the milk serum from the butter; too cold and uneven distribution of salt; and insufficient working. The recent advent of several reliable methods for determining the percentage of moisture in butter, makes a new era in creamery butter-making. Their use enables the butter-maker to do more careful and exact work. Butter-fat is a comparatively expensive product, and the butter-maker of the future must regard the composition or per cent. of fat in the butter he sells with just as much concern as the per cent. of fat in the cream he receives. The moisture test now makes such information possible. With this information he can regulate his methods of work so as to prevent any unnecessary loss, and to secure the greatest possible over-run consistent with the best possible quality. The moisture test should be regarded as a necessity in every well regulated creamery, to help control the leaks and losses.

Printing and Packing.

The neatness, style and kind of a package, is a butter-maker's advertisement to the consumer. These packages, if in one pound prints or blocks, should be oblong, with the corners square, not rounded and flat, and free from holes and finger marks, weighing 16¼ ounces to the pound. There ought also to be a neat design on the wrapper with the name of the creamery stencilled on with a good kind of ink that will not rub off. Fold wrappers neatly and place in a strong 45 or 60 lb. box which has been paraffined and lined with parchment paper. If butter is packed in boxes or kiels, they should be new and clean and the boxes must be paraffined thoroughly on the inside. (Those having spots not paraffined mould very quickly.) The best possible parchment paper obtainable should be used for lining the boxes; preferably two sizes should be used 11.5 inches by 52 inches, and 12.5 inches by 52 inches. These when soaked for 24 hours in a strong brine and one ounce of formalin added will prevent mould. The butter should be packed solidly and be finished neatly on top with a straight edge or fluted roller, allowing ½ to 1 lb. of butter for shrinkage on each box. Weigh each box before and after filling with butter, rather than afterwards only, as carelessness here often gets the maker into trouble. If weights are short, the buyer generally takes off more than he is entitled to, and if giving too much over-weight the proprietor and patrons are both losers.

Storing and Shipping.

The butter as soon as made should be put into the creamery refrigerator, yet often we find it in the make room for several hours in a warm temperature before putting it away. It is also regrettable to find so many creameries without a refrigerator of any kind. If butter is kept one week, and not more than two weeks in the best of the refrigerators, this is quite long enough. If kept for a longer period before being sold it should be shipped to one of the large cold storages, which will store it at a rate of ⅛ to ¼ of a cent per lb., per month, and keep it at a temperature below where any bad flavors can develop or where deterioration can take place. When shipping, care should be given the butter in order to see that it is not roughly and carelessly handled with unclean hands or loaded into unclean wagons or cars; and also that it is not exposed at too high temperatures and to the direct rays of the sun.

Cleaning the Churn.

Start churn revolving on the slow gear, rinse out all particles of butter with three or four pails of warm water, let this drain out, and fill churn one-fourth full of boiling water with a small handful of Wyandotte added; wash off the rolls and place these in the churn and wash with the fast gear for one or two minutes. (If left much longer it will wear the holes in the end of the board for the rolls). Allow to drain, take out rolls and rinse out the scum with two or three pails of hot water. Once or twice a week the churn should be steamed and given a wash with lime water. This will keep the churn sweet and clean, and by giving the rolls and inside of the churn a scrub with dry salt occasionally it will prevent the butter adhering.

A Good White Wash.

To one-half bushel of unslacked lime add sufficient boiling water to slack it, then cover to keep in the steam. Then prepare, one peck of salt, previously dissolved in warm water, two lbs. glue dissolved in 7 lbs. of water and when dissolved add 6 oz. of bichromate of potash and one-half pound of whiting; now add this to the lime, stir, strain and apply hot, either with brush or spray pump.

BOILERS, ENGINES, STEAM-FITTING.

By Geo. Travis.

Of all the apparatus necessary for the manufacturing of cheese and butter, the steam boiler seems to be the most essential. From it we get steam power for operating the other machinery, and steam for regulating the temperature of the milk and cream, and for other heating purposes as well; hence the selection, setting and care of the boiler, coupled with the construction of the arch and chimney so as to get the best results from the economic viewpoint, are matters of great importance to cheese and butter manufacturers.

Selecting a Boiler.

When selecting a boiler, get one of sufficient capacity to furnish all the steam required without forcing the fire under it. A boiler cannot be forced beyond its capacity, without injuring it. There would also be a waste of time and fuel forcing a steam boiler.

Setting Boiler.

In setting a boiler a good substantial foundation for the arch or furnace should be provided. The arch is really a part of the boiler and unless it is properly built, good results cannot be obtained.

It is best to get a plan for building an arch from some reliable boiler maker. Then have the masonry done by an expert. Provide good fire brick for lining and have them laid with fire clay. Make the side walls of the arch thick with good common brick. This will make it more substantial and retain the heat longer, thus lessening the cost of fuel.

Chimney.

Where coal is being used for fuel the chimney should be built of brick. The area should be at least one-fifth greater than the combined area of all the flues. The height depends largely upon its location—the higher the better.

Firing the Boiler.

Boilers newly set should not have fires put under them until the mortar of the brick work has had time to harden naturally. When fire is started, heat very slowly and let the steam go through all the pipes before any pressure is put on them.

Care of Boiler.

