COMMON SENSE IDEAS

S F
239
B63

FOR
DAIRYMEN
GEO. H. BLAKE.

Class SF2.39

Book B63

Copyright N^o

COPYRIGHT DEPOSIT.

GEORGE H. BLAKE
AUTHOR

Common-Sense Ideas for Dairymen

Being an Exposition of the Methods Pursued by the
Most Practical and Successful Dairymen
in the Elgin District

EMBRACING INSTRUCTION IN

Selection, Feeding and Care of Dairy Cattle, Corn and
Clover Culture, Care of Milk, Milk and Cream
Testing, and Cheese and Butter Making in
the Factory and on the Farm, Etc.

(Illustrated)

BY

GEO. H. BLAKE

Published by
THE ELGIN DAIRY REPORT
ELGIN, ILLINOIS.

COPYRIGHT 1900,
BY ELGIN DAIRY REPORT.

MAILED JAN
22 1900

SF239
B63

Note.

GEO. H. BLAKE, the author of this book is one of the most efficient butter and cheese makers and all around dairymen in the Elgin District. His long experience in dairy work, coupled with a mind analytical in its tendency, peculiarly fits him for the compilation of a book of this character. He is not a theorist, therefore each method described and recommended in this work has been thoroughly tried and proven by practical application.

Mr. Blake was one of the pioneer members of the National Dairymen's Association and has ever been active in promoting the best interests of that organization. He was elected a member of the lower house of the Wisconsin legislature in 1894, and was made chairman of the dairy and food committee of that body. He also presented a bill for the protection of public health and to prevent adulteration, deception and fraud in the manufacture and sale of dairy products. This bill became a law and has proven to be one of the most effectual measures bearing upon dairy questions ever incorporated in the statutes of Wisconsin.

We beg to acknowledge the receipt of cuts of cows from the Experiment Station, St. Anthony Park, Minn., through the courtesy of Prof. Haecker, illustrating the various types of cows in the herd at the time of making the tests regarding the cost of producing a pound of butter. Other cuts have been kindly furnished by the manufacturers, to whom credit is given in connection with the illustrations.

THE PUBLISHERS.

Preface.

This book has been compiled with the design to present to all dairymen, but more especially the dairy farmers, a concise and simple explanation of the important principles necessary for them to understand, that success may follow their efforts.

The purpose aimed at has been to point out the way to success rather than to analyze each of the numerous steps leading up to it. It is impossible to prepare a standard and handing it to the dairyman say to him, "here are your directions, follow them."

The successful dairyman cannot adopt machine methods in performing his work: neither can he, like light, always move in straight lines. He must often diverge to escape contact with obstacles. His mission is to know conditions, apply methods and make note of results. To aid in the accomplishment of these objects is the purpose of this book.

The quotations given are from the sayings and writings of prominent dairymen, whose eminent success in this line of work is sufficient guarantee that the instruction they impart is valuable and trustworthy. In short no theory is advanced nor method recommended in this book, the correctness of which has not been thoroughly demonstrated by practical experiment.

The whole trend of the book is to awaken in the dairyman a realization of the truth that knowledge, adaptability and enthusiasm are the cardinal factors of his vocation, and that if he possesses these all else will be made easy and comprehensive.

G. H. B.

Contents.

INTRODUCTION

CHAPTER I SELECTION OF DAIRY STOCK

CHAPTER II . . . FEEDING AND CARE OF DAIRY STOCK

CHAPTER III CORN AND CLOVER CULTURE

CHAPTER IV MILK AND CREAM TESTING

CHAPTER V CARE OF MILK

CHAPTER VI . . . BUTTERMAKERS AND BUTTERMAKING

CHAPTER VII CHEESEMAKING

CHAPTER VIII CREAMERY BUILDING

CHAPTER IX FARMERS' DAIRY CLUBS

CHAPTER X MISCELLANEOUS FACTS

Introduction.

Progressive dairying, like every other great industry, is fast demonstrating the fact that only those who familiarize themselves with each detail pertaining to their vocation, succeed. It is the "survival of the fittest" here as in every other pursuit of life. And success awaits only him, who by intelligent thought and method, removes obstacles and overcomes difficulties that otherwise would breed discouragement and ultimately lead to failure.

It is sluggishness of thought and the dairy farmer's unwillingness to face his own errors that often stands between him and success. He is loath to give up old customs for new, preferring to trudge along in the same rut rather than take the trouble to familiarize himself with new methods, that he may apply them in his business. He is inclined to trust to chance, hoping that something may "turn up" whereby he will be able to do better next year than he did this. Such a course cannot be otherwise than disastrous in the end. The dairy farmer who trusts in chance pins his faith to a bubble. In the pursuit of his vocation he is dealing directly with nature and her laws are immutable. He may make mistakes, she does not. Neither will she forgive him his errors, but will hold him to a strict account for all his short-comings.

It is reasonable to believe that wherever there is a luxuriant growth of grass, a salubrious atmosphere and plenty of pure water, there the dairy cow will thrive and the dairy farmer will prosper if he conducts his business along proper lines. But with all these advantages of climate

and soil, prosperity will not be his unless he becomes teachable. If he does not know the truth he must search for it. He must be willing to take in knowledge and to see himself as the facts show him to be. In short he must become an expert in his business, quick to detect whatever stands in the way of success, and skillful in removing it.

To do this he must be a thinker, and he must think toward expression. If his cows are poor replace them with better ones. If his butter and cheese are inferior in quality he must improve them. He must not be satisfied with anything short of the best. He should know crude labor can milk a cow, crude labor can start a churn, or pour the rennet into a vat of milk; but it takes skill born of a knowledge acquired only by patient study and thought, to search out and develop the best functions of the dairy cow or give to butter and cheese the superior qualities the market demands.

How is it that one farmer will realize from seventy to eighty dollars a year from each cow in his herd, while his neighbor will receive but little more than half that amount? The conditions of soil and climate are practically the same in both cases, yet one farmer becomes richer while the other grows poorer. The reason is easy enough to understand. One exercises a wider range of knowledge in the management of his business than does the other. One carries with him in his work energy and thought; while the other shuts his eyes to the truth and trusts in luck. One keeps a record of his own errors and by skill subdues them; the other being blind to his own failings sees nothing to improve. One is determined to have the best that study and experience can give; the other is content to take whatever comes, so long as he does not have to think for it. In short one is an animated success; the other a dead failure.

The question very naturally suggests itself here, what is the prime element of success in dairying? There can be but one answer to this query. It is the possession, by the dairy farmer, of a comprehensive knowledge of what constitutes correct management in the pursuit of his vocation. That success may be surely achieved it is necessary for him to have good cows, and that they should be properly fed and cared for. In order to select good cows he must first know what constitutes a good cow and how the presence of desirable qualities in the animal may best be determined. He must also know how and what to feed her, that these qualities may be developed up to the limit of her productive capacity. Therefore, it is evident that knowledge must lead if the dairy farmer would advance in the direction of successful achievement.

To a great many farmers the term "knowledge" as it is used in its relation to the dairy industry, implies a scientific research, to fathom the intricacies of which seems beyond their powers of comprehension. To them the term "scientific" stands for something so mysterious and formidable that they dare not grapple with its problems. The result is, they become discouraged at the beginning and often make but little effort in the direction of improved method.

This is a wrong conception of what a scientific knowledge of dairying really implies. It does not, as is often supposed, mean the acquirement of a knowledge based on abstract or speculative principles. It implies rather, information founded on a right conception of the relation of effects to causes, and perhaps should, more properly speaking, be called an art as its attainment depends almost wholly on practice and performance. Therefore the dairy farmer, who, noting an effect, is able to go back over the trail and locate the cause, has learned the art of dairying

and is applying scientific principles in the pursuance of his vocation. Such a man may justly be styled a scientific dairyman.

The farmer who follows this line of research is continually advancing from the known to the unknown; inductively acquiring new ideas and conceptions, which constantly lift him higher and broaden the range of his mental vision.

One of the most conspicuous benefits resulting from the growth and development of the dairy industry, is the stimulus it gives to a desire for a greater knowledge, not only of dairying, but of all agricultural pursuits. The individual who, by study, has mastered the more important features of dairying, is a better general farmer than is the one who has never engaged in dairy work. The reason for this is, the study necessary to the acquirement of success as a milk-producer, broadens the farmer's conception of all phases of farm labor, and he gradually becomes a scientific farmer. His efforts in any department of agriculture are methodical; revealing the possession of a trained mind that thinks toward expression. He has learned to reason from cause to effect. He is not satisfied with merely knowing that a certain thing does happen as a fact, but he searches out the why of the thing and seeks to bring it into relation with other facts, thereby enlarging the basis of its application.

The question may be asked, why does dairying awaken a greater desire for the acquirement of knowledge than do other lines of agricultural labor? We believe it to be because of the influence exerted on the individual by his being brought into frequent contact with more progressive minds and with greater individual achievement than he himself possesses or attains. It has been said that nothing is great only by contrast. We might reverse the expression

and say nothing is weak until compared with something stronger. Certain it is, that our failures are never so apparent to us as when we measure them by some other person's success. Our ignorance of the facts relating to any subject is brought home to us with crushing effect when exposed by the searchlight rays of a more enlightened mind.

