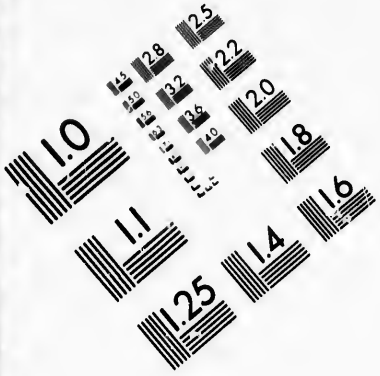

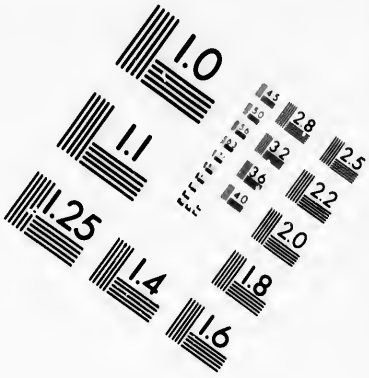

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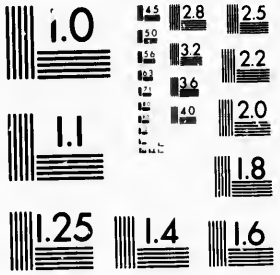

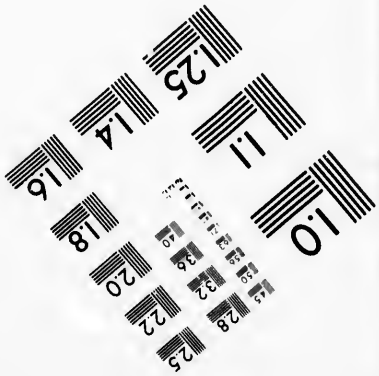

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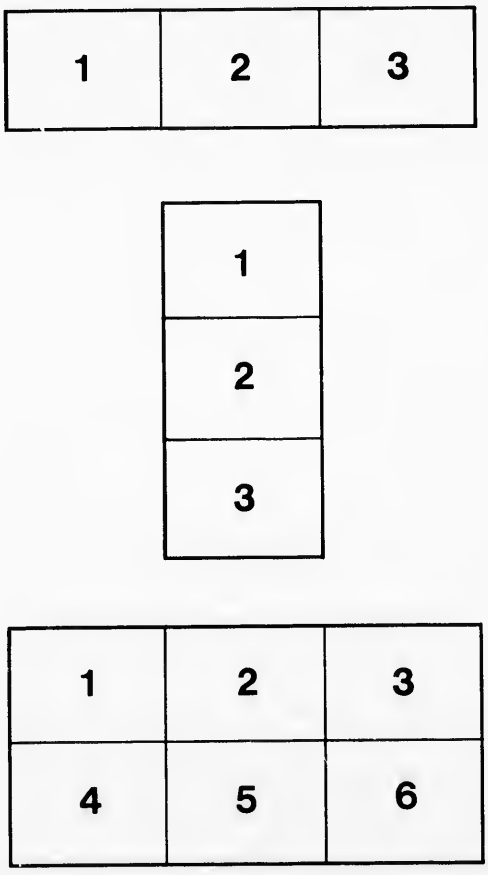

ESSAY

ON

MR. W. H. LYNCH'S PAMPHLET

ENTITLED

"SCIENTIFIC BUTTER MAKING"

BY

S. M. BARRÉ.

MONTREAL

1884.

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Joseph. Nap. Allard
Stanstead
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(55)

ESSAY ON MR W. H. LYNCH'S PAMPHLET

ENTITLED:

SCIENTIFIC BUTTER MAKING.

Mr. W. H. Lynch, of Danville, has written a book on "SCIENTIFIC" butter making. Wehave examined it carefully. There are many things in this book, of which we do not approve. For the presen. we shall content ourselves with reviewing his theories on the skimming of milk.

Success in butter-making depends to a great extent on the method of skimming milk, for both quality and quantity, are influenced considerably thereby.

MR. LYNCH'S THEORIES.

Almost all that Mr. Lynch has written on the skimming of milk, is reproduced in Mr. Lynch's own words, at the end of this pamphlet. For convenience of reference, we have numbered it by paragraphs.

As far as any ordinary reader can find out, a summary of Mr. Lynch's theories on the skimming of milk, may be given as follows:

"Avoid low cooling. It is injurious to the keeping quality and delicacy of flavor of butter. Milk ought to be heated to from 110° to 130° Fahrt., and cooled quickly to 70° than cooled slowly to 55° Fahrt. in order to get the largest quantity of butter without injuring the quality."

DEFECTS OF MR. LYNCH'S THEORIES.

We must take into consideration the fact that Mr. Lynch's book has been written specially for the definite purpose of butter making on the farm.

Since the book is written for a definite purpose, it should contain definite rules, and not "VAGUE THEORIES."

Any attempt to criticise Mr. Lynch's book is attended with difficulties almost insurmontable, for the reason that he does not take a decided stand on any question.

For instance, in paragraphs Nos. 1 and 2, he says: "Milk may be heated or not heated before setting—heating is not absolutely necessary."

In paragraphs No. 2, 3, 4 and 15, we find that milk can be heated to 90°, 100°, 120°, 130°, 140°, and even short of "*scalding point*" without any marked injury to the butter.

In paragraphs Nos. 2, 4 and 11, we see that milk may be "*allowed to cool*" down to 50°, 55°, 60°, 65° and even 70° Fahrt, without any inconvenience.

Whether the milk set in air or cold water, heated or not, cooled artificially or not, at so many different degrees of temperature, is to remain, in "*deep*" or "*shallow*" vessels, Mr. Lynch does not say.

Not a word is said in regard to the relative value of the different methods at the "*different stages of the milking period.*"

This question of "*deep* and *shallow*" setting in relation to temperature, and the question of the relative value of the different methods, at the "*different stages*

of the milking period," are of vital importance to any farmer who desires to manufacture good butter, obtain the *largest possible* quantity, and thus receive a fair return for his investment. Nevertheless, Mr. Lynch totally ignores this.

Evidently, Mr. Lynch is afraid to express an opinion, or rather Mr. Lynch has no opinion of his own. This accounts for the book being filled with useless quotations.

Mr. Lynch says, that after having conscienciously studied the treatises of the best authors on dairying, he has taken from each what he found good and useful, and applied it according to the best of his ability. (1)

We cannot commend Mr. Lynch for his discrimination, we are much afraid that in many cases he left the good and took the bad.

Mr. Lynch claims that his book is a manual of "*scientific and practical*" butter making, by the aid of which any farmer can manufacture butter just as well as a scientific expert. Still he gives no definite rules, the operator is left perfectly free to choose amongst the many different methods irrespective of temperature depth and seasons, and told to rely upon his *own* "*experience*" and "*circumstances.*" Where then is the science ?

(1) Après avoir étudié consciencieusement les traités des meilleurs auteurs en ces matières, j'ai pris à chacun tout ce que j'ai trouvé bon et utile, et je l'ai appliqué de mon mieux. La fabrication domestique du beurre, par Mr. Lynch, dans le deuxième rapport de la Société d'Industrie Laitière de la Province de Québec, 1883.