Before lighting the fire in the morning, care should be taken to see that the boiler has sufficient water in it. The glass gauge in the water column cannot always be depended on at sight, therefore, it is best to open the tap at the bottom of the glass to make sure that the pipes leading to, or from it are not stopped with scale or mud. See that the safety valve is in working order. This is the most important valve in connection with the boiler. Every boiler should have a blow-off pipe at the bottom. In addition to this, it should have a surface blow-off or some "scumming" apparatus. Nearly all foreign matter held in solution in water on first becoming separated by boiling, rises to the top in the form of what is commonly called "scum," in which condition much of it may be removed by the surface blow-off. If not removed, however, the heavier particles will be attracted to each other until they have become sufficiently dense to fall to the bottom, where they will be deposited in the form of scale, covering the whole internal surface of the boiler below the water line, with a more or less perfect non-conductor of heat. Where the water is very hard some good boiler compound may be used with good results. Different waters require different treatments. For ordinary water "sal soda" is all that is necessary.

The blow-off at the bottom should be opened enough each day to let any lime or mud that might have accumulated, escape. If this is not done, there is danger of the pipe being filled with dirt, thus excluding the water from the pipe. Then there is a danger of it becoming hot and bursting, causing a great deal of trouble.

If the pipe from the pump or injector which feeds the water into the boiler be attached so that the water will be fed in through the blow-off pipe, this danger will largely be overcome.

Pipe Fitting.

As there are also more or less steam pipes about the factory that need repairing, it is quite necessary that the maker should know how to do his own pipe fitting.

For ordinary work the tools required are, pipe, tongs, cutter, vise, and stock and dies. With these at hand any pipes or joints that may be leaking can be quickly repaired and will save the expense of sending out for a steam fitter. Steam escaping from bad joints or leaking valves makes a disagreeable noise, and is money evaporating into the air.

Engines.

The engine bed or foundation should be solid. If possible have the engine in a room separate from the boiler, as there is always more or less ashes and dust from the furnace and flues. This makes it difficult to keep clean. Any sand or grit lodging on the slides help to wear them out sooner than it otherwise would.

Some of the chief points to be observed are: See that it is kept clean, well oiled, and properly packed to prevent steam from leaking.

Before starting the engine, open the taps of the cylinder to let the water out, turn the fly-wheel over once, then open the throttle valve gradually until the engine gets in full motion.

HAND POWER CREAM SEPARATORS.

By M. Robertson.

It is more than a quarter of a century since the invention of cream separators; that is, since the invention of those which are practicable. However, it is only within the last twelve years that they have come into common use on the Canadian farm.

The first to purchase hand separators were those farmers who patronized creameries or manufactured butter at home. At the present time, however, separators are being introduced into what may be termed cheese factory sections, as farmers in these sections are finding them very useful for that portion of the year in which the factories are closed.

The fact that hand separators have been introduced so rapidly indicates that they must be of economic value to the farmer, as their first cost is comparatively high, the price being from fifty to one hundred and fifty dollars, depending upon the capacity of the machine.

The reasons for such rapid introduction of separators may be summed up as follows: When milk is set in shallow pans or deep cans the force of gravity impels the heavier portion, which is the skim-milk, to the bottom of the pan or can and the cream to the top, but the milk and cream are separated more or less imperfectly. On the other hand, when milk is delivered into the rapidly revolving bowl of a cream separator, which is travelling at the rate of hundreds of feet per second, exerting intense centrifugal force upon the milk, the separation is instantaneous and much more thorough.

Other advantages of the hand separator may be stated as follows:

1. It saves the cost of utensils and the space required for their accommodation.

2. It gives a better and more uniform quality of cream.

3. The richness of the cream can be easily regulated.

4. It saves labor in washing utensils, and in the handling of so much ice for cooling purposes; only enough being needed to cool the cream instead of the whole milk.

5. The skim-milk is in the very best possible condition for feeding purposes.

6. The dairyman is better able to handle his milk and keep more cows with a hand separator, than he was before their introduction, as many were so situated that they could not separate the cream from the milk properly and were out of reach of a creamery or cheesery.

Some of the chief objections to the separator are:—

1. The cost of the machines.
2. The labor involved in turning them.
3. Their complicated construction which makes it difficult to keep them in proper running order.

These objections, however, are more than counterbalanced by the advantages of the separator. Especially is this so, when we consider that the increased product from the extra loss of fat in the gravity skim-milk amounts to from five to ten dollars per cow each year.

In selecting a cream separator the average purchaser is under a great disadvantage, because he is probably buying a separator for the first time and does not know what are the important points to be considered.

At present there are many different makes of separators on the market, but it is impossible to say which is the best, as no one make comprises all the points of merit that the ideal should possess. The best separator may be described as being the one best suited to the special conditions under which it is to be used. The less exhaustive skimmer of two separators might be the more suitable of the two on account of some other advantages it may have over its rival; for example, it might be a more easily turned machine, more easily cleaned, or have some other point of vantage that would make it preferable to one that, while it does more exhaustive work, is hard to clean or turn. A hand separator would be considered as doing good work when running at full capacity it will produce a cream testing from 30 to 40 per cent. fat, and leave not more than .05 per cent. of milk fat in the skim-milk.

The important points in a cream separator are:—

1. Ability to do efficient and exhaustive creaming.
2. Simplicity and durability.
3. Easily turned.
4. Easily cleaned.
5. Low supply tank with reasonable height of handle.
6. Convenience in securing repairs.

