With the Author's compliments
BUTTER-MAKING.

(ILLUSTRATED.)

BY

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SHROPSHIRE.

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This Work is
Dedicated
by kind permission
to the
Right Honourable the Earl and Countess
of Aberdeen,
who by their sympathy and
great interest in the welfare of the
occupier of land, have done much
to encourage butter-making
and dairying generally.
PREFACE.

SINCE the lecture and demonstration on Butter-making given by me at the great Agricultural Dairy Conference and Show held at Ludlow in May, 1888, and at various places throughout the United Kingdom and in connection with the University College of North Wales, I have been much pressed to publish a treatise on the subject I have therefore written this little work, which I have now much pleasure in introducing to the kind attention of the reader. My aim has been not only to treat on the manipulation of milk and cream in the dairy, but to point out the very great importance of the feeding of the cow, the production and proper treatment of milk before it reaches the dairy, as from a lack of this knowledge on the part of the farmers themselves the most experienced dairymaids, after the exercise of the best of skill in the manipulation, fail to produce a butter of that delicacy of flavour which is acceptable to the palate of the consumer.

Dairying and butter-making in the present day is much occupying the minds of the people of this country, and it is to be hoped that, by the introduction of the most improved modern appliances and the carrying out of the correct system of manipulation and proper attention to the keeping of cows, that we shall see a large increase in the production of butter in this country and our holding the front position for perfection of quality.

CHARLES R. VALENTINE.

Dun Cow Dairy Farm,
Ludlow, Shropshire,
June, 1889.
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INTRODUCTION.

THE art of Butter-making does not commence by merely pouring the cream or milk into the churn and churning it, although some people are under the impression that it does; it commences in the production and proper treatment of the milk before ever it reaches the dairy; and this is where I purpose dealing firstly.

In Dairying, as you are all fully aware, there are three means of production, viz., milk-selling, cheese-making, and butter-making. Milk-selling is undoubtedly the most profitable of all, if you can dispose of it at a good price; but it has its disadvantages as well as its advantages. The great drawback of all is the delivery. It is all very well for farmers who reside close to a station where there is every facility for shipment, but to those who live some miles from any station it is most difficult to arrange always for delivery in all weathers, both night and morning, and this must be done in milk-selling. I mention particularly with regard to the wholesale milk trade, as it is needless to say how impracticable it would be for every producer to deliver to the consumer's door in either town or country. The other two out-puts are butter-making and cheese-making, but as butter-making is what I purpose dealing with, I will confine myself to that subject. One of the first questions we always ask ourselves whatever kind of business we undertake is, "Will it pay?" therefore we should naturally put the following question to ourselves, Will butter-making pay? This is a most crucial point, but it can easily be answered as follows:—Butter-making will pay if only carried out properly, and I trust that some of the few facts given will show the why and the wherefore. Another great point which always comes before us is the means of disposal. Now in the case of butter or cheese I do not think that any product could meet with a more favourable demand than those
if only of choice quality. Look at the enormous imports of dairy produce into this country every year—butter especially. Probably some of you have not read the official returns of imports, issued by the Government. The following were the imports of butter alone into this country, with the value, from 1884 to 1888:

**BUTTER IMPORTS.**

<table>
<thead>
<tr>
<th></th>
<th>1884</th>
<th>1885</th>
<th>1886</th>
<th>1887</th>
<th>1888</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>cwts.</td>
<td>£</td>
<td>cwts.</td>
<td>£</td>
<td>cwts.</td>
</tr>
<tr>
<td>From Denmark</td>
<td>335,067</td>
<td>2,008,451</td>
<td>377,447</td>
<td>2,117,831</td>
<td>400,556</td>
</tr>
<tr>
<td>&quot; Germany</td>
<td>146,400</td>
<td>864,084</td>
<td>143,482</td>
<td>788,899</td>
<td>119,154</td>
</tr>
<tr>
<td>&quot; Holland</td>
<td>1,112,212</td>
<td>4,982,165</td>
<td>307,861</td>
<td>1,061,380</td>
<td>359,013</td>
</tr>
<tr>
<td>&quot; France</td>
<td>509,716</td>
<td>2,895,184</td>
<td>459,933</td>
<td>2,578,618</td>
<td>402,620</td>
</tr>
<tr>
<td>&quot; Canada</td>
<td>54,214</td>
<td>249,754</td>
<td>36,259</td>
<td>146,166</td>
<td>31,548</td>
</tr>
<tr>
<td>&quot; United States</td>
<td>100,151</td>
<td>447,811</td>
<td>77,588</td>
<td>314,662</td>
<td>42,736</td>
</tr>
<tr>
<td>&quot; Other Countries</td>
<td>214,807</td>
<td>1,078,844</td>
<td>159,732</td>
<td>899,248</td>
<td>188,377</td>
</tr>
<tr>
<td>Total</td>
<td>2,472,567</td>
<td>12,526,293</td>
<td>1,553,302</td>
<td>8,506,204</td>
<td>1,543,494</td>
</tr>
</tbody>
</table>

In the last five years, 1884 to 1888, the greater part of butter has been imported from Denmark and France, the total was 2,205,185 and 2,219,329 cwts., valuing respectively £12,325,376 and £12,381,307, or taking the average yearly, 441,037 cwts. from
Denmark, and 443,865 cwts. from France, valuing respectively £2,565,075 and £2,476,261. Holland sends us the next largest amount, which in the last five years was 2,098,580 cwts., valuing £10,055,189. The remaining quantity is imported from other countries, especially Germany, Canada, and the United States. The production of butter in the United Kingdom is only 90,000 tons, while the consumption is 205,000 tons, so that every year more than 115,000 tons have to be imported.

In addition to the great amount of butter imported, margarine, formerly called butterine, is imported to a very great extent, the amount for the last four years being as follows:

**MARGARINE IMPORTS.**

<table>
<thead>
<tr>
<th></th>
<th>1885</th>
<th>1886</th>
<th>1887</th>
<th>1888</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cwt.</td>
<td>£</td>
<td>cwt.</td>
<td>£</td>
</tr>
<tr>
<td>From Norway</td>
<td>17,411</td>
<td>69,995</td>
<td>20,875</td>
<td>81,582</td>
</tr>
<tr>
<td>Holland</td>
<td>772,473</td>
<td>2,793,516</td>
<td>833,957</td>
<td>2,797,599</td>
</tr>
<tr>
<td>Belgium</td>
<td>40,456</td>
<td>144,404</td>
<td>20,002</td>
<td>69,240</td>
</tr>
<tr>
<td>Other Countries</td>
<td>16,923</td>
<td>46,764</td>
<td>11,739</td>
<td>38,879</td>
</tr>
<tr>
<td>Total</td>
<td>847,363</td>
<td>3,054,679</td>
<td>886,573</td>
<td>2,958,300</td>
</tr>
<tr>
<td></td>
<td>cwt.</td>
<td>£</td>
<td>cwt.</td>
<td>£</td>
</tr>
<tr>
<td>From Norway</td>
<td>16,650</td>
<td>61,962</td>
<td>7,784</td>
<td>25,045</td>
</tr>
<tr>
<td>Holland</td>
<td>1,172,074</td>
<td>3,549,591</td>
<td>1,043,401</td>
<td>2,951,522</td>
</tr>
<tr>
<td>Belgium</td>
<td>22,895</td>
<td>79,301</td>
<td>6,676</td>
<td>18,130</td>
</tr>
<tr>
<td>Other Countries</td>
<td>61,476</td>
<td>191,094</td>
<td>80,373</td>
<td>269,129</td>
</tr>
<tr>
<td>Total</td>
<td>1,273,085</td>
<td>3,869,948</td>
<td>1,138,174</td>
<td>3,263,826</td>
</tr>
</tbody>
</table>

The above table shows that the yearly average from 1885 to 1888 was 1,036,273 cwts., valuing £3,286,688. Besides this great bulk, a large quantity is made in this country—one factory alone, situated near Stranraer, is turning out several tons per week.

How often the question is asked, "Why is it so?" "Why do we import such enormous quantities of butter?" The answer can clearly be seen. It is, firstly, because our production is insufficient; and secondly and undoubtedly the chief reason, because the consumer can always rely upon foreign butter being of one uniform colour, texture, and flavour from one year's end to another.

There is every encouragement for dairying in this country, now-a-days, because if butter or cheese are made of really good quality, they will always sell at a profitable price, not as some products of the farm which in some cases barely bring home a profit. I will admit
that it is very discouraging for butter makers in the months of May and June, when they make choice quality, to find a perfect glut in their respective markets, and the only possible chance of realising is by selling it at an unprofitable price of say 8d. or 9d. per lb.; but this can and must be remedied, by encouraging winter dairying.

It should be remembered that not only must there be a uniformity in quality, but a uniformity of quantity from one year's end to another. This is where the foreigners meet with such success; and strange to say that when the glut is in our markets they (the foreigners) stop making to a very great extent, and what butter is imported does not favourably compare with their butter made in the winter time, for which they receive such lucrative prices when scarcity prevails in this country. Why cannot we do the same? We have one of the finest countries in the world for the work, possessing all the characteristics of a good dairy country—high undulating surfaces, numerous springs of never-failing water, soil retentive of moisture, sweet and nutritious herbage, rather low temperature, frequent showers rather than periodical droughts, and generally sufficient covering of ground in the winter to protect grass roots, so that the herbage may be permanent and enduring, and when our butter is of choice quality no country's can compare with it. Take for instance the exhibits of butter at most of our leading shows especially at the last London Dairy Show; it would have puzzled any foreigner to have produced butter to be named in the same day for excellence.

I think it a very weak point on our part to allow the foreigners to reap all the benefits in our own country, when we are able to do so ourselves if we only give our minds to it. One remark I should like to mention is the prevailing difficulty which is caused, to a great extent, by our own negligence in pleasing the consumer. A great many people are under the impression that finer butter was made by our forefathers than by ourselves, but there is every reason in contradicting that statement; and the answer is, "the taste of the consumer has become more refined, not only in dairy produce, but in every requirement for the palate." The first thing we have to do is to please the consumer, whatever the cost may be. I speak not only as a buyer and consumer but with a producer's point of view, and I do know the difficulties which arise in pleasing the consumer with our own country's butter, there being no regularity in either the quality or quantity. Take for instance our own country markets. If a buyer, I mean a factor or the middleman (whom some of our influential people think it possible to do without) goes into any of these markets and takes the first ten baskets of butter he comes to, he will
find the first two of probably very choice quality, the next two not quite so fine, the next two passable, and the other four of inferior quality, although the makers of the last four baskets consider their butter very good. And it is the same case with tubs of cured butter. You will find three tubs out of ten of very inferior quality. Often you find a much larger percentage of bad butter than mentioned. But this is not the case with the Normandy and Danish butter, which are the finest imported into the country. When you go into a foreign butter merchant's sale room you can taste one firkin or case of these butters, and can rely on fifty cwt. or more being exactly the same as the sample. Most of you, no doubt, have noticed in the shop windows in London and other large cities and towns, butter made up in rolls or attractive prints and labelled "So and So's Normandy or Brittany butter." Perhaps you are all not aware that this butter is made in its respective country one day and is sold to the consumer two days after, and frequently the next day in our large cities. The butter is always of the same colour, texture, and flavour all the year round, and that is what the people want. Uniformity. Yes, this word should be the golden guide to a buttermaker's success. Canon Bagot has many times suggested that a placard bearing the following words "Uniformity! Uniformity!! Uniformity!!!" should be hung up in a prominent position in every dairy; it is indeed an excellent suggestion and should be universally adopted.