EFFECT OF LOW COOLING ON THE KEEPING QUALITY OF BUTTER.

In paragraphs Nos. 2, 3, 4, 12, 14 and 16, Mr. Lynch tries to show the disadvantages attending the practice of "*low cooling or cooling below* 55° *Fahrt.*" He condemns the practice of "*low cooling*" in saying in No. 4, "avoid low cooling. It will be found that keeping quality and delicacy of flavor suffer from low cooling."

In this case Mr. Lynch has the courage of his convictions. Is Mr. Lynch's knowledge such as to make his opinion of any value on this subject?

Is he a scientist? No! Is he a butter exporter? No! Is he an expert in butter making? No! Is his assertion based upon personal and practical experience? Certainly not!

What evidence does he bring in support of his assertion that "*low cooling*" injures the "*keeping qualities*" of butter?

Quotations containing theories of doubtful value, not based on scientific and practical data. We reproduce Mr. Lynch's quotations of Arnold and Sheldon on this subject, in order to give the public the benefit of same:

EFFECT OF CHANGE OF TEMPERATURE ON MILK AND BUTTER.

"*It is believed that it may be safely laid down as a rule that wide and sudden changes in the temperature of butter globules, whether after or before they have been separated from the milk, tend to their destruction. The position here assumed is supported by the nature*

of butter itself, as well as by observed facts. It is known that the butter globule is an organized structure; small as it may be, each globule is composed of several atoms of fatty matters, differing from each other in their composition, and bound together in one organized body or globule. It is notorious that repeated shrinkage and swelling by change of temperature disintegrates the atoms of these globules, and causes the destruction of the mass of butter which an agglomeration of these globules constitutes. Since a number of changes produce a specific result, it must be evident that each single change has contributed something toward the end accomplished.

"But such changes have less effect while the globules are fresh and new than afterwards. A single change made at the most favourable period in the age of the butter globule need not be expected to produce a very strongly marked result.

"There may be other considerations which may make it desirable to heat or cool milk, and suddenly make wide changes in its temperature; but the effect of every such change upon the resulting butter, considered singly, and without reference to other effects, must be to impair its keeping."

If a sample of new milk is taken at 65°, and a part of it cooled suddenly to the freezing-point, or near it, and then raised again to 65°, and both parts continued at the same degree, the part which has remained all the time at 65° will keep sweet the longer of the two, showing that dropping the temperature and restoring it has injured its keeping.

"Nearly all the changes in milk and butter, by which they are spoiled, are caused by living agencies, none of which are destroyed by cold, although it may fall below freezing. By chilling milk or butter down below the temperature at which organic change advances, we at least only suspend advance, to have it start with renewed vigour whenever the temperature rises to a degree that will allow of its going on again.

"What injures the keeping quality of milk might well be expected to injure the keeping of butter made from it. This conclusion is corroborated by recent observations upon butter made by a refrigerating process, and exposed with other butter during a week of warm weather at a fair. It is also in accordance with observations previously made, and with observations reported by others."—Arnold

Mr. Arnold does not exactly say that "*low cooling*" injures the "*keeping quality*" of butter, and the fact that some butter made by a refrigerating process and exposed with other butter during a week of warm weather at a fair, did not keep, is not sufficient to prove that butter generally made by the "*refrigerating*" process (*low cooling*) does not keep. That may be Prof. Arnold's way of testing the value of a dairy process, but it will certainly not do for us.

Nobody knows who made this butter, no one knows whether all the other details of good butter making had been properly attended to. Before instituting comparaisons of this kind "*scientists*" like Messrs Arnold and Lynch, should obtain accurate scientific data, upon which to base their conclusions. Conclusions

drawn from hearsay evidence are of no scientific value.

Mr. Arnold is stronger in theory than in practice. Even in his theory, it is evident that he is far from following the strictly scientific method, and if we judge from articles lately published in the American press, the opinion of Mr. Arnold on dairy matters is of very doubtful value.

We quote from "American Dairyman," March 13th, 1884:

"*Mr. Arnold is the man of all men, who has brought disgrace upon the so called science of the dairy. Whenever he makes a statement about the dairy, there is always a history attached to his scientific enunciations.*"

In the same article the writer continues:

"*We are happy to say at present, such papers as 'the New York Weekly Times' and the Philadelphia 'Weekly Press,' papers that rank in ability, second to none in the country, are modestly but firmly asking Prof. Arnold to rise and explain.*"

Again in the same number of the "Dairyman" we read:

"In commenting Prof. Arnold's last absurdity, the Editor of the *Weekly New York Times* says: The misstatement in regard to low temperature is an echo of the bray that ice in the dairy must go and is utterly wrong and baseless."

This is more than sufficient to prove that it would not be safe to accept Mr. Arnold's theory, as being reliable.

Now let us see what Prof. Sheldon has to say on the subject :

"*It must, however, be borne in mind that butter made from cream that has been raised in refrigerators will not keep so well as if the cream had been raised at a temperature near to that in which the butter will be afterwards placed. If, for instance, the cream is raised at 45°, and the butter is kept at 55°, decay will sooner set in than if the cream had been raised at 50° to 55°.*"—*Sheldon.*

"*In the ice-water systems whether the cans be submerged or merely set in it to a depth equal to that of the milk, there can hardly be two opinions as to the cream being too thin—that is, having too much of the skim-milk with it.*"—

"*The cream in the ice-water system does not separate so perfectly from the milk as it does in ordinary shallow-pan setting—probably, in part, on account of the diminished surface of the milk—but it all rises into the upper portion or layer of milk, and remains there intermixed with more or less of the milk ; is softer, more liquid, and thinner than cream that has risen in the ordinary way. This appears to be the usual result of deep setting, whether the milk be cooled in ice-water or not ; and there would seem to be little advantage in cooling milk in ice-water in the cold weather of winter. The advantage of such cooling lies in keeping the milk quite free from sourness in the hottest weather. The thinness of the cream in the deep-setting system is by some regarded as a disadvantage, and by others not ;*

these say that it churns the better for being thin, those that it does not."—Sheldon

Although a scientist of high repute, Prof. Sheldon is a theorist, and certainly not a practical butter maker. His last sentence proves it. Why did not Mr. Sheldon ascertain the relative value of the two theories on the churning of thin and thick cream by actual experiments.

If for any cause, Mr. Sheldon was unwilling to make the ex eriment himself, there was, and is, a very easy way of settling the difficulty. Mr. Sheldon could have appealed to the experience of some recognized authority in practical butter-making. For instance to the Danes, who are recognized even by him as the best practical butter-makers. What do we find the Danes doing in regard to this question ? They obtain the cream "*very thin*" *by the swartz or low cooling system.* Even then it is not "*thin enough*" for them. They make it still thinner by adding from 25 to 30 % of sweet milk. This I have seen done, and practiced it myself, while studying butter-making in Denmark.

Has the correctness of Mr. Lynch's theories in regard to "*low cooling*" been fully proved by the highest and most competent practical authorities of Europe ? Not at all.

On the contrary, the highest and most competent practical authorities of Europe have proved that "*low cooling*" instead of being detrimental to the "*keeping quality*" of butter, is regarded as the best means of securing such qualities.

THE SWARTZ SYSTEM.