In selecting a cream separator the majority of the above points may be fairly judged by the average dairyman, but the loss in the skim-milk and the per cent. of fat in the cream can only be decided by the proper use of the Babcock tester.

With each separator is sent a "Book of Instructions" which contains full directions for setting up and operating the machine. These instructions should be carefully read and followed. A suitable place for keeping the separator should be provided, care being taken that a place is chosen that can be kept clean and free from dust with plenty of fresh air. It is most convenient to have the separating room near the barn, as it saves the labor of carrying the milk too far for separating and the skim-milk back for feeding purposes. It should not be placed in the stable as the air is impure, and the separating of the milk in the stable is bound to pollute the cream, thus injuring the quality of the butter. Also, aside from the matter of cleanliness, and loss in returns from the butter, a separator setting in the barn or stable will become filled with dirt and grit in the bearings, and will wear out much more quickly than if a proper place had been provided.

In setting up the machine, fasten the frame securely to a solid foundation, placing it perfectly level on all sides, as the bowl will soon get out of order if not perfectly level.

Before starting the machine all parts should be thoroughly cleansed and oiled. Special separator oil should be used, as coarse oil will not give satisfaction when applied to such fine bearings. The oil should be thin and clear, giving a clean drop, and free from any crude oils. It is a good practice to flush all bearings with kerosene occasionally as this removes all grit or gummed oil and enables the machine to run more freely.

The speed should be gotten up gradually until the proper number of turns, as indicated upon the handle are reached; this speed should be maintained uniformly throughout the entire run. Enough warm water at a temperature of about 110° F., should be used to fill the bowl, as this moistens the bowl parts and prevents the cream from adhering to them. Milk separates best when fresh and at a temperature of 90° to 100° F. Tests made with different hand separators and at temperatures below 80° F., showed in every case a much greater loss of fat in the skim-milk, than when similar milk was separated at 90° F.; therefore, if for any reason the milk has been allowed to cool below 80° F., it should be reheated to at least 90° F., before separating.

After the milk is all separated the bowl should be flushed with a little warm water (not hot). The power may then be removed and the machine allowed to run down. Do not use a brake, unless one is provided with the machine, as some injury may be done.

After the machine is taken apart all parts should be rinsed with warm water, then washed in water a little warmer, containing some washing compound and afterwards thoroughly scalded with boiling water, then placed out in the sun or in a dry, pure atmosphere. Do not dry with a cloth, simply wash thoroughly with a brush, then scald and the parts will dry themselves. Some owners of separators practice washing them only once each day. This is a filthy habit and cannot be too strongly denounced. Wash the separator thoroughly every time it is used.

Since the coming of the hand separators it has been said that the quality of the cream supplied to our creameries has not been up to the proper standard, and this the writer knows to be true. It is not the fault of the hand separator but of those entrusted with the use of it.

Immediately after the cream has been skimmed from the milk it should be cooled to at least 55° F., by placing it in good, cold water surrounded by a pure atmosphere. If the dairyman has a windmill or a cold spring, a box can be easily arranged where the cream can be kept and the water allowed to flow in near the bottom at one end and the warm water allowed to drain off from the top at the other end. By using shot-gun cans to hold the cream it is soon thoroughly cooled by this method. If no cold water is at hand the dairyman should provide himself with an abundant supply of ice to thoroughly cool his cream.

The question of variation in tests is a vexed one among creamery patrons, and many think that because they do not change the cream screw the test should remain constant. This is an erroneous idea, for while the richness of the cream is adjusted by either a cream or a skim-milk screw, depending upon the make of the machine, still there are many other things which affect the test of the cream, and which may be enumerated as follows:—

1. The per cent. of fat in the milk being skimmed. The richer the milk the higher the cream will test, other conditions being equal.

2. High speed and slow feed will give a high test.

3. Slow speed and full feed will give a thin testing cream.

4. Cold milk will give an incomplete separation and a low testing cream.

5. Allowing the skim-milk outlets to become partially closed with dirt will give a low testing cream.

6. The use of the same amount of flushing water with different amounts of cream will give a variation in the test.

It will be seen by the foregoing statements, that many conditions affect the test; therefore, it is necessary that the operating of a separator be carried on uniformly, and with as little variation in conditions as possible. Every dairyman should own a small Babcock tester, and by its use in testing his cows and the cream he is sending to the creamery, or selling off his farm, he would be in a better position to know exactly what he is doing. It would be a profitable equipment for his dairy.

One other important point in the operation of hand separators is the richness or percentage of fat in the cream skimmed. Too much low testing cream is supplied to our creameries. Patrons sending cream to creameries should endeavor to supply a cream testing between 30 and 40 per cent. fat. The reasons for this are as follows:

1. The high testing cream is less bulky therefore it will take less cooling and work in caring for it.

2. It will leave more valuable skim-milk at home for feeding purposes.

3. It will mean less quantity for the cream haulers, also less vat room at the creamery and a smaller quantity of ice will be needed for cooling purposes.

4. A more exhaustive churning can be obtained from a rich cream than can be got from a thin testing cream, which means less loss in the buttermilk and more money for the patron. Also the high testing cream can be churned at a lower temperature and a better quality of butter be made.

5. The cream with a high percentage of fat will keep sweet much longer than will a low testing cream, providing other conditions are equal, therefore, it is more likely to reach the creamery in proper condition.

