Field to dairy / by William Shepperson.

FIELD TO DAIRY

Embodying Hints on the Management of Fields and Cattle; the Production of Milk, Cream, Butter, Cheese, and the by-products of the Dairy.

FIELD TO DAIRY

Short Extracts from Press Comments.

Agricultural Chronicle.—". . . . . a complete book of reference in the different subjects treated upon."

The Creamery Journal.—"A very handy little book of reference for the dairy-farmer and all others connected with or interested in dairy work . . . ."

The Dairy.—". . . . a handy book of reference for those who have not the time or opportunity to study the complete history of a particular subject. The price is 2s. and the book is well worth the money."

The Field.—". . . . embodies interesting hints on the management of land and cattle, the production of milk, cream, butter, cheese, and the by-products of the dairy."

The Scotsman.—"It brings together a concise statement of the Chemical and Medical knowledge that concerns those who have to manage fields, cattle, and dairies."

The Irish Farming World.—"A concise history of Agriculture . . . . for those who have no time to wade through text books should prove of incalculable value for reference."

The Waterford News.—"The farmer or cowkeeper who has this book to study and refer to for guidance has a true and practical friend at his elbow."

The Scottish Farmer.—"The dairy farmer or dairyman will find a great amount of practical information in a very small compass."

The Illustrated Dairy.—"The author could not possibly press any more information into the space . . . Every Dairyman, no matter how well informed, must find something in it he did not know before."

The Grocer's Journal.—". . . . a handy book of information for those engaged in the management of fields and cattle."

The Irish Homestead.—". . . . full of information and deals with subjects like fishiness in butter, cause of bitter taste, rancidity, cold storage, cows, cream, milk, pasteurizing, preservatives, etc. . . . . useful book of reference, written in a clear style."

The Grocers' Gazette.—"An interesting and valuable publication. It embodies hints on the management of fields and cattle and the production of milk, cream, butter, cheese, and the by-products of the dairy."

The Mark Lane Express.—". . . useful hints on the management of both fields and cattle and the production of milk, cream, butter, cheese."

Farm, Field, and Fireside.—"Gives useful hints to dairymen and others on the management of fields and cattle, the production of milk, cream, butter, and all the by-products of the dairy."

The Shooting Times.—"We consider that Mr. Shepperson has loyally carried out the difficult task he set himself, the result being a handy book of reference, which should be appreciated by all dairymen farmers."

The Cowkeeper and Dairyman's Journal, *May*, 1906.—"'Field to Dairy.' An interesting work by Mr. W. Shepperson, F.C.S., which we recognise as being another addition to the dairyman's library of useful knowledge, embodying as it does hints on the management of fields and cattle; the production of milk, cream, butter, cheese, and the by-products of the dairy."

The Canadian Dairyman, *March*, 1906.—"'Field to Dairy' is the name of a valuable work on dairying, and gives concise hints on the management of fields and cattle, as well as on the production of milk, cream, butter, cheese, and the by-products of the dairy. This little book embodies the essential points pertaining to the various subjects treated and is a handy book of reference for those who have not the time to wade through large volumes."

Queensland Country Life, *April*, 1906.—"'Field to Dairy,' by Wm. Shepperson, F.C.S. (Simpkin, Marshall & Co.) We question if any writer could condense more valuable information relative to dairy work. The book deals with almost everything in connection with milk, cream and butter; from 'Amasi' (Kaffir milk), annato, asses' milk, drains and cold storage to manures, feeding, margarine, and tables of calculations, and should be in every dairyman's library."

Agricultural Economist.—"From the first page to the last there is no waste of words, and the suggestions thrown out, as well as the instructions so lucidly given, are practical to the last degree. The author lives up to his preface, in which he says that the object of 'this little book is to give in as concise a form as possible the essential points pertaining to the different subjects touched upon; and to serve as a handy book of reference for those who have not the time to study the complete history of a particular subject.' Thus Mr. Shepperson gives himself a task of much difficulty, and only one of his knowledge, ability and experience could accomplish it.—*Bookman.*"

FIELD TO DAIRY

BY

WILLIAM SHEPPERSON, F.C.S.

(Member of the Institute of Hygiene.)

AUTHOR OF "THE MEDICAL MAN'S HANDY BOOK," ETC.

Originator of the special processes adopted by Keeps, Ltd., in the manufacture of Preservatives, etc. Inventor and patentee of "Virol," the Infants' and Invalids' Food; the "Zoeco" Condensed Milk Preparations, etc.

Two Shillings net.

SECOND EDITION.

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PREFACE.

THE object in putting together the material that goes to form this little book, is to give in as concise a form as possible the essential points pertaining to the different subjects touched upon; and to serve as a handy book of reference for those who have not the time to study the complete history of a particular subject.

In these days of rapidity of movement, in which the Science of Agriculture and Dairying is as active as most branches of industry, it requires a considerable amount of energy and time to keep well posted in the march of progress, and condensed reports are almost a necessity.

I know of no food that is so dissected or assumes so many forms as Milk, and with the increased population of the world, the importance of our food supply must always be a vital one; and doubtless there will continue to be new methods devised for dealing with Dairy Produce, of which Milk is the basis, so I trow that a quick Reference Book may be of service to many.

I desire to acknowledge my great indebtedness to Mr. Alfred Stokes, F.I.C., for checking my notes, and for many useful suggestions.

W. S.

HAMPSTEAD HEATH,
LONDON, N.W.

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CONTENTS.

BUTTER-MAKING ON THE FARM.

FIELD TO DAIRY

Embodying Hints on the Management of Fields and Cattle; the Production of Milk, Cream, Butter, Cheese, and the by-products of the Dairy.

NO apology should be needed for the following suggestions, since on the proper management of our food supply depends the welfare of the whole nation, and, therefore, of each individual. The farmer may possibly find it of use to him to have recorded tersely the results of the experiences of those who have most successfully toiled in producing the food of the nation.

THE SOIL.—From this in every country the whole of the food supply is derived. It consists of clay, sand, limestone and manures (vegetable mould). From the proper mixture of these the success or failure of the crops will result.

If there be too much clay the soil will be "cold," and will need sandy material to make it more permeable. Limestone is needed to aid the decomposition of manures. Plant-food mainly lies in the humus or manure, and it is this portion of the soil that is always being used up, and so needs renewal.

A soil fitted for general agricultural purposes should contain about:—

60	per cent.	of sandy	material.
25	„	„	clay.
7½	„	„	limestone.
7½	„	„	humus.

In dry districts very light or very heavy soils should be given over to the plough.

Cattle rearing succeeds best in the damp valleys: there the land should be given over to grass, and every care be made to improve the pasture. If the grass be poor or sour, cattle will not flourish on it: the yield of milk will be unsatisfactory. Freshly drained land will not at once produce good grass; time is necessary for the old rank grass to be replaced by a better growth: a little lime will usually help this on.

DRAINS.—Do not neglect to drain all watery land, and see that the drains have a constant fall: any uneven part will result in a patch of sodden ground. A two-inch tile will drain four acres, a four-inch tile will drain seventeen acres. Even in stiff clay land a drain four feet below the surface will relieve it from stagnant water. If such surface water is not got rid of by draining, the sun, instead of warming the land, will spend its heat in evaporating the water, and the crops will not be benefited.

MANURE of some kind is an essential to replace the materials taken up by the plants that feed the cattle. It has been calculated that forty gallons of milk contain about 1 lb. of bone earth, and that each cow robs the earth of 19 lbs. of phosphates yearly. The land would soon become impoverished were this not replaced by the farmer in the shape of manure. Weeds and coarse grass

should be got rid of, since these take up the space of good grass, and are of little use for feeding stock. If left alone they rapidly multiply.

First-class grass land should produce twenty stone (imperial) of meat per acre. Where this result is not obtained, linseed or cotton cake should be fed to the cattle while grazing.

FARMYARD MANURE should not be exposed to the rain, else much of its fertilising elements will be lost and washed into the drains. It will pay to build a shed over the manure heap, since some thirty inches of rain fall annually in this country.

HAYMAKING.—When the grass just begins to turn brown it should be cut. It is better to cut both grass and clover before the seeds are ripe than a little after. Cut grass should not be stirred or gathered into cocks in damp weather. Unless the weather be dry, harm and loss will result to the hay by meddling with it.

COWS.—The most generally useful are the Shorthorn breed, but the queen of cows is that from the Channel Isles. Shorthorns give a large quantity of milk of good quality. Channel Island cows give a smaller quantity of milk, but this is much richer in cream. Dutch cows give a larger quantity of milk than other breeds, but this is poorer in cream. In breeding, attention should be given to the special qualities that are required to be produced; but if both of the parents have in common any pronounced defect they should not be put together, else this defect will preponderate. As a rule, "like produces like," and by a study of the qualities of the parents it is possible to produce the sort of change

GESTATION TABLE.

Showing at One View when Forty Weeks will Expire from any Day throughout the Year.

Jan	Oct	Feb	Nov	Mar	Dec	Apr	Jan	May	Feb	June	Mar	July	Apr	Aug	May	Sep	June	Oct	July	Nov	Aug	Dec	Sep
1	8	1	8	1	6	1	6	1	5	1	8	1	7	1	8	1	8	1	8	1	8	1	7
2	9	2	9	2	7	2	7	2	6	2	9	2	8	2	9	2	9	2	9	2	9	2	8
3	10	3	10	3	8	3	8	3	7	3	10	3	9	3	10	3	10	3	10	3	10	3	9
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20	27	20	27	20	25	20	25	20	24	20	27	20	26	20	27	20	27	20	27	20	27	20	26
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24	31	24	Dec 1	24	29	24	29	24	28	24	31	24	30	24	31	24	July 1	24	31	24	31	24	30
25	Nov 1	25	2	25	30	25	30	25	Mar 1	25	Apr 1	25	May 1	25	June 1	25	2	25	Aug 1	25	Sep 1	25	Oct 1
26	2	26	3	26	31	26	31	26	2	26	2	26	2	26	2	26	3	26	2	26	2	26	2
27	3	27	4	27	Jan 1	27	Feb 1	27	3	27	3	27	3	27	3	27	4	27	3	27	3	27	3
28	4	28	5	28	2	28	2	28	4	28	4	28	4	28	4	28	5	28	4	28	4	28	4
29	5	29	6	29	3	29	3	29	5	29	5	29	5	29	5	29	6	29	5	29	5	29	5
30	6			30	4	30	4	30	6	30	6	30	6	30	6	30	7	30	6	30	6	30	6
31	7			31	5			31	7			31	7	31	7			31	7			31	7

desired in the offspring. Too close in-breeding produces a feeble race, and should be avoided by mating several branches of the same stock. The ability of a cow to make flesh as well as milk must be taken into account, since the cow finally goes to the butcher.

MILK.—The milk given by the newly-calved cow should not be sent to the consumer during the first week; it contains an unusual amount of albuminous matter called colostrum. This, which is intended for the newly-born calf, is not advisable for human consumption.

If you wish to get a good supply of milk, feed your cows liberally. The cow that needs no feed, or next to none, has not yet been invented. Gentle exercise will help the cow to produce good milk. A cow will give from 400 to 800 gallons of milk a year; from this an average of 300 lbs. of butter may be obtained.