Some of our readers might consider me somewhat dictatorial in my humble advice, but no one but the actual retailer has any idea of the difficulty in pleasing the general public. I mean the consumer now-a-days. There is no consideration given now for the time of year the butter is made, or for the use of turnips in feeding, or any other excuse which in the winter time was frequently tendered to the purchaser: in fact years ago, bright-coloured butter was hardly sought after at that time of year, and the public were quite content to put up with it being pale and tasteless, or in some cases flavour affected by the feeding of turnips, but now things have changed, the foreigners are brought close to our door-step, and willingly supply the British public with butter of beautiful colour, good texture, and delicate flavour even in the depth of winter. Of course there is inferior butter abroad as well as in this country, but what is of secondary quality is so classed that the public are prepared for it and know what they are buying. Until the passing of the English Margarine Act the producer of pure butter met with most unfair competition, and it seemed as if nothing could prevent the adulteration of butter. Mixtures containing 20 to 25 per cent. of margarine were constantly being sold as pure butter, which the public readily
purchased and appreciated. Many of our public institutions were supplied with this mixture done up in neat packages and labelled, "Finest Creamery" or such like: one in particular in the Midland counties, it is known for a fact was supplied by contract, and one of the scrutineers who viewed the sample and selected it in preference to pure butter was heard to make the following remark, "that it was useless trying to make butter if butter of such beautiful colour, texture and flavour could be sold at the price." Margarine will undoubtedly do much to improve the quality of butter in our country, it is now taken in the place of secondary butters and is preferred: in fact now-a-days it is almost impossible to sell inferior butter, the public won't have it for love or money, and the confectioners who were generally considered the last resort now prefer margarine which they can procure at a very low price and suits their purpose better, therefore unless butter is of good quality, it might as well be thrown away or used as cart grease.

These facts only show what we have to compete against.

Now the question comes, How is it to be remedied? The answer can clearly be seen—*It is education in dairying and general dairy-work.*

Until the last year all that has been done in the way of education in dairy-work has been the outcome of individual or local effort. The Government have now taken the matter in hand, but have only voted a small sum for dairy education, which, although such a small sum, has been appropriated in different centres with good results; and it is to be hoped that another year the grant will be doubled.

As compared with other countries our Government has only done what they did years ago, and look where our neighbours stand now—the first in the field.

The great success of the dairy industry in Denmark, France, and other countries, is due to the excellence of the technical education given in their respective countries and the way in which it is carried even to the farmer's door.

Perhaps it is not generally understood that this country, although at the present time it is placed in the background as compared with other countries for the production of dairy produce, was really the pioneer and school for the world in the first instance.

Most of the delegates composed of scientific and practical men which were sent out by our neighbouring countries to pick up all the knowledge they could possibly scrape together, acquired the larger portion of it in our British Isles.

The holding of dairy demonstrations at the different shows have had their effect so far, and it is remarkable to notice the increased
interest taken in them each year. When first adopted it was merely looked upon as an adjunct to a show; but indeed now it is quite the leading feature, and especially when butter-making competitions form part of its attractions: take for example the working dairies of the Royal Agricultural Society of England and the Bath and West of England Society. In addition to these, which are looked upon as patterns of dairy demonstrations, I cannot refrain from alluding to the great Agricultural Dairy Conference and Show, held at Ludlow on May 17th, 1888, under the presidency of Sir Charles H. Rouse Boughton, Bart., which was originated by Mr. Alfred Salway, the well-known chairman of the County Magistracy and now chairman of the Shropshire County Council; although I assisted in its promotion, being honorary secretary and one of the lecturers; and as the "Times" newspaper very worthily said, "it was the event of the week, and its success is a matter of hearty congratulation."

Much good results from them as they show the producers what really can be done, but for actual improvement we must not stop there. Education must be taken to the very doorsteps, this can be done but by the adoption of dairy schools, where the farmers' wives and daughters can acquire a sound knowledge of the theory and practice of the most approved systems, in addition to these recent experience has proved itinerant teaching is even more direct in its effect. Very many of our largest land-owners have engaged a dairy specialist, and introduced him to the various centres of dairying on their estates, amongst whom are the Duke of Westminster, the Earl of Aberdeen, the Rev. Canon Lord Forrester, Lord Egerton, of Tatton, Sir Thomas Dyke Acland, Bart., and many others. These lecturers and practical demonstrations, close at the doors of the farmers, have not only shown them the best systems of manipulation as taught at the Dairy Schools, but has directly imparted to them in a familiar and effective form, the importance of proper production of milk, and its treatment before it reaches the dairy, and thus to avoid the evil which many of our best dairy-maids, who, after the exercise of skill in the manipulation of the milk and cream are unable to produce a butter of "really choice" quality on account of the lack, on the part of the farmers, of a perfect knowledge in seeing to the preliminary features as before referred to.

There are already many dairy schools in different parts of the country. Some have been promoted by companies formed of land-owners and tenant farmers, others by individual land-owners and tenants, most of which are doing splendid work; but the energy and interest shown by their promoters have not been received with that enthusiasm, nor has that support been accorded which their per-
severing efforts deserve. The construction of the several schools varies. Some are newly built model dairies, and others are remodelled old buildings which answer the purpose admirably, and these show how well our present farmsteads can be adapted with little expense. On the other hand if a new building is essential and must be erected it will be found cheaper and more effective to have it constructed on the most modern principle.

The council of the Bangor University College of North Wales are to be congratulated on the great stride they have taken, not only in the way of dairy education, but the education in agriculture generally. It has been decided to establish three dairy schools under its auspices at different centres, one of which has been already started for Montgomeryshire, at Welshpool, and is doing good work. The other two will be opened in a few weeks at Denbigh for Denbighshire and Flintshire, and at Bangor for Anglesea and Carnarvonshire, the three are under the direction of the agricultural department of the University College. In addition to this movement, courses on dairying, with practical demonstrations, have been given at Pwllheli and Llanerchymedd before large and appreciative audiences, under the presidency of the most influential land-owners of the district. So much success has been attributed to these that the college intend holding similar ones shortly at Bala and Bangor. Several courses on other agricultural subjects have also been given, and exhaustive trials on manures at different centres by Dr. Dobbie, the professor of chemistry and geology, who has been mainly instrumental in promoting this bold step which the University College has taken. Further than this a professor of agriculture, and one of zoology and physiology, will be elected shortly, thus making the agricultural department complete. The following are some of our most prominent dairy schools:—Bangor University College; Denbigh and Flintshire, Montgomeryshire Dairy Institutes; The Munster Dairy School; Lord Vernon's Dairy School; Willis' Dairy Institute; British Dairy Institute; Cheshire County, Western Dairy Institute (near Berkeley); Migratory Dairy School of the Bath and West of England Society; Kilmarnock Dairy School, the Gloucester Dairy School, and others.

SELECTION OF BREED.

With regard to the selection of breed, one of the things contributing to a butter-maker's or in fact, a dairy farmer's success is the skill in selecting and breeding of his dairy stock. The question before us
now is, "What is the best all round cow for butter making?" The cow to be looked for is one of big frame, giving a large quantity of milk of good quality, and when the time comes for her to be weeded out of the herd, she will be a good beast for the slaughter-house. There are many good breeds suitable for butter-making, the following standing foremost: Shorthorn, Jersey, Guernsey, Devon and the Welch. Experience has proved the Shorthorn one of the most suitable, and in almost all cases she has the majority of friends, being undoubtedly a "general purpose" cow. She acquires all the points of a good butter-making cow just mentioned, and is hardy, kind, and suitable for nearly every climate, in fact she is well known in nearly every country. The Jersey and Guernsey breed have many favourites, and certainly for milk of much richness it must be acknowledged that they cannot be surpassed: but when it comes their turn to be fed off, they do not compare favourably with the Shorthorn. It will always be found most profitable to have one-eighth Jersey in a herd of Shorthorns: the milk of the Jersey being so much richer and as the cream globules are larger in size and more in number than the Shorthorn, they rise to the top much quicker, bringing the smaller globules of the Shorthorn up with them. Although this introduction is strongly recommended by most of the eminent authorities, the Jersey and Guernsey breed are not suitable for bleak and humid districts. The Welch Cattle are well adapted to the country to which they belong, and I have seen some very good specimens, having more or less in own herd, but they want carefully selecting. The crosses of these with Shorthorn are excellent. The Ayrshire and Kerry breeds are large milkers, considering their size, hardy, and thrive on poor pastures, but they are more suitable for cheese-making than butter-making. A great many people are under the impression that no breed, with the exception of those mentioned, can be utilized for the production of butter; there is no reason to doubt for one moment that any breed, if selected from a milking strain, and properly fed, why they should not turn out good milkers; of course they cannot be expected to give so large a yield as our famous dairy breeds. It is not my intention to go fully into the breeding of dairy stock, as no one is better acquainted with that part of farming than the British farmer of the present day, as from his judgment selections of animals for breeding purposes are made and exported to all parts of the world; but it will be most essential to draw attention to one important feature, viz: the selection of the sire from a good milking strain.

The breeding should be so arranged as to have cows calving in equal numbers both winter and summer, so as to prevent shortness
of supply in the winter, and thus retaining to ourselves the advan-
tages which we have been giving our foreign competitors, as before
alluded to.

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**DAIRY RECORD.**

Another golden rule is the keeping of a dairy record; many
think it a great deal of trouble, but all those who have adopted it
never wish to give it up. It tells accurately the yearly yield of milk
from every cow, it is good evidence as to the value of certain pastures
and foods, as it gives the daily yield also. You are able to see at a
glance whether a cow is returning you what she ought, which enables
you to weed out all the bad milkers. This is a very important point,
as there can be no greater loss to a butter-maker than to keep a bad
milker, she costs nearly the same as a good one, and gives no return
for the outlay.

Very often the question is asked, how many gallons of milk per
year should a cow yield to give a proper profit. Experience tells
us that a cow for butter-making should not yield less than 560 gallons
per year. This would return 248 lbs. of butter if the whole work
was properly done.

\[
\begin{align*}
248 \text{ lbs. butter @ } \frac{1}{2} \text{ per lb.} & \quad \cdot \quad \£14 \ 9 \ 4 \\
412 \text{ galls. skim milk, either sold or made into} & \\
\text{skim cheese, @ 2d. per gallon} & \quad \cdot \quad 3 \ 8 \ 8 \\
\text{Making a total of} & \quad \cdot \quad \£17 \ 18 \ 0
\end{align*}
\]

Against this we have the cost of maintenance
and labour. Assuming the maintenance
of the cow for seven winter months of 212
days @ 1s. per day \quad \cdot \quad \£10 \ 12 \ 0
153 days being the five summer months, and
as it is generally understood that one
acre of good grass, worth from 30s. to
35s. per acre, is sufficient for one cow
for that period \quad \cdot \quad 1 \ 15 \ 0
And charging for labour, &c. \quad \cdot \quad 2 \ 0 \ 0

\[\£14 \ 7 \ 0\]

The price given is that of rich dairy land; of course it must be
considered that where it is not so good, and would be at a lower rent
per acre, the cost would be comparatively the same. The charge for labour, &c., is also a covering sum. This will show a profit of £3 11s. per head.

The 560 gallons as an average yearly yield is a low one compared with many cows, several dairies average 700 to 750 gallons per head, and even more through the herd, but the example given shows a low average giving a good return.

TREATMENT OF STOCK.

In the treatment of the cow, great care should be taken in driving cows from the pasture to the cow-house. They should never be hurried or made to go faster than a walk, and on no account should a dog be allowed to assist the driver. It makes it very painful for cows with well filled udders to move over the ground faster than a walk, besides in warm weather by hurrying the animal there is a danger of overheating her milk, which not only injures it but affects all other milk with which it comes in contact. In the heat of the day in summer-time many farmers keep their cows in, letting them out in the cooler part of the day; this prevents to a great extent the attacks of the cows' great enemy, the ox warble fly, which nearly drives them mad, as you are fully aware, and does more to injure the milk than anything else. Another great failing is the want of kindness and gentleness to stock. Cows should be kept as quiet and as comfortable as possible, and no person should be employed in milking that the animal fears. Any nervous excitement not only lessens the quantity of milk, but depreciates its quality. The consideration of these points will be found most profitable to the dairy.