Since the introduction of the hand power separator, the patrons have assumed a portion of the butter-maker's duties; that is, the skimming of the cream. Therefore, it is important that they give this part of the work, which they have taken from the maker, their intelligent attention, and aim to supply him with a first-class article, or they will not receive, nor should they expect, first-class returns from the finished product.

FARM BUTTER-MAKING.

By Miss Laura Rose.

While each year sees more milk manufactured at the creameries and cheese factories, butter will ever be made at home on the isolated farm, or where a fancy dairy trade is established.

Where conditions are entirely under one's control it stands to reason that the products can be superior to that made where uncontrolled conditions have to be met; yet it is a lamented fact that much of the dairy butter cannot be classed as first quality. This is probably due to a lack of knowledge in the art of butter-making, and because of the pressure of other duties.

There is always a good market for extra choice food products. If the dairy farmer makes a No. 1 Butter quality and quantity to be always relied upon—he can get a good paying price for it.

Each branch of the farm should be made to pay. There is a lot of labor about the care of cows and the making of butter, and if no profit results, an investigation should immediately be made.

The Cows.

Many farmers have little or no idea what their cows are doing, or even what to expect in return for good food and proper care. The cow should give after her first milking period 6,000 pounds of milk testing 3.6% milk-fat, or should make from 250 to 300 pounds of butter per year. The only way to know if the cows are reaching this standard is to weigh and test the milk. Quite accurate results may be obtained by weighing and testing the milk from each cow one day, fortnightly, or monthly. Many farmers have yet to learn that quality, not numbers, is the essential in a dairy herd. Better keep five good cows only, than ten indifferent ones.

The Stable.

So many of the bad flavors in milk may be traced to the bad condition of the stable, that it must receive more attention. The building need not be expensive but it must be well lighted. Nothing is such a cheap and effective germicide as sunshine, so let its health giving and germ destroying rays stream into the stable. It must be well ventilated, and be kept clean in order to have the cows healthy and the milk pure.

Nothing adds so much to the appearance of the inside of the stable as giving it an annual coat of whitewash. It can be quickly put on with a spray pump.

Food and Water.

It is the poorest economy to stint the cows either in the matter of food or water. They need a liberal supply of both, in order to give a large flow of milk. The food should be so balanced as to supply all the constituents for the manufacture of milk.

Many cows drop off in their milk flow during the heat of summer when pastures get poor. A timely provision would prevent this. Nothing is cheaper or easier handled than corn silage, and a small silo for summer use is a wonderful means of tiding over a dry spell and increasing the profits from the herd.

Milking.

There is no nicer place to milk cows than in a clean, airy stable.

Milk quietly, quickly, cleanly, and thoroughly. Cows do not like unnecessary noise or delays, and show their dislike by dimished quantities of milk. Commence milking the cows at the same hour night and morning, and milk the cows in the same order. Before beginning to milk, wipe the cows' flanks and udders with a damp cloth to prevent loose dust and hair falling into the milk pail. The wide flaring pail is far from desirable. The Freeman pail with its small opening and hooded top prevents much dirt getting into the milk. The first streams of milk should go into a separate dish. They contain many objectionable bacteria. Do not wet the hands with milk—a practice to be recommended is to rub a little vaseline on the hands. This keeps the teats in nice condition and overcomes the desire to wet the hands.

Do not save strippings. Milk the cows out clean, otherwise they will soon go dry.

Straining the Milk.

Remove the milk as soon as possible from the stable and immediately strain it through several thicknesses of cheese cloth. Place the cheese cloth over the bottom of the strainer and secure it with an easy fitting tin hoop. The cloth must be removed and well washed, first in tepid water, then in scalding water, after each time of using.

Remember straining only removes *visible dirt*. Our endeavor, should be to keep the dirt entirely out of the milk. It is the dissolved, unseen dirt that is really harmful.

Creaming the Milk.

Shallow Pans. This method is the oldest, and is still used when but a few cows are kept or when ice cannot be secured or the supply has become exhausted. Tests of the skim-milk show that when the milk has been properly set and skimmed, the loss of milk-fat is no greater from the shallow pans than from creamers. The milk should be set in clean, bright tins, and should not exceed three inches in depth. It is most necessary that the milk room be clean and free from all odors, as milk so readily absorbs any taint that may be in the atmosphere. The temperature should range between 50 and 60° F. Avoid having the milk close to the wall or in a strong draught, so as not to have a leathery coat form over the cream, due to rapid evaporation. Skim before the milk thickens. Loosen, with a thin bladed knife, the cream from the sides of the pan. Lift the pan to the edge of the cream can, tilt it to allow a little of the skim-milk to wet the edge of the pan, then with the aid of the knife, quickly glide the sheet of cream into the cream can.

Dilution System. Many devices have been put on the market for creaming milk by adding a certain percentage of cold water. We have tried several, and do not recommend any. There is danger of contaminating the cream by using impure water. It robs the cream of its flavor.

The loss of milk fat is usually heavier than when the deep cans are used. The skim-milk is too much diluted for feeding purposes.

Creamer. If the cream is raised by the deep setting system, the cans should be placed immediately in water the depth of the milk and the milk brought as soon as possible to 45° F. or below, and held at that temperature. *Use plenty of ice.* It is economy to have ice always in the water, and just as necessary to use it in the winter as in summer. A water-tight box or barrel will do as effective work as an expensive cabinet creamer. We prefer a slant-bottom can, with a tap to draw off the milk. Having the slant carries away any sediment and permits all the skim-milk to be drawn off.