The following set of rules issued by the Department of Agriculture of the U.S.A. are worth perusal:—

Observe and enforce the utmost cleanliness about the cattle, their attendants, the cowhouse, the dairy, and all utensils.

A person suffering from any disease, or who has been exposed to a contagious disease, must remain away from the cows and the milk.

Cowhouses should be well ventilated, lighted, and drained; should have tight floors and walls, and be plainly constructed.

Never use musty or dirty litter.

Allow no strong-smelling material in the cowhouse for any length of time; store the manure under cover outside the cowhouse, and remove it to a distance as often as practicable.

Use no dry, dusty feed just previous to milking; if fodder is dusty, sprinkle it before it is fed.

Promptly remove from the herd any animal suspected of being in bad health, and reject her milk. Never add an animal to the herd unless it is ascertained to be free from any disease, especially tuberculosis.

Never allow the cows to be excited by hard driving, abuse, loud talking, or unnecessary disturbance; do not expose them to cold or storms.

Provide water in abundance, easy of access, and always pure; fresh, but not too cold.

Do not allow any strong-flavoured food, like garlic, cabbages, and turnips, to be eaten, except immediately after milking.

Do not use the milk within twenty days before calving, nor from three to five days after calving.

The milker should be clean in all respects, and should not use tobacco while milking; he should wash and dry his hands just before milking.

Brush the udder and surrounding parts just before milking, and wipe them with a clean damp cloth or sponge.

Milk quietly, quickly, cleanly, and thoroughly. Cows do not like unnecessary noise or delay. Commence milking at exactly the same hour every morning and evening, and milk the cows in the same order.

Throw away (but not on the floor—better in the gutter) the first two or three streams from each teat; this milk is very watery and of little value, but it may injure the rest.

Milk with dry hands; never let the hands come in contact with the milk.

Remove the milk of every cow at once from the cowhouse to a clean, dry room, where the air is pure and sweet. Do not allow cans to remain in the cowhouse while they are being filled with milk.

Strain the milk through a metal gauze and a flannel cloth or layer of cotton as soon as it is drawn.

Cool the milk as soon as strained—to 45 degs. Fah. if the milk is for shipment, or to 60 degs. if for home use or delivery to a factory.

Never close a can containing warm milk.

Never mix fresh milk with that which has been cooled.

Milk utensils for farm use should be made of metal, and have all joints smoothly soldered. Never allow them to become rusty or rough inside.

Cans used for the return of skim-milk or whey should be emptied, scalded, and cleaned as soon as they arrive at the farm.

Clean all dairy utensils by first thoroughly rinsing them in warm water; next clean inside and out with a brush and hot water, in which a cleaning material has been dissolved; then rinse, and, lastly, sterilise by boiling water of steam. Use pure water only.

After cleaning, keep utensils inverted in pure air, and sun, if possible, until wanted for use.

Cleanliness, both of the cow and the milker, is above all requisite. Dirty milk will not keep sweet; so that the farmer too often has a lot of stale milk returned to him which might have otherwise been a profit instead of a loss to him.

Almost all the complaints made of late by medical officers as to the mortality of infants, the necessity of sterilising milk, the establishment of municipal dairies, etc., have been due to the want of cleanliness shown by some farmers. Certainly, every effort is made by the town purveyor to get rid of this dirt so unnecessarily allowed in. It is to the interest of the whole dairy trade to do their best to exclude every atom of dirt from the milk; it is in fact suicidal not to do so. Milk once discredited as a safe and wholesome food would be less used, and the whole dairy fraternity would suffer. The present consumption of milk is enormous. Each individual consumes on an average sixteen gallons per annum, and about twice this amount in the form of butter, cheese, and cream.

THE FOOD VALUE may be noted from the fact that:—

3¾ lbs. of milk equal 1 lb. of beef in flesh-forming materials.

3 lbs. of milk equal 1 lb. of beef in heat-giving materials.

A perfect food should give one part of flesh-forming to 3¼ parts of heat-giving materials.

The proportions of flesh-forming to heat-giving ingredients present in ordinary foods are as follow:—

	Flesh-formers.	Heat-givers.
Milk	3¾ ...	8¼
Cheese	24 ...	31
Meat	14½ ...	30
Wheaten flour	12 ...	74
Rice	7½ ...	76½
Potatoes	2 ...	21
Beans	22½ ...	45½
Peas	22½ ...	52⅓
Fruit	½ ...	11⅓

Hence milk is the only perfect or complete food we have. It is replacing beer for consumption amongst the workmen in the Imperial Dockyards at Kiel. A milk purveyor, whose sales in 1905 averaged 2,000 to 3,000 bottles of milk per month, is now supplying 18,000 bottles per month. The cold season has made no break in the consumption, as the freshly pasteurised milk is brought to the consumers in closed, insulated vans. Through the introduction of pure cheap milk, the demand for beer and other alcoholic beverages should be considerably reduced, especially as the use of alcohol reduces the physical capacity of the workmen.

Milk varies greatly in composition according to the breed of cows, time of lactation, period of the year, intervals between milking, etc. But a general average for all England throughout the year would show in 100 parts by weight about:—

87·25	parts	of natural water.	
3·75	„	fat.	
3·4	„	casein or curd and albumin	Non-fatty solids.
4·75	„	milk-sugar - - -	
0·75	„	mineral salts - - -	

Of course, many samples fall below this, and many contain a larger proportion of nutritive constituents.

The Board of Agriculture has fixed a minimum of 3.0 for fat and 8.5 for non-fatty solids. Any milks coming below this have to be returned by public analysts as adulterated. The law, however, only says that "a presumption shall be raised till the contrary is proved that the milk is not genuine." It is therefore always open to the dairyman to produce evidence showing the milk to be that actually given by the cows, and that it has not been tampered with.

It is exceedingly unwise to feed cows to give milk that will only just come up to this standard, and still worse to so manipulate good milk to make it only just pass the standard. A good article always commands a ready sale, and a fair price in the long run. Adulteration pays no one: such milk has to be sold at a lower price, it almost inevitably brings on a cutting trade, and when detected involves finally the extinction of the trader and the adulteration.

Milk should be cooled down to as near 50 degs. as possible directly it is taken from the cows; it will then travel safely to the place to which it is consigned without the sender being annoyed by having stale milk returned on his hands, *i.e.*, providing the market is not too far distant and the weather not too hot. In these cases, science, in the form of preservatives, is sometimes called upon to assist nature, but I must not touch on this subject, but I could! Milk coolers on various principles are numerous, but care should be taken from time to time to see that no part of the cooler leaks. When the tin wears off the cooler should be at once retinned; contact of the milk with copper often causes an unpleasant flavour. Every farmer would do well to personally superintend his milk supply; the inducements for his servants to be careless, if not worse, are so great that special supervision is necessary. A business involving unremitting labour early and late, Sundays and week-days, with a too scanty supply in winter and a too full flush in summer, needs the watchful care of the responsible proprietor.

A Simple Method for Sterilising Milk.—Milk may be sterilised by boiling or by the agency of steam. If

steam is used, it may be done in two ways—*i.e.*, either by the continued or the interrupted method; the latter is the more scientific and rational, and if after it has been properly carried out the air is excluded, decomposition is impossible. The interrupted method is based on the fact that the spores of bacteria are more difficult to kill than the bacteria themselves. The milk is therefore put through a preliminary warming which matures the spores into fully developed bacteria; the milk is then subjected to the influence of steam at a temperature of 215 degs. Fahr. for twenty-five minutes, which destroys the germs of disease and fermentation. If milk is sterilised according to this method, it will keep for almost any period, and further, being sterile, it cannot communicate any disease.

Milk in summer, owing to the grass eaten by the cows, if of a yellowish tint. In winter the milk naturally would be almost colourless. The public, not knowing this, demand uniformity; hence the use of milk colouring matters. That made from annatto has been used for very many years; it is a harmless vegetable colour, and has never seriously been objected to. Other colouring materials made from coal-tar are considered injurious, and many convictions have been obtained for using them. Coal tar colours may be detected by adding a drop or two of hydrochloric acid, which turns them pink.

Simple Test for the Purity of Milk.—To discover if milk is pure enough for domestic purposes boil it; if it will boil without coagulating it can be used with safety. Fresh milk can be kept pure and sweet for several days, in the hottest weather, by the addition of a harmless boron preservative.

NURSERY MILK.—Milk intended for the nursery should be stirred at frequent intervals until cold, in order to distribute the cream evenly.

AMASI (KAFFIR MILK).—Some years ago when I was visiting Grey Hospital in King William's Town, South Africa, going round the wards with my friend Dr. Fitzgerald, he very kindly showed me the many lupus cases they invariably had there. The faces of many of these were so consumed by the disease as to render it necessary to feed them by means of a funnel, and as they were all kept in a dark tent, the sight was weird indeed! The food they fed these poor creatures on was known by the native name—Amasi—and it was prepared in the following manner, and I little doubt if we could even to-day (and it is nearly twenty years ago since I was there) improve upon it as an easily digestible, nourishing food for invalids or children:—Get a jar and put in one pint of milk; put in the sun for an hour or so; then place aside and shake well during the day. The next day add another pint of milk; place in the sun again for an hour or so, and repeat the shaking as before. Do this for ten days, and add a pint of milk every day, when the milk is in a state partially digested (Koumiss), but has a nasty bitter taste, which is overcome as acquired. Afterwards add the pint of milk daily, and let the patient go on taking it.

SKIM MILK.—Various methods of setting milk so that the cream might rise and be skimmed off have been devised, but with the advent of the separator these are little used now. In a very short time the cream may, nine-tenths of it, usually be removed, leaving the skim milk quite fresh; while by setting milk only six-tenths

of the cream can be obtained, leaving the skim milk generally sour and useless. The food value of skim milk has for a long time been largely under-estimated, but it is rapidly being more recognised every day, and I don't believe it is generally known that skim milk has two-thirds of the nutritive value of whole milk. Chevalley, in 1886, proposed to substitute it for water in bread-making. It is said that the increase in the cost of making is 10d. per cwt. of finished bread. According to Mer, the best proportions are 11 gallons of skim milk to 170 lbs. of flour. This gives 236 lbs. of bread. Skim milk is sometimes fed to pigs at the rate of about three gallons a day; but it is more profitably used in rearing calves, in combination with small quantities of potato, rice, or linseed. In Germany, earthnut oil is added at the rate of 2 per cent. of the skim milk, but the oil is bad for weakly calves. For calves, the milk must not be at all acid, and should be heated to about 95 degs. Fahr. If sour it is given to the pigs. Skim milk is also useful for poultry and lambs. Many persons are of opinion that the skim milk should be sterilised before being given to young animals, especially in the case of sucking pigs, to prevent intestinal disorders.

SEPARATORS can now be obtained to work by hand or by steam, that will separate the cream from milk from a few to hundreds of gallons per hour, so that only one-tenth of the butter-fat is left in the separated milk.

Modern separators do not leave much more than 0.1 per cent. of fat in the separated milk.

Separators should be firmly fixed and run at a uniform rate, usually from 6,000 to 7,000 revolutions per minute. The milk to be separated should be heated to a uni-

form temperature, and should flow into the bowl at an unvarying rate. Both the separated milk and the cream should be at once cooled down, if they are intended for immediate sale. If milk or cream is kept for any length of time in refrigerating chambers for storage, these should not be cooled below 38 degs. Fahr.