In like manner the dairy farmer is brought into contact at the creamery or at the shipping station with those engaged in the same business as himself, affording him frequent opportunities to draw comparisons between their achievements in dairy work and his own. He notes that some are more progressive than himself; for with no greater natural advantages than he possesses they far outstrip him in the returns they receive from their herds. Their cows are producing more and richer milk and the check they receive for it at the end of the month is from 60 to 100 per cent larger than his own. These are object lessons which are sure to make an impression, and he at once begins a search for the causes which render their dairies so much more profitable than his. He begins to study their methods and as he investigates, facts he did not know existed are brought to light, which in turn reveal other facts, unveiling and exposing his errors in the management of his dairy work, while at the same time they point the way to improved methods and larger returns. The knowledge these conditions bring to him creates a desire for further information and so he advances by slow gradations from a state of ignorance to one of enlightenment, until at length he develops into an expert dairyman.

The old-time farmer who followed the system of single crop production, did not enjoy these opportunities for comparing the results of his own labor with that of others engaged in like pursuits. Thus his isolation robbed him of the incentive to study and research afforded by such

comparisons. The old-time farmer might be ignorant of basic principles and yet achieve partial success, but the dairy farmer must be informed regarding his work or he will surely fail.

Therefore the trend of the dairy industry is to broaden the farmer's perception and add to his store of useful knowledge. In the first place, because he must understand certain principles, if he would succeed; and afterwards, because the acquirement of a limited knowlege creates a desire to possess more.

Dairying has, and is bringing many benefits to the American farmer. It is enriching his soil, rendering it more productive, thereby adding to the money value of his farm. It is teaching him economy by enabling him to do business on a cash basis. It is paying his debts and lifting the mortgage from his farm. But, desirable as are these advantages it has brought to him a greater benefit, one on which all others may be said to depend, a mind trained, broadened and enlightened by a rich store of practical knowledge.

Chapter 1.

Selection of Dairy Stock.

A well known and eminently successful dairyman has said, "The basis of improved dairying is selection of cows. Feeding, training and handling, surely are factors of influence, but cannot be said to be the basis of progressive dairying." This truism should commend itself to every farmer who is engaged in, or contemplates entering upon the vocation of dairy farming. For however well fortified he otherwise may be, against the many difficulties with which the dairy farmer must contend, if his cows are of inferior grade much of his labor is thrown away. The first question then for the dairyman to understand is—what constitutes a good cow?

The same writer, in enumerating the qualities of a good cow, says,

"(1) She must be a good feeder and have good assimilating powers. From four to nine years old; an easy milker; kind disposition, medium size, and thoroughly feminine in her organization.

(2) She should be characterized by an inherent tendency to convert her food into milk and have an organization especially adapted to that work."

He should also have added, she should be distinguished for the superior quality and quantity of milk she gives and the persistence of its flow.

MUST BE A GOOD FEEDER.

The truth of the assumption that a cow, to be profitable in the dairy, must consume a large quantity of food is too self-evident to admit of argument. At the very

threshold of his business is the dairy farmer confronted by a problem on the solution of which his success or failure largely depends. One that he cannot solve unless he is fortified by a knowledge of what constitutes a good dairy cow. He must know that to be valuable in the dairy she must be a good feeder. Her body is a chemical laboratory in which, by nature's mysterious process, food product is transformed into milk, and, if her powers of assimilation are of a high order, the more food she consumes the larger quantity of milk she will give; but do not lose sight of the fact that this result is wholly dependent upon her assimilative capacity. Many cows, up to a certain point, convert the food they consume into milk, but any increase beyond this limit is converted into flesh and the milk increase is suspended. Such an animal does not possess the higher qualities that characterize the perfect dairy cow; the cow which every progressive dairyman desires to possess.

The true dairy cow will continue to increase the flow of milk up to the limit of her digestive capacity. That is to say, as her ration is gradually increased after freshening, the flow of milk will increase, in like proportion up to the point where she will refuse to partake of a larger quantity of food. This increase should be gradual, and as near as possible, uniform from day to day; not reaching the limit of her capacity for six weeks or two months from the time of freshening. If at that time she will consume from fourteen to sixteen pounds of concentrated food a day, and give an adequate return in milk without any perceptible increase in flesh condition, she has proven herself a fit cow for the dairy.

QUALITY OF MILK.

Another point to consider in the selection of a dairy cow, is the quality of the milk she produces. A few

years ago the dairy farmer considered the quantity of milk a cow furnished to be the gauge by which to judge her fitness for a place in his herd. The cow that gave the greatest quantity of milk was considered the most valuable, and those animals whose pedigrees traced back to such a cow were eagerly sought after by dairymen. In those days factorymen paid their patrons in proportion to the number of pounds of milk they delivered to the factory, without regard to its productive quality. Hence the more milk a cow gave the more valuable she was to her owner, but not always so to the factoryman. These conditions have changed since the introduction of the Babcock test. A cow's fitness for a place in the dairy is now based upon the *quality* as well as the *quantity* of milk she gives. The question now asked, is not only how many pounds of milk will she give each day, but how much butter and cheese will it produce? Where quantity was once the only point of excellence considered, now quantity and quality are both requisite qualifications. The more progressive dairymen have a definite standard of butter production and any cow falling below that standard is put out of the herd.

The knowledge of what the individual animal in a dairy herd is producing is not so difficult to obtain as it may at first appear and will certainly present no obstacles to the thrifty dairy farmer. Take account of the food each cow consumes in a given time, and its cost, then figure the value, at the market price, of the butter and cheese she has produced during the same period, and it can easily be determined on which side of the balance sheet she belongs. Ask the average dairy farmer how much butter this or that cow in his herd produces in a year, and it is safe to assume he cannot tell you. He knows in a general way, though often vaguely, the production of his herd as a unit, but little or nothing of the productive

capacity of the individual animals that compose it. He has no accurate data regarding the cost of maintaining the different cows in his herd, and seldom even knows what it costs him a year to feed his herd as a whole. He may be milking a dairy of twenty-five cows, twenty of which are giving him fair returns for the feed they consume; while the other five are charging him more in rations for every pound of butter they produce than he can get for it in the market, and consequently are absorbing a good portion of the profits realized on the other twenty cows. The farmer who conducts his business along these lines may possibly be ahead at the end of the year; if so it is his good fortune rather than the result of correct management. This lack of knowledge of the merits of the individual animals comprising their herds, is costing the dairy farmers of this country thousands of dollars every year, which might be saved to them if they would give more attention to details, and, by research and experiment master this important factor of progressive dairying. The successful merchant keeps an accurate account of his assets and liabilities, and at the end of each year takes account of stock, that he may know the exact condition of his business; determine what particular lines of goods are in greatest demand and what lines are dead stock; know the qualities in the several lines he carries, that meet with the most ready sale in the community where he is doing business. He studies carefully and critically his own business methods; adhering to and improving those which experience has shown to be successful, while those found to be unprofitable are discarded. The dairy farmer, to be successful, must do business along similar lines. His cows are his stock in trade, and good business method demands that he know the money-producing value of each of them. He should have an accurate knowledge of—

First. How much feed does each cow consume in a given time, and the cost of the same.

Second. The quantity of milk she gives in return for this feed and its butter-producing quality.

Third. The persistence of her flow; or in other words, the length of the period of lactation, and,

Fourth. Her ability to impart to her off-spring her own constitutional qualities of excellence.

It matters very little to what breed she belongs if, at the end of the year, she shows a good margin to her credit above what it has cost for her maintenance.

INDIVIDUAL MERIT, VERSUS BREED.

We do not wish to be understood as under-estimating the importance of breed. We would, however, emphasize the fact that successful dairying, involves not only a choice of breeds, but what is of greater importance, a choice of the individuals of that breed. Much is yet to be learned in regard to the secrets of animal nutrition, and if experimenters will abandon the practice of making comparisons between different breeds, and give more attention to individual animals, making experiments on the line of different types in milk production, progressive dairying would at once be lifted to a higher plane of excellence than it has yet attained. Because a certain breed of cattle is characterized by the development of specific qualities it does not necessarily follow that each individual animal of that breed possesses these qualities. The Americans are a progressive people, but not every American is progressive. Italy is called the land of song; but not every Italian is a musician. Neither is every Jersey cow a good butter producer, or a Holstein a good milker. While it is acknowledged wise and practical to select stock from the breed most distinguished for possessing the qualities desired, yet it is unsafe to depend upon breed alone. Select

from a certain breed if you will, but before giving the cow a place in your herd familiarize yourself with her individual qualities.