Cans without a tap should be skimmed with a funnel-shaped dipper, having a long straight handle and no wire around the rim. With a knife loosen the cream from the sides of the can; wet the dipper in water or milk, then lower it, point first, into the can, allowing the cream to flow evenly into the dipper. Repeat until all the cream is removed. Avoid getting too much skim-milk with the cream.

Milk should always set twenty-four hours before the skim-milk is drawn off, and thirty-six hours in winter is even better. Milk allowed to stand only twelve hours before skimming will give a cream testing from 16 to 18 per cent. fat, while the skim-milk will test as high as from .6 to 1 per cent. Cream from milk allowed to stand twenty-four hours will test from 18 to 22 per cent. fat, and the skim-milk from .25 to .35 per cent., or in other words we have in the latter case a richer cream and less loss in the skim-milk—two desirable conditions in the creaming of milk.

Cream Separators. A separate article in this bulletin is devoted to the hand separators; otherwise, much might be said in favor of this method of creaming milk. It certainly is the ideal way of obtaining the cream. A separator, even with only a small herd, pays, for it means less labor, richer cream, less loss of milk-fat and warm skim-milk for the young stock.

Care and Ripening of Cream.

Cream which contains from 24 to 26 per cent. fat, or in other words, cream which will make three pounds of butter per gallon is best suited for hand churning.

During the collecting of cream for a churning, the cream can should stand in the coolest place in the cellar in summer, while in the winter it may be kept in a room where the temperature ranges between 50 and 60° F.

The surrounding atmosphere should be clean and sweet. The can must always be covered. Have a tin stirrer which reaches to the bottom of the can and stir thoroughly, from the bottom to the top every time fresh cream is added.

Each time the can is emptied it should be well washed, scalded and put in the sunshine for several hours. In order to be able to do this, it is a good plan to have two cream cans.

When beginning to collect cream for a churning, add to your first skimming a culture or starter which you know has a clean, pleasant, acid taste and smell. This culture may consist of a cup or two of sour cream from your previous churning or the same amount of good flavored sour skim-milk. The reason for adding the culture is that the bacteria which you know produces a fine flavored butter may take possession of the new cream before other germs which might prove objectionable gain control of it.

Another method is to hold the cream sweet until twenty-four hours before churning, then heat it to 65° F. and add one pint of culture to every gallon of cream. In the evening, cool to churning temperature or below, and hold at that temperature over night.

Separator cream should have the foam well stirred in, and by placing in cold water, should be quickly cooled to 60° in winter and from 50 to 55° F. in summer. Stir the cream occasionally while cooling. It is most essential that this thorough and quick cooling be done before adding the cream to the cream can, otherwise separator cream cannot make choice butter.

It is the neglect of this prompt cooling which gives the bad flavor to so much of the dairy separator cream and butter.

Examine the cream, and when it has a smooth, glossy appearance, pours like molasses and has a pleasant acid taste and smell, it is in proper condition to churn. Churning should be done not less than twice a week in summer and three times in two weeks in winter.

To insure a good body in the butter have the cream lowered to churning temperature or below, several hours previous to churning. It does no injury to raise the temperature to that desired, but when the temperature of the cream is lowered just before churning, the fat globules have not had time to harden, and the result will be a soft, weak-textured butter.

To prevent loss of butter fat in the buttermilk, sweet cream should not be added during the last twelve hours before churning.

Perfectly sweet cream will churn in the same time as ripened cream and makes a mild creamy-flavored butter which is gaining in favor in the best markets. If the temperature of sweet cream is kept low there is no excessive loss of butter in the buttermilk.

I think the time is not far distant when little cream will be ripened for butter-making purposes. The sole care of the butter-maker will be to have the cream as clean and sweet as possible.

Complaints are sometimes made about a bitter flavor in cream. When held sweet for sometime at a very low temperature this bitterness frequently develops. To overcome this difficulty, either pasteurize or get the cream started to sour.

Pasteurization.

For farm butter-making we do not consider pasteurizing the cream necessary, but if bad flavors are found in the sweet cream it will, to a great extent, destroy them. If cream obtained from cows a long time in milk proves difficult to churn, pasteurizing it will assist greatly in getting the butter to come.

To pasteurize cream, place the can holding the cream in a dish of hot water on the stove, and bring the cream to 160° F., and keep at that temperature for twenty minutes; then quickly cool to 60° F. or below. It is always necessary to add a culture to pasteurized cream if you wish to ripen it.

The Care of the Churn.

Before using, the churn should be scalded with boiling water and afterward rinsed with cold water. It is better and quicker to pour the water out than let it run through the bung-hole. Floating dust will not then cling to the sides of the churn. After using, the churn should be rinsed down with hot water to remove any particles of butter, then thoroughly scald with hot water to which has been added a little good washing soda compound, after which it should be well rinsed with boiling water. Wipe the outside, but do not touch the inside with a cloth. Never allow buttermilk or wash water to remain in the churn when not in use. Leave the plug out and the lid ajar, and keep in a cool place to prevent warping.

The worker, ladles, and butter-printer may be prepared just before using. With a fibre brush, a dipper of water, and a little salt, give them a good scouring and cool well with cold water. After using, remove any butter with hot water, again scour with salt [illegible] with boiling water and allow them to dry.