THE MANUFACTURE OF CASEIN from separated milk has become a very large industry, and may be performed in the following manner :—The milk is put into a jacketed pan, heated by steam to a temperature not exceeding 150 degs. Fahr. When this temperature is reached, the skim is treated with one-thousandth part of its volume of dilute sulphuric acid. Hydrochloric acid is sometimes used instead of sulphuric. In summer less will suffice, as the milk becomes sour spontaneously. The curd, which is the casein, is filtered off by a cloth supported on a frame, rinsed, and allowed to drain. In twenty-four hours it is very hard, although it contains about 50 per cent. of water, and can be stored. Another method is to allow a thin stream of milk to flow over superheated cylinders. This crude casein can be used for many purposes after drying. Various drying apparatus have been devised for drying casein on a large scale. Those of Lebrasseur and Fouche may be mentioned. The average yield of casein is about one-twenty-eighth of the weight of the skim milk. The uses of casein depend upon whether it has been prepared by the use of acid or by the use of rennet. In the former case, the casein is soluble casein—*i.e.*, is soluble in weak alkaline solutions. In the latter, it is insoluble. The soluble casein, however, becomes insoluble on heating, and thus constitutes a binding material of great value, and when used to bind

inert solids into a continuous mass gives excellent imitations of ivory, meerschaum, etc., as well as valuable cements. For example, a solution of it in borax is an excellent cement for wood, china, and anything that will stand the coagulation temperature. Soluble casein is also used in dressing fabrics and as a thickening in calico printing. It has great nutritive value, and all kinds of products are made with it—*e.g.*, plasmon, caseone, nutrose, globon, eukasine, sanose, sanatoken, *et hoc genus omne.*

PASTEURISED MILK.—Pasteur first demonstrated that all decomposition was due to the action of fungoid bodies, now generally called bacteria. He showed that these could be destroyed by heating for longer or shorter periods. Milk heated in a closed vessel for one hour to 160 degs. Fahr. has the bacteria killed, though the spores of these are not destroyed. Such milk will keep fresh for a couple of days or more; but while a considerable range of temperature is permissible in pasteurising, still in the pasteurisation of milk for commercial purposes there are certain conditions that must be met, and these determine the temperature to be employed in such a case. They are as follows:—(1) The milk must not undergo any undesirable physical changes. (2) The taste and appearance of the pasteurised product must not differ from that found in raw milk; thus the temperature must be limited to such a degree as will not affect the milk in this way. The lowest temperature at which the cooked taste becomes permanent, when the milk is heated from fifteen to twenty minutes, has been found to be 158 degs. Fahr. Hence if the cooked flavour is to be avoided, this condition determines that milk shall not

be heated above 158 degs. Fahr. At lower temperatures than this, when milk is heated for some time, a slight cooked flavour may be apparent, but it usually disappears again on cooling. This may be largely prevented by excluding excess of air during the process, *i.e.*, by heating in closed pasteurisers.

Again, it is essential that there shall be no change in the creaming properties of the milk; it must throw up its cream as quickly and as thoroughly as raw milk. Russell has clearly shown that when milk is heated above 140 degs. Fahr. the state of aggregation of the fat globules of the milk is so altered that the milk no longer creams in a normal manner. At temperatures above 140 degs. Fahr. the clusters of fat globules which occur in raw milk becomes split up, and the globules become homogeneously distributed throughout the liquid—a condition which prevents them coming to the surface quickly and thoroughly.

In order that the keeping quality of the milk should be improved, and to ensure absence of disease bacteria, it is necessary in all cases to exceed the thermal death point of all the actively developing bacteria. This temperature will depend on the duration of the heating period. Of the disease organisms, the one which is most important, because of its wide occurrence and also its high degree of resistance, is the *tubercle bacillus*. This organism, therefore, may well be taken as the standard in fixing a pasteurising limit, looked at from this second standpoint.

Scientists' opinions differ as to the exact temperature at which the organism of tuberculosis is destroyed, since all experiments must include inoculation into living animals. The results of recent experiments made by

Russell show clearly that when tuberculous milk is heated to 140 degs. Fahr. the virulence and vitality of the tubercle organism is destroyed.

THE ADVANTAGES OF THE PASTEURISING SYSTEM AS APPLIED TO BUTTER-MAKING.—A series of interesting experiments were made by Prof. Dean in Canada with the object of testing the keeping qualities of the butter made from pasteurised milk as compared with that obtained from milk separated in the ordinary course. For the purpose of this experiment, the contents of a vat of milk was thoroughly mixed, and one quarter of it was separated at an ordinary temperature of 85 degs., another quarter was separated at 140 degs., a third at 160 degs., and the fourth quarter at 180 to 185 degs. Each lot of cream was ripened and churned separately, and the butter was put into cold storage at a temperature of about 40 degs. The experiment was made in the month of May, and repeated once a month during the next three months. The butter was judged at the end of about one month, again in two months, and again when three months old. The quality of the butter stood in the order of the temperature to which the milk was heated. That made from milk heated to 180 degs. was best in quality, that heated to 160 degs. was second, that heated to 140 degs. stood third, and the butter made from milk heated to ordinary temperature for separating was poorest. These results confirmed the experiments of former years. The conclusion come to, therefore, is that butter made from milk heated to 180 to 185 degs. possesses keeping qualities not obtained by separating at ordinary temperatures, nor by heating to temperatures ranging from 140 to 160 degs.

It is essential that the milk should be quite fresh before being pasteurised, as sourness would be fatal to good results. The acidemeter is useful in making quick tests for milk acidity, and simple to use. The following method is recommended:—The acidity in the milk, whey, or cream is neutralised by adding a solution of caustic soda of a certain strength, the exact point of neutralisation being indicated by a crimson colour produced in the liquid by the use of a chemical substance called Phenol-phthalein. The greater the degree of acidity present, the more soda solution will be required to produce the crimson tint (*i.e.*, to effect the neutralisation) and *vice versâ*.

THE COMMERCIAL VALUE OF MILK.—This is estimated at the creamery by its richness in butter-fat, and farmers who sell milk on this basis should always run the night's milk through a strainer, immediately before sending away, to break up the cream that has risen during the night.

CONDENSED MILK.—The original milk is evaporated down in vacuum-pans till it is reduced to between one-third and one-fourth of its bulk; it is now placed in tins, heated to boiling point, and sealed up. This will keep for an indefinite time, but directly the tin is opened it will commence to decompose like ordinary milk. If, however, during the condensing, some sugar (usually about 40 per cent.) is added, the condensed milk will keep even after the tin is opened for a very long time. Separated milk is also condensed in the same way. Its food-value is dealt with under the heading of Skim Milk. It should never be used for feeding infants. They would certainly starve on such a diet. The

law insists that condensed separated milk should be legibly marked "Machine Skimmed Milk."

MILK POWDER.—If we could get rid of the 87 to 88 parts of water naturally present in milk, we should have the nutritive materials in far less bulk. This is now done by letting the milk flow in a thin stream over rotating rollers that are internally warmed by saturated steam. The water is driven off, and a thin cake of milk solids is left sticking to the cylinder; this is cut off and powdered. The heat renders it sterile, so that it is not likely to decompose; but it has been clearly demonstrated (1) that no change in the chemical constitution of the milk solids could be detected as a result of the drying, and (2) that the milk powder was absolutely sterile, and remained so after long keeping and a voyage round the world. Virulent germ cultures were added to the milk before drying, but in every case the process killed these off completely. But the physiological tests are the most important, appealing as they do to the plain man and the man of science alike. In the summer of 1903, when infant mortality was at its height, 850 children of poor parents in New York were fed for four months entirely on milk reconstituted from milk powder. The experiment was made under the most careful official, medical, and charitable supervision. The result, we are informed, was satisfactory; but until a process has been devised to enable manufacturers to dry milk, so that the resulting product is freely soluble in cold water, and that when the diluted powder is added to tea, coffee, etc., it will impart that opaque colour characteristic of new milk, its uses must of necessity be very much restricted.

Normal milk contains 87.5 per cent. of water, and the

fat is in a very fine state of sub-division, and it is not an easy problem to take away the natural moisture and add it again at will, with results identical with Nature's fine emulsion.

CREAM.—There is no legal standard for cream. The London wholesale market, however, requires that it should contain 50 per cent. of butter-fat. It is the universal custom, and absolutely necessary in warm weather, to add to the cream some preservative. The only one so far found to be unobjectionable, tasteless and effectual is a soluble form of boron compounds, which require very special skill in manufacturing and elaborate machinery. Cream is too valuable to allow it to be wasted.

The question of the most suitable preservative for cream was very carefully considered by the Parliamentary Committee appointed in 1889, and after two years, during which time every opportunity was seized upon to obtain the most practical and the most reliable evidence on this important question. The final decision was, that it is necessary to use preservatives in cream, limited to 0.25 boracic acid, the most harmless form of preservative yet known to science; but cream preservatives containing other chemicals, such as salicylic acid and the like, are not to be allowed, so it is very important to the cream merchant to get a preservative that complies with the present recommendations.

Cream as well as milk very rapidly absorbs any smells or bad odours. It is, therefore, very necessary to keep the room, vessels, etc., and all surroundings absolutely sweet and clean, else a decided taint may be communicated to the milk or cream. Neglect of this precaution sometimes results, especially at the farm, in the milk get-

ting ropy or slimy. In this condition the milk may be drawn out into threads when touched by the finger. This is due to the presence of a fungus which rapidly multiplies and grows in the milk. If not stopped in time, the whole of the milk supply from a farm or dairy may get into this condition. The only remedy is to thoroughly clean the milking sheds and to limewash them, also to take care that all vessels are well scalded.

THE EFFECT OF PASTEURISATION ON THE VISCOSITY OF CREAM.—Pasteurisation does not appreciably affect the specific gravity of milk and cream, but it lowers the viscosity considerably. In a recent laboratory experiment it was discovered that 50 c.c. of pure separated cream, containing 53 per cent. of fat, when heated to 125 degs. Fahr., gave a viscosity of sixty-two seconds. The same quality and quantity of cream pasteurised at 170 degs. Fahr., and cooled quickly, gave, on being re-heated to 125 degs. Fahr., a viscosity of seventy seconds. Other samples of cream, after being treated in the same way, showed a similar variation.

Another result is the loss in bulk by the process. The globules of fat get split up and go into less compass. Then, again, if cream is run thin from the separators, say 45 per cent. fat, it will never thicken, even if kept at a very low temperature. To counteract this defect, a harmless preparation, marketed under the title of "SESCO," has been devised, the use of which causes a re-uniting of the fat globules—thus giving a heavier body to the cream—and materially facilitates its whipping qualities.

BUTTER consists mainly of the fatty matter of milk Only traces of the other constituents, curd, sugar and

mineral salts, are left in. Average composition of 100 parts of butter may be taken as follows:—

Water	13 parts.
Fat	85 „
Salts	1 part.
Casein (curd)	1 „

The cream from which it is to be made should be put into perfectly clean pans, and allowed to become sour either naturally or by the aid of a starter. In winter time it may be necessary to add some colouring matter, otherwise the resulting butter would be almost colourless. In creameries or factories where butter is made on a large scale, the best results are obtained by mixing the butter-colour with the salt and preservative before working into the butter. It is important to keep always to the same sort of colouring matter and to the same tint. The public get accustomed to a certain appearance, and will not take to what is practically the same article, unless it is of the same shape and colour to what they have been used to. Uniformity for market purposes is of all importance. When the cream is slightly sour, and from .5 to .6 per cent. acid, it should be run through a strainer into a thoroughly clean churn.