The Cowhouse.—Oftentimes milk is spoilt on account of the bad sanitary condition of the cowhouse. This building should be properly ventilated and constructed in such a way as to resist the heat of summer and coldness of winter, and to ensure a good circulation of fresh air without draught. Uniformity of temperature is very conducive to a regular milk yield, and if the quantity is depended upon the kind and amount of food given, the quality is affected by the kind of air inhaled. So far as concerns the quality of the milk, there need be no hesitation in asserting that the expense and study of a proper system of feeding is thrown away, in the case of cows kept in badly ventilated buildings, breathing an atmosphere charged with carbonic acid gas and ammonia,
the products of decomposition. The due proportions in the air are most essential to the purity of the blood of the animal, and also of the milk which is a secretion from it. While speaking of the impurity of the blood, the milk of a cow should never be used for butter-making at the time of her periods.

FEEDING.

In the feeding of a cow it is necessary to understand the several functions which food has to perform; it has to provide warmth to the body, the formation of flesh and bone, and for the manufacture of milk in a milking cow, therefore, all foods should contain the properties to bring these results. There is not the slightest doubt that the best food for milch cows is either good grass or good hay, as these give the necessary constituents required for her maintenance; but it should be remembered that, not only must a milking cow have food sufficient for her own maintenance, she must have food sufficient to produce milk. And as it is generally understood that the constituents of certain foods give relative results in the quality of milk: for instance, food rich in fat produces a large amount of fat in the milk; again, food rich in albumenoids produces also a relative quantity of caseine or curd in the milk. These are facts which too much attention cannot be given to, and especially in looking after the richness of milk, as no constituent varies so much as the butter-fat; and, unless this is always of a good percentage, it is utterly useless in trying to make butter to profit. In the absence of a bountiful supply of good grass or hay, it is always found desirable too, and especially in the very cold weather, that a food should be given richer in fat than at any other time, as it naturally follows that they take more fat, which is heat-producing, to provide more warmth to the body; therefore, this would be robbed from the milk to a great extent unless more food is substituted. There is no reason for one moment that milk should not contain as large a percentage of cream in the winter as in the summer, if only the proper care is given to the stock, both in treatment and feeding. One great feature in the feeding of a dairy cow is, to know the composition of the food you give, especially of artificial foods; those only should be purchased from a reliable firm, on analysis, as so much is adulterated now-a-days. It is also most important that all foods should be easily digestible. Foods naturally vary very much in their relative effects as to the quality of milk. For instance, linseed and decorticated cotton cake
are known as most valuable in producing a rich milk, whereas brewers' grains, potatoes, mangolds, turnips, or any other succulent foods, which have a very low percentage of fat, and contain a large amount of water, give poor milk and quantity. This treatment would, no doubt, suit the milk-seller, but to the butter-maker it would be useless unless other foods were given producing a larger percentage of cream. Another point worth noticing is the flavour which certain foods impart to butters—for instance, turnips produce a turnip-y taste, unless properly treated, which the public will not put up with. Again, foods containing much moisture always give a weak, watery flavour in the butter and so on. Turnips should never be given to cows for butter-making unless they are pulped twelve hours before given, and exposed to the air; this will prevent a great deal of the disagreeable flavour imparted into the butter. There is a further remedy which should always be adopted in the treatment of cream, which is dealt with on page 50.

Many people are under the impression that turnips should not be used under any circumstances in feeding for butter-making; this rule could never be carried out in many districts, take for instance the eastern counties of Scotland, where turnip-growing is one of the chief features in farming; there need be no fear attached to the bad flavour imparted to butter by their use, if only the precaution before alluded to is taken.

With regard to the quantity of food to be given to each cow, much depends upon the size of her, the time of year, her age in milk, and the kind of food. Some are under the impression that the use of artificial foods will never pay. Experience has proved otherwise; and not only does it redound to an improved milk yield, both in quality and quantity, but it benefits the cow and the land generally.

**Ensilage.**—A great deal is spoken of ensilage now-a-days, and it is proved that it is a most beneficial food for stock generally and especially for dairy cows, but it must be of good quality. Many people have the idea that the making of ensilage is a remedy to improve half-harvested hay, but it is impossible to make good ensilage of bad material—in fact, there cannot be worse food for dairy cows than bad ensilage; it spoils the milk and all other with which it comes in contact. To make ensilage properly, the crop should not be allowed to get over ripe; it should be cut in its full succulence, loaded immediately after it is cut, and exposed to as little sun and wind as possible, although a small quantity left overnight and carried next morning will not suffer much injury. One of the best systems up to the present day is Johnson's Pressure—it is efficient and
economical, and can be removed to any part of the farm without much trouble. As long as we have fine weather to gather in our harvests I don't think there is much prospect of ensilage being generally adopted; but, on the other hand, in wet weather there cannot possibly be better means of producing good fodder than to fall back on the making of ensilage.

Before concluding my remarks on the feeding of the cow, I wish to mention again that great economy can be attained by the proper sheltering of the cows from bleak winds and storms. We hear of cows kept out in all weathers, and oftentimes are farmers prosecuted for the adulteration of milk when they actually do not adulterate it, but the cows do it for them in taking out such properties which are the fats of the milk to sustain warmth in the absence of proper shelter.

The following table shows the average composition of food given to both dairy and feeding stock. The analyses have been taken from the "Chemistry of the Farm," by Mr. R. Warrington, F.R.S.

<table>
<thead>
<tr>
<th>FOOD</th>
<th>Water</th>
<th>Albuminoids</th>
<th>Fat</th>
<th>Soluble Carbo-Hydrates</th>
<th>Fibre</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton cake (Decorticated)</td>
<td>10.0</td>
<td>41.2</td>
<td>14.0</td>
<td>18.0</td>
<td>9.0</td>
<td>7.8</td>
</tr>
<tr>
<td>Ditto</td>
<td>11.5</td>
<td>26.6</td>
<td>6.2</td>
<td>30.2</td>
<td>20.8</td>
<td>6.7</td>
</tr>
<tr>
<td>Linseed cake</td>
<td>12.0</td>
<td>28.1</td>
<td>12.0</td>
<td>39.3</td>
<td>11.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Beans</td>
<td>14.5</td>
<td>25.5</td>
<td>1.6</td>
<td>45.9</td>
<td>9.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Peas</td>
<td>14.3</td>
<td>22.4</td>
<td>2.0</td>
<td>57.0</td>
<td>6.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Oats</td>
<td>13.0</td>
<td>12.9</td>
<td>6.0</td>
<td>53.8</td>
<td>10.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Wheat</td>
<td>14.4</td>
<td>11.3</td>
<td>1.5</td>
<td>68.1</td>
<td>3.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Barley</td>
<td>14.0</td>
<td>10.6</td>
<td>2.0</td>
<td>63.7</td>
<td>7.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Maize</td>
<td>11.4</td>
<td>10.4</td>
<td>5.1</td>
<td>68.5</td>
<td>3.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Malt dust</td>
<td>9.5</td>
<td>23.7</td>
<td>2.2</td>
<td>44.9</td>
<td>12.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>14.0</td>
<td>14.2</td>
<td>4.2</td>
<td>50.4</td>
<td>11.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Brewers’ grains</td>
<td>7.7</td>
<td>4.8</td>
<td>1.4</td>
<td>9.7</td>
<td>5.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Clover hay</td>
<td>16.0</td>
<td>12.3</td>
<td>2.2</td>
<td>38.2</td>
<td>26.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Meadow hay</td>
<td>14.3</td>
<td>9.7</td>
<td>2.5</td>
<td>41.0</td>
<td>26.3</td>
<td>6.2</td>
</tr>
<tr>
<td>Bean straw</td>
<td>16.0</td>
<td>6.3</td>
<td>1.0</td>
<td>36.7</td>
<td>35.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>14.3</td>
<td>3.0</td>
<td>1.5</td>
<td>32.6</td>
<td>44.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Meadow grass</td>
<td>80.0</td>
<td>3.5</td>
<td>0.8</td>
<td>19.2</td>
<td>4.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Green clover</td>
<td>85.0</td>
<td>3.3</td>
<td>0.7</td>
<td>7.0</td>
<td>4.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Potatoes</td>
<td>75.0</td>
<td>2.1</td>
<td>0.3</td>
<td>20.5</td>
<td>11.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Mangels</td>
<td>88.5</td>
<td>1.2</td>
<td>0.1</td>
<td>8.2</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Swedes</td>
<td>89.3</td>
<td>1.5</td>
<td>0.2</td>
<td>7.3</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Turnips</td>
<td>91.7</td>
<td>1.1</td>
<td>0.2</td>
<td>5.3</td>
<td>1.0</td>
<td>0.7</td>
</tr>
</tbody>
</table>

**Pure Water.**—Too much attention cannot be over-estimated in the providing of an abundance of pure water for dairy cows. Every dairy farmer must have observed how rapidly the milk of cows de-
creases in hot, dry weather, when water is scarce and the animals do not get their usual supply. Another great point is to see that all drinking-places are easy to approach. Oftentimes cows get an insufficient supply of water on account of the difficulties of ill-appointed drinking-places.

**MILKING.**

The hours of milking should be regular, and each cow should be milked in regular order; and cleanliness is the first point to be considered. All dirt should be rubbed off the cow's udders, and the hands of the milker kept clean. The milking should be done gently, quickly, and perfectly; all chucking and plucking at the teats to be avoided. The first, because everything that soothes the animal is beneficial; and the last, because you obtain the richest milk, known as the "stripplings," which are invaluable to butter-makers. It has been proved, and I know by my own experience that, by dividing a cow's meal of milk into four equal parts, you will find about 10 per cent. of cream in the first part drawn, and about 40 per cent. in the last, which shows how essential it is that the greatest care should be given to

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**BYRD'S PATENT MILKING CAN.**

**PATENT CAPILLARY REFRIGERATOR.**

this point. Besides, by not removing every drop of milk in the cow’s udder at each meal, the secretion will gradually diminish in proportion to the quantity of each day left behind, as well as tend to injure the general health of the cow.

As soon as the milk is drawn from the cow, it should be taken outside the cow-house, carried as gently as possible into the dairy; there strained through a fine sieve, and the quantity entered in the dairy record. It is recommended that everyone should have their cans gauged, which proves a great saving of time. If the weather is warm, or the milk intended for transit, it should be cooled down immediately after milking, before any injurious change can possibly take place. It is a well-known fact that milk is preserved in proportion to the rapidity with which it is cooled down. Scientific investigations have proved beyond doubt that when milk is suddenly cooled, the infusoria or vital organisms (the cause of rapid decomposition) are destroyed, and the milk is consequently preserved; whereas, if cooled by slow degrees, these vital organisms will be found in it.

**MILK MEASURING AND WEIGHING MACHINE**

This machine weighs and measures the milk at the same time, and is invaluable where a dairy record is kept of the produce of each cow.
THE DAIRY.

The best position for the dairy is a quarter under ground, not too far from the cowhouse, but out of the way of odours and gases arising therefrom, and from the decomposition of manures, the windows covered with perforated zinc, all facing the north, which ensures an immunity from the hot glaring sun in summer, the roof to be a good non-conductor, and a sure prevention from the harbouring of insects. Close proximity to pure spring water, perfect drainage, well-ventilated with pure air, cool and dry. The best floor is of flags or smooth surface quarries, and should always be kept dry. Damp floors are a great evil in any dairy, as damp tends very much to the development of organic germs, which, floating in the air by thousands, although invisible to the naked eye, attack the milk immediately it is brought in, and finding in it such a suitable medium for development cause sourness, fermentation and putrefaction. Paraffin oil cans, onions, or any other strong-smelling matter should never be kept in the dairy, as milk is of such an absorbent character that it takes up very quickly any foul odour. The shelves are better made of stone or slate than wood, being less absorbent. Too great attention cannot be given to cleanliness in everything connected with the dairy.

MILK.