This system which is known as the Swartz, or system of *cooling milk* in ice at 32° Fahrt., or in "*cold water at* 40° *and* 45° *Fahrt.*" was practiced in Sweden and Denmark, some 20 or 25 years ago. It spread rapidly in Denmark, and is to day, the most extensively used in the small dairies of that country.

Since a number of years, it has made its way in all countries, where ice is available for dairy purposes.

It has been carefully tested by the most eminent scientists of Europe, and pronounced by them to be the method best adapted for the production of the greatest quantity of "finest" and longest keeping butter, or butter for export.

Such is the opinion of Thos. R. Segelcke, Prof of of dairying at the Royal agricultural college of Denmark, Prof. J. N. Fyord, the great dairy scientist and experimenter of Denmark, Dr. Deklenze, manager of the Weihenstephan dairy experimental station, Germany, of Eugène Chesnel, secretary of the Paris agronomical institute, Paris, France; of A. F. Pauriau, scientist, and late professor of agriculture at the Saulai and Grignon agricultural schools, of L. Chevron, professor of Chemistry and dairying at the Gembloux agricultural college, Belgium, and of many others.

These scientists and experts, are in favor of the "low cooling" system of skimming milk, and do not see in it, those disadvantages discovered by Mr. Lynch, who is neither a scientist nor an expert.

Before quoting from my own authorities, I shall give

the opinion of a man who should be dear to the heart of Mr. Lynch, since he has copied from this gentleman's, work on "dairy farming," much of "*scientific butter making*:"

Prof. Sheldon says at page 522 of "dairy farming" n speaking of butter for exportation made in Denmark.

"*The method by which this is made, is not alone applicable to export butter, but it is certainly the best method of obtaining a perfectly sweet* durable *article of first quality for any purpose whatever.*"

"The first condition, is the setting of the milk at a low temperature after Swartz's method." (Low cooling at 32° Fahrt.)

In speaking of the advantages of the Swartz or "low cooling" system, Prof. Thomas R. Segelcke, the highest dairy authority of Europe, said in 1872:

As far as the quality of butter is concerned, which is the most important point to be taken into consideration, I believe, that even in disadvantageous circumstances, it" (the low cooling system condemned by Mr. Lynch) "will produce the very best of butter." (1)

In a work published in 1879, the same gentleman says:

"*If the temperature of milk during the skimming operation is kept at* 55° *to* 59° *Fahrt. or more, the*

(1) "Hvad kvalitaten af smóret angaar, som yo er det, fórste vigtige punkt, der maa tages i betratning, troer jeg, at under mindre gunstige forhold, er muligt at Skaffer smór af allerbedste kvalitet. Om meieriv œsenet af Thos. R. Segelcke."

milk decomposes, lactic acid forms, as well as several other principles and amongst these aromatic ones. It is sufficient to churn the cream thus obtained to get "aromatic" *butter. If on the contrary, the temperature during the skimming is kept near zero degree Réaumur* 32° *Fahrt, the decomposition necessary for the production of the "aromatic butter" is checked, and consequently, the aroma (flavor) from fresh cream is so slight, that it is hardly perceptible to people accustomed to aromatic butter made in France and elsewhere. But it has many other qualities amongst others that of* keeping *which to a certain extent are* wanting *in the butter obtained from milk kept at* 55° *to* 59° *Fahrt.*

Therefore Prof. Thos. R. Segelcke states in a most definite manner that "low cooling" (condemned by M . Lynch) is favorable to the development of "keeping qualities" in butter, and that butter obtained from milk kept a 55° to 60° Fahrt. (This is the method advocated by Mr. Lynch) is wanting in such qualities.

Prof. A. F. Pauriau (an eminent French scientist) in his criticism of the Swartz or "low cooling" system of skimming milk, very distinctly and repeatedly says that :

"The 'low cooling' system is the best adapted to the production of salted butter for export, on account of its efficiency in developping "KEEPING QUALITY," but he believes that low cooling appears unfavorable to the production of unsalted aromatic butter, such as is required in large quantities in the French markets for home consumption.

As regard the "*Aroma*" Prof. Pauriau is to a slight extent right in one respect, but I shall demonstrate

further on that "*Aroma*" (*flavor*) can be developed in butter obtained by the Swartz or "*low cooling*" system just as well as with any other system of skimming milk.

He also states that the Danish and Sweedish butters bring the "HIGHEST PRICES" in the British markets, on account of their "KEEPING QUALITIES" and that such butters are obtained by the use of the "Swartz or low cooling system."

Finally Messrs. Pauriau and Chevron show that the finest and best Danish butter shipped to South America, and the West Indies, where it is exposed to the greatest variations of temperature,is obtained by the "Swartz or low cooling system" and that the great companies doing the export trade in the above named countries have imposed on the farmer from whom they buy butter, the "Swartz or low cooling system of skimming milk."

To show that these are not mere theories, it is sufficient to state that, in 1877, one of these c mpanies, Busk Jr. and Co., was provided with machinery and apparatus, by which they packed 20,000 lbs of butter daily, &c.

These companies absolutely refuse to accept butter, unless it is made by the "LOW COOLING" system.

NOTA—We give below the exact quotations from Mess. Pauriau and Chevron, of which the above is a very comprehensive summary.

"Nous allons maintenant examiner le parti que l'industrie laitière peut retirer en France de l'adoption de la méthode du refroidissement (low cooling) pour la fabrication du beurre. A notre

avis ce système convient ESSENTIELLEMENT A LA PRÉPARATION DU BEURRE SALÉ DESTINÉ A L'EXPORTATION, mais il paraît peu favorable à celle des beurres fins (non salés) destinés à la consommation de table, nous allons essayer à le démontrer."

" La laiterie " de Pauriau, page 156, édition de 1881.

" Actuellement, le grand débouché des beurres danois et suédois, réside dans " l'exportation," et il n'est pas douteux que ces beurres salés soient très estimés sur les grands marchés des deux mondes, parce qu'il est reconnu que les beurres préparés par cette nouvelle méthode sont susceptibles d'une plus grande conservation.

" La laiterie " de Pauriau, page 156.

" Mais de la grande extension que le commerce d'exportation des beurres a prise en Suède, surtout au Danemark, faut-il conclure, à la supériorité de ces mêmes beurres sur ceux fabriqués en France et destinés à la grande consommation ? Nous n'hésitons pas à répondre négativement, et voici pourquoi : "

1. Il n'y a pas de comparaison possible à établir entre les meilleurs beurres du Danemark et nos bons beurres français, parce que les premiers, au sortir de la baratte, sont immédiatement salés à une dose de sel qui varie entre 4 et 6 pour 100, suivant la saison, tandis que les nôtres arrivent non salés sur les marchés.

" La Laiterie " de Pauriau, page 156.

2. La consommation de beurre frais, sans sel, paraît être une chose à peu près inconnue dans les pays du nord, tels que le Danemark, la Suède, la Norvège, et une partie de l'Allemagne ; tandis qu'en France, en Angleterre, en Belgique et en Autriche, etc., on fait grand cas des beurres frais non salés."

" Il résulte de cette différence qu'en France, nos producteurs s'appliquent à obtenir dans leurs fermes un beurre destiné à la consommation de la table, ou aux usages culinaires, et dont les consommateurs apprécient la valeur en raison de son arome, sa saveur, sa consistence, etc , etc.