Churning.

Always strain the cream into the churn through a dipper with a perforated tin bottom. In winter add just sufficient butter color of a reliable brand to give a nice yellow tint. Do not depend on pouring it in, but count the drops for a small churning, allowing 3 or 4 drops to the pound of butter.

No definite temperature for churning can be given, but the necessity for the constant use of a thermometer must be emphasized.

Many conditions influence the temperature of the cream for churning. These are often not given due consideration and consequently cause trouble. It must be remembered that the poorer the cream in fat; the fuller the churn; the drier the food of the cows; the longer the cows have been in milk; the colder the room in which the churning is done—all these are conditions which demand higher churning temperature. Aim to make conditions favorable for a low churning temperature, as it insures a better butter and a more exhaustive churning. Long churning is sometimes caused by slow speed of the churn—so long as the cream drops it does not matter how fast the churn revolves—the extra concussion hastens the process of churning.

Start with the churn about one-third full, which means not more than five gallons in a No. 3 churn, and regulate the churning temperature so as to have butter within from 20 to 30 minutes. That proper temperature can only be ascertained by past experience with similar cream.

I would suggest a range of temperatures for summer from 54 to 58° F. and in winter from 58 to 64° F.

Cream that contains too much skim-milk and is too cold will foam. Never add hot water to the cream. It must be taken from the churn and heated by placing the can in a pan of hot water and stirring until the desired temperature is reached.

Poor cream often breaks, but will not gather. Try churning slowly. If this does not overcome the difficulty the only remedy is to add a little water a few degrees warmer than the cream. Revolve the churn a few times, let stand a minute or two, then draw off part of the buttermilk to lessen the liquid and churn slowly.

Very rich cream is likely to paste or thicken in the churn, so that concussion ceases. Add enough water at the same temperature as the cream to dilute it so that it will drop.

When the churning is about completed, add a couple of quarts of water several degrees lower in temperature than the cream was. In the summer it may be quite cold. This floats the butter and allows the buttermilk to run off more freely. When the butter is the size of wheat grains it is sufficiently gathered. Look frequently at the inside of the churn lid, and when but few small specks are seen on it, the churning is usually finished. Watch the buttermilk as it runs through the strainer dipper, and if any butter comes with the first streams, a little more churning is necessary.

Washing the Butter.

When the buttermilk is drawn, rinse the butter with a little water to further remove the buttermilk. Temper the water in winter, having it from 50° to 58° F. according to the condition of the butter and the temperature of the room. In hot weather the wash water may be as cold as possible. Have as much or more water as there was cream. Strain it into the churn through cheese cloth. Revolve the churn rapidly about a dozen times, and wash but once. We recommend washing butter twice if it has come very soft or has an objectionable flavor, or is going to be packed for winter use.

Salting the Butter.

Salt according to the demand of the market. If the butter is for immediate use and is salted on the worker ¾ ounce per pound of butter is usually sufficient. If salting in the churn use an ounce, as not so much is incorporated in the butter. We strongly recommend salting in the churn, as by so doing butter free from streaks can be had with the least possible amount of working, but the churn must be without dashers, and the butter in firm granular form. The only difficulty in this method is gauging the amount of salt. Estimate the weight of butter from the last churning, then weigh the salt. Have the butter evenly spread over the bottom of the churn, sift on part of the salt, tilt the churn forward to cause butter to lap over, sift on more salt, then tilt the churn backward and put on the remainder of the salt. Put on the lid and revolve the churn very slowly until the butter forms in several lumps. It may be taken out and immediately worked, but if possible it is much better to allow it to stand either in the churn, or in a firkin, if the churn is in too warm a place, for one or two hours, and then give one working.

If salting on the worker, take the butter from the churn, weigh it, and allow ¾ ounce of salt per pound of butter. Spread the butter over the worker, sift the salt on evenly, fold the salt under and begin working.

Working the Butter.

For the farm dairy there is nothing nicer than the V-shaped lever butter-worker. It is not expensive and is a great saver of time and strength, besides preserving the grain of the butter.

Work by means of pressure only; avoid a sliding motion, as it makes a greasy, salvy butter. Work sufficiently to expel the moisture and thoroughly distribute the salt. Any portion of the butter not reached by the salt will be light in color.

If the butter is very soft or very hard, work but slightly, allow it to stand, and when at the proper firmness give it a second working.

Printing the Butter.

The brick-shaped pound print is the most popular form in which to market butter. Finish the butter smoothly and press the print down into the butter until the mould is well filled. Cut with a ladle the surplus butter from the bottom. Wrap the print neatly in good parchment paper, which has been previously wet in clear, cold water. It is a good plan to have the paper stamped with the name of the farm or butter-maker. It is often the means of securing a choice trade. Be sure the print weighs a full pound or slightly over. The butter when wrapped in the wet wrapper should weigh full 16¼ ounces.

Keep the butter in a cool clean place and get it to the consumer as soon as possible.

Packed Butter.

When the butter is to be kept for winter use we advocate pasteurizing the cream and seeing that in every respect it is of No. 1 quality. Wash twice and salt heavier. Either allow it to stand in the churn for several hours after salting, or give it two workings. Pack in well glazed, thoroughly-scalded crocks; finish off to within ½ inch of the top. Cover with parchment paper and with a layer of moistened salt. Tie down with paper, and keep in a dark, cool place. If the salt on top dries, add water to it. It is better to keep the butter frozen if possible.