Milk of average good quality contains about 87 per cent. of water, which is for the most part an emulsion of fatty particles (commonly spoken of by scientists as milk globules) in a solution of caseine or curd, milk-sugar, and a small amount of mineral matters. The following is the proportion in 100 parts of average good quality milk:

Water . . . about 87 per cent.
Butter . . . " 3½ "
Caseine or curd . . " 3½ "
Milk-sugar . . " 5 "
Mineral matter . . nearly 1 "

Total . . . 100

The composition of milk varies in different cows, at different seasons, or when fed upon different kinds of food, the greatest variation in either of its solid constituents being in the butter fat; the fatty particles, or milk globules, are enclosed in little cells of caseine.
or, in other words, the butter is encased in curds, which are generally round or egg-shaped; the size of them varies in different animals, and even in animals of the same kind they vary from 1-2,000th to the 1-4,000th part of an inch.

The white appearance of milk is due to the milk globules in it; as these globules are separated in the shape of cream, the milk becomes clearer and acquires a bluish tint, which at once indicates its character, "As blue as skim milk," the old adage well-known to everyone. Completely separated from the milk globules, the fluid is a perfect solution of curd, or caseine, albumen, milk-sugar, and mineral matters; these globules, being lighter than milk, rise on standing, and are removed as cream, the shells of caseine or curd which enclose the milk globules must receive every care of the butter-makers in getting rid of them, as they form a large proportion in the buttermilk, and in them the greater part of the mischief lies. The butter fat of milk is the constituent to deal with principally in conformity with the subject, the other constituents, although injurious to butter-making, are proved invaluable in cheese-making.

MILK-TESTING.

The testing of milk is a very important feature, and should receive every attention. In the production of butter its advantages cannot be over-estimated. The fact that the butter fat varies more than any other solid constituent in the milk gives good foundation for its proportion being frequently tested. Oftentimes we hear farmers say that as long as their cows fill the milk pail each meal, they are satisfied. Their theory of quantity is all very well for butter-making if it possesses quality.

If milk registers less than 10 per cent. of cream, or produces less than 1 lb. of butter to 10 quarts of milk, it is useless trying to make butter to profit, unless the milk (if poorer) is sold or produced at an equivalent cost.

There are several systems of testing the quality of milk, but it is proved that there is no accurate test short of chemical analysis.

The Creamometer, or test tube is quite sufficient to enable a farmer to see at a glance the proportion of cream in the milk. The milk is poured into the tubes, until it reaches the top mark, and allowed to stand for a few hours. The cream rises to the top, and its quality per cent. in the milk may be seen.
THE VICTORIA MILK AND BUTTER TESTER.

This machine is constructed on the principle of the Centrifugal Cream Separator. It is simple, cannot get out of order, is easily worked, and will give an exact indication of the richness of any sample of milk in two or three minutes in any kind of weather. The illustration (Fig. 1) is from a photograph of the complete apparatus for hand power only. Fig. 2 gives a view of the revolving disc with two milk tubes in position. Fig. 3 is a full-size view of a milk tube, and Fig. 4 of a butter tube. To use the apparatus for milk, a tube is filled with a fair sample and laid inside the disc. The milk will not run out when the tube is laid down. The disc cover is then put on, and the machine set in motion. Under the centrifugal action thus set up, the heavier portions of the milk are separated from the cream, and are driven to the outer end or bottom of the tube, leaving the cream in the narrow neck. A few minutes' spinning suffices to separate all the cream from the milk. When the test tube is taken out, the percentage of cream may be read on the graduated scale. Twelve different samples may be tested at once. It will thus be-

![Fig. 1](image1)

Fig. 2
seen that what this apparatus does is to show, quickly and accurately, at any time, the proportion of cream contained in any sample of milk.

In addition to the testing of milk, the machine is also extremely useful for testing butter, margarine, or other butter substitute. By its aid the exact proportion of pure fat, water, salt, and other impurities contained in any sample of butter or margarine may be ascertained in a few minutes. Hence, as the value of any sample of butter or margarine, either commercially or considered as an article of food, depends so much upon the amount of water, salt, and other impurities which it contains, the usefulness of the testing machine will be at once apparent. The machine may also be used for testing lard for water. It will show in a few minutes whether any sample of lard contains water, and if so, how much. Of course it could hardly be expected for every small farmer to adopt it, but there is no reason why a few should not co-operate together.

THE LACTOBUTYROMETER.

This instrument, for the determination of fat in milk, consists principally of a glass tube closed at one end, and divided by marks into three divisions, each of a capacity of 10 cubic centimetres, and marked “milk,” “ether,” and “alcohol” respectively, the uppermost division being further subdivided into $\frac{1}{10}$ c.c. The divisions are meant for measuring the three fluids, the names of which they bear, but it is very much preferable to use 10 c.c. pipettes for the purpose.

Measuring liquids by means of pipettes is done as follows: Hold the pipette near its upper end between the thumb and the third finger of the right hand, insert the lower tapering end into the liquid, and fill it by exhausting the air with the mouth, then remove the lips and quickly close the upper end by means of the second finger. The pipette is then removed from the liquid, and by raising
the second finger slightly, so much of the contents allowed to escape, drop by drop, until the lowest point of the curve forming the surface of the liquid coincides with the mark on the upper part of the instrument. The contents are then discharged, the pipette being quite emptied by blowing out the last few drops of the liquid.

The lactobutyrometer is worked in the following manner: 10 c.c. of milk are measured by means of the pipette marked "milk," and discharged into the graduated tube; 10 c.c. of ether are then added, the tube closed with a well-fitting cork or the thumb, and well shaken until milk and ether are thoroughly intermixed and a homogeneous fluid formed; 10 c.c. of alcohol, containing 91 parts by volume of pure spirit in 100 parts, are next added, and the shaking resumed until the precipitated caseine is subdivided into very fine flakes: the tube cannot be shaken too much. Whilst the tube is being shaken the cork or thumb, whichever is used, must be several times removed, in order to relieve the pressure formed inside. The tube should then be tightly corked, placed in water at a temperature of from 100° to 105° Fahr. (=38° to 41° centigrade), and allowed to remain in it until the fat globules, which have been formed and immediately begin to rise to the surface, have all collected in a layer at the top.

If no water of the required temperature is at hand, it may be prepared by filling the brass cylinder, supplied with the apparatus, with cold water, pouring some alcohol into the tray which forms the foot of the cylinder, and setting it alight. As soon as the thermometer,
immersed in the water, indicates the proper temperature the flame is extinguished.

When after about ten minutes it is found that fat globules have ceased to rise, the tube may be placed in a glass cylinder, previously filled with water of a temperature of about 68° Fahr. (20° centigrade). The clear liquid below the fat layer will then be seen to become cloudy and after a time clear again, and after about 15 minutes the fatty layer will generally be found to have very slightly increased. The extent of the fatty layer is then read off, the graduation giving the volume in \( \frac{3}{8} \) th part of a cubic centimetre.

As the placing of the tube in the second bath makes only a very slight, if any, difference in the results obtained, it may be dispensed with, without any serious disadvantage.

The addition of two or three drops of a 25 per cent. potassium hydrate solution to the mixture of milk and ether will prevent the precipitation of caseine by the subsequent addition of alcohol, and thus facilitate in some degree the process of shaking, which, however, should be continued sufficiently long to form a very intimate mixture of milk, ether, and alcohol. We repeat that the tube cannot be shaken too much. In far the larger number of cases the presence or absence of potash makes no difference to the final result, but it appears that in some instances more correct results are gained if potash is added, while in others the reverse is the case. It is, therefore, always advisable to make two determinations of each sample of milk, the one with, and the other without potash, and to take the higher result as the more correct one. If there is reason to suppose that all the fat has not risen to the surface, the tube should be again shaken and once more placed in the warm water bath, the fatty layer soon re-forming.

The strength of the alcohol used for the test is of the greatest importance, and must be checked by means of an alcoholometer, which is supplied with the apparatus. The ether ought to be washed ether, made from pure spirit.

Milk containing less than 1.2 per cent. of fat does not throw up a fatty layer when tested with the lactobutyrometer, but the apparatus may, nevertheless, be used for determining the percentage of fat, even in samples of poor skim milk, by proceeding as follows: After the percentage of fat in a sample of normal milk has been determined in the above manner, 5 c.c. of this milk are taken and mixed with an equal quantity of the poor milk in question, and the percentage of fat in the mixture determined. The result of the latter determination is then doubled, and from the figure thus obtained, the result of the former determination—percentage of fat in the normal milk—
subtracted. The rest indicates the percentage of fat in the poor milk.

**TREATMENT OF MILK ON COMING INTO THE DAIRY.**

As soon as the milk has reached the dairy, and after it has been well strained through a fine sieve, and the quantity entered in the dairy record, if intended to be set on the ordinary cream-raising system should be poured into the setting pans at once, but if on the other hand the milk is required to be run through the centrifugal separator it should be poured into the feed tin.

**CREAM RAISING.**

There are several methods of cream-raising, but of all the centrifugal separator is the most advantageous, not only as regards the augmented and improved butter yield, but also the freshness and good quality of the skim milk and cream.

Centrifugal separators having been adapted for dairies of all sizes, every facility is afforded to their adoption, and it is to be hoped it will bring about a general improvement in dairy practice. The advantages derived are very numerous.

1st. The cream can be separated from the milk immediately after milking. 2nd. 15 to 20 per cent., and in many cases 25 per cent. more butter can be obtained than by the ordinary setting system. 3rd. Great saving in space and time. 4th. Great saving in labour and number of utensils used. 5th. Improved and more uniform quality of butter, characteristics which place the foreign butter so prominent on the market. 6th. The skim milk, always perfectly sweet, which is invaluable as food for calves, with the addition of some food, rich in oil, in lieu of the cream taken out. 7th. All animal matter, dirt, and impurities found in the most carefully strained milk are removed from the milk, and will be found sticking to the outer wall of the bowl.

The cream and skim milk, directly after being separated, should be cooled down, which will add very much to their keeping.

**CREAM SEPARATORS.**

The best known separators in the market are the “Victoria;” “De Laval;” “The Danish” and “Alexandra.” With regard to efficiency in work there is very little difference in either of the several makes, as they all skim the milk equally well; but some possess more advantages than others.
THE "VICTORIA."

The Victoria Separator is manufactured by Messrs. Watson, Laidlaw & Co., of Glasgow, who have long been makers, on a large scale, of centrifugal drying and separating machines, for use in the Sugar, Chemical, Textile, and other Industries.

They claim to have been amongst the first to separate cream from milk by centrifugal action, and still have in their possession an experimental machine, made many years ago, in which this separation was effected.

The illustration Fig. 1 is from a photograph of the "Victoria" Separator for 50 gallons per hour. Fig. 2 is a sectional view of the hand-power machine. From these two views the construction of the machines will be quite clear. The whole milk enters the small inner cone whilst the machine is in motion, and passes through channels in the bottom into the outer inverted cone, which is the separating drum. It then rises from the bottom to the top of the
drum, and is separated as it does so—the skim milk and the cream finding their way through separate channels into the collecting covers.

Some important advantages are claimed for this machine, \textit{viz.},

It is supplied with an Automatic Feed Regulator, which is adjustable so that the quantity and density of the cream may be varied whilst the machine is in motion.

The separating drum will empty itself when the machine is stopped.

It is removed for cleaning without disturbing the spindle. It will be noticed that the drum is open at both ends, which is a great essential in cleaning.

It has enormous strength owing to its shape and the material of which it is made—a special forged steel. It would be perfectly safe even at higher speeds than that specified.
The entire machine is very compact and takes up but little floor space.
The bearings of the countershaft are self-oiling, and provision is made for the perfect lubrication of every other bearing surface.
There are no parts liable to rapid wear; but any part required for renewal can always be sent on receipt of particulars.

The other sizes for power made are machines separating 70, 100 and 150 gallons per hour,

Fig. 3 is an illustration of the hand power "Victoria," of which Fig. 2 is a sectional view; this separates 20 gallons per hour, is strong and substantially made; the working having large surfaces the wear and tear being therefore trifling; it occupies very little space, and can be fixed to any stout table, and a strong boy or girl can
drive it easily at full speed; it also possesses the advantage; which are claimed for the power machines.