Dans le nord de l'Europe, au contraire, on fabrique des beurres salés, destinés surtout à l'exportation et dans lesquels, les qualités

qui font le mérite de nos bons beurres français sont détruites ou masquées et remplacées par une seule, et autre qualité, LA RÉSISTANCE AU RANCISSEMENT."

"La Laiterie" de Pauriau, page 157.

"Quant à ces derniers (beurres salés), ce sont ceux du Danemark et de la Suède qui atteignent les plus hauts prix moyens, viennent ensuite ceux de la France, d'Allemagne, de la Hollande, et enfin, avec une infériorité de prix notable, ceux du Canada et des Etats-Unis. La plus-value établie sur les marchés d'Angleterre par les beurres danois et suédois démontre une fois de plus que ces beurres préparés spécialement en vue de l'exportation (par le Système swartz) sont très appréciés dans ces pays, et surtout en raison de leur résistance au rancissement."

"La laiterie" de Pauriau, page 227.

Depuis 15 à 18 ans, il s'est formé, en Suède et en Danemark, de puissantes compagnies d'exportation de beurre salé, non seulement en Angleterre, mais aussi dans l'Amérique du Sud, et jusque dans l'extrême Orient.

Parmi les grandes compagnies fondées pour l'exportation des beurres salés, nous citerons plus spécialement celle de Busk, fils & Cie, dont les ateliers et la machinerie permettaient en 1877 de mettre journellement en boîte 20,000 lbs de beurre destiné pour la majeure partie à l'Angleterre. Cette compagnie a passé des contrats avec un grand nombre de fermiers de la Suède méridionale, et du Danemark, qui leur livrent le beurre fabriqué et mis en tonneau suivant les prescriptions indiquées par la compagnie elle-même, que nous allons énumérer ici.

1. Le lait doit être mis à refroidir hors de l'étable, le plus rapidement possible, cette condition ayant une grande influence sur la quantité de crême obtenue. Le refroidissement a lieu par la méthode Swartz (low cooling).

"La Laiterie" de Pauriau, page 188.

A la page 31 de la fabrication du beurre par le système du refroidissement, le Prof. L. Chevron dit :

"La compagnie Busk a imposé le système Swartz' LOW COOL-

ING aux fermiers du Danemark, et de la Suède méridionale avec lesquels elle a passé des contrats."

This is more than sufficient to prove that Mr. Lynch's assertion, in regard to the effects of "low cooling" on the "keeping quality" of butter, is completely erroneous.

EFFECT OF "LOW COOLING" ON THE "AROMA" FLAVOR OF BUTTER.

In paragraph No. 4, Mr. Lynch also says that "*delicacy of flavor suffers from low cooling.*"

According to Prof. T. R. Segelcke, the aroma of butter is simply a decomposition of the milk or cream. It can be developed at will, by submitting the milk or cream to circumstances favorable to lactic fermentation. Therefore, we can obtain flavor in butter independently of the skimming process. I know this to be true, by practical experience.

"If, says Prof. Segelcke, milk is set and kept at 55° 60° Fahrt, this decomposition or ripening of the cream takes place to a certain extent during the operation of skimming.

"Generally it is sufficient to churn such cream to obtain *aromatic* butter, but if cream so obtained is, by accident or otherwise, kept at a comparatively high temperature," (and it is on most of our farms in summer) "during a few days before churning, the result will be a very high flavored, soft, oily and short lived butter."

"On the other hand, if milk is kept at 32° Fahrt, or a little above that degree of temperature, the decompo-

sition or ripening necessary for the development of *aroma* (flavor), is checked, consequently the aroma from fresh and sweet cream, is so slight, so delicate, that it is hardly perceptible to people accustomed to the aromatic butter made in France and some other countries.

" If, continues Prof. Segelcke, a more aromatic butter is desired it is sufficient to submit the fresh cream obtained by "*low cooling*" to circumstances favorable to lactic fermentation, and in a few hours the result is obtained."

" This last point has been generally overlooked, and explains why experiments with '*low cooling* made in France or elsewhere have produced, in as far as *aroma* is concerned, results contrary to those expected, and to those obtained in Denmark, where the system is well understood."

Consequently, far from being injurious, "*low cooling*" is regarded by the best butter-makers of the world as the best means of securing "*delicacy of flavor*" and of keeping its development within safe and proper limits.

It gives me great pleasure to quote again from a gentleman, for whose opinion I am certain Mr. Lynch has the greate t respect. Prof. Sheldon says at page 295 of his book on " Dairy Farming ":

" The great merit of the Swartz system (low cooling at 32° Fahrt) lies in the perfectly sweet and fresh cream, which it produces, and it is only from cream in this condition that the finest flavored butter can be obtained 'gilt edged' butter the American dairymen term it."

That M Lynch should have made a serious mistake on this question of "*aroma*" is not surprising, because scientists of good repute have fallen into the same error.

DENMARK'S SUCCESS IN BUTTER-MAKING.

In speaking of the best butter-makers, Mr. Lynch says, at page 34 of his pamphlet :

" First are the Danes who are perhaps more successful than others," says Prof. Sheldon. " They study the principles of their art, which are propounded to them by scientific teachers, and they follow out the most approved systems, and adopt the most modern utensils."

The real improvement and progress of the butter industry of Danemark dates from the time of the introduction of the " Swartz or low cooling" system of skimming milk in that country.

It was first introduced a little before 1869. In 1872, Prof. Segelcke is found reco mending it as the best sy tem for the production of the finest and best keeping butter.

In 1875, the agricultural commission of Jutland, Denmark, offered a number of prizes to the best kept " ice or cold water ' dairies, and also some pecuniary encouragements for the best essay on the subject of skimming milk by the " low cooling " system.

In 1877, at the International Exhibition of dairy products in Hamburg (Germany), the largest quantity of finest and best butter was found in the Danish and Sweedish exhibits. It is a well known fact that the

Danes and the Sweedes use mostly the "Swartz or low cooling" system of skimming milk. (1)

In 1879, at the International Exhibition of London, England, in the butter class open to the world, a Dane, from Th'sted, Jutland, took the first prize.

In 1880, at the Holbæck exhibition, Danemark, the largest number of prizes were taken by butter made by the "Swartz or low cooling" system of skimming milk.

The following is an extract from a report of that exhibition:

"Out of 53 prizes, 33 were taken by butter made in the 'ice or cold water dairies.' Out of 112 exhibitors having dairies of from 10 to 15 cows, 17 obtained prizes, and of these 14 used the 'ICE OR COLD WATER SYSTEM.' In a conference given by Prof. Thos. R. Segelcke, he highly recommended the adoption of the 'ice or low cooling system' in dairies were it was not yet in use." (2)

Consequently, if Denmark now holds an enviable reputation, as the producer of the finest and longest keeping butter of the world, it owes its reputation and success, to a great extent, to the use of the "low cooling system of skimming milk."

(1) "La fabrication du beurre par le système du refroidissement du lait," par le Prof. L. Chevron, page 30.