The Care of Milk Pails, Pans, Cans, Etc.

Clean all dairy utensils by first rinsing in tepid water, then clean inside and out with a brush and hot water in which a cleansing material such as washing soda is dissolved. Lastly rinse with plenty of boiling water and leave inverted in pure air and sunshine, when available, until wanted for use.

Applied Proverbs.

Praise the day at eventide, and the cow at the end of the year, if she then deserves it.

Children are the riches of the poor; but if you get them interested in the dairy they will help lift the mortgage from the farm.

The shoe knows whether the stocking has holes; the farmer *should know* where the leaks are that rob him of the profits from his dairy, and should set about mending them.

Cleanliness is next to godliness; this applies as much to the *cow stable* as to the *front parlor.*

It is hard for an empty sack to stand straight; but still harder for a lazy man to succeed in the dairy business.

We'll take the good will for the deed. Did you ever hear the cows say that when you neglected to properly feed and water them?

Penny wise and pound foolish is the woman who still uses old-fashioned, out-of-date dairy utensils.

'Tis good in every case you know
To have two strings unto your bow;
Some clucking hens and a brooding sow
Increase the profits from the dairy cow.

FARM CHEESE-MAKING.

By Miss Laura Rose.

Most of our country people are English enough to like home grown and home made food products. This is mainly why the making of small farm cheese appeals to them. If made at the time of year when milk is cheap one can produce an extra nice quality of cheese at a very reasonable cost.

Cheese does not hold its proper place in our dietary. It should be more largely used on our tables, and should often take the place of meat at a meal. A well-made, well-cured cheese is highly nutritious, not hard to digest, and if made in the home would be more freely used.

In manufacturing cheese on the farm we make the process as simple as possible.

From the time of starting until the cheese is put to press is between four and five hours.

The milk must be sweet and pure. If the fresh morning's milk is mixed with the previous day's milk it is usually in about the right condition for making cheese in regard to the acidity. With the acidimeter it should show .18 to .19 per cent. acid or by the rennet test 20 to 24 seconds.

A large tin or new tub, in fact any clean vessel which will hold milk and not injure it, will answer as a cheese vat.

Heat the milk to 86° F. by setting it on the stove and stirring or by placing a clean can of hot water in it, and keep it as nearly at that temperature as possible. If the cheese is to be colored, use one small teaspoonful of cheese color to 100 lbs. of milk (10 gallons). Add the color to a pint of the milk and stir well into the milk in the vat.

For every 25 lbs. of milk use one teaspoonful of rennet. Try to get the rennet at some cheese factory; junket or rennet tablets, such as druggists sell, are often not satisfactory. Dilute the rennet in a cup or more of cold water and pour it in a stream up and down the milk, stirring well all the time, and continue stirring two or three minutes. Cover the vat to keep the milk warm. Try the milk occasionally to see when it has sufficiently coagulated, by inserting the index finger into the curd and with the thumb making a dent or slight cut in the curd just at the base of the finger, then slowly moving the finger forward; if the curd breaks clean like a firm but tender custard it is ready to cut. The time from setting or adding the rennet to cutting is usually about twenty minutes. The older or riper the milk the more quickly the rennet will act upon it. Over-ripe milk will give a dry, acidy cheese.

If one expected to make much cheese I would advise getting a set of curd knives. While more tedious, a long bladed carving knife, or thin bladed sword answers the purpose. First cut lengthwise into strips, one-third of an inch wide, then crosswise the same, as well as one can horizontally. Begin stirring gently and continue the cutting if the carving knife is used till the curd is of uniform size. At the same time heat may be slowly applied. The vat may be set in a vessel holding warm water, or a clean can filled with hot water may be put into the vat. One-half hour should be taken to get the curd heated to 98 degrees. After it is brought to that temperature it is not necessary to stir continuously, but it must be frequently stirred to prevent the curd from matting, and the temperature must be maintained. The curd is usually ready to dip three and one-half hours from the time the rennet is added to the milk. The right condition for the curd to be in at this stage is ascertained by feeling the curd. If it is rather firm, has a shiny appearance, and falls apart when pressed in the hand, it is ready to have the whey drawn.

By the acidimeter it should show from .19 to .2 per cent. of acid, or when a little of the curd is squeezed well in the hand and pressed against a hot iron (a stove poker answers the purpose) and when gently withdrawn leaves fine hair-like threads one-quarter of an inch long on the iron, it is a sign the whey should be removed.

If the vat is without a tap, dip the curd and whey into a strainer dipper or colander and put the curd in a large cheese cloth on a lever butter worker, if one is in the house. The curd must be well stirred for ten or fifteen minutes to allow the whey to escape; then it may be salted at the rate of one ounce to every 25 lbs. of milk. Sprinkle the salt over the curd; stir well, and allow it to stand a little while before putting it in the hoops. One cannot get along without a cheese hoop. It may be of wood or tin, but must be round, straight, strong and the ends clean cut without any rim to them. A nice size is 7 inches in diameter by 14 inches high; this will press a cheese weighing from 6 to 10 lbs.

The circle or follower of wood placed in the hoop on top of the curd must fit well or the cheese will have shoulders.