The legal limit for water in butter is 16 per cent. Anyone in the United Kingdom found selling butter with more than this amount of water is liable to prosecution, unless a notice is given at the time of sale of the excess of water.

The object of washing and working butter is to get rid of the curd. This, if allowed to remain, would render the butter liable to decay rapidly, and to become rancid. Very often the bitter taste in butter is caused by an in-

fection of the milk or cream with particular microbes, but the bitter taste can also be produced in butter through milk having remained in rusty pans. In this case appreciable quantities of iron have been found under the form of lactate. The conclusions from the experiments are :—

1.—Milk coming in contact with rusty surfaces dissolves oxide of iron, and forms, with the lactic acid, lactate of iron, which has a very bitter taste.

2.—This dissolution is particularly active in cream owing to the great acidity of the latter.

3.—Lactate of iron disperses in all the products and by-products of the dairy. Dairy managers should therefore see that all their pans and tanks are thoroughly well tinned.

FISHINESS IN BUTTER.—This is a very common complaint, and may be brought about from causes too numerous to enter into in the small space obtainable in a handbook, but those concerned will do well to give first attention to the following points :—

Insist upon suppliers carefully cleansing cows before milking, and discontinuing the use of milk from newly-calved cows or cows with inflamed udders. Attention should be given to water holes, which are liable to get dirty and boggy. Fencing off the hole or dam and pumping into troughs by windmills is the best and cheapest remedy. Factory managers should stop the use of rusty utensils, or vessels off which the tin is worn. Only clean water should be used for butter-making, and the cleansing and rinsing of all dairy utensils. Butter-makers should so manipulate their butter as to leave as little butter-milk as possible in the finished product by

attention to temperature and method of rinsing the butter. Everything in connection with the preparation or treatment of dairy products should be kept scrupulously clean, and if this is done the term fishiness as applied to butter will most likely disappear.

BUTTER AS IT IS MADE IN THE CREAMERY.—The creamery system has made such rapid strides of late that only those actually engaged in the work and seeing it every day can possibly keep pace with the latest developments in creamery butter-making. I am, therefore, indebted to Mr. R. Gibson, of the Public Creamery Market, Limerick, for the following notes:—

See that your cream is ripened, not merely allowed to get putrid.

To ripen, you must in winter keep cream at 60° to 65° F.; in summer at 50° F.

Cream will not ripen properly unless frequently stirred by pressing top layer down and drawing up the bottom layer, so as to bring it into contact with the air.

Lactic acid bacilli are non-motile, so must be helped by currents to get through the cream and destroy injurious organisms.

Churn when ripe, never before, as you lose flavour, quantity, and keeping properties by churning unripened cream.

Churn slowly for first five or six minutes, venting every ten revolutions, until no more gas escapes, then quicken up, never exceeding fifty-five revolutions per minute.

Always strain cream into churn to secure even churning.

Churn at 50° F. or under in summer or at any time of year that temperature of atmosphere is high; at 52° to 53° F. in moderate weather; at 58° to 60° F. in cold or frosty weather.

At once, when cream breaks and shows very small grains of butter on eye-piece, stop churn, open and wash down with the coldest water you have, close churn, and start very slowly for from one to two minutes, carefully watching eye-piece. Stop when grains are the size of large wheat. Again wash down; then lift the butter out of the churn in a hair sieve and drop it into a tub of pickle, made with either Salt or Preservative, according to whether the butter is to be saltless or salted.

If churning has been stopped at right time, butter only requires

one washing in the pickle. If ever so little over-churned it may require to be washed in another tub of pickle, but only carelessly churned butter requires the second washing. Lift out of pickle and allow to drain for a few minutes.

Then cure with your Salt or Preservative, put on through a wire sieve. Never roll butter before adding Salt or Preservative; always put them in while the butter is in the grains.

Now give two (or three at most) rounds on the table, roll up the butter in loose rolls and set aside from one to three hours, according to temperature, in winter even half an hour may suffice. After the rest, give three more rounds on table, and immediately pack.

Anyone working on these lines has always good flavoured, good coloured, good textured butter, always provided the milk was good.

Nothing can make good butter from rank, diseased milk.

Nothing can really restore butter that has once gone bad.

Therefore use Preservative at once that your butter may not become bad in course of transit.

Butter could be made from fresh cream, but it will then lack the taste and aroma of the butter made from ripened cream. A great variety of churns are now in the market: some will in a few minutes produce butter; this, however, is not usually considered to be so good as the butter produced by the old form of churn. The temperature of the cream should always be taken by a thermometer. Never in any dairy work trust to feeling, but always verify the true temperature by using a thermometer. Guesswork will produce varying results, and will spoil much good material.

Great care should be taken to put the butter up in convenient rolls or pats, and to wrap these up in muslin that has been scalded, and then dipped in brine solution containing half a pound of a good boron preservative to the gallon. Butter papers soaked in this solution overnight, and squeezed out before use, cannot possibly mould. Once you have adopted a satisfactory system of

package, keep to it always. The public judge mainly by the appearance of an article.

Remember that no machine, however perfect, will produce good results unless cleanliness, care, and attention are also used. The first requisite in all dairy work is *cleanliness.*

The quantity of butter that should be obtained from cream depends upon the richness of the cream in butter-fat.

THE FOLLOWING TABLE SHOWS THE AMOUNTS PRODUCED BY GOOD WORKERS:—

	Quarts of Cream Churned.								
	2	4	6	8	10	20	40	60	100
Percentages of fat in Cream.	Pounds of Butter Obtained.								
15	0·87	1·74	2·18	3·48	4·35	8·70	17·4	34·8	43·5
20	1·17	2·35	3·52	4·70	5·87	11·7	23·5	47·0	58·7
30	1·75	3·50	5·26	7·00	8·77	17·5	35·1	70·2	87·7
40	2·30	4·62	6·94	9·00	11·55	23·1	46·2	92·5	115·6
50	2·82	5·64	8·46	11·28	14·1	28·2	56·4	112·8	141·0

THE CHANGES THAT TAKE PLACE IN BUTTER IN THE PROCESS OF BECOMING RANCID.—In the development of rancidity there are observed, first of all, several changes as regards colour, odour, taste and general appearance. The sample first begins to acquire a lighter colour, the change appearing on the surface and parts most exposed to light, from which points the action spreads slowly downwards, until finally the whole mass has become bleached. With this loss of colour is noticed also the development of a characteristic so-called "lardy" smell and taste, and as the rancidity becomes greater the smell increases in pungency, while the taste,

which at first was not markedly acid, becomes exceedingly burning and unpleasant. In addition, there are changes in the consistency of the butter-fat; originally firm and solid in texture, it assumes a granular appearance, and, after many months, finally turns into a pasty mass. On determining the chemical and physical constants of the fat at various stages of its rancidity, and comparing them with those obtained when in a fresh state, certain characteristic changes are noticed. With the development of rancidity we usually observe a decided increase in the amount of free acid as well as in the specific gravity, with a decrease in the insoluble fatty acids and iodine absorption—the latter being of a very marked description. The constituent in butter-fat which is most susceptible to chemical change is oleic acid. This being an unsaturated compound, it absorbs oxygen with great avidity, yielding either oxy-compounds or decomposing into simpler bodies of lower molecular weight. This instability and the chemical changes consequent upon it serve to explain the alterations in the constituents mentioned above.

Be careful never to send out a particle of rancid butter; such butter was saleable once, but margarine has made it almost impossible to sell inferior butter now!

RENOVATED BUTTER.—Inferior or rancid butter has some marketable value, as science again has stepped in, and by a few dexterous turns of the wrist and one or two little conjuring tricks, this butter can speedily be transformed into its original pristine freshness as far as the public taste is able to pronounce a verdict, and all this is being done on a surprisingly large scale; and with a general and practical knowledge of the different pro-

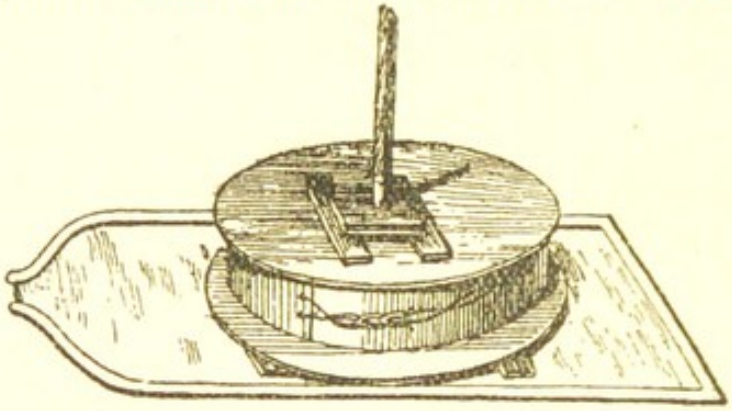
cesses adopted, I should select the one in which sour skim milk is used, and washing the butter in a specially prepared alkaline solution. This certainly removes the rancid taste and imparts fresh aroma to the butter.

MILK-BLENDED BUTTER contains from 20 to 30 per cent. of water; in this case a mixture of milk and cream is worked up with butter in a sort of pug-mill. It cannot, however, be sold without a declaration on each packet that it is a mixture. The keeping qualities are poor.

MOROCCO BUTTER.—From the *Milch Zeitung* we learn how the Moor prepares butter in an original way, and gets a different taste from the usual one. Fresh butter ("zibda," as he calls it), as known to us, he despises, and uses only for cooking. It must be old if it is to be liked. After it has lain in a hole in the ground for some years and has got a certain appearance, it becomes a delicacy. To make butter, a goat skin is turned outside in. It is filled with milk, bound tight, and tied to a tree. There it is beaten backwards and forwards till the butter is made. That is why you cannot get butter in Morocco without hairs all through. The butter is then laid on pieces of wood, and the maker goes to sell it. Possible buyers lift the dirty cover, put in their fingers, and take out a taste, and if the goods do not please, close it down again, and the salesman pursues his way.

CHEESE.—That which is thrown away in making butter, the curd, is the chief constituent in cheese. Weight for weight cheese is more nutritious than meat, and, if properly made, is more easily digested. Cheese may be made from whole milk, milk with added cream, or from separated milk.

SWEET CREAM CHEESE.—Take a mixture of half new milk and cream, rennet it at a temperature of 86 degs. to 88 degs. Fahr. by adding one dram of cheese rennet to every gallon of the mixture. The rennet should be stirred into the cream and milk in one direction until it thickens. If coagulation does not take place within three minutes, either the milk is not suitable for cheese-making or an insufficient quantity of rennet has been added. After coagulation has taken place, let the curd stand for an hour or two undisturbed, then place it to drain on a close-woven cloth which has been



SOFT CHEESE PRESS.

CURD BOWL OR SCOOP.

stretched over a milk pan or some other open-surface vessel, when the cheese will become as stiff as firm butter; it should then be moulded, as hereafter described.