Experiments made at the various experiment stations fully establishes the fact that breed alone cannot always be depended upon as establishing a cow's fitness for dairy purposes. In an address delivered before the National Cheese and Butter Association on "The Cost of Production," Prof. T. L. Haecker, of St. Anthony Park, Minnesota, has the following to say, bearing on this point: "At our experiment station during the past four or five years, I have devoted nearly all of my time to one subject, and that is the cost of production. I started out in this work in a sort of a general way, thinking perhaps we could get some information that would show the farmer what it would cost to make a pound of butter. Fortunately,

SWEET BRIAR

Experiment Station, St. Anthony Park. Record—6,344.6 milk, 371.49 butter.
Cost per pound butter, 05.59.

we had a very mixed herd at St. Anthony Park. It was composed of various breeds of cattle, and various types. The work was carried on for one year, weighing every

ration before it was given to the cow, and then making a record of that ration. When the cow was milked the milk was weighed and tested for fat. After this work had been carried on for a year, some very curious facts began to make their appearance. We compared the Holsteins with the Jerseys, the Shorthorns with the Guernseys and the natives, and tried in that way to get some results as to what was the best breed. And what was the result? Simply this: The figures show that certain cows of any one breed would produce much better results than others of the same breed under exactly the same circumstances. So nothing satisfactory resulted from this comparison. After the year's work was completed and I noted this peculiar variation

OLIVE.

Experiment Station, St. Anthony Park. Record—7,005.3 milk, 284.25 butter.
Cost per pound butter, 05.05.

between the different cows, the question arose: Why does this cow produce butter for eight cents per pound, while that one charges sixteen cents? Why does this Holstein produce butter for nine cents a pound, while another Holstein charges us seventeen cents? Why does this Shorthorn produce a pound of butter for twelve cents, while the other Shorthorn charges eighteen cents?"

Thus you see after a year devoted to the most rigid and accurate experiments it was clearly demonstrated that when the production of butter is the object in view, the breed of cows comprising a herd cannot be depended upon as certain to give satisfactory results. In this herd at St. Anthony Park, experiments showed no superiority of one breed above another in the production of butter, as a breed, while it clearly demonstrated the excellent qualities of individual cows in all the different breeds experimented upon. What should we learn from this? Does it not show that butter production is an inherent quality in cows of a certain type irrespective of breed? While this type may prevail more extensively in some breeds than it does in others, yet, wherever it is found, whether in the thoroughbred Jersey or in the scrub native, the same points of excellence are in evidence; the same superior qualities are found to exist. Prof. Haecker continued his experiments by adopting another plan. Instead of comparing different breeds he made two divisions of the herd; putting the cows that charged the most for butter on the one side, and those that charged the least on the other. On one side were Shorthorns, Jerseys, Guernseys, Holsteins and natives, and the same was the case on the other side. Similar methods, regarding care and feeding, were observed in both divisions. After pursuing this course for a year it was found that the cows that had a tendency to lay on flesh, gave on an average, two hundred and sixty-seven pounds of butter-fat per annum, at a cost of 13.8 cents per pound; while the spare cows in the other group gave an average of three hundred and thirty-seven pounds of butter fat at a cost of 11.6 cents a pound. It was also observed that some in the group of spare cows did not do as well as others in the same group, both as to butter yield and cost of production. Similar variations were also

noticed in the beefy group. After carefully comparing the record of each animal in the herd with the annual yield and cost of feed, it was clearly shown that the greater the inclination to lay on flesh the greater was the cost of butter production

To further carry on investigation in this line, and have it cover a period when an exact record could be kept of all food consumed by each cow, the winter season was chosen and a record was kept of the amount and kind of ration fed to each cow, and the amount of milk and

FORTUNE,

Experiment Station, St. Anthony Park. Record—9,111.5 milk, 492.99 butter,
Cost per pound butter, 4.27 cents.

butter-fat produced. In summing up the winter's work, variations similar to those observed in the yearly record, were noticed; that is, the cow with a beefy tendency was shown to be less profitable than the spare cow. As before remarked, there were variations in each group, and the next problem to be solved was, why these variations? As demonstrated by the experiment referred to above it was found that, while, generally speaking, the spare cow was more profitable than the cow with a tendency to lay on

flesh, yet there were exceptions, showing that other conditions existed that had a bearing on the problem. To demonstrate this fact the herd was again divided; this time into four groups, based upon conformation. In the first group was placed the cows having a strong tendency to grow meat; this group charged for feed, on an average, 17.5 cents for a pound of butter. The second group was composed of cows that had less tendency to lay on flesh, yet were quite plump and smooth at the close of the winter's work. These charged for feed an average of 15 cents for a pound of butter. Group three was composed of all the cows that were spare and angular in conformation, but lacked in depth through the middle of the body. This group charged, on an average, 14.6 cents for a pound of butter.

The cows assigned to group four were spare, but were deep through the middle of the body. They charged, on an average, 12.1 cents to produce a pound of butter. Another fact worthy of record is, that each individual cow in this group charged less for a pound of butter-fat than did any cow in the other three groups. In other words, the cow making the poorest showing in group four, charged less for a pound of butter than did the cows making the highest record in either of the other three groups; and the more spare the cow, and the deeper she was through the middle of the body, the less she charged for a pound of butter. To make the result more clear, it was found by comparing the record made by each cow in the herd with the amount of feed each consumed, that the cow that gave the least returns carried the most flesh and lacked depth of body, while those making the largest returns belonged to the fourth group; and the more spare the cow and the deeper the body the greater returns for the food given her. To make the experiment more conclusive two

cows were selected, one from group three and one from group four, representing the two shapes of spare cows. Each ration fed to these cows was weighed and charged up to them at market price. The two cows had about the same weight, but the representative of group four consumed sixteen pounds of digestible food per day, while the cow from group three could take but twelve pounds; and the difference in the butter-fat they produced was in like proportion. Here were two cows, neither of which had a tendency to convert food into flesh; being nearly of the same weight, yet one of them could eat sixteen pounds of digestible nutriment per day, while the other could eat but twelve pounds, thus showing that the animal having great depth of body has a large digestive capacity. To otherwise state it, the measure of the middle of the body is an index of the amount of food an animal can digest.

Another type was compared with the representative of group four; a cow from group two—the group that converted a part of their food into milk and a part into flesh. The rations fed to these cows were charged up to them as in the case above referred to. The two cows came in at about the same date, and the returns they gave for the food they consumed, was, for a time, practically the same. At the end of four months, however, it was found that the representative of group two was charging 11.7 cents for every pound of butter she produced, while the cow from group four was only charging 4.8 cents for each pound she produced. As just observed, at the beginning of the period of lactation the two cows were pretty evenly matched in their weekly butter yield; but at the close of the winter's work there was a marked difference. The cow from the fourth group was still yielding 12.6 pounds of butter per week, while the representative of group two was giving only 4.4 pounds. During a period of four

months the cow from group four gave 210.5 pounds of butter at a cost of 4.6 cents per pound, while the cow from group two gave only 123.7 pounds of butter at a cost of 7.8 cents per pound.

From these several experiments we learn that the cow having a tendency to convert a large portion of her food into flesh, made the poorest showing and was, therefore, an unprofitable animal to keep in a dairy herd; yet it is a fact that a great many farmers would select such a cow in preference to one of the angular representatives of group

ETHEL.

Experiment Station, St. Anthony Park. Record—4,099.8 milk; 197.04 butter.
Cost per pound butter, 10.85 cents.

four. Having never made a study of the qualities indicated by the different types of cows it is natural they should choose the ones most symmetrical in form. Their want of information as to the outward signs of certain inherent qualities, renders them incompetent to judge of a cow's merits by her conformation; so they base their opinion of her value on her general appearance. If she is plump and sleek, it is conceded she is a good cow. If she is spare and angular, her appearance stands in evidence

against her, and she is rejected. We observe in the last experiment alluded to that, in the short period of four months, the spare cow with depth of body gave in return for the food she consumed, 86.8 pounds more butter than did her more comely companion; and we see further, that she charged only four cents more for making 210.5 pounds of butter than did the sleek representative of group two for making 123.7 pounds. By carrying the comparison a little further and figuring the market price of butter at twenty cents per pound we find that the spare cow made \$42.10 worth of butter for \$9 68 worth of feed while the beefy cow made only \$24.74 worth of butter for \$9.64 worth of feed, making a net difference of \$17.32 in favor of the spare cow. It is evident, therefore, that had the place occupied in the herd by the representative of group two been supplied by a cow the counterpart of the one from group four, the receipts of that dairy would have been increased \$17.32; while the expense for feed would only have been increased four cents. It is admitted that the showing made by the cow from group four is above the average, even for good cows; yet a great many dairy herds throughout the northwest, contain cows representing as wide a difference in merit as do the two referred to in this comparison; and the dairy farmers continue feeding inferior stock from, year to year, all the time complaining of hard times, and wondering how it is that others succeed so much better than they do. In all probability a little research would show the cause to be their own lack of judgment in the selection of cows.