THE LAVAL.

The Laval Separator owes its origin to Dr. De Laval, a native of Sweden, who has also patented many other important dairy machines. The machine has had a most successful career and is well known in every country.

Its construction is simple, and very little mechanical knowledge is required for its operation and care. This point is of great practical moment. Experience in the whole range of agriculture shews that only the simplest constructed machines and tools have been able to secure a general and continued preference. No complicated implement can in practice gain any great favour, not even if from a theoretical point of view it is declared ever so excellent as regards the idea upon which it is founded. A simple machine, easily attended to and cleaned, possesses greater durability, and thus affords greater security. It is easily cleaned, all the parts being open to view and accessible at any time.

The Separator itself is not liable to wear, and the few wearing parts can be sent by post and replaced by anybody at a trifling cost. A Laval Separator may be run night and day for a month without any heating of the bearings, and with no attention beyond feeding
and oiling. The great speed of these machines, while ensuring the most perfect separation of the cream, is no drawback, as the bowl which does all the work simply spins on a steel point, which can be easily knocked out and replaced at the cost of a few pence once in twelve months.

The several sizes made are the “Baby” (12 gallons per hour), the “Vertical” (24 gallons per hour), the “Horizontal” (35 gallons per hour), these are for hand power. The power sizes are capable of separating 90 and 150 gallons per hour.

The Steam Turbine. This is the most ingenious invention and greatest boon that Dr. De Laval has ever given to the dairy
world. The spindle carrying the cylinder is driven directly by a jet of steam, without the intervention of the above-mentioned factors, and by a very clever device the Turbine is so constructed that the wear from friction renders the running bearing or joint more and more steamtight, instead of causing it to leak. The waste steam may be used for warming milk or water, and other purposes. It runs very smoothly, and can be driven up to any rate of speed. The consumption of steam is about the same per horse-power as when an engine is used; but the saving in the first cost of establishing a factory, and in the running expenses, is so considerable as to far more than pay the cost of the Turbine itself. No mechanical knowledge is required for managing it, the speed being regulated by opening or closing an ordinary steam cock, raising or lowering the steam pressure, which is indicated by a steam gauge fixed at the inlet on the steam pipe close to the Turbine. With no belts and shafting it requires very little room, the base of this machine measuring only three square feet, and it can be placed in a corner without any foundation whatever. Some of the very first sold have run to the present time without any renewal of wearing parts.

These machines are made in the same size as the power ones. The illustration given is that of "The Gustavus," to separate 150 gallons per hour fitted with Laval's Milk Warmer, which consists of a closed copper vessel, within which hot water is circulated and kept at the required temperature by a small jet of steam; the milk fills a hollow space in the centre, entering through a feed regulator attached to the warmer, and then flows over the outside into a receiver underneath, through a tube in the centre of which it passes into the separator, and with the Laval Centrifugal Milk Raiser, which raises the separated milk to a height of 16 feet, this is worked from the spindle of the separator and requires very little extra power to drive it and no attention from the person in charge.

The whole of the work is performed by a jet of steam, direct from the boiler, and without the intervention of an engine of any kind.

THE "DANISH."
capable of separating 13 gallons per hour, and can be worked easily by a boy or girl. The illustration given is that of a B size, suitable for horse or any other power; both sizes are of similar construction, and possess the same advantages. The following is a brief description of the largest size.

The drum of this machine, which is 27 in. in diameter, revolves at 2,700 revolutions per minute, and is stamped by hydraulic pressure from the finest pressed steel, thus entirely obviating the risk due to castings, which may appear perfectly sound and yet contain several flaws. Several great improvements have taken place in this machine since last year; the output has now been increased to 220 gallons per hour, and a new method of delivering the milk into the drum has been adopted, which has greatly facilitated the production of thick cream, although this is a point in which the separator has always distanced some of its rivals, owing to the fact that the skimming tubes do not rotate with the drum, and can, therefore, be adjusted while at work. To obviate any chance of the separator being overdriven, should the governor of the engine fail to act, we find that a most ingenious form of intermediate motion has been adopted, which, without springs or other gear liable to get out of order, will remove the belt from the fast to the loose pulley should the speed of the driving shaft become excessive; at the same time a gong is struck, warning the attendant that the speed is excessive. The governor balls on the intermediate fly out directly the speed is excessive, and, acting on the weighted levers, release the belt guide from the clutch and transfer them to the loose pulley. The milk, on
entering the drum through the pipe and ring, is separated by the centrifugal force into the cream and skim milk, the latter passing at the back of the annular plate into the upper part of the drum. The cream and skim milk are drawn off by the tubes, and, if required, are elevated to a height of 8 or 9 feet above the machine. The skim milk can thus be scalded, cooled, and refrigerated without any manual labour; this in a large factory means a considerable saving, as fewer attendants are required in the dairy.

THE "ALEXANDRA."

The "Alexandra" is also of Danish production, and is claimed to be of entirely new design. It is manufactured by Messrs. Koefoed & Hauberg, of Copenhagen, who have spared neither expense or labour to perfect every detail of construction, and practically test it in every possible way. In Denmark this machine is a great favourite and is being generally adopted in the new Co-operative Dairies there.
The principal feature consists in the drum or bowl of the separator being carried and driven on the ball-shaped top of the spindle, the bowl is therefore driven by friction, and perfectly balanced. This self-centration enables the high speed of the bowl to be maintained without the slightest vibration or shaking, dispensing with an expensive foundation or fixing in any way, and the machine may stand loose on the floor.

It will be seen at a glance from the sectional view given that it is of simple construction, the bowl or cylinder being loose it is easily cleaned, as it can be lifted off and put into a tub of water without the least difficulty; this is of the greatest importance. Unless the separator can be easily cleaned it is impossible to make the finest flavoured butter from the cream. The bowl or cylinder is made of cast steel and most accurately turned; all these are tested at such a speed that the strain on them is double that occasioned in ordinary work.

There are several sizes made, their capabilities of separation being 27, 44, 65, 130, and 220 gallons per hour.

The 27 gallon per hour size is for hand-power, and can be easily worked by a boy or girl, continuously.

CREAMERS.

Of all the setting systems the "Jersey," "Dorset," "Speedwell," and "Cooley" Creamers are the best.

THE "JERSEY" CREAMER.

The "Jersey" Creamer seems to be favourite and holds its own against all other systems for all round good work.
The pans are double bottomed, have double sides, and are made of tinned steel plates (inside pan) and tinned and enamelled steel plates (outside pan).

The open part of the pan is to receive the milk, and the empty space between the pans to contain ordinary cold water (45° to 60°) conducted into each pan by a brass tap connected with the barrel at the back of the creamer; water being supplied by the pipes on the premises, or if there be no water supply, by means of an ordinary tank (as shown in drawing).

The double space being filled, the water should be kept flowing as long as possible through it (at least until the milk has fallen to the same temperature as the water); the surplus water escaping from an overflow at the back of each pan into a trough connected with a small waste pipe at the side. The action of the water flowing round the pan causes the cream to rise in from 12 to 15 hours—instead of 36 or 48 as with the old systems.

If the milk has been allowed to cool down below 90° F. before it comes into the dairy, which is more often the case than not—it is strongly advised, before the milk is poured into the pan, to fill the double-bottom first with boiling water, in order to take the chill off the metal; then, to draw out this water to be replaced by another lot which will raise the temperature of the milk to say 110° F.; as soon as this result is obtained draw out the hot water and cool the milk down as quickly as possible by letting the cold water flow through the small taps into the double-bottomed pans. The previous heating will greatly increase the power of the cold water and make the cream rise quicker and thicker.

Each pan is fitted with a tube, having at its lower end a very fine wire gauze, through which the skim milk passes, leaving the cream in the pan, from which it is taken by removing the tube and stopper or by simply tilting the pan forward on its hinges,—see drawing.

The lids are constructed to act as ventilators, and greatly assist the raising of the cream; they will allow all gases to escape; at the same time prevent dust, flies, &c., coming into contact with the milk.

Calves are reared successfully on this skim milk, which remains perfectly sweet, and which can be obtained of any required richness.

The "Tiny Jersey" Creamer is constructed and acts entirely on the same principle as the "Jersey" Creamer; it has been introduced principally for use in private houses where no cows are kept, as it deals with from half a pint of milk to two gallons according to size, the smallest size holds two quarts or less, and the large two gallons or less.
also consists of a double pan. The top pan holding the milk, underneath and all round the sides is a hollow chamber, the entire depth and length of the top pan. This chamber is provided with an inlet and outlet, and water is passed in and circulated underneath and round the pan which contains the milk, passing out at the opposite end, a continual flow of water round the entire body of milk being thus ensured. The action of the water flowing round the pan gives similar results of the "Jersey,"—the cream rising much quicker than the old system. In cold weather hot water is passed in with splendid results.

Each pan is fitted with an exit at the one end, covered with a removable cup of very fine wire gauze through which the skim milk passes, leaving the cream in the pan, which is taken out by removing the plug and cup.

The patent Raiser (Fig. 1), a cellular tin vessel, the upper portion of which forms a curved dish or cream reservoir (R), into which the cream rises from the milk contained in the cells (G).

The patent Skimmer, also of tin (by one dip of which, as shown on Fig. 2, all the cream, or just so much as is desired, is instantly removed).

The zinc, or galvanized iron, bath, in which only ordinary spring or well water is used.
The raiser is charged with milk up to the top line on the glass eye-piece, and is thus left, in cold weather, till the cream has risen, and is ready for skimming. In warm weather the raiser is set in its bath containing the coldest water available. The skimming is done with one dip of the patent skimmer, as indicated on Fig. 2. If a proportion of cream is to be left in the milk, then a little skim milk is drawn off from the outlet pipe (B) till the proportion of cream to be left in has sunk, as witnessed through the eye-piece (A) below the reach, or cutting line of the skimmer, which line is also marked on the glass (A)—or this can be effected by skimming in a shorter time, before all the cream has risen.

"SPEEDWELL" PATENT RAISER
Fig. 1.

"SPEEDWELL" METHOD OF SKIMMING.
Fig. 2.

It is claimed that the "Speedwell" will raise more cream in from three to six hours than can be raised in thirty-six to forty-eight hours by the old systems. This saving of time will admit of the same pans being used for both morning and evening's meal. One may wonder why this system is so amazingly rapid in its action; this can clearly be seen by glancing the eye at Fig. 1—it shows that the narrow cells allow nearly every particle of the milk to be brought in close contact with the water, which gives the desired effect.

THE "COOLEY" CREAMER.

In the Cooley process, round cans (as Fig. 1) are submerged in a refrigerator (Fig. 2) filled with cold water, the cans being covered
with a loose lid, and as the water flows over them the air is entirely excluded, at the same time permits impure gases in the milk to pass off into the water, and become absorbed by it. Each can is fitted with a syphon tap by which the skim milk is run off.

By the use of these several systems of cream raising 15 to 20 per cent. more butter can be made than by the old systems.

**THE SHALLOW PAN.**

Although this system is proved a thing of the past owing to its capabilities of separation being non-effectual as compared with the modern process, still it must be remembered that as good butter can be produced by the shallow pan as by the most approved method, but to give these results the quantity has to be sacrificed, owing to the length of time it takes for the cream to rise.

The milk should be skimmed carefully after it has stood twelve hours, care being taken that what is skimmed off consists of cream, unmixed with milk. A second skimming may be made twelve hours afterwards, but the cream should not be mixed with the first cream taken off until about six to nine hours before churning. In cool weather the cream can remain on the milk for twenty-four hours, but should be never over that time. On this point a great many butter-makers fail. They imagine that as good butter can be made with cream remaining on the milk for thirty-six hours, and even forty-eight hours, as that of twelve hours and twenty-four hours; but it is a very great mistake. The cream that rises first is the best, and to make
choice butter the cream should be taken from the milk before it becomes old and sour. The greater the decomposition of milk the more will the cream be affected, and as a consequence, the more difficult will it be to obtain a nice quality of butter from it.