A bandage made of cheese cloth should be placed inside the hoop, and the curd put into it and a square of cotton wet in hot water, placed on the top before the wooden follower is put on. The temperature of the curd when put to press should be from 80° to 84° F.

Many contrivances may be used to apply the pressure—a cider press answers, or a fulcrum and lever press is easily constructed. Too much weight must not be put on at first, and the pressure should be increased gradually.

The next morning the cheese should be taken from the hoops, dampened with hot water on the outside, the bandages straightened and trimmed and the cloth allowed to extend half an inch over the ends. Cut a circle of cheese cloth, the size of the top, place carefully on the cheese, cover with a square of wet cotton, place the hoop on top and force the cheese into it. Finish off the other end in the same way. Put again to press till the next day. Take from the hoop and place in a cool cellar, turning it upside down every day for a month and then occasionally. Do not worry, if it moulds; it will be on the outside only, and should be well washed off before the cheese is cut. At the end of two months it should be ready for eating, but is better if kept for five or six months.

If the milk be sweet and good and the necessary care taken in the manufacture, this method produces a rich, meaty cheese much liked by every one.

SOFT CHEESE-MAKING.

By Frank G. Rice.

In dealing with the subject of soft cheese-making only a general idea of the process can be given, as one has to alter one's process according to circumstances, such as, variety of cheese to be made, and the age of the milk from which the cheese is to be manufactured.

The making of soft cheese is, practically speaking, new to this country, so that the taste for these dainty little cheese needs cultivating.

As these cheese will not keep for any length of time, being usually eaten in the fresh state, one must have a ready market for them.

The main object in soft cheese-making is to retain in the cheese a high percentage of moisture. It is this high percentage of moisture together with the fat, which produce the soft texture; hence the name, soft cheese.

The process of manufacture is as follows: Fresh whole milk is brought to a temperature of 82° F. to 84° F. (As it is necessary to have perfectly sweet milk, milk straight from the cow stable, which has not lost its animal heat, is preferable.)

Sufficient rennet is added to this milk to bring about a soft and tender coagulation in about one hour. When the curd is sufficiently firm it is dipped with a culture ladle in small slices into moulds of various shapes according to the variety of cheese to be made, standing on straw mats to facilitate draining.

At the first dipping only sufficient curd is taken to cover the bottom of the moulds. At intervals of 15 minutes, more curd is put into the moulds until they are full and no more curd remains to be dipped.

The cheese are left to drain at a temperature of from 62° F. to 70° F., according to the time of year--the lower temperature for the summer. When the cheese are sufficiently firm to handle, the moulds may be removed and the cheese salted. Salting is done by carefully rubbing the salt all over the outside of the cheese.

These cheese need very careful handling, as rough handling causes loss of fat and curd, resulting in an inferior cheese being produced.

Now the cheese are ready for market, and will keep for about one week at a temperature of about 55° F. It is essential that the temperature of the making room should be constant and the atmosphere not too dry.

Among the varieties of cheese made at the Dairy School are the following: Double Cream, Gervais, Cambridge, Camembert, Coulommier and Wensleydale.

The first two are made from mixtures of cream and new milk; the other four from fresh whole milk. All these cheese made at the Dairy School have met with a ready sale.

As an example of soft cheese-making we shall discuss in detail the manufacture of Coulommier Cheese. This is a cheese which is ready to eat sooner than most, and usually meets with a ready sale.

Coulommier Cheese. 10 lbs. of milk will produce two cheese weighing about 1 lb. each. Take 10 lbs. (1 gallon) of fresh sweet milk and heat to a temperature of 84° F. Add sufficient rennet to bring about a tender, though firm coagulation in one hour. The quantity is usually one cubic centimeter (1 c.c.) per 10 lbs. milk, but it depends on the strength of the rennet used. Stir in the rennet for about five minutes. Five minutes later stir the surface to keep the cream from rising before coagulation has taken place, as any cream on the surface at the time of coagulation will be lost in the whey. When the coagulum is sufficiently firm, place the moulds on a well scalded board and a clean straw mat. The mat is placed between the moulds and board to facilitate draining. Dip sufficient curd, with a culture ladle, into the moulds to cover the bottom, care being taken not to break the curd by letting it drop into the moulds, as any broken curd results in a loss of cheese.

At intervals of 15 minutes, more curd may be dipped into the moulds. All the curd is dipped, usually, in six to seven dippings.

When the cheese have shrunk half way down the moulds, the upper rim may be removed and the cheese turned by means of placing another straw mat and board on top and inverting the whole. Remove the straw mat and board which were at the bottom, but are now on the top, care being taken not to break the top of the cheese. This takes place the following day.

When the cheese have shrunk a little more, the upper side may be salted by sprinkling on a little fine dry salt. When the cheese are firm enough to handle, the moulds may be removed and the cheese turned with the hand onto a clean mat, at the same time salting the other side and rubbing a little round the edges.

The cheese are now ready for consumption and will keep good for six or seven days at a temperature of 50° to 55° F. The size of the cheese when finished is 5 inches in diameter and 1½ to 2 inches deep, weighing 1 lb. or a little more.

The moulds are in two pieces—the top fitting into the bottom. The circular top is 5 inches in diameter and 2¾ inches deep, and the bottom is 5 inches in diameter and 3 inches deep. The boards should be 14 inches by 8 inches and ½ inch thick. The straw mats are 13 inches by 9 inches.

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