The experiments referred to in the preceding pages, are only a few of the many that have been made along similar lines. Great care has been exercised in these experiments that the results might be authentic and reliable. A single comparison of different types has not

been considered sufficient on which to base a positive conclusion. So numerous trials have been made, extending over a period of several years, and the results have been practically the same in every instance. The spare cow, with great depth through the middle of the body, has invariably made the best showing. And, as before stated, it should be noted as significant, that in the experiments made at St. Anthony Park, the cow giving the smallest returns in the group of spare cows, having depth of body, exceeded the product of the best cow in either of the other three groups. Right here we wish to insert a simple method Prof. Haecker employs in determining the merits of a dairy cow. He says: "There's one point in a cow to look at first, and the same point in the calf, which is this: with the eye measure the distance from the tail about half way down from the rump, as it drops straight down to the rear line of the thigh, and the greater the distance between these points and the more curving the thigh, the better the cow." He further adds: "Lately we had a delegation of some eighty farmers from Meeker county, to visit the Experiment Station. They went down into the live stock room and we brought in six cows, and as they had some doubts about our ability to discover the kind of calf that would make the best dairy cow, we sent for the calves, and they were simply miniatures of the cows. Now, there are also a great many other points to be considered in judging of a cow; but we always try to do away with the little details, laying more stress on fundamental principles, so that every one with an eye can see for himself. When we have decided as to the disposition an animal makes of food, the next thing is how much work will the cow do from day to day, and that is answered by the depth of the middle of the body, or the grist-mill that the animal carries, and the larger the mill the greater the grist."

ONWA.
Owned by Hood Farm. Record—10,230 milk in one year.

The physical characteristics given below should also be considered in selecting cows for dairy purposes.

In thoroughbred Jerseys the following standard of excellence, adopted by the American Jersey Cattle Club, is indicative of superior dairy qualities:

(1) The neck should be thin, rather long, with clean throat, and not heavy at the shoulders.

- (2) Should be broad across the loin.
- (3) Barrel should be long, hooped deep and broad at the flank.
- (4) Hips wide apart; rump long.
- (5) Fore udder full in form and not fleshy.
- (6) Hind udder full in form and well up behind.
- (7) Teats rather long, wide apart and squarely placed.
- (8) Milk veins prominent.

To these should be added a quiet disposition and apparent rugged constitution.

LILY ELLA.

Record—12,282.68 lbs. milk; average per cent. fat, 6.42; butter, 912.5 pounds.
Property of James H. Beirne, Oakfield, Wis.

KATY SPOFFORD CORONA,

Property of E. H. Knapp, Fabius, N. Y. Record—590.65 lbs. milk; 20.882 lbs. fat, in one week.

Points of excellence for Guernsey cattle as adopted by the American Guernsey Cattle Club.

(1) Skin deep yellow in ear, on end of bone of tail, at base of horn, on udder, teats, and body generally.

(2) Skin loose and mellow with fine soft hair.

(3) Milk veins long and prominent.

(4) Udder full in front.

(5) Udder full, and well up behind.

(6) Udder large, but not fleshy.

(7) Barrel round and deep at flank.

(8) Hips and loins wide.

(9) Rump long and broad.

Points of excellence for Holstein-Friesian cattle, as adopted by the Holstein-Friesian Association of America:

(1) Head showing full vigor, elegant in contour.

(2) Forehead broad between the eyes; dishing.

(3) Face contour graceful, especially under the eyes; medium in length, broad muzzle.

(4) Neck neatly joined to head and shoulders, and of good length.

(5) Chest low, deep and full.

(6) Barrel well-rounded and large abdomen.

(7) Loin and hips broad, full long and level.

(8) Milk veins long and large.

(9) Teats large and well spread.

Points of excellence for Pure-Bred Ayrshire cattle as adopted by the Ayrshire Breeders' Association:

(1) Head short; forehead wide; nose, fine between the muzzle and eyes; muzzle, large; eyes full and lively; horns, wide set on, inclining upwards.

(2) Neck, moderately long and straight from the head to the top of the shoulder, free from loose skin on the under side, fine at its junction with the head, and enlarging symmetrically toward the shoulders.

(3) Fore-quarters—Shoulders, sloping; withers, fine; chest, sufficiently broad and deep to insure constitution; brisket and fore-quarters light, the cow gradually increasing in depth and width backward.

(4) Back, short and straight; spine well defined, especially at the shoulders; short ribs, arched; the body deep at the flanks.

(5) Hind-quarters, long, broad and straight, hook-bones wide apart and not overlaid with fat; thighs deep and broad; tail, long, slender, and set on level with the back.

(6) Udder, capacious, and not fleshy, hind part broad and firmly attached to the body, the sole nearly level and extending well forward; milk veins about udder and abdomen well developed; the teats from two and one-half to three inches in length, equal in thickness, (the thickness being in proportion to the length) hanging perpendicularly, their distance apart at the sides should be equal to one-third of the length of the vessel, and across to about one-half of the breadth.

(7) Legs, short in proportion to size.

(8) Skin, yellow, soft and elastic, and covered with soft, close, woolly hair.

(9) Color, red, of any shade, brown, or white; or a mixture of these colors.

(10) Average light weight, in full milk about one thousand pounds.

The foregoing standards of conformation apply to pure blood in the several breeds referred to, but should also be distinguishing features in graded stock.

INDIVIDUAL TESTS IN THE HERD.

Having considered at some length the different types that indicate the presence of desirable qualities in a dairy cow, the question now arises: Are these outward

manifestations an unfailing index of the real merit of the animal?

It must be admitted they are not. While every good cow must essentially conform to a considerable degree to the types and shapes referred to in the preceding pages, yet it is possible for her to possess these characteristics and still be an unprofitable animal in the dairy. So much depends upon development and training that, though the lines of conformation indicative of excellent dairy qualities may be present, their influence may have been warped or destroyed by mismanagement in rearing the animal. Therefore, unless we know the training a cow has received from birth to maturity, we cannot depend upon the type she represents as being a sure index of her merit as a dairy

BELLE.

Experiment Station, St. Anthony Park. Record—5,762.9 milk; 284.56 butter.
Cost per pound butter, 8.62 cents.

cow: For example: she may give a large flow of milk of a very poor quality, or she may be satisfactory as to quality but wanting in quantity and persistence. These conditions, if they exist, can only be determined by a knowledge of the work she is really doing from day to day, and the sum total of her achievement during the whole period of lactation. It is well understood the chief points sought in a dairy cow

are the quantity and quality of milk she is able to give. The quantity is very easily determined, but to ascertain the quality requires a little more labor and skill. In speaking of the quality of the milk we have reference only to its fat content, without regard to the other solids it contains. Before the invention of the Babcock test it was not an easy matter to determine the fat content of the milk of each cow in a dairy herd. The introduction of that machine, however, has removed the many difficulties that stood in the way and rendered it a comparatively easy task to keep a record of what each cow is doing. The entire process is quite simple, and can be readily learned by anyone who is competent to manage a herd. With this means of measuring a cow's value in the reach of every farmer, he can offer little apology for not knowing the individual merits of his cows. Had it not been for the Babcock method of testing milk the comparisons given in the preceding pages could not have been made with any degree of accuracy. By the use of it, however, the experiments were made possible and the important facts they brought to light were established. The Babcock test is a reliable censor, and no dairyman who uses it intelligently, need be ignorant of the individual worth of each animal in his herd. To the shrewd, progressive dairy farmer, the test machine is the most important item in his outfit, and so necessary has it become to him in determining the real status of his business that he would not attempt to manage a herd of dairy cows without it. By its use he is enabled to tell what he is doing from day to day, whether this or that cow is returning him a profit on the feed she consumes. By the proper use of the test he gains a knowledge of facts and conditions which those who do not use it can only guess at. The Babcock test is the best invention that has been made in the interests

of dairymen, and if they fail to use it the loss will be their own. A dairy cow is in many particulars different from other lines of stock. The machine with which she does her work is on the inside. She may have all the external appearances of a good cow and still be unprofitable. Consequently if the farmer would know what a cow is worth he must test her. We do not mean by this that he is to carelessly procure a sample of her milk and take it to his factoryman to be tested, and when the work is done assume that the cow's value is determined by this one test. A cow should not be judged by one test or even by three or four. There may be conditions which we do not know, that cause her to test high or low. In order to determine her value accurately she should be tested at least once a month during the entire period of lactation. At the end of the season the several tests

LYDIA.

Experiment Station, St. Anthony Park. Record 8,030.13 milk; 322.15 butter.
Cost per pound butter, 7.16 cents.

added and the average determined. By this means a very true estimate of her value can be formed. The farmer who has never tested his cows may rest assured a great

many unlooked for conditions will confront him when he begins the practice. The variations he will find in the productive qualities of milk from different cows will surprise him. He will find that the cow giving the smallest quantity does not, as is often believed, test the highest. Neither does the cow giving the most milk test the lowest.

In the accompanying chart is given the result of a two days' test made by W. T. Styles of Lake Mills, Wisconsin. As will be observed, he has kept a record of the cost of the food consumed by each cow, and deducted the same from

CHART NO. I.