The Improved Revolving Disc Milk Pan Stand as shewn above is worthy of notice. It is simple, substantial and portable, and has several advantages to recommend it:

It utilizes space as it can be placed in line or in square; the revolving discs or tables allow of skimming each pan without moving from one position; being portable it can be placed in the most desirable position for ventilation and for thorough cleansing of the milk-house walls, which fixed shelves do not admit of.

**PREPARING THE CREAM FOR CHURNING.**

*Ripening Cream.*—If cream be churned sweet the butter will lack that fine nutty flavour which cream slightly ripened gives. No doubt a great number wonder what this ripening or slightly souring of the cream consists of. The proper ripening is the result of certain chemical changes that go on because of its exposure to the air; frequently stirring facilitates ripening, and secures a uniformity of the process. Temperature has a good deal to do with the ripening, because at a
low temperature the chemical changes go on slower; oxygen being the principal agent in producing these changes. If cream is wholly excluded from the air ripening will stop, there will be no oxygen to unite with the soft fats and produce flavour, nor with the milk-sugar to produce lactic acid, cream should therefore be kept in a pure atmosphere.

It has been proved that by ripening or slightly souring the cream before churning 3 to 4 per cent., or even 7 per cent., more butter can be made than butter made of sweet cream.

To artificially ripen cream (which is desirable), heat the cream gradually to about 64° Fah. in cold weather, or 60° Fah. in summer, about twelve hours before churning, and add about 3 per cent. of sour cream, milk, or buttermilk.

*Scalding the Cream.*—At the time of year when the young grass affects the flavour of butter, or when turnips are used in feeding, in addition to the treatment before referred to (see p. 25), good results can be obtained by scalding the cream (by placing the can to stand in boiling water); as soon as the little crinkle is observed on the thin skin which forms on the top, remove the pan to a moderate temperature of about 50° Fah., to cool the cream down, this method tends much to improve the quality of the butter. Care must be taken not to scald the cream above 150° Fah.

*Straining the Cream.*—Cream should have a uniform consistency, as well as being of uniform ripeness, when it goes to the churn; and should be well strained by putting a piece of muslin or fine sieve on the mouth of the churn, and pouring the cream through it into the churn.

*Colouring of Butter.*—One of the market requirements in butter is that it should be of a rich yellow or golden colour. The fact that grass butter always has a rich shade without resorting to artificial colouring is sufficient reason on the part of consumers for suspecting that pale butter must be of inferior quality, uniformity being the only rule that will sell butter in the present day. Late fall or spring butter made from the milk of cows fed upon hay is generally deficient in colour, and, unless some artificial means be employed to give it the desired shade, it will not command a price in the market equal to butter of the same texture and flavour that has been coloured.

Pure annatto not mixed with water is the best; this prevents any uneven or streaky appearance, and should be added to the cream in the cream pot before churning. A colour may be prepared from pulped or scraped carrots, which answers very well, the roots when ready are pressed, and the liquid from them is strained and kept for use.
The amount of colouring to be used much depends upon the depth of colour required and must receive the discretion of the dairy-maid.

**Thermometer.**—No one should attempt to make butter without using a good thermometer, in fact no dairy is complete without one. Old and experienced butter-makers may guess at the temperature pretty accurately; but the temperature varies so much from day to day that no one can be sure of being right without an accurate instrument for determining the degree of heat required in the cream to produce the best results.

The illustration given is that of a floating Dairy Thermometer specially adapted for testing the temperature of milk and cream, being plain glass it is easily cleaned.

**Temperature for Churning.**—Too great importance cannot be attached to this point, as the difference of a few degrees of temperature in the cream would spoil a whole churning. The proper temperature to commence churning much depends upon the ripeness and quality of the cream and the time of year; but from 55° to 60° Fah. will be found most beneficial, the former in summer and the latter in winter.

A Temperature Can (see illustration) will be found most useful for raising or lowering the temperature of the cream when in the churn (if required); it can either be filled with hot or cold water.

Cream should always be churned two or three times a week, but to those small dairies who only deal with a few pounds of butter each week, the cream should be kept in a cool dry place, and when about 12 hours before the churning be heated up to the proper temperature.

**Churning the Whole Milk.**—The present system of churning the whole milk as carried on in most districts, *viz.*, by keeping the milk for two or three days, and sometimes a week, until it naturally coagulates, must be totally dispensed with if choice butter is required. To produce a really good quality by this method, the milk, as soon as it reaches the dairy, after being strained through a fine sieve, should be artificially soured, or coagulated, by pouring into it three per cent. of sour cream, milk, or butter-milk, and keep the whole in a warm temperature of about 70° Fah., for twenty-four hours, never longer than thirty-six hours, and then churn it.

This process involves a great amount of labour, but is adopted principally in those districts where the people have a taste for the consumption of butter-milk.
SELECTION OF CHURN.

Much depends upon the selection of a good churn: the points to be considered are:—simplicity, easy to clean, without dashers or with movable ones, with large mouth to enable both arms to be put in for cleaning, etc., the least power to work, and one which makes the best butter and brings it simultaneously in one uniform granulation.

There are many good makes of churns; the best known are Bradford’s, Hathaway’s, William’s, Waide’s, Woolridge’s, and Llewelyn’s; but for all round work Bradford’s “Diaphragm” cannot be surpassed, they possess the points of excellence in selection of a churn.

Great care should be taken that all new churns are well seasoned, and both new and old kept scrupulously clean; perfectly good cream is often spoiled in the churn from negligence in properly cleansing it. When once the churn absorbs the milk taints, it is very difficult to eradicate it even by subsequent cleansing.

THE "DIAPHRAGM" CHURNS.

The makers of these churns need very little introduction as they are universally known in the dairy world. The illustrations of their
churns given are the "Diaphragm" of barrel type. The "Index Diaphragm" adapted for small sizes is of similar type but differs in shape,—the circumference being increased and the width reduced, by which the churning power of the small sizes is equal to the larger ones.

THE "CHARLEMONDT DIAPHRAGM" OF END OVER END CONSTRUCTION.

The slow speed required of the "Diaphragm" churn takes from one third to one half less manual or steam power, according to size, than other makes, the milk or cream being, in fact, partly the motor, acting upon the "Diaphragm" as a propellor during two-thirds of the churn's rotation, as well as insuring the perfect mixing of the cream, and the simultaneous churning every portion of the cream whatever may be the quantity.

With other revolving churns the cream is worked or churned from the centre of motion to its periphery, and what is the necessary consequence or result? The cream that courses round the periphery of a barrel churn, at each revolution, is worked, or churned, a great deal more than the cream that is nearer, or nearest, to the centre of motion, and the result is that granulation is not simultaneous, the cream
becomes tired and sleepy, and cannot, will not, churn; or, if the butter is at last produced, it is often more or less imperfect in quality, streaky to the naked eye,—and always streaky under the magnifying glass,—and without true flavour.

The question very naturally suggests itself: How does the "Diaphragm" Churn, which also revolves, overcome this inevitable result of rotary motion? The answer is,—by the introduction of the "Diaphragm" or central division, which, while neutralizing centrifugal force, works the cream, by its louvre construction, to—not from—the centre of motion; and at a very slow speed—with half the expenditure of power—ensures the required perfect butter-producing results, vis.:

It mixes the cream perfectly. It agitates equally every portion of the cream from beginning to ending of the churning. It ensures granulation into butter being simultaneous and certain—not one portion of the cream being over-churned and the other portion being under-churned, but the whole churned equally, hence the perfect sample of butter it produces. The butter granulations when formed flow passively through the stationary "Diaphragm," and are absolutely uninjured; whereas, with a mechanically-revolving "Dash," the floating granulations would be struck and injured.

The correctness of the churning principle, as well as the mixing principle, of the "Diaphragm," is perhaps best attested by the simple

INDEX "DIAPHRAGM."

A. "Diaphragm" Dash as placed when not in use. When slid into the Churn groove, it indicates the quantity of cream in the Churn.


C. Rest for left hand while churning with the right hand.

D. Lid, which is turned hollow to receive the butter from the churn.

E. Plug (when not in use) in socket rest.
fact, that it is equally efficient in every size, whether churning one gallon or one hundred gallons, this is a remarkable fact that should be fully ascertained and clearly understood by all interested in butter-making.

The "Diaphragm" is self-securing, and can also be instantly removed, leaving the interior of the churn perfectly clear for cleansing or for butter-making manipulation, for which the large lids are admirably adapted, and the patent fastenings of which lids ensure absolute security against leakage while churning.

The glass outlet, fixed in the lid, is so moulded as to admit the plug or stopper (or a common cork), and also serves as the best possible ventilator or air outlet, rendering impossible the secretion of any impurities, to which metal spring ventilators are liable.

THE DECLIVITY BOX CHURN.

This churn is most suitable for churning very small quantities of cream, and is also Bradford's make.

One half the cover is a fixture and therefore effectually prevents back slop or leakage; the movable half affords ample space for taking out the dash and cleansing the interior.

The two wood set screws are to tilt the churn when either an unusually small or an exceptionally large quantity of cream has to be churned; in the former case the cream is collected at the lowest point of the churn, and gets the full benefit of the dash, and in the latter case the capacity of the churn is largely increased, as the cream will not leak at the end of the spindle even with a larger quantity—say, one fourth—than the churn will hold on the level.
CHURNING.

The churning of cream, although a mechanical process, is aided by a chemical action induced by allowing the cream to become ripe or slightly sour, which is easily understood, for, by allowing the sourness to take place, lactic acid is formed which dissolves the shells of caseine or curd which surround the globules of butter fat as already mentioned. These being removed the globules are allowed to come together and cohere by the operation of churning.

The churning should be done with regularity, the speed depending upon the make of churn, the "Diaphragm," as explained, only requires to be turned from 40 to 45 revolutions per minute, whilst others require to be rotated from 60 to 70 and even more per minute, commencing slowly and after the swelling has subsided, which will be in about 4 to 5 minutes, increase the speed a little.

Ventilate the churn frequently by removing the plug for a few seconds or by pressing down the ventilator as the case may be, to allow the gases to escape which are caused by the expansion of cream through the agitation; this ventilation must be continued until the air has finished rushing out when the plug is removed, which generally takes place during the first ten minutes; the time varies according to the ripeness of the cream, the more sour the cream is the expansion will be greater, causing more gas. The ventilation should receive every attention, for by not doing so, the expansion has no relief and is one of the causes of "sleepy" cream, results of which are too well-known to describe.

Listen attentively to the sound of the cream and immediately it changes in the least degree, stop the churning, remove the lid, and examine its contents.

If the grains of butter thus formed are no larger than a pin's head the churning is finished, and the butter ready for washing; but if the grains are smaller return the lid and rotate the churn a few times, which will increase the grains to the desired size; not as the greater number of butter-makers do, who believe in churning their butter into lumps about the size of your fist, which is the cause of the greater part of the inferior butter made. It stands to reason that if these grains are lumped together in one homogeneous mass they incorporate a certain amount of buttermilk in them, and to get rid of the buttermilk it has to be overworked, which gives us butter of bad texture and soft. There is a great saying amongst our old dairymaids, "Gather the butter well before drawing out the buttermilk." This only shows how wrong the action is; if it really must be gathered let it be done after the last washing, when the butter-
milk is free from it. If the weather is cool, withdraw the buttermilk; to avoid loss pass the buttermilk through a hair sieve, which will retain any particle of butter that may escape with the buttermilk and return it to the churn, but on the other hand, if the weather is warm and the grains of butter inclined to be soft, it will be found best to sacrifice part or even the whole of the buttermilk if necessary, by pouring in cold spring water to cool the grains of butter and keep them floating. It will be found beneficial in hot weather to add to the grains of butter in the churn when they just form one eighth pure cold spring water, say one quart of water to eight quarts of cream, then continue the churning until the grains are enlarged to the required size. When the butter has just formed the temperature of it should never register above 60° Fah., it would be better for it never to be higher than 56°, and then you can rely upon having firm grains, hence good textured butter, otherwise there would be no certainty even if the churning is stopped at the proper time. Too much attention cannot possibly be taken in seeing that the buttermilk is separated from the butter at the proper time, viz., when the butter is in a granular form. The greater part of the bad flavour imparted into butter, either from improper feeding or treatment of stock, or for want of a proper knowledge in the manipulation of the milk and cream, is found in the constituents of buttermilk, this only shows how important it is that every particle of the buttermilk should be excluded from the butter.
GRAINS OF BUTTER IN SIEVE, SHEWING HOW THE BUTTER OULD BE TAKEN FROM THE CHURN.