RIPENED CREAM CHEESE, which is a more palatable variety, is made from cream which has been slightly soured. The sourness depends on the flavour the cheese-maker wishes to develop, a condition experience alone can teach. However, the uninitiated will do well to select thick cream of velvety appearance about two or three days old, and which has reached the *sweet* sour stage. Butter-makers recognise this stage in cream as that from which butter of the fullest and richest quality is made.

A small quantity of the cream of the quality described is spread over a piece of muslin, which has been passed through cold water, and tied over an open-mouthed vessel, and allowed to thicken naturally. It is sometimes advisable occasionally to remove the cheese from the cloth with a bone or silver knife to facilitate draining, especially with cheese made from sweet cream. The necessity for this attention depends on the temperature of the dairy, the age and consistency of the cream, and need not be resorted to unless draining is likely to occupy more than twenty-four hours, as waste may take place if the cheese is disturbed too often. The best temperature for making cream cheese is about 60 degs. Fahr. If the

SOFT CHEESE MOULDS.

cheeses are made in winter time, the draining must take place in a room as near this temperature as possible, and the cream must be soured artificially, and not allowed to sour of itself, or the quality made will be very inferior, owing to the protracted decomposition of the milk sugar. Moulding cream cheese is quite a simple matter. Moulds, square or round, to hold quarter-pound or half-pound cheeses, can be purchased at a few pence at a dairy implement shop; the silver paper to cover the cheese, and the printed labels explaining the condition of the cheese, are quite inexpensive.

Cream for cheese-making should contain from 28 to 30 per cent. of fat; it will then develop a full flavour in ripening and require no water to thin it if used for

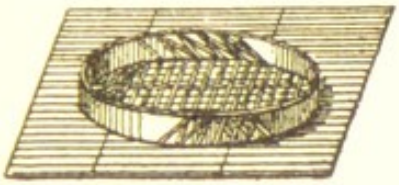
churning. (2) Cheese may be tested for fat by the Babcock apparatus for milk testing in the following way:— Take a true sample of cheese by drawing out a plug extending from the outside to the centre. Cut this into small strips extending from end to end of the plug—strips that will pass through the neck of the test bottle. Weigh from four to five grams of these strips of cheese and put them into the test bottle. Add to these from 12 to 14 c.c. of hot water to dissolve the cheese. If there is any difficulty in getting a thorough solution, add a small quantity of potash or ammonia. Shake the contents of the test bottle until a complete solution is obtained, then cool the sample to 60 degs. or 70 degs. Fahr., and proceed as for testing milk.

$$\frac{\text{Reading} \times 18}{\text{grains used}} = \text{percentage of fat in the sample tested.}$$

ACID AVERAGES.—The following figures are taken from Mr. Lloyd's "Investigations into Cheddar making." They are averages for May over a period of six years (1892-1897), taken in connection with the work of the Bath and West School:—

	Time of day at which different operations were done.	Acidities. (Per cent. acid.)
Evening milk		·195
Mixed M. and E. milk		·192
Stale whey used (¼ per cent.) as "starter"		·4
Mixed milk renneting time	7.40 a.m.	·201
Curd cut	8.30 a.m.	
Heating commenced	9.53 a.m.	
Curd in scald 1h. 43m.		
Whey drawn off	11.36 a.m.	·185
Curd lifted from tub to cooler	12.35 a.m. (last drainings tested.)	·256
Curd put under press	5.0 p.m. (first liquid from press tested.)	1·06

The bacterial action on the mineral matter of milk is worth considering. Firstly, it must be borne in mind that the food of the different species of bacteria varies very much; but, undoubtedly, like plants, they require a certain proportion of mineral matter for building up their structure. Where this matter consists of alkaline and earthy gases and inorganic acids it is, no doubt, absorbed and rejected by the bacteria for the most part unchanged. Some of the salts of milk, however, consist of citrates and proteids, and it is very probable that the citrates are in certain conditions changed into butyrates, and the proteids into the general decomposition products of casein. It is certain that the salts play a very important *rôle* in assisting bacterial action, and the calcium salts—more



WHITE CHEESE MOULD.

BRIE MOULD.

particularly the phosphate—form combinations with casein which seem to be essential to the progress of the general reactions.

The varieties of cheeses made are so numerous that it is impossible to give any detail of their manufacture. Soft cheeses are made by coagulating the milk at a low temperature with rennet; the temperature not usually exceeding 85 degs. Fahr. Types of these cheeses are the Brie, Camembert and Bondon. They are made more rapidly than other cheeses, but will not keep so long.

HARD CHEESES are prepared from milk precipitated by rennet extract. These comprise the Stilton (which

usually contains added cream), Cheddar, Cheshire, Gruyere and Gorgonzola, made from whole milk. Skim milk cheeses, more or less free from cream, consist of such samples as Derby, Gloucester and Dutch.

Roquefort cheese is made from sheep's milk.

PASCHA CHEESE.—A cheese eaten largely in Russia. The plainest kind is made as follows:—From three to four kilogs. of curds are laid between two clean boards, stones are placed on same, and the liquid pressed out of the curd. This is kneaded with ¼ litre thick sour cream, 250 g. butter, 250 g. sugar, two teaspoonfuls of salt, and pounded almonds according to taste, and is put into a mould in the bottom of which is cut the Greek cross. A board is then laid upon same, pressed down upon it, and the Pascha left twenty-four hours, when it is turned out, and decorated with artificial flowers. The best Pascha cheese is distinguished from this only by the fact that more cream is used (not sour, but sweet), as also a large quantity of almonds or pistachio kernels, vanilla, and frequently, tpo, the yolk of an egg is added.

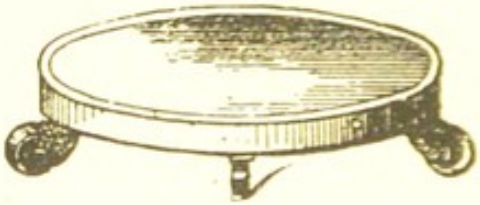
RENNET is obtained by cutting up the fourth stomach of the calf and soaking this in a solution of salt. An extract or essence obtained in this way, by a somewhat elaborate process, is suitable for use; or a powder may be prepared that will serve the purpose; but it is most important to use a thoroughly reliable article, else the cheese may get tainted or the rennet be unequal in its action. More uniform results will be obtained by using a factory-made rennet. It will be well to leave this branch of cheese-making to others, as very few indeed have the facilities for preparing a rennet essence equal to the factory-made. This must have a high degree of

milk-curdling power, be free from objectionable taint or odour, and remain permanent or sweet and sound for an indefinite time under favourable conditions. It is purely a matter of strength as regards value to the cheese-maker, and it is obvious it is cheaper to buy the strongest and best, as all other expenses are the same—carriage, bottles, etc., on a cheap imitation as on a good one. The time in which a definite amount of rennet will curdle a certain amount of milk at a fixed temperature should be ascertained so that the proper amount of rennet may always be used, as there is a great difference in the strength of different makers. There is a certain temperature at which rennet produces the best effect for each class of cheese. If the temperature be too high or too low, the curd produced will be soft. An overdose of rennet causes the milk to coagulate, and the cheese to ripen too quickly.

THE EFFECT OF PASTEURISATION ON THE COAGULATION OF MILK.—Recent experiments show that milk, after the process of pasteurisation, does not respond readily to the action of rennet. Whereas coagulation in twenty samples of pure milk renneted at 86 degs. Fahr. averaged four minutes, milk of the same cows pasteurised at 156 degs. Fahr., and renneted at 86 degs. Fahr., averaged six minutes. Coagulation was made with 0.1 c.c. rennet in 100 c.c. of milk.

RENNETING OF MILK.—If the mixed milk shows much longer time of coagulation than twenty seconds, add from ½ to 1½ per cent. starter, and keep the milk at 84 degs. or 86 degs. Fahr. until the time of coagulation by this test falls to twenty or twenty-one seconds. The acidity in milk at renneting should be as near as possible to .20 per cent.; in whey at drawing .19 to .20

per cent.; and in last draining from curd 1.0 per cent. The knives or instruments used for cutting the curd should have sharp edges, free from any roughness. If the curd be crushed, the fat and casein will be broken into small particles, and will be lost in the whey. It is necessary to get out as much of the whey as possible, else the milk sugar therein may set up fermentation. A slight acidity produced either by heating to about 100 degs. Fahr., or by the addition of about two quarts of sour whey to 100 gallons of milk at the time that the rennet was added, is advisable, and helps to get out the whey.



TROLLEY.

BASSINES OR ROUND OPEN TANKS FOR RENNETING MILK. TO FIT ON LITTLE TROLLEY FOR CONVENIENCE OF MOVING.

The curd should now be broken up in a pug-mill furnished with knives. If the action of the rennet is not controlled, the cheese will putrefy. Salt, therefore, is added, but not in too great a quantity, else the cheese will not ripen. Nor must too little be used, or the cheese will ripen too soon, and decomposition will set in. The more fat there is in the cheese, the less salt will be required. The salt should be well and evenly mixed during the grinding of the curd.

The *ripening* of the cheese should be at a temperature from 65 degs. to 75 degs. Fahr., in a perfectly clean room, free from any dampness.

STARTER (HOME-MADE).—In spring or autumn, or when the weather is cold, it is advisable to use a commercial starter—that is, one prepared from a pure culture. In summer, or when there is no difficulty in obtaining quick and pleasant acidity at home, a home-made starter may be used. Here are instructions for preparing the latter: Milk in as cleanly a manner as possible, and carefully sieve three quarts of milk into an enamelled pail. Cool quickly to 65 degs. Fahr., then cover lightly with muslin or a piece of glass, and set in a well-ventilated and clean room at 60 degs. to 65 degs. Fahr. In from twenty-four to forty-eight hours the milk will become sour and thick in an even and smooth jelly.

Now a new culture should be made. Heat four quarts of fresh and clean separated milk to 160 degs. Fahr. Cool quickly to 70 degs. Fahr. Skim an inch layer off the surface of the previously thickened sour milk, then lift into a measure one quart or less of the lower portion. Stir this smooth, and pour it through a muslin or straining cloth into the prepared fresh milk, which stir well afterwards, and set aside at 65 degs. Fahr. Next day make a new culture with a lower proportion of sour milk to sweet, for each culture made is stronger than the previous one. When one pint of thick sour milk at 65 degs. Fahr. will thicken six times its bulk of fresh milk in twenty-four hours, the starter may be considered strong and pure enough for use in the cheese. Do not use more than two per cent. of starter of this strength in the milk for cheese. In using artificially

prepared starter, it is wise not to use more than one per cent., as it is stronger, as a rule, than any prepared at home.

FACTORY CHEESE.—As with cream, the farmer should only be paid for the milk delivered, according to its analysis. Watered or skimmed milk is not only of less value than normal milk, but it, unless recognised as abnormal, may cause great losses owing to the resultant cheese not turning out well. So, too, milk brought in not cooled and fresh may cause a failure in making good cheese of saleable quality.

COLOURING.—Cheese is usually coloured so as to preserve a uniform colour throughout the year, otherwise the winter milk would give an absolute colourless cheese. A specially strong liquid annatto is made for this purpose. Some cheeses, such as the Dutch, are highly coloured on the inside, so as to distinguish them from others. Some, too, are painted on the outside to prevent the attacks of insects. In no case should any materials injurious to health be used for this purpose, or in any way in the preparation of food.