NO.	LBS. MILK		TEST, B'TTER		VALUE.	COST OF FEED.				
	Nov. 30th.	Dec. 1st.	Per Cent.	Lbs. Pr Day	Per Day	Silage.	Meal.	Clover.	Total.	Profit.
					CENTS	CENTS	CENTS	CENTS	CENTS	CENTS
1	35	36	3.40	1.38	34.5	6.2	5.6	4	15.8	18.7
2	36	36	3.70	1.53	38.3	6.2	5.6	4	15.8	22.5
3	32	31	3.15	1.14	28.5	6.2	5.6	4	15.8	12.7
4	31	31	3.55	1.26	31.6	6.2	5.6	4	15.8	15.8
5	23	24	3.40	.92	22.9	6.2	5.6	4	15.8	7.2
6	23	24	3.90	1.05	26.3	6.2	5.6	4	15.8	10.5
7	21	24	3.25	.84	21.0	6.2	5.6	4	15.8	5.2
8	20	20	3.90	.89	22.4	6.2	5.6	4	15.8	6.6
9	22	23	2.95	.733	18.3	6.2	5.6	4	15.8	2.5
10	18	22	3.90	.89	22.4	6.2	5.6	4	15.8	6.6

the value of the butter she produced. The feeds given were ensilage, fifty pounds; middlings, nine pounds, and clover hay, ten pounds. He estimated the value of ensilage at \$2.50 a ton, middlings \$12.50, and clover \$8.00. Nearly the same amount of feed was given to each cow. Fifteen

per cent. was added to the fat test to cover the churn increase and twenty-five cents a pound was allowed for the butter.

While in this herd of ten cows none were kept those two days at an actual loss, it will be noticed the profit varied from 22.5, cents the highest record made, to 2.5 cents, the lowest. The cow making the best showing gave in the two days, seventy-two pounds of milk, while the one making the lowest record gave forty-five pounds. In other words, the cow with the lowest record gave 62.5 per cent as much milk as the one having the highest record, but only about 11 per cent. as much profit. Had the relative value of these two cows been measured by the quantity of milk each gave, it will be readily observed how erroneous the conclusion would have been.

In a paper read by C. L. Hill of Rosendale, Wisconsin, before a Farmers' Institute, on the importance of making fat tests, he cites an instance in his own experience that goes to show the utter futility of trying to judge of the comparative value of a number of cows, by a comparison of the quantity of milk produced by them in a given time. He had two cows about the same size and condition and receiving the same feed and care that in a seven days' trial showed the following results: One gave 269.25 pounds of milk, an average of 38.5 pounds daily. The other gave 183.5 pounds of milk, or 26 pounds daily. The first one gave 11 pounds of fat, or an average test of 4.1 per cent while the other gave 11.75 pounds of fat, or an average test of 5.7 per cent. Two other cows in his herd, tested in the same way for one week, show a like difference between the quantity of milk given, and its productive quality. The first gave 203.75 pounds of milk, making over 14.5 pounds butter, while the second, giving 197 pounds of milk, made but 11.5 pounds of butter. There was but six and

three-fourths pounds difference in the amount of milk given by these two cows, yet one produced three pounds more butter than the other. Differences as marked as these, and even

CHART NO. II:

SHOWING THE TEST FOR SEVERAL DAYS.

NO. OF COWS.	FIRST		SECOND		THIRD		FOURTH		FIFTH		AVERAGE	
	Amt	Test	Amt	Test	Amt	Test	Amt	Test	Amt	Test	Amt	Test
1	18	4.0	21	3.4	37	4.4	36	3.6	34	3.8	29	3.84
2	22	4.0	29	3.0	39	4.6	36	3.7	34	3.7	32	3.80
3	16	3.0	22	3.3	38	2.6	33	3.1	32	3.2	28	3.04
4	21	3.2	22	3.6	33	3.3	31	3.3	33	3.4	28	3.36
5	17	3.4	21	3.3	21	3.4	24	3.4	23	3.4	21	3.38
6	9	4.2	16	3.2	23	3.9	24	3.8	28	3.7	20	3.76
7	20	3.2	24	3.0	29	2.8	24	3.6	24	3.6	24	3.24
8	15	3.6	18	3.0	26	3.4	20	4.0	20	4.0	20	3.60
9	16	4.2	25	3.7	19	3.8	22	3.8	26	3.9	22	3.88

covering a wider range of divergence can be found in a large majority of the dairy herds throughout the northwest. The Babcock test, however, opens the way to improvement; making it possible to base the estimate of a cow's value on her actual productive capacity, rather than on the quantity of milk she gives; but, as before stated, her merit or want of merit should not be judged by one or two tests.

The farmer should also be careful to make the test when the cow is in as near a normal condition as possible. If she is in heat, off her feed, has in any way been unduly excited, or exposed to extreme changes of temperature, do not test her, as the result would have little value as showing the productive quality of her milk. Remember the immediate result of an abnormal

condition of the animal is a high test, followed by a reaction and low test. Hence, if a cow has from any cause become physically deranged, do not test her while in that condition; nor until her bodily functions have regained their normal equilibrium. Prof. Farrington says that when a cow in the World's Fair test showed an abnormal per cent of fat, the superintendent would go immediately to the barn and take the cow's temperature. They would nearly always find her feverish. There were some days a cow gave nearly twice as much butter as the day before. A test made on either

HOUSTON.

Experiment Station, St. Anthony Park. Record—8,797.8 milk; 512.84 butter.
Cost per pound butter, 4.17 cents.

of these days would have been unreliable. The Guernsey cow that made the highest weekly record for that breed in the World's Fair test ($16\frac{1}{4}$ pounds) was fourth among the Guernseys in production, in the ninety day test, and the lowest in the thirty day test.

These comparisons go to show that it requires good judgment and much patience and time, to establish beyond a doubt the actual productiveness of the dairy cow. This,

however, to the dairyman who is in the business for profit should breed no discouragement.

KEEPING MILK RECORDS.

In testing a cow, samples from two consecutive milkings should be taken, mixed together, and, if possible, the test should be made at once: Or each sample may be tested as soon as taken, and the sum of the results divided by two, will give the average test for the two milkings. To illustrate: a sample from a cow's milk in the morning contains 4.9 per cent of fat; a sample taken from the same cow's milk in the evening shows 5.1 per cent of fat; the sum of these two tests is 10 per cent, which divided by two gives 5 per cent, the average test for two milkings. The amount of butter-fat this represents can be ascertained by taking 5 per cent of the number of pounds of milk the cow gave at the two milkings. Another, and perhaps a more reliable method, is a composite test, covering a period of one week, taken once a month, beginning the second month after freshening and continuing during the period of lactation. This will give a very accurate result of the cow's work. Of course, a record of the amount of milk she gives, during the entire period, must also be kept if you would know how much butter she has produced. To do this, a milk record must be kept; without it you will not be able at the end of the year, to tell within several hundred pounds of how much milk each cow in your herd has given. Some you will estimate too high and some too low. A cow, at her flush, may give a large mess of milk, but wanting in persistence, gradually decline, until at the end of the year her record will fall below that of the cow giving at first, a smaller quantity of milk, but with greater uniformity and persistence.

Mr. C. L. Hill states that one of his herd gave 41.75 pounds of milk, daily, at her flush, and in three hundred

days gave 5,400 pounds; while another giving 36 pounds a day at her flush, gave 8,050 pounds in the same time. It is evident, therefore, that to possess an accurate knowledge of what a cow is doing, a daily record of the quantity of milk she is giving must be kept. To do this, provide yourself with a set of scales for weighing milk, then prepare a sheet of paper after the manner shown in the chart, tack it on a board, and hang it in the cow-barn. Allow two columns for each cow; writing her name or number at the top of the column; at the left of the columns, write the days of the month in a perpendicular line. In the first column place the amount of milk the cow gives in the morning, and

FORM FOR PAGE IN STOCK BOOK.

COW NO. 1.

1900	Amount Milk.	Test	Butter Yield	Price per lb.	Value	Cost of Feed	Profit
Jan....	1080	3.5	44.1	25 cents	\$11.02	\$4.74	\$6.28
Feb....	.....	.....	.....	.....	.....	.....	.....
March..	.....	.....	.....	.....	.....	.....	.....

in the second place the total for the morning and evening. Thus: A cow gives in the morning sixteen pounds of milk which place in column one; at night she gives fourteen pounds, which added to the sixteen pounds gives thirty pounds, the total milk for the day. Place this in column two. At the end of each month these milk sheets should be added and the amount of milk given by each cow, together with the per cent of fat her test showed for that month, should be recorded in a book kept for that purpose. At the end of the year add the monthly records and you have the amount of milk each cow has given during the year. Multiply this by the average per cent of the several tests made, and you have the butter-fat she has produced.

If you have been progressive, and have kept an account of the amount and cost of the feed each cow has consumed during the year, you are enabled by these simple records to know exactly what each animal has done for you.

This is what you should know, what you must know if you would master the problem of progressive dairying. The form herein given for a page in the stock book is simple and comprehensive and will require but little time to keep.