(2) Af 53, prœmier ere de 33, til falden de enten "Is" eller koldtvandt mælkerier. Af 112, Udstillere, med 10-15 koer, have 17 faat prœmie for deres smór, og af dem have de 14 enten "Is" eller koldtvandt mælkerier. Prof. Segelcke meget anbefale anlœggelse af "Is" mælkerier hvor de ikke ere indforte.

Beretning af Holbæck udstilling 1880.

Still, this is the very system (low cooling) that Mr. Lynch condemns, and asks the Canadian farmer to avoid.

THE HEATING OF MILK.

If Canada had an "experimental dairy station," the different theories advanced from time to time could be examined and judged on their merits, if good recommanded, if bad condemned. Unfortunately, Canada has no such station to which the agricultural interest of the country can look for advice. The result is, that we find a number of persons having but a very superficial knowledge of butter-making giving advice, which, if followed, cannot fail to seriously injure the dairy interest of the country.

Amongst these persons, we find Mr. Lynch, of Danville, who advocates the "*heating of milk or heating method*" without well understanding it himself. This method, we shall now explain in its true light. After which we shall point out how unfit it is to be recommended as *the* method for making butter on the farm, and how injurious it would prove if carried out according to Mr. Lynch's directions.

In paragraphs Nos. 1, 2, 3, 4, 5, 6, 7, 8, 11, 13, 14, 15, and 16, Mr. Lynch tries to show the advantages of "*heating milk*" in butter-making on the farm.

Therefore any intelligent reader will see at once that Mr. Lynch's pet theory is the "heating of milk."

The heating or scalding of milk is an old practice.

It originated, I believe, in Devonshire, England. In speaking of this Devonshire practice, Mr P. C. Jensen says on page 77 of his book on dairying.

"The milk is kept in tin vessels 12 or 24 hours, heated short of scalding, and then set 24 hours, in a cool place. Butter is thus readily obtained, but it tastes like boiled milk, and is granulated. (1)

Such butter may suit the taste of a few customers, but is certainly not the article wanted for our canadian trade.

We may be allowed to state now, and we shall prove it further on, that the proper butter to manufacture in this country is above all "good keeping butter."

For this reason the "*heating of milk*" is a method altogether unfit for butter making on the farm.

THE THEORY OF "HEATING MILK."

The correctness of the theory of raising cream at a falling temperature is generally admitted.

The best results are obtained by a fall from natural heat of the milk, say from 100° to 32° Fahrt.

It is possible to obtain a wider range by artificial, means, (by heating) but this is the widest range that can be obtained safely and profitably.

If the milk be allowed to cool, before setting, it

(1) Mœlken opsies i Blickfade of henstaar 12 to 24 times. Efter den tids forlób, anbringes mœlke fadene, of mœlken opvarmes til naesten kógepunkt, of hensœttes derpaa igjen i Ro 24 times. Smor udvindes let paa denne maade, men har smag of kógt maelk, og er grunet.

looses a part of its power to yield cream. The more it is allowed to cool, the greater is the loss.

The capacity to yield cream, can be restored to milk to a certain extent by heating it to a few degrees above the extreme natural heat, 100° Fahrt. but this temperature must never exceed 104° Fahrt.

The more the milk has been cooled the higher the temperature must be raised to restore to it, its cream yielding power.

But the "*heating of milk*" even to the comparatively low temperature of 104° Fahrt., has the effect of increasing the quantity of *cheesy matter* contained in the cream, thereby "injuring the keeping quality" of butter.

In a report of experiments made on the "*heating of milk*" prof. J. N. Fjord, says:

"The heating of milk (to 104° Fahrt.) did not increase the yield as much as we expected, the cream from such milk did not churn completely, an excess, of *cheesy matter*, *appeared in the cream and constituted a defect that could be very detrimental to the quality of butter*." (1)

If the cream so obtained is cooled to the ordinary churning temperature say 55° to 58° Fahrt. the excess of *cheesy matter* contained in such cream prevents its churning completely. A part of the cream remains

(1) Opvarming of mœlken (40 celcius) ekke skaffede den forventede smór udbytte, flóden fra den mœlk ekke har kunnet kjærnes tilstrœkkelig rent, de viste sig nemlig "ost i flóden" foraarsage de den saaledes en Fejl der kan Skabræsvanger for smórrets godhed." J. N. Pjords foredrag 18 Oktober 1882.

in the butter milk, thereby causing a "LOSS" in the butter yield, and in some cases, a very notable one.

Since Prof. Fjord says that this excess of *cheesy matter* developed in the cream could be "*very detrimental*" *to the quality* of butter, il is evident that this difficulty can be obviated in some way.

It can be obviated to a great extent by cooling such cream to 40° or 43° Fahrt. The higher the "*heating of the milk*," the lower most be the *cooling* of the cream.

The facts above stated have been fully demonstrated by Prof. J. N. Fjord, in his latest experiments at the "*Experimental Station*" connected with the "*Royal Agricultural college of Denmark.*"

We may here state that Prof. Fjord is a scientist and expert of the highest rank, that he has been in the employ of the Danish government, for a great number of years, that he is looked upon in Denmark, where butter making is thoroughly understood and practiced, as one of the greatest authorities on the subject.

Mr Lynch has taken this heating theory from Prof. Sheldon's work ou dairy farming. Unfortunately he did not take the whole of it. He took what suited himself and in so doing left out a most important part of it. For the benefit of those who are trying to make some practical use of Mr Lynch's pamphlet, we shall give the remainder of the theory in Prof. Sheldon's own words, taken from page 292 of dairy farming.

"*A good deal of importance is attached by many people to the practice of heating the milk soon after it is drawn from the cow, and before it is set for creaming, up to* 130° *or* 140° *Fahrt, and there can be no reason-*

able doubt, that this practice if intelligently carried out is a sound one. In the first place, it will expel the animal odor, cowey smell from the milk; it will for the time being checkmate all germs leading to decay that milk may naturally contain, or that it may have absorbed from the air, and it will dissipate the peculiar flavor, which some kinds of food turnips for instance impart to milk, that is produced by their aid. But it must be borne in mind that milk at a high temperature will quickly go sour, so that especially in warm weather and unless it should without delay be cooled down again to about 70° by means of cold water, after which the cooling may be allowed to proceed more slowly during the time when cream is rising."

" Whilst it is being cooled from the high temperature it should be kept in motion, or an albuminous skin will form on the surface, and this will interfere with the rising of the cream.

This system of heating and then cooling will enable the milk to remain sweet a longer time than cooling without heating; and after the cooling has been done it is a good plan to place a cover over the milk, the more nearly air tight the better, in order to keep the milk from contact with the atmostphere. Only a particularly pure atmosphere could do the milk any good at this period, therefore it is safest to exclude it altogether. This system of scalding milk produces perfect butter, it prevents alike the hasty souring of the milk in summer before the cream has risen, and the bitterness so commonly developed by long standing in winter, but it is a perilous system, when left in the hands of a

careless or otherwise incompetent person for if carried too far the delicate flavor of the butter is liable to be dissipated, and if the after cooling is not carefully finished, the milk is apt to turn sour." (1)

Though no believer in this method for butter-making on the farm, I have given the method as it should be given.

Let us see how Mr. Lynch's advice agrees with this, the true theory on the subject.