The remarks made under Rennet as to the importance of getting a good article, regardless of cost, in the manner explained, as invariably the more expensive is the cheaper, apply with equal force to the colouring for cheese, and perhaps even more so. In rennet you can judge immediately of its strength and action, whereas in colouring or annatto you cannot tell what is going to happen until you cut the cheese, which may not be for many months. If the colouring is not made from pure annatto, the cheese may be spoilt for marketable purposes as first quality cheese, although in reality it may be of superior quality.

ANNATTO, TEST FOR.—Cheese-makers would do well to test all their colourings for aniline dyes, preferably by an analyst, but where this is not convenient, it can be simply done by adding a little acid to the suspected solution, and filtering; if the filtrate comes through almost colourless, it is annatto, but if tinged with colour, the solution contains colouring material other than annatto. The colouring strength should also be tested, and a simple means of doing this is to take two Nessler tubes or tumblers, preferably long and narrow, fill them with water, and drop in a few drops of the liquid annatto, and observe the strength of colour, and you will see at once which solution is the stronger, and be able to judge of their respective values.

COLD STORAGE.—For small quantities of dairy produce some form of ice chamber may be found sufficient. But where any quantity has to be preserved, the use of systems of cooling, worked by the alternate compression and expansion of either carbonic acid or of ammonia, is essential.

The ammonia system is the one more generally used. The temperature, however, should never be allowed to sink quite to the freezing point, otherwise the taste and aroma of the article will be injuriously affected.

ASSES' AND GOATS' MILK.—In the milk of these animals, the fat globules are much smaller than in the cows' milk, and are very similar in size to those of human milk; for this and other reasons, the milk of the ass and the goat is more easily digested than that of the cow. Hence, in some illnesses, patients have such milk prescribed to them.

PEPTONISED MILK.—Some invalids find it impossible to digest ordinary foods, including milk. In such cases partially digested milk is found of great service. A small amount of pancreatic extract is mixed with the milk, made slightly alkaline by the addition of bicarbonate of soda, five grains to the pint, and warmed to 100 degs. Fahr. for from ten to twenty minutes. The milk becomes of a watery appearance, owing to a partial digestive change. When this is thought to be sufficient, the milk is rapidly boiled, to prevent the digestive action going too far.

KOUMISS is cows' milk altered by the action of a ferment, so as to be more readily digested by invalids. It is an imitation of the fermented milk of Russian mares. It is usually prepared by adding some grape-sugar and yeast to a partially skimmed cow's milk. A small amount of alcohol and much carbonic acid gas are produced, so that the material becomes highly effervescent, and has to be kept in an ice-safe. Being a food and also a stimulant, it can be retained in cases, such as gastritis, etc., where other foods are unsuitable, and cannot be tolerated.

HOMOGENISED OR FIXED MILK.—All milk preparations, such as humanised, pasteurised, and sterilised milks, after being in bottle a short time, give rise to a clot of cream in the neck of the bottle. This at first can be remixed with the milk by shaking; after a time it needs warming to recombine with the milk, even on shaking. If, however, the milk is by very great pressure forced through very minute holes, the fat-globules may be broken up so small that there is but little tendency

for the cream to rise to the surface afterwards. This, for many reasons, is very desirable, and is now largely adopted.

MILK ANALYSIS.—Milk passes through so many hands, from farmer to his employer, railway-carrier, middleman, dairyman, and the servants of these, as well as the customers' cooks, and finally the sanitary inspector's, that it is absolutely necessary to keep some supervision on the supply.

THE LACTOMETER tells one if the milk has been either seriously watered or skimmed; but if it has been both diluted and skimmed, the lactometer is quite fallacious and useless.

THE CREAM GLASS for very many years was supposed to give us a fair notion of the quantity of cream present in milk; but temperature, the breed of the cow, the shaking on the railway, so affect the milk that the cream-glass is no longer believed in. It has been replaced by the *Gerber Process*, in which a mixture of milk, sulphuric acid, and fusel oil are very rapidly rotated in special tubes, and the amount of fat ascertained. A certain knack is necessary, and some knowledge of the composition of milk, to ensure getting accurate results. The services of a skilled analyst are usually resorted to by most dairymen, to guide themselves and satisfy their customers. For, after all, it is essential to convince the consumers of the high quality of one's goods.

The cow is not a machine; milk, therefore, varies naturally from time to time. The cow knows nothing of a legal standard; milk, therefore, will occasionally come below this standard. The morning's milking is generally poorer than the afternoon's milking. During the months

of April, May, and June milk is of lower quality than during the rest of the year. The period of lactation of the cow also greatly affects the quality of the milk.

Though milk is most prone to turn sour in hot months, such as August, it also keeps very badly during October and November. In these latter months the masses of decaying leaves round the farms give off such quantities of fungus-spores, which the winds convey into the milk, that it is difficult to prevent this going sour, however clean the dairy may be kept.

PRESERVATIVES.—On this subject I prefer to be silent—owing to the position I occupy in relation to a company engaged in the manufacture of preservatives—but upon the all-important subject of the effects of Borax and Boric Acid on the human system, I would refer my readers to a treatise by Dr. Oscar Liebreich, o.ö. Professor der Universität, Berlin, und Geheimer Medizinalrat, now translated from the German, and published by J. and A. Churchill. The conclusions arrived at are as follows:—

"No proof whatever has been given that Borax has a cumulative effect on human beings. It has been proved on animals, as is mentioned in my first treatise, that after the disappearance of the Borax in the urine, the various component parts of the animal's body contain no Boron combination. In a normal human being no Boron is to be found in the urine, under the strictest examination, after 8 to 12 days. . . .

"I think THIS FREQUENTLY REPEATED OBJECTION TO BORON PREPARATIONS MUST BE DROPPED.

"The investigations offer a further proof that Borax and Boric Acid are substances which cause no injury to health when judiciously used."

The official recommendations of the Departmental Committee appointed to inquire into the use of preservatives and colouring matters in the preservation and colouring of food, as they appear in the Blue Book (1901) applicable to cream, butter, and margarine, are given as follow:—

CREAM.

(*a*) That the only preservative which it shall be lawful to use in cream be boric acid or mixture of boric acid and borax, and in amount not exceeding 0.25 per cent. expressed as boric acid. The amount of such preservative to be notified by a label upon the vessel.

BUTTER AND MARGARINE.

(*b*) That the only preservative permitted to be used in butter and margarine be boric acid or mixture of boric acid and borax, to be used in proportions not exceeding 0.50 per cent. expressed as boric acid.

From which it will be seen—that Boron preservatives only are advised, and in certain defined proportions. Cream producers, however, insist that 0.50 of boracic acid is even more necessary for cream than butter.

Mr. R. Gibson, of the Public Creamery Market, Limerick, has given me his opinion and experience of the value and use of preservatives in comparison with salt, of which the subjoined is an extract:—

Preservatives properly prepared are aids to digestion, as well as true preservers of food, so that it may remain in a wholesome and easily digestible condition.

Those who use heavily salted foods suffer fearfully from indigestion and various skin diseases.

Boron Preservatives do their work and are passed quickly and easily out of the system when their work is over.

Half of 1 per cent. of good Boron Preservatives does more to preserve food from the attacks of pathogenic germs than *four* per

cent. of salt would do. The Boron Preservatives really preserve the food; salt only alters it, changing good wholesome food into tough indigestible stuff.

Animal organs find it very difficult to clear the system of the mineral matter salt, but very easy to clear out Boron Preservatives.

Preservatives, in conjunction with salt, help to neutralize the effects of salt; therefore wherever the public taste is so vitiated as to demand salted foods, Preservatives should be used in conjunction with them.

These are facts which are slowly making their way through the crust of superstition and prejudice in which medical men have encased themselves.

MARGARINE.—One method of producing oleo-oil is as follows:—The selected fat is taken from the cattle in the process of slaughtering, and, after thoroughly washing, is placed in a vat of clean, cold water, and surrounded with ice, where it is allowed to remain until all animal heat has been removed. It is then cut into small pieces by machinery and melted at an average temperature of 150 degs. Fahr. until the fat in liquid form has separated from the fibrine or tissue, and then settled until it is perfectly clear; then it is drawn into graining vats and allowed to stand a day, when it is ready for the process. The pressing extracts the stearine, leaving the remaining product, known as oleo-oil. It is this article which, when churned with cream or milk, or both, and with sometimes a small portion of creamery butter, the whole being properly salted, preserved, and coloured, gives the food product Oleo-Margarine. Each animal yields an average of about forty pounds of oleo-oil.

WHITEWASH FOR THE DAIRY THAT DOES NOT WASH OFF OR MOULD.—Dissolve 2 lbs. of ordinary glue in seven pints of water, and when all is dissolved add 6 ozs. of bichromate of potassium dissolved in a pint of hot water. Stir the mixture up well, and then add sufficient whiting to make it up to the usual consistency, and apply

with a brush in the ordinary manner as quickly as possible. This dries in a very short time, and by the action of light becomes converted into a perfectly insoluble waterproof substance, which does not wash off even with hot water, and at the same time does not give rise to mould growth, as whitewash made up with size often does. It may be coloured to any desired shade by the use of a trace of any aniline dye or powdered colouring matter, and once applied will last for years, while, by the addition of a small proportion of calcic sulphite, its antiseptic power is much increased.

USEFUL CALCULATIONS TO REMEMBER.—

1 Barn gallon equals 2⅛ Imperial gallons.
1 Imperial gallon of milk weighs 10 lb. 5 oz.
1 Imperial gallon of cream, containing 30 per cent. of butter-fat, weighs 10 lbs.
1 Imperial gallon of cream, containing 50 per cent. of fat, weighs 9¾ lbs.
To convert degrees Centigrade into Fahrenheit degrees, multiply the Centigrade degrees by 9 and divide by 5, then add 32.
60 degs. F. = 15½ C.
100 degs. F. = 37¾ C.
1 foot = 0.3 mètre.
1 yard = 0.91 mètre.
1 quart = 1.136 litres.
1 litre = 0.22 gallon.
1 gramme = 15.43 grains.
1 kilogramme (the "kilo") = 2¼ lbs.
1 hundredweight = 50 kilos.
1 gallon = 4½ litres.

WARRANTIES.—A warranty may be pleaded as a defence in a prosecution under the Sale of Food and Drugs Acts, provided that—

(i.) The vendor gives notice within seven days of the issue of the summons that it is his intention to rely upon the warranty as a defence.
(ii.) He sold the article in the same state in which he bought it.
(iii.) He had no reason to believe that the article was not genuine.

Warranties must be specific, *i.e.*, they must refer to the particular consignment. A general warranty, such as "All milk guaranteed genuine," is of no value unless there is something in writing on or with each consignment to connect the consignment with the general warranty. In the case of milk, a warranty in terms such as "100 gallons of milk in 6 churns, Nos. 1, 2, 3, 4, 5, 6, warranted genuine, with all its cream," might be held to refer to the whole consignment, and the plea of warranty in the case of deficiency of cream in one churn might be upset on the grounds that the milk, as a whole, contained all the cream, and should be considered as one consignment. A label on each churn in terms such as "Warranted pure milk, containing all its cream," would, however, specifically refer to the milk in that churn.