Rule the page so it will contain eight perpendicular and twelve horizontal columns. Above these columns write the name or number of a cow whose record you are keeping, as shown in the form. Beginning at the left, write above each perpendicular column, the following phrases in the order named. The year, amount of milk, test, butter yield, price per pound, value, cost of feed, profit. In the first horizontal column write in the record for January, in the second for February, and so on throughout the year. These monthly records can be compiled from the milk sheet kept in the cow barn, and from the monthly test, the market price of butter, and the cost of feed. While it may not always be convenient to weigh every ration fed to stock, by weighing a few, the farmer can approximate very nearly the amount consumed daily by each animal in his herd

RAISE YOUR OWN DAIRY STOCK.

Having considered at some length the qualities possessed by a good dairy cow, and the several types that indicate the presence of these qualities, the question now presents itself: where, and how is the dairy farmer to procure her? If he could enter the herd of his more progressive neighbor and there select the cow he wanted the question could be easily answered; but this he cannot

do. Neither can he hope to procure her from the dealers who ship cows by the carload into his community, for with few exceptions, these cows are the culls from dairy herds in some other section of the country. For example, a buyer from Illinois goes over into Iowa to purchase a carload of dairy cows. He is compelled to look for the stock among the dairy farmers of that state, as cows cannot be found in sufficient numbers anywhere else. What is the result? The Iowa farmers, glad of the opportunity to weed out their herds, sell to him the inferior animals, while they retain the best cows in their own dairies. This is perfectly proper so far as the Iowa farmers are concerned, but how does it affect the dairymen of Illinois who purchase these cows at the highest market prices? Is it any wonder they often complain of the unprofitableness of dairy farming? Is it not the more surprising that they succeed at all? Yet it is a fact that this is the method by which a large proportion of the dairy herds of Northern Illinois are replenished; and what is true of Illinois is also true of other states. Wisconsin dairymen are supplied with the culls from the Iowa herds, while their own inferior stock is shipped down to the milk producers of Illinois; and so it goes on to the end of the chapter. It is encouraging to know, however, that progressive and far-seeing dairymen are ceasing to do business in this way. They have come to know that a dairy cow is a machine that will wear out, and it is possible for her to possess very favorable outward lines of conformation, and yet be an unprofitable animal to keep for dairy purposes. They do not under-estimate the importance of type, shape, and breed, in judging of a cow's merit, but they desire to know that the qualities of excellence thus typified have not been destroyed by improper care, overwork and general mismanagement. In short, they disbelieve that a dairy farmer in Wisconsin, or elsewhere, who intends to

continue in the business is going to dispose of his best cows to dairymen in other states. Hence they look with suspicion on the stock shipped into their districts, and are rapidly realizing the fact that the only safe place for the farmer to go for the dairy cow is among those of his own breeding. They see the futility of striving to build up the dairy industry with inferior cows and are already beginning to raise the standard of their herds by home breeding and selection. A distinguished dairyman has said: "There are two ways by which this may be accomplished—either by purchasing thoroughbreds with good pedigrees, and from individual merit, or by thoroughly and carefully testing each cow in the herd, and then from the very best of them, grade up by using a thoroughbred sire of good, approved merit." It is obvious that the second method is the more practical one for the average dairyman to adopt, as it is by far the less expensive. Not every farmer has the means to purchase a herd of thoroughbred dairy cows, but he can select the best from the stock he possesses, and make them the basis of an improved herd. The dairyman quoted above has the following to say as to how this can be accomplished: "After a dairyman has determined which are the best cows in his herd he should divide them into families, the same as the various breeds of thoroughbreds are. In order to do this accurately, it is best to keep a home herd book, and then label the cows and keep them registered in the home book. To rely entirely on one's memory is not a good way. To grade up the herd in this way is somewhat slow, but there are few things of much importance that are attained in a day. If this work is done faithfully to the end the result will be worth all the effort it requires." It should not be expected, however, that every calf gotten in this way will make a good dairy cow. There will be some failures. Some will not possess the qualities of excellence

that characterize the mother. She may not have the power to transmit these qualities to her off-spring, or they may exist at birth and be subsequently destroyed by mismanagement in rearing the calf. Some may do better through their grand daughters than through their daughters. In order to determine these conditions the records must be carefully kept. The type or shape of the calf should be noted as soon as it is born, and if there is an absence of the physical characteristics which distinguish the good dairy cow, the calf should be rejected. If, on the other hand, it is a miniature of the mother, whose qualities you know to be good, then it should be selected.

H. C. Taylor, the celebrated breeder of Jersey stock, says: "After a calf is selected it should receive its mother's milk from four to six days, then taught to drink, and gradually brought to a skim milk ration, accompanied with oats, bran and clover hay. This calf should be grown with an idea of developing a healthy, strong animal but not a fat one, and from the first day to maturity should receive no check in its growth."

A calf matured in this manner will pay its way after the second year, and from the third year until it is nine years old, should be a source of profit to its owner. Another source of advantage possessed by the farmer who raises his own dairy stock over the one who does not, is the certainty that he will soon have surplus cows, of established merit, to sell. He will thus become in a few years, a dealer in high-bred dairy stock, as well as a milk producer; thereby opening to himself two sources of revenue from his business where but one existed before. This is a very important point, for the dairyman who desires to achieve the greatest success in his business, to consider. Again the calf that is reared from its earliest life to maturity, on the same farm, surrounded by the same scenes and conditions, is, if properly

cared for, contented and happy, and because of this, will at all times do the best work for which she is capable, providing she is healthy. On the contrary, if the cow is removed from her familiar surroundings, her usefulness is much impaired for at least a year, and perhaps forever. This is one great objection to purchasing cows that are shipped long distances. In speaking on this point Prof. Haecker cites the following incident which occurred at the Minneapolis Experiment Station: "There were two cows in our herd that had been together all their lives and had become very much attached to each other, but it became necessary to remove Fortune, one of them, and place her in another barn. As soon as Duchess found her mate gone; she began to hunt from stall to stall for her lost companion. She would go all over the pasture looking through the clusters of trees trying to find her. She suffered so much because of the separation that she rapidly fell off in the flow of her milk, in spite of all we could do. I went down to the other barn to see Fortune. She was glad to see me, but kept looking out of the window for Duchess, and she, too, had fallen off in her flow of milk. When these cows were together they would pass the whole winter without any perceptible change in their flow of milk. How careful we should be; not only to feed our cows properly, but to do everything in our power to make them contented and happy. Then only can we hope to get the maximum return."

It is evident, therefore, that contentment is an important factor in determining the achievement of the dairy cow, and should not be under estimated by the dairyman.

Believing that a fact established by practical experiment, is worth any amount of theory, we will cite one more instance where home breeding has been found to pay, before closing this chapter.

J. H. Brown of Climax, Michigan, in a paper recently read before a Farmers' Institute, says: "We have made a specialty of growing clover, corn and potatoes, in crop rotation, and in wheat-growing. We changed our plans and went into dairying, because we were obliged to, and because we had been educated into seeing that it was much more profitable for us to do so. When we commenced we

DIDO.

Record—Cost of butter-fat 18.2 cents per pound.

had cows of all kinds, and we had them all mixed up—several breeds in one animal. We found from reading dairy papers, bulletins, reports of the Experiment Stations and dairy schools, that it does not pay to keep that kind of a cow; so we began to look about us for an improvement in the line of a profitable dairy. On account of not having sufficient money, we concluded to raise these cows ourselves, instead of going out and spending three or four hundred dollars for registered cattle. We commenced with a pure-bred Jersey bull and a Babcock tester. We tested

seven cows, and found that three of them were not paying for their board. These were weeded out and others put in their places. We have kept weeding out until we have a herd of grade Jerseys and Shorthorns that now average a little over one and one-eighth pounds of butter per day. Still we are not satisfied. Our aim is to secure a herd that will average each year three hundred pounds of butter per cow. We weigh the milk of each cow, and every two weeks we have been testing the milk. From the record kept we know just how many pounds of milk each cow is giving, the average per cent of butter-fat, and can closely reckon the number of pounds of commercial butter that we make from that number of pounds of fat by adding one-sixth to the total fat."

In concluding this chapter we will repeat what has already been said, that success in dairy farming cannot be achieved with inferior cows. However painstaking the farmer may be in feeding and caring for his stock, if they do not possess the inherent qualities that distinguish the milk-producing animal from the one bred for other purposes, he cannot succeed. He must have cows trained for the distinctive purpose of converting food into milk and butter. Then, with judicious management in their feeding and care, he has a right to expect that a reasonable measure of success will repay his efforts.

Chapter 2.

Feeding and Care of Dairy Stock.

Next in importance to having good dairy cows is to know how to feed and care for them. In discussing the question of feeding the most important factor to consider is economy. This statement should not be interpreted as meaning, on how small a quantity of food can the farmer maintain his herd, but, how can he feed an ample quantity of the food products most readily assimilated, and appropriated to milk production, to the best advantage. An able writer on this subject says: "The most economical feeding depends on when, and where, and to what the feeding is to be done; on the kind, age, and purpose designed for the animal, and largely on the relative cost of different feeds." Therefore, what the dairy farmer should know, is: first, what kinds of food products are the best adapted to milk production, and second, how can these foods be obtained at the minimum cost.