With respect to "*heating*," the safe limit is 104° Fahrt. (2) We find him fixing the safe limit at between 110° to 130°, average 120° Fahrt. On his dairy thermometer, he fixes it at 125° Fahrt.

He has fallen into an error of from 16 to 21 degrees. Anyone who knows anything about butter-making, will understand the gravity of such an error.

He has given as a safe limit to "*cooling*" 55° Fahrt. The true safe limit is 32° Fahrt. Another error of 23 degrees—not a small one.

As we have already proved by Mr. F. Fjord's theory, "*the heating of milk*" has the effect of increasing the quantity of "*cheesy matter*" contained in the cream, thereby injuring the "*keeping quality*" of the butter.

Again we have demonstrated that the excess of "*cheesy matter*" produced in the cream by "*heating*" prevents its "*complete churning*", thereby "*diminishing the quantity.*"

Had Mr. Lynch advised the farmers to cool the

(1) This particular point Mr Lynch forgot to mention in his book on ' Scientific butter making."

2) In ordinary practice I would not advise to heat milk previously cooled to a higher temperature than 85° to 90° Fahrt.

cream from "*heated milk*" to 40° or 43° Fahrt, these defects in quality and quantity might have been to a great extent nullified.

It is but fair to add that in paragraph No. 13, Mr. Lynch does not advise to heat or cool the milk, in order improve the quality, but to secure a wider range of temperature and thereby more cream and butter.

We are sorry to be obliged to destroy this illusion of Mr. Lynch's.

According to Prof. T. R. Segelcke, the milk comes from the cow at a temperature of about 100° Fahrt (38°, to 39° Celcius). (1)

On a farm, the delay generally attending the setting of milk may produce a fall of about 5 to 8 degrees. Therefore with care, nothing can prevent the farmer from setting it at a temperature of from 92° to 95° Fahrt; average, 93°

According to Mr. Lynch's method, the temperature falls from 120° to 55°; range of temperature, 65°. According to the Swartz method (which I advocate), the temperature falls from 93° to 32°; range of temperature, 61°.

Mr. Lynch would appear to have here a gain of 4 degrees.

But we have already demonstrated that milk cannot be safely *heated* to a higher temperature than 104° Fahrt. This reduces the fall to 49 degrees. The range of temperature advocated by Mr. Lynch is then 12° less than the Swartz's range.

(1) Landmænd's Ordbog, 1880, side 436.

Another of Mr. Lynch's little errors is that he sees no objection to allowing the milk to be cooled only to a temperature of 65°, and even 70°. (See paragraph No. 11.)

Prof. J. N. Fjord has demonstrated in his 14th Report to the Royal Agricultural Society of Denmark, that cream, obtained by any method of skimming, at a temperature varying from 56° to 61° Fahrt, must be cooled to a temperature which must not be higher than 45° Fahrt. It would even be better to cool it to 34° Fahrt.

The loss of butter caused by neglecting to do so, will amount to (according to the degree of the acidulation of the cream) from 2 to 4 °/₀ in the case of cream obtained at 56°, and to 19 °/₀ in that obtained at 62° Fahrt.

Thus if the farmers do what Mr. Lynch says "they may do," they would be certain to loose. It would be only a question of how much they would loose.

In order to practice Mr. Lynch's method, in a systematic and proper manner, it requires *fuel*, and a specially constructed *heating* and *cooling* apparatus. It requires an attentive person to stir the milk while heating, in order to prevent the formation of an albuminous skin at the surface. It must also be carefully watched while cooling, so that it may cool rapidly to 70°, and that it may then cool slowly from 70° to Mr. Lynch's safe limit, 55° Fahrt.

It also requires the use of ice.

We have already demonstrated, by Prof. Fjord's theory, that the defects attending the practice of *heating milk* can be counteracted by *cooling the cream*

to about 43° Fahrt. No well or spring water, during the summer, will suffice to produce this result.

It is far too complicated and cumbersome, requires knowledge, care and attention, far more knowledge than the farmer generally has, and more care and attention than he is either willing or can afford to give to it. It would be well in this connection to read over again the concluding remarks of Prof. Sheldon.

It also requires experience for does not Mr. W. H. Lynch say in paragraph No. 3, that in the case of "how high to heat and how low to cool the experience of the operator and circumstances will best determine." Considering that this book was written for the instruction of the farmer, this last sentence is rather curious.

Consequently, Mr. Lynch, in condemning the low cooling system and advocating the practice of heating milk, is very far from rendering the farmer or the country a service. On the contrary, if listened to, he will do to both farmer and country a positive injury.

There are many more objections to the doctrines propounded in Mr. Lynch's pamphlet. We would also have a word or two to say in regard to his "specially" constructed thermometer. Want of time prevents us from touching on them at the present moment. We may, however, on some future occasion, if opportunity offers, return to the subject.

THE TRUE DOCTRINE ON THE SUBJECT OF SKIMMING MILK, ON THE SMALL DAIRIES OF CANADA, OR DAIRIES OF FROM 5 TO 20 COWS.

1st. We may here be permitted to state that with the present scarcity and high price of farm laborers, we firmly believe that the quickest and surest way to improve butter-making, is the establishment of butter factories.

2nd. We must take into consideration the fact that two kinds of butter are made in the dairy world. Each kind is rated as first quality, but serves to meet the requirements of different markets. The one kind obtained by setting the milk at a comparatively high temperature say, 55° to 60° Fahrt, possesses a very high flavor (such is the French and American butter), but it is not generally uniform in quality, and in general, it does not keep long.

This kind of butter is made mostly to suit local tastes and to meet the wants of immediate consumption. The greater part of the butter made in France and United States finds a ready and favorable market at home. (1)

The other kind, obtained by setting milk at a low temperature, say about 33° Fahrt, has a very *firm consistency*, a more *delicate flavor* (such is the Danish butter) and keeps longer than the first. This kind of butter is the best adapted for export to distant countries.

(1) The yearly production of butter in the United States amounts to about one billion pounds. During the fiscal year 1882-83, the total export of butter from the United States amounted to 12,348,641 lbs., and out of that quantity 4,817,302 lbs. only, went to Great Britain.

It is also the best adapted to the wants of Canada, for the following reasons :

1st. In the interest of agriculture, it is desirable to increase the butter production of Canada. If the butter production is to be increased, butter must be exported. The market for export butter is very large and increasing from year to year.

2nd. In this country, butter is made during seven months of the year only. Therefore, the butter made for the home market must keep as long, and even longer than that for export.

3rd. By modifying to a slight extent the process of making good *keeping* butter, a very aromatic butter, suitable for special tastes, can be obtained.

Therefore, the methods, which should be adopted, are those that are considered the best fitted for the production of *good keeping butter.*

What is the best system of skimming milk for the production of good keeping butter on the small farms of Canada?

1st. The highest practical authorities, have proved that the Swartz or "*low cooling*" system of skimming milk, is the *best adapted* to the production of the *largest quantity of finest and longest keeping butter.* (1)

2nd. The same authorities claim, and with reason, that this system gives a *more uniform product* be-

(1) For large farms and factories, there is a method superior to all others, as far as quantity is concerned, and equal to the best with respect to quality. I refer to the centrifugal. For small farms, the "low cooling" is undoubtedly the best.

cause the milk is kept at the same temperature, all through the year.