If a portion of the milk in a churn is removed, it must be proved, in order that the plea of warranty may be valid, that the milk was well mixed to redistribute the cream, and it must also be proved that no separation of the cream took place on any subsequent occasion before the sale of the milk on which proceedings were founded. Unless this be done, it cannot be pleaded that the milk

was sold in the same state as purchased. It has been held that the addition of colouring matter to the milk upsets the plea of warranty on the ground that it was not sold in same state as bought.

If the vendor of an article of food for which he has received a warranty has had previous consignments analysed, and the analysis has shown that one or more of them have not been genuine, or, in the case of milk, have raised a presumption till the contrary is proved that the milk is not genuine, he cannot plead warranty, as he had reason to believe that the article was not genuine; if, however, he drew the attention of the person selling him the article to the result of the analysis, and received a satisfactory explanation, and sufficient time, during which consignments had been analysed and found genuine, had elapsed to restore his confidence, he can then plead warranty.

Under the Sale of Goods Act, every vendor of food is assumed to know that the article is to be used for food, and to have given an implied warranty that it is fit for food; unless the contrary is expressly stated, the purchaser is assumed to rely upon the skill and judgment of the vendor, to determine that the article is fit for food, even though he does not possess the requisite skill and judgment. The vendor is liable for all damages that can be proved to have been caused by the article when used for food, unless he can prove that the article when he sold it, and for a reasonable time afterwards, sufficient to allow of its consumption, as an article of food, was fit for its intended purpose.

The retail vendor has a claim for damages against a wholesale vendor in the event of judgment having been given against him, provided he can prove that he sold

the article in the same state in which he bought it, and that he relied upon the vendor's skill and judgment, and not upon his own. It is more difficult for a retail vendor to sustain an action against an wholesale vendor, than for a private purchaser to sustain an action against the retailer.

VALUATION OF FEEDING STUFFS.—Feeding stuffs for cattle are valued by adding to the percentage of carbohydrates (starch, sugar, gum, mucilage, etc.), 2½ times the percentage of oil or fat, and 2½ times the percentage of albuminoids (proteids or proteins). The total gives the number of feeding units.

This method gives very good results; with regard to oil or fat the factor 2½ is theoretically and practically exact; in the case of albuminoids it is exact, provided that gelatine or other albuminoids of little value as food are not present, and that directly injurious substances, as castor oil seeds, are absent. It is very rare that any such substances are present.

The feeding units give the real food value when a proper proportion of all constituents in the total feed is maintained.

GLOSSARY OF DAIRYING TERMS.

English.	German.	French.	Italian.
Milk	Milch	Lait	Latte
Cream	Rahm	Crême	Crema
	Sahne		Panna
Skim milk	Mager-milch	Lait écrêmé	Latte scremato
	Abgerahmte-milch		
Butter	Butter	Beurre	Buttiro
Cheese	Käse	Fromage	Formaggio
			Cacio
Curd	Gerinnen	Caille	Caglio
	Quarg		
Whey	Molken	Petit lait	Latticello
	Käse-milch	Serai	
Separator	Separator	Ecrêmeuse	Spannatrice
Churn(Butter)	Butterfäser	Barratte	Zangola
Milk sugar	Milchzucker	Sucre de lait	Zucchero di latte
Lactose	Laktose	Lactose	Lattosio
Casein	Kasein	Caséine	Caseina
Fat	Fett	Graisse	Grasso
Albuminoid	Eiweisskörper	Albuminoïde	Proteina
Proteid	Protein	Proteine	
Rennet	Lab	Prèsure	Caglia
Salt	Kochsalz	Sel marin	Sale
Cow	Kuh	Vache	Vacca
Sour milk	Geronnte-milch	Lait caillé	Latte cagliato

BUTTER-MAKING ON THE FARM.

THE NATURAL SOURING OF CREAM.—The souring of cream is a natural process caused by the action of bacteria which develop rapidly in cream of a suitable temperature. The principal change is the conversion of a part of the milk sugar into lactic acid. This change in the condition of cream has the effect of liberating the butter-fat from association with the casein, thus rendering churning an easy operation. Cream may be said to be ripe for churning when it contains between 0.50 and 0.60 per cent. of acidity. If it is kept beyond this point fermentative changes occur which are responsible for the rapid deterioration in the quality of butter. Cream will sour naturally in about two days when exposed to the air at a temperature of 58-60 degs. F.; in three days at a temperature of 56-58 degs. F.; in about four days at a temperature of 54-56 degs. F., which is an ideal temperature for ripening cream in dairies where churning takes place twice weekly, and where "starters" are not employed. When cream is kept above a temperature of 60 degs. F. churning should take place almost daily, or the fermentative changes will proceed too far, and the result be rancid butter. Natural souring does not take place in cream that is kept below a temperature of 52 degs. F., and the cream invariably develops butyric acid and other unpleasant flavours, which are the result of the activities of organisms that develop at low temperatures.

THE ARTIFICIAL RIPENING OF CREAM.—The ripening or souring of cream can be hastened by the application of high temperature, or by the addition of a "starter," such as fresh buttermilk or properly soured milk added at a suitable temperature. When heat alone is applied, the temperature of the cream should be gradually raised to 90 degs. F. twenty-four hours before churning, or to 75 degs. F. thirty-six hours before churning, by placing the cream vessel in hot (not boiling) water. The cream must be stirred occasionally during the heating process, and afterwards kept as near 60 degs. as possible until churned. A better method of ripening cream is to add 5 or 10 per cent. of a natural or good commercial starter to the cream thirty-six hours before churning, according to the degree of ripeness present, and at the same time to raise the temperature to between 68 and 70 degs. Either of these methods will ensure a full-flavoured butter if the cream is sweet and good when treated.

PASTEURISATION AND STERILISATION.—By pasteurisation is understood the application of a temperature capable of destroying the natural bacilli of milk. This is effected at a temperature of 160 to 180 degs. F.; sterilisation at a temperature of 212 degs. F. The difference is that the latter process destroys pathogenic germs as well as the natural bacilli of milk, thus rendering milk sterile or germ-proof as long as it is not exposed to the air. The former process renders milk capable of being satisfactorily treated with an acidity generator, thus ensuring a full-flavoured butter.

PASTEURISING CREAM FOR BUTTER-MAKING.—Pasteurisation is the only means by which the butter-maker can absolutely control the ripening of cream and

so ensure a uniform quality butter. Process:—Heat the cream immediately after separating it from the milk to 160 degs.; if the cream is at all tainted, to 180 degs., as great heat drives off foreign flavours resulting from injudicious feeding. On no account must a temperature higher than 98 degs. (new milk heat) be applied to sour cream, or the butter will be oily in consequence of the separation of the fats. Pasteurising can be accomplished either by placing the cream in a pasteuriser, in a copper of boiling water, or applying live steam. When the desired temperature is obtained, cool the cream quickly to dairy temperature, or to as near 56 degs. as possible. In the case of very small quantities of cream this can be done by placing the cream vessel in iced water and stirring it occasionally until cold. When considerable quantities of cream have to be treated, a cream cooler is necessary, as the cooling of each can of cream must never occupy more than half an hour, or the texture of the butter will be injured.

STARTERS.—Where pasteurising cream obtains, the use of a pure culture starter, a commercial starter or a natural starter to ripen cream is necessary, unless the dairy is over 60 degs., when the cream will ripen of itself in two or three days. Pure culture or commercial starters can be obtained from most chemical laboratories and from many dairy institutes, and their use is to be strongly recommended when the flavour of the butter is poor or unsatisfactory. Natural starters, which, when properly made, are practically pure cultures of lactic acid, can be made at home if ordinary care and scrupulous cleanliness are observed. (For natural starters see page 43.)

ACIDITY TEST.—McCraith's acidimeter is a useful apparatus, and using this—one cubic centimetre of caustic soda will neutralise 0.1 per cent. of lactic acid.

BLENDING AND STORING OF CREAM.—The secret of uniform butter lies in the blending and ripening of cream. This is a point which seldom receives due attention in small dairies, hence the cause of so much indifferent butter. By blending cream is meant not merely stirring the cream round with a cream stick when fresh cream is added to that already collected, but thoroughly mixing the cream which lies at the bottom of the jar with that which is at the top, at least once a day, and at the same time applying a temperature which induces ripening. If it is impossible to mix cream thoroughly by stirring it, pour it from one vessel into another, and at the same time take the precaution to pass it through a straining cloth to prevent the inclusion of foreign matter. Straining cream at this point is always beneficial; it makes the cream smooth and of even quality. The lactic bacilli of milk, which are responsible for the natural souring, are aerobic, and require air for their development, and need external aid when travelling through the cream, if they are to perform the work of souring or ripening cream satisfactorily. For this reason stir the cream. Cream for churning should be stored in glazed earthenware jars, box tin, or porcelain, kept uncovered, and in a cool, well-ventilated place.

MIXING CREAM.—Cream of different ages, both sweet and sour, should be mixed together at least twelve hours before churning takes place, to ensure the sample being of uniform quality. As previously explained, loss occurs

during churning if this precaution is neglected, and the quality and keeping properties of the butter are impaired in consequence of the addition of sweet cream.

THE TEMPERATURE OF CREAM FOR CHURNING.—Cream can be tempered for churning by the addition of water below 98 degs., or by placing the cream vessel in hot water. In very cold weather, and when very poor cream has to be treated, the latter plan should be adopted.

THE PREPARATION OF BUTTER-MAKING UTENSILS.—The churn and butter worker used in the manufacture of butter should be first rinsed with cold water, scalded with boiling water, rubbed with salt, and cooled with cold water to the temperature required. The churn should be cooled to churning temperature, the butter worker to that of the water used for washing the butter.

CHURNING.—Churning is a mechanical operation which causes the butter-fat globules to coalesce and form butter. The length of time occupied in churning depends on (1) the thickness of the cream, (2) the quality of the cream, (3) ripeness, (4) temperature, (5) the quantity to be dealt with. Churns give the best results when half full. If more than three-parts full, churning will be prolonged owing to the absence of perfect concussion, and the quality of the butter when obtained will be inferior. Time of churning varies between twenty and forty minutes under suitable conditions. Summer churning temperature, 54-57 degs. F.; winter temperature, 58-62 degs. F. Causes of lengthened churning are (1) churn too full, (2) cream too cold, (3) cream too thick; very thick cream adheres to the sides of the churn, and

perfect concussion is impossible. Very sweet and very sour cream take a longer time to churn than ripe cream, and can be treated at a slightly lower temperature than cream that is properly ripened. Churning ought to proceed slowly for the first ten minutes, and the churn be ventilated freely to let all gas escape. Then the speed of the churn should be increased to between fifty and sixty revolutions per minute (according to the make of the churn), and the churning proceed at an even pace until the butter breaks, when water should be added to reduce the temperature, which has naturally increased during churning.

BREAKING STAGE.—The breaking stage in butter is arrived at when the first indications of butter and buttermilk are evident. At this point water should be added to solidify the grains and to separate the butter from buttermilk. One quart of water to each gallon of good rich cream is usually sufficient; less should be used if the cream is of poor quality. The temperature of water for washing and cooling butter depends on the condition of the cream and the surrounding air. Summer temperature, 45 to 50 degs.; winter temperature, 50 to 55 degs. If ice is not obtainable, salt can be used to reduce the temperature of water; 1 lb. of salt added to a gallon of cold water will reduce the temperature of the water 3 or 4 degs. In summer time, when neither ice nor salt are used, butter-making should take place between 4 and 5 a.m. Pieces of ice should not be put into the churn with the cooling water or washing water, as ice coming in contact with butter granules injures the colour of the butter. When the granules of butter are as large as small shot or

wheat, the buttermilk should be drawn away through a hair sieve covered with muslin, and the washing water poured into the churn.