Then, to consider the first question, as to kind of food: We are told that the elements used up in the production of milk, are of the kind known as protein; hence the necessity for feeding protein foods. Protein is a gelatinous semi-transparent substance obtained from albumen, fibrin or casein, and is considered the basis of animal tissue and of some substances of vegetable origin. Protein foods include among other products, all the ordinary grains, though some grains are richer in this element than others. An eminent German chemist asserts that vegetable and animal protein are common. The albumen, fibrin and casein in milk, are obtained from protein foods and

are identical with the vegetable albumen, fibrin and legumen, and are first formed in the vegetable before they are appropriated by the animal. Protein elements then, form the most essential articles of food for the dairy cow; as scientific investigation has established the fact that the liberal feeding of food products rich in protein, will increase milk production. It must be borne in mind, however, that these foods fed in large quantities, materially increases the cost of production.

COST OF PROTEIN FOODS.

In studying the question of how and what to feed his cows, the farmer should consider the relative cost of food products and their influence on milk production. It is not so important for him to know what kinds of feed give the highest results as to quantity, as it is to understand the kinds and combinations that bring the most profitable returns. Feeds rich in protein are the most expensive, as the farmer usually has to go outside of his farm products to procure them. The question then, for him to determine is, will the increase in milk production warrant him in doing this? Will the difference in yield obtained, pay him for expending large sums of money in the purchase of bran, shorts, oil meal, et cetera, at high prices? The solution of this question depends entirely on the cost of these protein foods, the increase of yield produced by feeding them, and the price of milk and its products. If the outlay equals, or exceeds the value of the increased milk production the farmer must depend more upon the food products raised upon the farm. Prof. Woll, of the Wisconsin Experiment Station, tells us that, "if a farmer arranges to have clover hay on hand, and oats and peas, he will have all the protein substances needed for the proper nutrition of his dairy cows; and he will be independent of millers, oil companies, distillers and brewers." Few farmers, however,

are thus fortified, and the wisdom of what to feed, and in what quantities, must depend on market values. If the cost of carbonaceous foods, such as corn, silage, hay, etc., is about the same as that of protein foods, it is wise to feed larger quantities of the latter; but if protein, or nitrogeous foods are the more expensive, feed only enough of them to bring the nutritive ratio down to about one to seven. That is to say, one part nitrogeous digestible matter to seven parts carbonaceous digestible matter.

COMPARATIVE VALUE OF FEEDS

Numerous experiments have established the fact that there is ordinarily no great difference in the feeding value of the cereals and mill refuse feeds. Wheat bran at twelve dollars per ton is cheaper than oats at twenty-five cents a bushel. Wheat at fifty cents a bushel may be considered of similar value as barley at forty cents a bushel, or corn at sixteen dollars a ton. According to Prof. Woll, the relative cost, as between the linseed meal or cotton seed meal on one hand, and bran or oats on the other, the latter are usually the cheaper feeds at our ordinary market prices; comparative feeding experiments of oil meal refuse feeds, and of cereals or flour mills refuse feeds, have failed to show any great superiority of oil meals over the last mentioned feeds. Thus cotton seed meal was found only one-fifth more valuable than corn for milk production, at the Pennsylvania Station, and oil meal only slightly more valuable than corn meal, at the Wisconsin Station. As the price of oil meal is usually about fifty per cent higher than corn meal, and double that of bran, while the difference is still greater between these and cotton seed meal, it is evident that, at usual prices, we ought not as a rule, feed more of these feeds than is necessary to furnish variety and stimulate the appetite of the cow. In these respects, these

feeds possess a value that cannot be measured by their protein content, or the content of any other single component.

DIFFERENT FEEDS FOR DIFFERENT ANIMALS.

It is impossible to give the component parts of a ration and say to a farmer, this should be your standard. While it is universally conceded by progressive dairymen, that heavy feeding pays, and that he who would succeed in dairying must feed liberally, yet the fact is equally well established that cows cannot all be fed the same ration with similar results. This is true both as to kind and quantity of feed given. The same kind of feed will have different physiological effects on different animals. For instance, one cow may be able to consume as high as ten or twelve pounds of corn meal in a day, and give ample returns for the same in milk production; while another cow would cease giving milk at once and go to laying on fat on a much smaller ration. Perhaps though, if the last mentioned cow was given a ration in which the food elements were differently proportioned her flow of milk might be increased up to the limit of her digestive capacity. These are conditions which must be noted by the farmer, and by carefully studying the physical tendencies of the different animals comprising his herd, he must adapt the ration fed to the cow's condition, stage of lactation, and assimilating powers; feeding her, when in full flow of milk, up to the limit of her assimilative capacity, and no farther. In answer to the question, what is the best ration to get the most milk from a cow, for the least money, an eminent dairyman has said: "That would vary somewhat according to the make up of the animal. If it was an animal inclined to lay on fat, you would have to be sure to have in that ration, a larger amount of protein food, than you would if she was strictly a dairy cow. A dairy cow that will handle large quantities of carbonaceous food is the most profitable cow to

keep, because the corn crop is the cheapest crop we can grow. If the cow is one inclined to put on fat; I would give her no corn; but I would give a dairy cow four pounds of corn, four of oats, four of wheat bran, and one and a half oil meal. I would feed her very largely on corn or clover silage; that would be the larger part of the ration, and this should be balanced by a grain ration so that she would consume about twenty-five pounds of organic matter. That will contain from fourteen to sixteen pounds of digestible food, and she ought to have that amount some way or other.

WHAT FEEDS TO RAISE.

Mr. H. C. Taylor tells us in an able article written by him, on "The Physiology of Milk Production," that a liberal supply of fluids is necessary for the production of milk. Hence, all green foods are beneficial, and no ration can supplant good green pastures and running brooks. Clover and corn silage for winter feeding, is the nearest approach to nature that has yet been attained. The same writer, in referring to rations for dairy cows, says: "The dairyman must have good food and he must have cheap food. Of course you have now, or will have a silo. Allow four tons, two hundred cubic feet of corn silage for each cow. Cut up, and carefully shock, all corn that does not go into the silo. Do this when the ears are glazed and the stalks yet green. As you commence feeding silage, commence hauling in the corn and put it through your silage cutter, ears and all. Mix with silage equal parts, then sprinkle to a condition a little more moist than the silage. Allow it to lay twelve hours in your feeding hall, when you will find it warm, and the cattle will eat the whole of it and relish it." He adds, "you will be surprised to see how much stock that patch of corn will winter. If any one makes you believe this is not a well

balanced ration, you may add a little oatmeal, oil meal or wheat bran.”

CORN SILAGE.

The importance of corn silage as a feed for dairy cows cannot be over-estimated. It is both cheap and milk-producing. Corn is the staple crop grown in the dairy districts of the central west, and, at prevailing prices, is the best and most economical for either fat or milk production. A considerable percentage of its food value is lost to the dairy farmer, however, if he fails to feed a large proportion of it in the form of silage. Most of the objections that once existed, as to the utility of feeding silage, in any considerable quantity, to dairy cows, have been brushed aside, by the favorable results of practical experiments. It is difficult at this day to find a progressive dairy farmer, especially in the west, who does not believe in the practical advantages resulting from silage feeding. Indeed they would not attempt to conduct a dairy farm without it. It was once believed that silage feeding injured the flavor of dairy products. The fallacy of this claim, however, has been established beyond question; as practice has demonstrated that silage, properly kept and judiciously fed, improves the flavor of both butter and cheese.

To the question recently asked in a Farmers' Institute in Wisconsin: "Does silage give a bad flavor to butter?" The following answers were given by some of the most practical and progressive dairymen of that, and other states:

Mr. Brown, of Climax, Michigan, said: "We have a large condensing factory at Lansing, and they are using milk, made from silage, right along. Milk condensing is a business where any flavor that would be produced by the silage would be sure to affect the milk, but they have never had any complaints. I do not see why the feeding

of silage should injure the flavor of milk, if it is handled in the right way and properly fed."

Mr. Noyes, one of the largest manufacturers of butter in Wisconsin, said: "In the vicinity of where I manufacture butter, silage is fed in the right way, and we get no bad effects from it in the butter, while we are sure we do get good effects. It causes the cream to churn readily and gives the butter a good flavor."

Mr. Goodrich, a manufacturer of high grade butter, and a conductor of Farmers' Institutes, said: "That was a question that bothered me for some years after I built a silo, and it was with fear and trembling that I sent my butter down to Chicago. After two shipments had been sent, made from the milk of silage-fed cows, the commission man voluntarily wrote to me this, not knowing anything about what I had been feeding: 'Mr. Goodrich the flavor of your butter is excellent; never so good before at this season of the year.'"

Of course if you feed rotten, mouldy and bad-smelling silage, you will have bad-smelling butter, but good silage will make fine flavored butter.