[Copyright.]
All the best makes of churns are fitted with a glass, which indicates when the butter first forms, by the butter-milk washing the glass clear. When the churning is first started the glass is of a dull appearance, caused by the cream. It is not well to always rely upon the glass, as sometimes, when the cream is very thick, and has not been thinned by the addition of water or milk before starting, or if it is of unequal ripeness, or again, if of too high a temperature when poured into the churn, the buttermilk does not always wash the glass at the first formation of the butter.

*Valentine's patent "Grain" Brush.*—This is simply a kind of whisk formed of stiff fibre, which is used to brush the grains from the inside of the churn, and for general use in cleaning the churn, etc. It is now used in all the leading dairies.

*Washing the Butter.*—The butter should be thoroughly washed with pure cold spring water by half filling the churn, giving it two or three turns, and then withdraw it in the same way as the buttermilk; repeat the washing till the water comes out clear, but no longer, as it is possible by excessive washing to extract from its fine aroma. Allow the butter to drain and harden naturally in the churn for five or ten minutes, a longer time if required, and then take it out by means of a butter-scoop and sieve, as shown in illustration, and put it on the tray or butter-worker; care being taken never to touch the butter with the hand.

**THE BUTTER-WORKER.**

One of the best and most useful introductions ever made into a dairy was that of the mechanical Butter-Worker. It proves a great saving of time and a sure preventative of the most objectionable practice of touching the butter with the hands. Now that butter-workers can be bought from a few shillings upwards no dairy should be without one. The best makes are undoubtedly Bradford's "Astle Albany" for dairies of small and medium sizes. They consist of a fluted roller, made of sycamore wood, working in a malleable galvanized iron frame, which operates in a rectangular tray carried on a strong frame. It rolls out the butter into a fluted layer by a forward movement, and again rolls or lumps it up by a backward movement, ready for re-rolling, thereby ensuring not only its being perfectly cleansed, but also perfectly salted in the easiest possible manner.
Two valuable little improvements have been made in these butter-workers, which make them incomparably the best. The first is, that the higher end is made so that it can be removed instantly, thus forming a table guarded on three sides, but the end, or side nearest the user is free and open for the convenient making-up of the butter. The second improvement is in the very ready and convenient way the roller can be instantly removed from, and replaced in, the framework.

When not in use as a butter-worker, the fluted roller can be instantly removed and placed between the galvanized iron standards in the bottom stay of the table, and when the tray is reversed and secured, it forms a most useful and convenient dairy table, as Fig. 2.

Figs. 1 and 2 are illustrations of the "Albany" Butter-Workers. These are of the same construction as the "Astle Albany," with the exception that the carriage for the roller is made of wood instead of malleable galvanized iron. Figs. 3 and 4 are illustrations of the "Astle Albany," without stands, specially adapted for small dairies, as they can be used on any ordinary table. For power the circular butter-workers, Fig. 5, are more suitable.
THE "DELAITEUSE" CENTRIFUGAL BUTTER DRYER.

The machine is of French origin, having been invented by M. Baquet. It extracts the buttermilk and water from the butter after being washed without either pressing or squeezing, which is a sure preventative of injuring the "grains" of butter by overworking.

The action of the machine, briefly described, is as follows:—The butter, after leaving the churn, is, while still in a granular state, placed—about 16 lbs. at a time—in a canvas bag. This bag is then placed in a metal cylinder, perforated with holes like a colander, which from motion communicated by the horizontal spindle is made to revolve rapidly—700 to 800 turns per minute. The buttermilk, and any other moisture the butter may contain, is driven off to the circumference, and thence through the holes into the outer case whence it passes out by the pipe into a receptacle underneath the butter remaining in a perfectly dry condition, in immediate readiness for being worked up into pats of whatever shape may be
required. The whole operation only takes four minutes, and directly one lot of butter is dealt with another may be put in. It follows, then, that taking five minutes as the time required, changing included, about $\frac{1}{4}$ cwt. of butter can be dealt with in an hour. There is a friction brake attached by which—after the butter has been spun round for three or four minutes—the machine can be immediately stopped to put in a fresh lot.

The illustration given is of power size, hand power sizes are also made.

The Working of Butter.—The object of working butter is to free it from water, or any buttermilk which remains in it after the washing; to give it a more solid consistency, and when dry salted to mix the salt evenly in it, without the least injury to the grain, every stroke should be a direct pressure, avoiding any rubbing or sliding motion.

Salting of Butter.—If the butter only requires slightly salting it is recommended to brine it while in the churn and especially in the hot weather, when there is always a risk of over working it.

The brine (1 lb. salt to 1 gallon of water) should be poured into the churn through a piece of fine muslin and the churn moved two or three times so that the brine would be well mixed with the grains.
The salting of butter must depend upon the taste of the consumer; in the case of brine, it can easily be regulated by the brine remaining a longer time on the butter.

In drysalting butter, the butter should be rolled out into a fluted layer on the worker, and the salt sifted through a fine sieve so as to ensure it being worked in evenly. If the butter is too dry when removed from the churn, which generally causes it to stick in being worked with the salt, it is well to pour a quart or two of cold water over the butter in the worker. It would only be misleading to state the amount of salt to use as it must be regulated according to circumstances; but the salt and the butter should always be weighed and a dairymaid should know the exact amount she is putting into the butter; for instance, supposing a customer is satisfied with a dairy of butter as to amount of salt one week, that dairy should contain exactly the same percentage of salt week after week, and in the case of brining the butter while in the churn, the dairymaid should remember the length of time the brine remains on the butter which suits the customer best. The best dairy salt should only be used.

Making up, depends upon the custom of the market to which it is consigned, local tastes having to be considered. Whatever form is adopted it must be of attractive neatness, which well repays the trouble of the maker. It is recommended that fresh butter should be made up in rectangular shapes, or rolls; they afford great facility in packing and when at their journey's end come out none the worse for transit; each roll or print should be wrapped up in either muslin or parchment paper, the latter more preferable, and the butter should be packed in light wood boxes (made especially) of suitable sizes. Some markets prefer butter done up in light firkins, tubs, or cools, from 1 4 lb. size upwards, others in baskets of similar sizes. There is everything now-a-days in appearance and how the goods are laid before the public. This is where the foreigners meet with such success, as their butters are always imported in the several forms just mentioned to meet the demands of our respective markets.

The Improved Lever Butter Press is designed to make butter up into rectangular and round shapes pounds or half pounds, which it does very neatly and in one quarter the time it can be done by hand.
Curing of Butter.—In the curing of butter for winter use the object is to bring every particle of caseous ferment present more or less in all butter into contact with the salt, or other preservative used, and so check its own tendency to decay and its consequent action on the butter itself. It is therefore most important to bring about the entire and thorough mixture of the salt with the butter, the amount of salt required much depends upon the taste of the consumer, but 1 lb. of salt to 14 lbs. butter is about the proper average.

Tubbing Cured Butter.—In tubbing down cured butter care should be taken to see that the tubs are of right wood, and perfectly watertight. Too much attention cannot be given to this one point, as it is the cause of the greater part of inferior salt butter which has brought our English markets into such ill repute. The butter should be well pressed down, and the top of the tub when filled be covered with a cloth with a layer of salt over it. The butter should be brined every week or fortnight by pouring a little brine over it, first pouring off the brine of the previous week. The brine should be boiled and of such strength to float an egg, and allowed to become cool before using. The tubs or steins containing the butter should be kept in a cool dry place. There are only a few kinds of wood that are fit to pack butter in; oak makes an excellent package, but the wood should be well seasoned before using. The packages should have a clean and neat appearance, as everything that is laid before the consumers of the present day must be faultless.
There is not the slightest doubt that the best and most suitable all round power for dairy purposes is steam, as it possesses so many advantages. In addition to it providing the motor, it can be used for heating the dairy with the most favourable results, and for scalding no system can surpass it. Whatever power is adopted in the dairy, nothing is more important than absolute steadiness of speed; and especially in the driving of cream separators.

The illustrations given are of a Vertical Boiler and Engine; of a Horizontal Engine and Vertical Boiler; and of a Vertical Boiler suitable for dairies that require no power, or for driving the Steam Turbine Separator.

These engines are made from \( \frac{1}{2} \) nominal horse power and upwards, and both engine and boiler are mounted on a substantial water tank requiring no brick foundation; they combine simplicity, compactness, and strength, are easily managed, occupy very little space, stand quite steady, require comparatively no fixing; and are fitted with a patent safety governor which ensures a regularity of speed. Each engine is carefully tested and worked under full steam pressure, and is sent out complete, ready for work on arrival, and every boiler is tested to 150 lbs. per square inch and provided with the usual mountings and fittings. These engines and boilers can be made portable so as to be of use in different parts of the farm.

The Boilers are made in the most improved manner of either Siemens' Mild Steel or best Staffordshire iron plates, and fitted with all the necessary mountings and fittings.
THE PETROLEUM ENGINE.

This new engine is manufactured by Messrs. Priestman Brothers, and is a splendid introduction for the dairy, where power is only required, but as there is no boiler it does not answer where hot water is wanted. Still, as a great number of our large dairies have good hot water arrangements, this engine will be found all that could be desired.

The special improvement claimed for it is that it has been brought out to use the common Petroleum Oil of commerce, i.e., ordinary mineral oil as used for lamps, etc., in contradistinction to those that will work only with Petroleum Spirit, i.e., benzoline, etc., or naphtha, these having a very low flashing point and igniting or firing if the atmosphere becomes hot, while the oil has a high flashing point and will not ignite until heated to a great heat. A test for this can be made by throwing a lighted match into the oil without any effect, the match being extinguished by the oil.

Construction.—The general arrangement of the engine is similar to a gas engine, the cycle being the same as the "Otto," but it is simple, and comprises all parts and details necessary for the working of the engine. The power is obtained by forcing the oil, which is contained in a small tank, by means of air pressure, into a vaporiser, where it becomes mixed with the requisite quantity of air to form a combustible charge, which being heated passes into the cylinder; here it is at first compressed and then fired by an electric spark. The exhaust, upon becoming freed, passes away round the vaporiser and forms the heating power for the incoming charge, and thence passes into the open air through an exhaust pipe.

Use for this Engine.—It can be used for any driving purposes as well as other special purposes, but it is particularly suitable for isolated districts, places where coal or gas are difficult to get, or where both are moderately expensive, or where the gas mains are some
distance away, as it is entirely self-contained, needing no connections, etc., of any kind for its supply, oil being the only material used for working, and this being of the commonest kind is obtainable anywhere. It has already been applied for many purposes, among those for which safety is an object may be mentioned thrashing, chaff-cutting, corn-grinding, etc., on farms. For cleanliness, driving bakery machinery, cream separators, and dairy machinery, sewing machines, etc.; also for pumping in collieries, electric lighting in private houses, etc.

It has also been made as a portable engine, which type is very suitable for all farm and similar purposes and is the first time an engine of this description has been introduced to the public.

Advantages.—The entire absence of danger. Unlike a steam engine it requires little or no attention after starting, and can be safely left to run on by itself, as when the oil in the supply tank becomes exhausted the engine will cease to run. The engine is compact, and requires but little space, it can be worked anywhere and in any climate, it is easily and quickly started, has very few parts likely to get out of order and therefore the repairs are very small. An important fact in connection with these engines is that where they are used no extra insurance premium is charged by the fire insurance companies as is the case with other engines.