WASHING BUTTER.—Washing butter is recommended (1) to remove the nitrogenous matter from association with the butter-fat, (2) to solidify the butter so that the working is rendered comparatively easy. Sufficient water to float the grains of butter should be strained into the churn, the lid put on, and the churn revolved quickly a few times. One washing water is sufficient unless the cream is stale or has been over-churned, when two or three washings may be required to remove the buttermilk. If brine is to be used to salt the butter, it should be ready to be poured into the churn when the washing water is drained away. If dry salt is to be used, the butter is lifted out of the washing water on to the butter worker, and made up as hereafter described.

SALT.—A good salt for dairy purposes is one that is readily soluble in water, free from grittiness, and will retain its dryness indefinitely under suitable conditions. Many dairy salts contain gypsum and other chemical impurities which injure butter. I have recently examined many samples—both in the laboratory and the dairy—and amongst them the LYMM-PURE SALT, which I can recommend with every confidence as the best I have yet seen.

BRINE.—A slight brine is made by dissolving 1 lb. of salt in a gallon of water, which, if left on the butter for ten minutes, will deposit about ¼ oz. of salt to each lb. of butter. A slightly heavier salt may be obtained by doubling the quantity of salt and leaving it to stand on the butter for twenty minutes. It is never possible to

obtain a heavily salted butter by brining at ordinary temperatures. Brine should be strained into the churn through a muslin or fine straining cloth, the lid put on the churn, and the churn turned rapidly a few times, and the brine left to stand on the butter whilst the butter worker is prepared. The advantages of brining butter compared with dry-salting are: (1) The salt is more evenly distributed, (2) the colour of the butter is improved, (3) the butter requires less working, and in consequence the texture is better. On the other hand, the quantity of salt when used as brine is greatly in excess of the quantity used as dry salt. One oz. of salt when applied as dry salt may be said to be equal to 1 lb. of salt dissolved in a gallon of water and used as brine.

How to Remove Butter from the Churn.—Remove the butter from the churn with a wooden scoop by lifting it into a sieve previously covered with muslin. For convenience, place the sieve on an empty pail so that the water can drain away whilst the sieve is being filled. Empty the sieve, when full, on the butter worker in front of the roller; and when all the butter has been lifted out, let the brine or water drain away, and rinse down any particles of water that may be adhering to the sides of the churn into the sieve. Place the sieve and pail at the end of the butter worker, and commence working the butter.

Working Butter.—Guide the roller over the butter at a speed that corresponds to the turning of the roller handle, and exercise care not to apply friction by rubbing instead of pressing the butter. Pass the roller over the butter until firm enough to roll up, then reverse the handle of the roller and roll the butter up to the end of

the butter worker, mop up the water on the butter worker, and repeat the rolling process until the butter is firm. Properly worked, butter shows no presence of water when cut with the scotch hands and pressed. It is firm like soap, and when broken shows a distinct fracture, as seen in a piece of broken iron. The amount of working necessary to expel all visible moisture from butter depends on the size of the butter grains. Large grains take much less working than small grains, and are to be recommended when there is any difficulty in working the butter.

DRY-SALTING BUTTER.—When dry salt is applied to butter it should be sprinkled on evenly with the aid of a dredger as soon as the grains of butter have been pressed together, and before the water is worked out. Two or three rollings after the salt has been added are usually sufficient to mix in the salt, and it is advisable, except in frosty weather, to let the butter stand in a cold place for a few hours, so that the salt can dissolve before the working of the butter is completed. The amount of salt to use for salting butter depends on the degree of saltness required. A ¼ oz. to the pound of butter will give a slight salt taste; ½ oz., a full flavour of salt; ¾ oz., a degree of saltness that will effectually disguise the characteristic flavour of good butter; but, where a saltless butter is desired for marketing purposes, it is imperative that a reliable Boron Preservative be used, either alone or in conjunction with a small percentage of salt, in the proportion of 1 oz. to each 12 lbs. of butter—added in the manner described for salt.

MAKING UP BUTTER.—When butter is sufficiently worked, weigh it in 1 lb. or ½ lb. blocks, and mould it by

pressing and turning it over with the scotch hands. On no account must butter be rubbed on the butter-board by turning it round instead of turning it over, as friction so applied will cause the butter to become streaky.

PACKING BUTTER.—Pack butter for market in parchment paper, not in muslin or vegetable matter.

THE EFFECT OF DIFFERENT FOOD ON THE QUANTITY AND QUALITY OF BUTTER.—Change of food does not appreciably affect the fat content or the milk yield, but it interferes with the composition of the milk, and consequently has a deleterious effect on the quality of the butter.

CAUSES OF BUTTER NOT KEEPING.—(1) Cream too sweet or too ripe when churned. (2) Using inferior preservative or impure salt. (3) Sudden change in the feeding of the cattle ; food changes should be gradual. (4) Admixture of newly-calved cows' milk with that intended for butter-making. A lapse of nine days is necessary since calving before milk becomes normal, so as to be suitable for the manufacture of cheese or keeping butter ; but it can be mixed with other cream for making fresh butter after the third day.

ANALYTICAL.

The International Institute of Physiology and Hygiene.

1, Queen Victoria Street, London, E.C.

17th November, 1905.

"Keeps Preservatives bear every evidence of preparation on scientific principles, and our analysis proves them to be absolutely free from all deleterious constituents whatsoever.

"They are specially characterised by :

"1. Extreme solubility, ensuring uniform and thorough antiseptic action.

"2. An exceptionally low percentage of water, securing not only economy in use, but enabling the user to be certain he is employing the percentage necessary for the preservation of the particular food.

"3. The composition is kept uniform.

"The anhydrous condition of the powders, and their uniform composition, are most important advantages, for they entirely obviate the danger of using an insufficient quantity of preservative, as is so often done in the case of cheap powders containing from forty to fifty per cent. of water, with the result that the food does not keep.

"Using these powders according to directions the proper quantity of preservative is always assured, and yet in strict conformity with the Food and Drugs Act.

"From the results of our analysis and tests, we are able to certify Keeps Preservatives as thoroughly reliable, and presenting the highest standard of a harmless, effective antiseptic."

J. Grant Stephen, D.Sc., Ph.D.,
Director of Laboratories.

"THE DAIRY SHOW,"

LONDON.

OCTOBER, 1905.

KEEPS, LIMITED.

"The Holborn House maintains its high position. The cream, butter, and milk preservatives and colourings are in greater favour than ever. Last year the firm were in a curious predicament. They offered a prize for cured butter treated with their preservatives and gaining a prize at the 1904 Show. As a matter of fact all the prize-winners, five in number, had used the firm's preservative, but Messrs. Keeps cut the Gordian knot by giving each a special prize. This year their success is again very evident. Butters treated with their preservative have gained the 1st Prize in Class 56 for fresh butter, the 1st Prize in Class 57 for mild cured butter, and also twelve prizes out of fourteen in the minor awards in the Commercial Classes for butter, making a total of fourteen prizes out of a possible twenty. The 'Diamond Brand' preservative ought to tempt the De Beers Syndicate."

—The Dairy.

DAIRY SHOW, LONDON, 1906.

"The following is the result of the awards this year in the Commercial Classes for Butter, as regards exhibitors who used 'Keeps' Preservative. Class 60—for fresh butter—first and fourth prizes and three H.C.s; Classes 61 and 62—for mild cured butter—one first, two seconds, one third, and four H.C.s; Class 63—for cured butter—second, third, and fifth prizes, and three H.C.s—making a total of NINE prizes and TEN 'mentions' out of a possible twenty."

SESCO (Reg.).

SESCO IS SPECIALLY DEVISED FOR USE IN CREAM—TO INCREASE THE CONSISTENCY AND TO FACILITATE WHIPPING.

The object of this preparation is to assist Cream Separators in giving a firm consistency to their cream, which sometimes is interfered with by Pasteurisation or other causes.

SESCO is devised to remedy this, and to cause a re-uniting of the fat globules—thus giving a heavier body to the cream—so greatly appreciated by the general public.

Thin Cream is not attractive, although frequently thin Cream has been found to be quite rich in fat. This may be due to several causes, perhaps foremost among them the want of knowledge of manipulation of Cream after separating or the effect of Pasteurising, which has a tendency to give Cream a thin appearance and indirectly affect its "whipping" qualities.

SESCO used in the manner directed is quite harmless, in fact beneficial, even to the youngest child, being composed of elements identical with new milk.

Sole Manufacturers—

KEEPS, Ltd., 24-26, HOLBORN, LONDON.

KEEPS CREAM PRESERVATIVE.

(Special.)

A most powerful and harmless Boron preservative in the form of an anhydrous powder, the result of a distinct invention and prepared by an entirely ORIGINAL PROCESS, ensuring the highest possible preservative power.

It is guaranteed to conform with the requirements of the Parliamentary Committee (1901) appointed to consider and report upon preservatives.

DIRECTIONS.

For **each gallon of cream,** use **half-an-ounce** of this Preservative, and mix thoroughly, or it may be dissolved in its own weight of hot water or milk, and then added to the Cream ; this ensures entire solubility.

We are now manufacturing a Cream Preservative without any sweetening material, which is listed as

"Cream Preservative, NON-SWEET."

Keeps Oleo-Butter Colour.

(DIAMOND BRAND.)

Purely Vegetable Colouring for Butter or Margarine, prepared from absolutely the finest ingredients, and guaranteed free from any harmful colouring material, and is not detectable even by the keenest palate when combined with Butter, &c.

Co. LONGFORD,
November 30th, 1904.

"In response to your enquiry we are glad to inform you we are all satisfied with Keeps Oleo-Butter Colour which we ordered from you some time ago, and any further lots which we will require we will order from you."

(*Signed*)

KEEPS LIQUID ANNATTO.

(DIAMOND BRAND.)

CHEESE AND MILK COLOURING that will give one even tint throughout, does not fade or appear patchy in places, because it is pure and unadulterated Annatto. Guaranteed free from Coal Tar dyes and other impurities.

The subjoined report—from one of the foremost Dairy Institutes in England—represents the results of a season's working, under the personal observation of the Principal.

The Midland Agricultural and Dairy Institute,
Kingston, Derby.

September 7th, 1904.

(KEEPS LIQUID ANNATTO.)

"I have now had the Cheese Colour supplied by you subjected to a thorough and prolonged practical test, and I am pleased to be able to inform you that the results obtained are entirely satisfactory."

(Signed) J. F. BLACKSHAW,
PRINCIPAL.

Keeps Milk Preservative.

Keeps Milk Perservative is guaranteed free from Salicylic Acid, Formaline Compounds and injurious metallic impurities. It owes its powers of retarding decomposition solely to the Boron Compounds.

KEEPS

"Special" Milk Preservative

(Guaranteed free from Boracic Acid, Salicylic Acid, etc.). In 1 and 7 lb. boxes.

Printed by Hazell, Watson & Viney, Ld.,
London and Aylesbury.