3rd. It will keep the skim milk, in a *better condition* longer than any other system.

4th. In a country like this any amount of *ice or snow* is produced, every winter by nature, and costs but the storage.

Consequently the system best adapted for the production of butter in the small dairies of Canada, is the swartz or low cooling system of skimming milk. (Deep setting at 32° Fahrt.)

NOTA —As a continuation of this work I shall soon publish in an other pamphlet, Prof. Fjord's experiments on the conservation of ice and also a complete description of the Swartz system.

QUOTATIONS FROM MR. LYNCH'S PAMPHLET.

NOTE.—The pages given at the end of the quotations are the pages of Mr Lynch's pamphlet.

Setting in Closed Milk-Vessels.

No. 1. The advantage of a closed vessel is that the impurities in the atmosphere are excluded from the milk. But before milk be closed against the atmosphere and ventilation, in such a way that its own impurities cannot escape, it is necessary that the milk be purified. This may be done by aëration—exposing the milk to pure air, *or by heating it*, to expel or kill the germs. *The advantage would be in favour of heating, since heating would more effectually purify the milk, and increase the range of falling temperature.*

Aëration would lower the temperature of the milk, which in itself is not desirable.

Where milk is set in closed vessels, air is never depended upon for cooling, except the *milk has been heated to a high temperature before setting. Where pure cold water is used, milk may be set in closed vessels without heating.* The water may be used to seal the cover from the outside atmosphere and yet ventilate the milk. The water, being colder than the milk, condenses and takes in the odours that escape from the milk.—(Page 3.)

Heating the milk.

No. 2. Heating milk before setting it is not commonly practised, *nor is it absolutely necessary.* All that *can be said for it is that it has certain advantages in the process, and that it is better for quality's sake to heat before setting than to practise low cooling,* or cooling below 55° to 50°. *If good results in cream-rising are obtained by setting the milk at its own temperature, without low cooling, then heating may be dispensed with. If heating be employed, let it be no higher than necessary, the range being from* 100° *to* 140°. *The more defective the milk, the higher the heating.* If the milk is in a normal condition the extreme temperature may, both for sake of saving in labour and quality, be avoided. *A good average will be from* 110° *to* 130°.

The heating may be done by setting the vessel containing the milk in a vessel containing water, the latter being heated in the most convenient manner.—(Page 3.)

Best range of temperature.

No. 3. With the present knowledge of the effects of temperature upon the melting point of butter, it is not easy to give a definite rule for placing the range of temperature A suggestion may, however, be given. The process demands lowering the temperature to 55° for the purpose of washing. If this change, or fall, of temperature is not sufficient, it will be better *to take advantage of higher tempera-*

ture before cooling lower. That is, it will be better to heat above 90° *or* 100°, *than to cool lower than to* 55°. *Ten degrees above* 100° *will give more advantage to the process than ten degrees below* 55°. *How high to heat before cooling below* 55° *it is not easy to say.* The experience of the operator *and circumstances will best determine. The rule will be to keep, as far as possible, within safe limits both in heating and cooling, and yet obtain for the process every necessary advantage from cooling and heating.* If making butter for a far market, give its melting point, or keeping quality, the benefit of any doubt ; which means to cool or heat less rather than more.—(Page 3.)

Cooling the milk.

No. 4. The first part of the cooling, when the difference between the temperature of the milk and the cooling agency is greatest, will be the most rapid. This is well, because the milk, if kept long at a high temperature, will quickly sour. But when the milk is down *to from* 75° *to* 65° *it is better to cool slowly ;* that is, it is better that the temperature should change slowly and be *constantly falling* than that it should fall too quickly and then *stand unchanging* at its lowest point.

Where air is depended upon as a cooling agency and is variable in temperature, it is not easy to accomplish this. The general rule given may be kept in mind. Where heating or aëration is employed, it is not so difficult to do. Where milk is heated to 120° and above, and more or less of the germs it contained are killed, it will keep a longer time at high temperature and so be allowed to cool more slowly. Where the air of the milk-room is the cooling agency and it is high, say up to 70°, the advantages of heating before setting would be greater. Aëration will cool the milk a few degrees and it will thus loose some of the advantage of the falling temperature, but it will allow the milk to be more slowly cooled afterwards.

Avoid too low cooling. It will be found that keeping quality and "delicacy of flavour" suffer from low cooling. For this reason sp ing water or running water are better than ice, and the mode-

rate employment of heat is desirable whenever it saves the necessity of cooling too low.—(Page 4.)

Warming Up and Cooling.

No. 5. Where the temperature has been lowered too quickly and to *a very low point*, it may happen that the cream *has almost ceased to rise*, and there is yet some cream held in suspension near the top, on its way up. This case may be met, if the milk-vessel is suitable, by applying *heat—water or steam*—at the bottom, and *raising the temperature* a few degrees. This warms the milk, and the cooling which follows sends up more cream. In this way the effects of a falling temperature are availed of indefinitely. The heating must be done *gradually*, not too fast, and *only a few degrees.*—(Page 4.)

How long Milk may Set.

No. 6. The length of time that will be required to rise the cream, will depend on the means used in setting for cooling. Where advantage is taken *of the help of artificial heating* or cooling, cream will rise in twenty-four, or even twelve hours. Setting milk in the most primitive way it will require thirty-six or forty-eight hours to rise. Cream may be raised in twelve hours, without loss in quality, and with great gain in saving of time and labour.—(Page 4.)

Temperature.

No. 7. The rising of cream is dependent upon temperature. A high temperature is favourable to the rising of cream; *in a low temperature cream moves sluggishly.* A changing temperature, if it be a falling one, is most favourable for the cream to rise. The rapidity of change affects the quantity of pure cream. *If it be too rapid, the quantity will be deficient—the quality of the cream will be thin and mixed with milk.* The artificial *heating or cooling of cream may be employed to produce good results, or the contrary.*—(Page 14.)

Effect on Quality.

No. 8. Extreme temperatures are injurious to milk and its product. Milk may be heated *too high or too low, not only for quantity but quality, both eating and keeping quality, of butter.*—(Page 14.)

Milk-Setting – Depth.

No. 9. A consideration of the effects of temperature is necessary to a rule for bulk, body, or depth in milk-setting. To get much benefit from temperature, the milk must not be cooled too fast to get the full benefit of a falling temperature. On the other hand, if milk is cooled too slowly, it will sometimes sour before the cream has risen. *Heating may be employed as a means to at once give a wider range of falling temperature* and to make the milk keep longer sweet while slowly cooling. Again, water may be employed as an agency for cooling, and its advantages will allow deeper setting than could be practised where air is the cooling agency. The effects of temperature and the utilization of water as a cooling agency will be more fully treated of in other and separate connection.—(Page 15 and 16.)

Heating and Cooling Milk.

No. 10. The object in cream-rising is: *first*, to separate all the cream from the milk; *second*, to leave the skim-milk sweet, or in a condition to be of highest value for use, feeding or cheese-making; *third*, to manage with little cost, time and labour.

These objects require mainly that the milk be kept as long as possible sweet, and that a wide range of falling temperature be secured, being the most favourable conditions for raising cream.—(Page 16.)