Cost of working.—This is practically very small, as the material is cheap, and no driver is required. By recent improvements in the engine the oil consumed has been as low as 1½ pints per actual horse power per hour, which at the present cost of oil is less than 1d. per actual horse power per hour. No lubricating material is required for the cylinder, as the charge itself does all that is necessary in this way, and beyond the saving this is in itself an advantage.

Merits of the Engine.—In proof of the merits of the engine nothing can be better noted than the fact that the Royal Agricultural Society have awarded two of their silver medals, one at the Nottingham meeting, 1888, when the engine gained one of two medals given by the judges in competition with 69 new implements, and one at the Windsor meeting, 1889, when it underwent most exhaustive trials. Beyond this there has been a free run of orders for both home and foreign use, mostly given by people who have made very careful enquiries as to the merits of the system, and lately several repetition orders have been given by those who have had engines at work for some time, and the numerous and satisfactory testimonials given by users speak in further proof of these assertions, as also does the list of orders, included in which are the names of some highly
influential gentlemen, authorities, and firms, and great satisfaction is generally expressed.

Types of the Engine.—The most general form which is asked for is the ordinary horizontal type, and to meet requirements two forms of this are supplied, one being the engine itself mounted upon a substantial sole plate, and having a separate tank for circulating water, the pipes connecting tank and cylinder being arranged as usual for self-circulation. The other form consists of the engine being mounted upon a substantial cast iron tank or water vessel which in itself forms a massive foundation; with this is also supplied a small pump worked off crank shaft of engine for circulating the water round cylinder. In addition to the horizontal types, as already mentioned, a portable engine has lately been introduced and at the present time the construction of both launch and tram car engines is under consideration.

Minor Improvements.—Many minor improvements have lately been made in the construction and working of these engines, more particularly so as to ensure economical and reliable working and to still further simplify the attention necessary. A new form of electrical battery has been added which is an ordinary storage cell, it will last for from two to three months daily working, and is easily recharged.

Engines Working.—Many engines are now working in different parts of the kingdom, so that it is not difficult to see one running in almost any district.

THE OTTO GAS ENGINE.
The illustration given is that of the Horizontal "Otto". Gas Engine, manufactured by Messrs. Crossley.

These engines are also made of Vertical type and are being worked in many town dairies with splendid results, and have long held a fame with all kinds of businesses where gas can be obtained; but as there is very little prospect of gas being brought to every farmer's door, we can hardly expect them to be generally adopted in country dairies; they, like the oil engine, do not answer where hot water is required, having no boiler. The engines are made from \( \frac{1}{2} \) nominal horse-power upwards, and the consumption of gas is very small.
SELF-ACTING MILK ELEVATOR AND TIPPER.

This Milk Hoist, by means of which milk, as it is delivered at the factory or dairy, can be raised to any desired height and automatically tipped into the receiver of a weighing or gauging machine, or into the vat for supplying separators or any other purpose.

All the actions of elevating, tipping and lowering are entirely automatic. As compared with the old systems of lifting the milk churns, these machines effect a great saving in labour and time.

MILK-CAN CLEANER.

This machine was invented by Mr. Pocock and is manufactured by Messrs. Freeth & Pocock. It entirely supersedes the old-fashioned way of cleaning the cans by hand brushes, as each can is effectually cleansed both inside and out at one operation; the average time taken to thoroughly clean a can (cover included) is eighteen seconds. This is a most useful machine in large factories, in fact, no factory should be without one.
LAWRENCE'S MILK HEATER AND COOLER.

By means of this apparatus the milk may be heated to any desired temperature.

The annexed illustration shows an apparatus for scalding and cooling milk. The heater (A) is fitted with a patented arrangement for circulating boiling water internally. The milk to be scalded is allowed to run over "A," where it is heated to say 170 or 190 deg.
Fahrenheit. It then flows over the refrigerator (B) and becomes cooled and ready for use.

It is recommended as a perfect apparatus for heating milk; hot water in circulation being the heating medium, the possibility of burning the milk is entirely obviated, whilst the sudden cooling prevents it obtaining a "scalt" taste.

**MILK-CAN ELEVATOR.**

For raising the railway milk-cans or churns, and delivering contents into the rank for supplying separators. This is an entirely new invention, and is fitted with the patent compensating bar, which ensures a direct and equal lift on each chain under all circumstances; and the self-acting tipping apparatus for emptying can when it arrives at the top of machine. The can is lowered with speed and safety by the patent friction brake. Both tipping and return actions are entirely automatic.
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The “Claremont Diaphragm”
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The “Declivity”
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The “Dorset”  The “Cooley”
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The following Analysis will show that the PHŒNIX PURE CALF MEAL has the highest possible percentages of desirable qualities in food of this character:

ANALYTICAL LABORATORY,
11, SALISBURY SQUARE, FLEET STREET,
LONDON, E.C.

ANALYSIS OF A SAMPLE OF CALF MEAL SENT BY THE PHŒNIX OIL MILL CO.

<table>
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<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Moisture</td>
<td>8.40</td>
</tr>
<tr>
<td>Oil</td>
<td>6.30</td>
</tr>
<tr>
<td>*Aluminous Compounds (Flesh-forming Matters)</td>
<td>19.75</td>
</tr>
<tr>
<td>Mucilage, Sugar, Digestible Fibre, &amp;c.</td>
<td>54.01</td>
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<tr>
<td>Woody Fibre (Cellulose)</td>
<td>6.80</td>
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<tr>
<td>Mineral Matter (Ash)</td>
<td>4.74</td>
</tr>
<tr>
<td>Including Sand and Silica, o/89</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
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*Containing Nitrogen 3.16%

(Signed) AUGUSTUS VOELCKER & SONS.

We beg to draw your attention to this Analysis, and think it will be admitted that the Meal has a full proportion of Oil, and that the nitrogenous element is present in a high degree in the proper proportion to the fat-forming and flesh-forming substances, while the woody fibre and mineral matter are kept within the smallest possible limits, and sand and silica are merely indicated.

For the convenience of consumers, the Meal is packed in 1 cwt. bags, bearing our registered Trade Mark in the following form:

The price is 17s. 6d. per cwt., delivered at any Station. When the Meal is forwarded with other goods sold free to rails, the proper allowance shall be made for the carriage.

DIRECTIONS FOR USE.—The Calf Meal should be mixed with boiling water to the consistency of paste. More boiling water should then be added, the mixture being well stirred the while. It will be ready for use when allowed to cool to the temperature of new milk. It is early enough to begin the use of the mixture when the calves are from nine to twelve days old. It may then be gradually substituted day by day, for a similar quantity of milk.
Testimonials.

Wm. Moxon, Esq., Biggin Hall, Thurlaston, writes:—“I am very much pleased with the Calf Meal you supply. I rear about 35 Calves every year, and find, after giving new milk the first month, the Calf Meal may be gradually substituted, mixed with skim milk. I have 20 autumn reared Calves looking uncommonly well.”

Mr. Thomas Capper, Holt, near Wrexham, writes:—“I am very well satisfied with the Phoenix Pure Calf Meal I had from you. I shall want more next season.”

Mr. Charles Davies, Crab Mill Farm, Rossett, writes:—“My opinion of the Phoenix Pure Calf Meal I had from you last season is that it is a good Meal for Calves. It has served mine well, and they like it much.”

Mr. John Jones, Horsley Bank, Gresford, writes:—“I am perfectly satisfied with the Phoenix Pure Calf Meal you supply. My Calves have done well, they like it very much.”

Mr. G. Furniss, Bakewell, writes:—“I always like to tell any good news of anything I try in the shape of Meal, Manure, &c., &c., and your Calf Meal is equal to everything you say of it. I have tried ever so many different kinds of Calf Meal, and I find yours suits the animals far better than any other even at much greater cost.”

D. H. Thomas, Esq., Derllys Court, Carmarthen, writes:—“I have great pleasure in bearing testimony to the good effects of your Calf Meal. I have always used it in connection with milk, regulating the quantity to meet the scarcity of milk, and have found the Calves do well with the mixture.”

Mrs. Wrightson, Paddington, Warrington, writes:—“I am perfectly satisfied with your Calf Meal, and shall not use any other. I have tried most of those advertised, so I speak from experience when I recommend its use. My Calves were out of condition and suffering from scour, but, after using it a few days, they began to thrive, and have gone on well ever since.”

T. G. Davies, Esq., Oswestry, writes:—“I like the Phoenix Calf Meal better than any I ever used before.”
Mr. James Parry, Holt, near Wrexham, writes:—"The Phoenix Pure Calf Meal which I had from you gave me very great satisfaction. It is the finest milk substitute I have used in my thirty years' experience."

George Graham, Esq., Oaklands, Birmingham, writes:—"Enclosed you have cheque for Calf Meal. I like it much, and shall go on with it. It is the best I have ever used."

Mr. Joseph Davies, Gwenteog, Marchwiel, near Wrexham, writes:—"I am very much pleased with the Phoenix Pure Calf Meal with which you supplied me. I shall want a much larger quantity next season."

E. J. Morris, Esq., Stapleton Castle, Presteigne, writes:—"Like all the other products manufactured by the Phoenix Oil Mill Co., I have found their Calf Meal a very superior article, and cheap in comparison with other makes. Calves take to it kindly, and thrive well upon it."

Mr. Walter Edwards, Bailiff to B. Piercy, Esq., Marchwiel Hall, Wrexham, writes:—"The Phoenix Pure Calf Meal I had from you last Spring is the best milk substitute I ever used. My calves have done very well on it, and I shall use it again."

Mr. Edwin Bellis, Holt, near Wrexham, writes:—"In answer to your enquiries about the Phoenix Pure Calf Meal, I am pleased to inform you that I like it very much; my calves have done exceedingly well on it. I consider it a good food, and I shall use it next season."

George B. Cliff, Esq., Northwich, writes:—"My customers who are using your Calf Meal speak very highly of it, indeed, they say it is quite equal to that which they used before, and considerably lower in price."

Mr. Richard Cliff, Bentley's Farm, Marchwiel, near Wrexham, writes:—"On the Phoenix Pure Calf Meal I had from you this season my Calves thrived well. They liked it better than any other I ever used. I consider it a good food for Calves."

Mr. John Eardley, Cocks' Wood, Rosset, writes:—"I like the Phoenix Pure Calf Meal I had from you, and my Calves have done well on it. I shall rear on it again next season."

Col. Corbett, Longnor, Leebotwood, writes:—"I have used your Calf Meal for about two years, and I find it quite equal to any I have previously used at 20/- per cwt."

Mr. James Matthews, Gweryn-Fechan, near Wrexham, writes:—"Your Phoenix Pure Calf Meal has given every satisfaction. My Calves have thrived well. The Linseed Cake and Cotton Cake you supplied me with are the best I ever used."
Mr. Edwin Challinor, Bridge Street, Holt, writes:—"The Phænix Pure Calf Meal with which you supplied me is a good food for Calves. Mine have done well with it alone."

Mr. A. Lanslit, Cid Farm, near Gresford, writes:—"I consider the Phænix Pure Calf Meal you supplied me with a good milk substitute, and I shall use it again next season."

Wallace Walker, Esq., Wolverton Park, Basingstoke, writes:—"Having used your Calf Meal for upwards of two years, I can confidently state that I have never tried anything that answers so well for bringing up young animals."

Mr. Thomas Rowlands, Holt, near Wrexham, writes:—"The Phænix Pure Calf Meal you supplied me with last season suits the animals admirably. I shall use it next season."

Edmund Wright, Esq., Halston, Oswestry, writes:—"The first time your Calf Meal was given to the Calves they took to it with relish, and the result has been entirely satisfactory."

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Profir tuhwnt i amheuaeth gan yr awdur yw'l enwocaf mai un o'r prif hanfodolion er gwneuthuriad Caws ac Ymenyn ydw y marinwydiadu y diwygiadau diweddaraf mewn peirianau. Mewn trefn i'r Amaethwyr gael ei lwy'r argyhoedd o'r fantaia fewniliadig trwy eu harfer.

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