Obtaining a Falling Temperature.

No. 11. A falling temperature may be obtained by allowing the milk to set in an atmosphere colder than itself. This fall of tem-

perature is limited by the ordinary conditions under which milk is set. There is usually a considerable fall, say to 85° before the milk is set. Sometimes the atmosphere of the dairy, or milk-setting room is at an unduly high temperature, say 60° to 70°. There may be obtained in ordinary setting, therefore, only 15° or 25° of fall. *Artificial means may be employed here to increase this range of falling temperature.* Water, applied to the vessel containing the milk, may be used to cool the milk, more speedily and to a lower temperature than can be attained by air. Water is a better conductor of heat, it is in summer colder than the air, and always of a more uniform temperature. By the use of water, therefore, *milk may be artificially cooled to the end of obtaining a longer range of falling temperature. Again, the milk may be heated up to its original warmth or higher*, and then allowed to cool, or be cooled, thus giving a greater fall of temperature. Thus to obtain a falling temperature, the artificial means may be employed of heating and cooling, one or both.—(Page 17.)

Safe Limits of Temperature.

No. 12. *Milk may be cooled to so low a temperature that it will cease to throw up cream, and where it will have an injurious effect upon the colour, taste and keeping quality of the butter. On the other hand there is a high temperature to which milk may be heated, that will have a marked unfavourable effect on the quantity of cream and quality of butter.* The range of temperature between these two opposite points, is sufficient to make it no object to approach too near these unsafe limits.—(Page 17.)

Changing Temperature.

No. 13. *The object of heating or cooling milk, and causing it to pass through a range of different degrees of temperature, is not to improve the intrinsic quality of the butter.* So far as the needs of the butter grain go, if the milk could be allowed to cool down gradually to *temperate*, 60° *and remain there, nothing better could be*

asked. Any change of temperature before or afterwards, if it has any effect on the butter, will be in the direction of the disorganization of the butter grain, and unfavourable. *The object that is had in view in securing a wide range of temperature, is for the mere sake of process, the obtaining of the cream, and afterwards the butter.* Therefore the aim will be to make as little change as possible to secure to the process the advantage of change, and to make that change where it *will least affect the grain itself.* It will also be the aim of the operator never to cause a change of temperature for the sake of advantage in the process that will do any marked injury to the quality of the butter.—(Page 17.)

Safe cooling Limit.

No. 14. It is *difficult from what seems at present known, to fix the safe cooling limit. A great deal has been said and written of the good and evil effects of cooling that has not taken into account the whole question as here presented.* It is evident that the limit must at least be fixed on the warm side of freezing or 32°. There are two facts that will give a rule of operation. *While in heating the advantages to process are increasingly less, the unfavourable effects on quality of butter are increasingly greater as the cooling* goes on. The rule would be to stop between *freezing* and the lowest of the high temperatures that may be said to be absolutely necessary,—to stop as near as possible to the *latter* (55°), *and as far as possible above the former* (32°).—(Page 17 and 18.)

Safe Heating Limit

No. 15. *The outer limit in heating for safety against market injury is short of scalding. There is in scalding milk risk of lessening the quantity of cream that will rise, and of injuring the quality of butter.* It is doubtful if the effects of scalding are practically so unfavourable as those of freezing. Butter made from whey that has been heated to 170°, to cause the cream to rise quickly, is a better article than butter made from whey that has been cooled quickly down to 60°.

The practice has been followed of scalding not only *milk, but cream. If whey and cream stand so high heating, milk will stand it better. It would appear that a safe limit would be found anywhere short of scalding.* To say that such a temperature would be a safe limit, does not mean that it would be an object in ordinary cases to heat to that degree. Ordinarily there would be no necessity for approaching that temperature, as a lower temperature would usually serve all requirements. If, however, there are any defects in the milk that cannot be cured at a lower temperature, it would be well to avail *of the advantages of heating*, and to *approach* scalding. For instance, flecks in butter are cured by heating ; the butter would be worse with the flecks than with the high heating necessary to cure the defect.—(Page 18.)

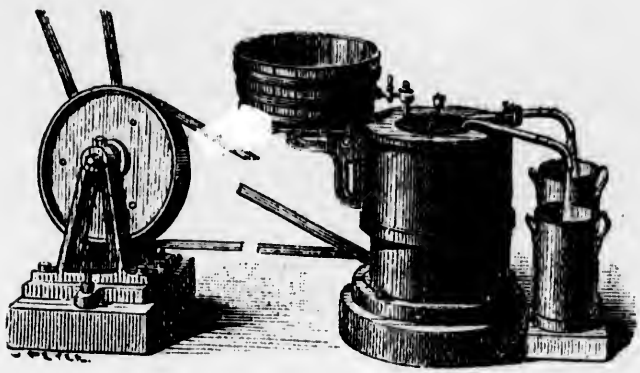
Heating vs. Cooling.

No. 16. *Heating milk before setting gives a wider range of falling temperature ; it destroys germs in the milk, and will allow it to stand at a higher temperature, for a longer time, before souring.* Heating cures some defects that low cooling only imperfectly provides against. Heating purifies the milk, and makes it of more value because of its purity, besides affecting the process.

Cooling milk is necessary, whether heating is adopted or not; and slow cooling, by what may be called artificial means, or by the application of water, to get the best results, is desirable. *But fast or low cooling, while not necessary, is of questionable value.* The special advantage cooling has over heating is that if cooling, which is necessary in any case, can be employed to make previous or artificial heating unnecessary, the labour of artificial heating is avoided. The *italics* in all of Mr. Lynch's quotations are ours).—(Page 19.)

S. M. BARRÉ.

THE END.



BURMEINSTER & WAIN'S IMPROVED DANISH MILK SEPARATOR.

This separator was awarded two gold medals (one in class A separators for two horses, and the other in class B or separators for one horse) at the Aalborg Centrifugal Milk Separators Exhibition, and also a silver medal at the last St. John, N. B., exhibition. In each case it had to compete with De Laval's Milk Separator.

The large size A machine requires 1½ horse power to run it, and will skim 1,200 lbs. of milk per hour. The B size requires 0.88 horse power and will skim 700 lbs. per hour. A summing up of the result of the Aalborg and Vestervig competition may be described as follows :

1st. With the same completeness of skimming and the same quantity of milk per hour, De Laval's separator requires one-third more power.

2nd. With the same completeness of skimming and the same consumption of power, Burmeinster & Wain's small B separator skims, one-third more milk than De Laval's.

3rd. With the same quantity of milk, worked per hour, and the same consumption of power, De Laval leaves from 64 to 65 per eent. more fat in the skim milk.

Table showing the relative maximum capacity of the Burmeinster & Wain and the De Laval separators, and the amount of motive power required to drive them :

TAKEN FROM PROF. J. N. FYORD'S REPORT.

	Capacity.	Completeness of skimming.	Speed.	Motive power required.
	Lbs. per hour	Fat left in the skim milk.	Revolutions per minute.	Horse power.
Laval's Separator.....	700	0.29	7,000	1.20
Burmeinster & Wain's (small size)...	700	0.30	3,000	0.88
Burmeinster & Wain's (large size)..	1,200	0.25	2,000	1.50

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