SILAGE CORN; WHEN TO CUT IT.

The variety of corn to be planted for the silo must be determined by climatic and other conditions. A variety that will give the best results in one section of the country, might be very unsatisfactory in another. Climatic conditions and the character of the soil, must, to a large extent, determine this question. It is well, however, to plant varieties that mature late. Corn that grows a tall, slender stalk, is well eared, and bears a heavy foliage, and does not mature too early in the season, will generally give the more satisfactory results; as the yield will be heavier per acre, the quality better, and the time of maturing renders it more convenient for silo filling.

It has already been observed that the corn should be well matured before it is put into the silo. Mr. A. P. Noyes, of Beaver Dam, Wisconsin, who is an enthusiast on silos and silage, says: "The dent varieties should be dented and the flint varieties glazed, before it is cut."

Two very potent reasons exist why this is true. First, well matured corn will keep better in the silo, and second, it contains a larger amount of food materials, than it would if cut in an immature stage. Prof. Ladd, in an analysis of fodder corn cut at different stages of growth, obtained the following results. The area considered is one acre:

Gross weight, when tasseled.....	18,045.0 pounds
Gross weight; when glazed.....	32,295.0 pounds
Water in crop, when tasseled.....	16,426.0 pounds
Water in crop, when glazed....	20,542.0 pounds
Dry matter, when tasseled.....	1,619.0 pounds
Dry matter, when glazed.....	7,202.0 pounds
Crude protein, when tasseled.....	239.8 pounds
Crude protein, when glazed.	643.9 pounds
Crude fiber, when tasseled.....	514.2 pounds
Crude fiber, when glazed.....	1,755.9 pounds
Starch and sugar, when tasseled....	653.9 pounds
Starch and sugar when glazed.....	4,239.8 pounds
Crude fat, when tasseled	72.2 pounds
Crude fat, when glazed.....	269.0 pounds

It will be readily seen by these figures that the nearer maturity the corn, the greater the amount of food material it contains. It is obvious then, that economy would dictate, if no other reasons existed, that the crop be allowed to stand till the corn is well glazed, or as long as the leaves will keep green, before cutting for the silo. The figures given above suggest another fact worthy of consideration. That is the doubtful utility of sowing corn broadcast, to be fed to dairy stock, in an immature state, during the late summer months and early autumn. Such fodder, unless

supplemented by a heavy grain ration, possesses but little value; analysis having demonstrated that it contains only about ten per cent of dry matter, the other ninety per cent being water.

To illustrate more fully the actual nutritive content of such fodder, the following comparison is given:

The chemical composition of milk, according to Foster, is—

Casein.....	48 parts
Albumen	5 parts
Fat.....	45 parts
Sugar	40 parts
Salts	5 parts
Water	857 parts
Total ..	1000 parts

These figures show that milk contains about 14.3 per cent of solids. Of these solids, 4.5 per cent is fat; leaving, after the fat has been taken from the milk, 9.8 per cent of solids. Therefore skim milk contains 9.8 per cent of solids, while green fodder corn that has been sown broadcast contains but ten per cent of solids; being scarcely any richer in food material than skim milk. By a comparison of these figures the farmer can see the inferior quality of corn sown broadcast as a food for dairy cows.

SILAGE, VERSUS DRY CORN.

While it is true that corn fully matured contains a considerably larger amount of food materials than it does when cut in the glazed stage for the silo, experiment has shown, however, that a large percentage of these materials are saved by feeding corn in the form of silage than when it is fed in the dry state. When fed as silage it is also more nutritious and palatable.

Prof. King has demonstrated by frequent experiments that in feeding from the silo only about ten per cent is lost

in spoiled silage, and dry material. He estimates that the average farmer who is a good dairyman, can save, under proper conditions, from 88 to 90 per cent of the feeding value of the corn crop when fed in the form of silage; whereas only from 60 to 75 per cent is saved when the crop is cured and fed dry.

CLOVER HAY AND SILAGE.

Clover, either in the form of hay or silage, is both an economical and ideal feed for dairy stock. Economical, because the farmer who has a plentiful supply of clover, either in the form of hay or silage, is relieved from the large expense incurred by purchasing high-priced concentrated feeds. Clover is rich in protein elements, and when fed with corn meal or corn silage greatly increases milk production. The raising of clover is also economical because of the fertility it brings to the soil.

Clover silage is estimated to contain about 20 per cent more feeding value than corn, and is usually considered cheaper than corn. Mr. Noyes says clover silage costs him from seventy-five cents to one dollar a ton, while corn silage costs him from one dollar to one dollar and twenty-five cents a ton. He adds that the highest yield he ever had from corn is fifteen tons per acre. He has also obtained as high as fifteen tons of clover per acre. Experienced farmers agree that the time to cut clover for the silo is when it is in full bloom.

At this stage, according to Prof. Atwater, it contains the following quantities of food materials per acre:

Green weight.....	12,650 pounds
Dry matter.....	1,410 pounds
Crude protein.....	189 pounds
Crude fiber.....	390 pounds
Starch and sugar.....	682 pounds
Crude fat	33 pounds
Ash.....	107 pounds

In siloing clover it is advisable to weight it as being lighter than corn silage it does not pack as well.

A WORD ABOUT SILOS.

As we cannot have silage without silos, a word here in relation to their construction, cost, etc., will not be out of place.

A silo is an air-tight receptacle in which can be put partially green fodder and preserve it in a fit condition for feeding to stock. Silos are usually built of wood or stone. Men of the largest experience in their construction, claim that a wooden silo can be built for one dollar per ton of its capacity, and a stone silo for one and a half dollar per ton of its capacity. The latter are usually considered cheaper because of their greater durability.

To insure better packing, the silo should be round in shape, and not less than twenty-four feet deep, and of a diameter that, with the stock fed, from two to three inches will be taken off each day.

If built of stone they should be cemented on the inside, and sheathed on the outside, leaving a four-inch air chamber between the sheathing and the wall. That the height may be lessened they should be built partially underground where the character of the soil will permit of this being done. The labor required in filling, and getting the silage out will also be greatly lessened, if the silo is constructed in the side of a hill or elevation.

SOILING.

To know how to keep the largest number of cows on the smallest acreage of land is another source of economy in dairy farming. If the old system is followed, of pasturing in summer, and depending on the farm products for winter feeding, the farmer tilling but fifty or sixty acres of land can keep but a small dairy herd. This will not pay, neither will it be profitable to purchase the feed

to keep a larger number of cows. This difficulty can be largely overcome by following a system of farming known as "soiling." As it is practical results rather than theory, the dairyman wants, we give the methods pursued by Mr. Crossfield, of Ft. Atkinson, Wisconsin, who has been remarkably successful in this way of farming.

Mr. Crossfield has but fifty-eight acres of tillable land, the balance of his farm being boggy marsh and timber land affording little or no pasture; yet he keeps at a profit, on this little farm, over forty dairy cows and several horses, about fifty head of stock in all. We will endeavor to tell you how he does it. Late in the summer he sows several acres of rye, and one or two acres of winter wheat. The rye usually makes him some fall pasture. In the spring, as soon as the land is in fit condition and the rye has sufficient start, the cows are turned on and allowed to eat the rye as fast as it grows, until time to plow the land for spring crops. A small piece of rye, which has not been pastured, is then mowed and fed to the cows in the barn. This is followed by the winter wheat, which is relished by the stock until it is ripe. After the winter wheat, oats are fed, which with green clover and millet, carries the stock through until the corn is fit to feed. In connection with these green feeds corn silage and a grain ration are fed. The ground from which the rye is mowed is planted to corn for the silo, and the winter wheat ground is sown to millet or hungarian. The rest of the feed for his stock is raised in the following proportions: Corn thirty acres; oats thirteen acres; clover fifteen acres.

Twenty acres of the corn is planted thick in drills, using about one-half bushel of seed to the acre. This goes into the silo. The other ten acres is planted in check rows, and allowed to mature, when it is husked. In the winter

the stalks are run through the feed cutter and fed to the cows.

The oats are cut just as the top kernels are turning ripe and the straw is yet quite green. They are bound in small bundles, and set up, two and two, and capped. When thoroughly dry they are stacked, two loads in a stack, close to the barn, and drawn in a stack at a time, as they are wanted for feed.

The clover is made into hay, and fed to the cows during the winter in connection with other feed. He feeds about two pounds of oil meal per day during the winter, but none in the summer. Of course bran, corn meal, etc., is also fed.

By pursuing the methods above given, and planting corn on the same land twice in succession, he gets a rotation of crops every four years. The manure is drawn onto the clover sod during the winter and spring, before it is plowed for corn. This system of soiling might not be practical in all seasons or in every locality; but it serves to show what can be accomplished by studying conditions, and taking advantage of opportunities as they present themselves.

SUCCULENT FEED.

Dairymen should not underestimate the value of succulent feed in a cow's ration. Experience has demonstrated that a cow will eat about one-third more of the rich grain feed, with plenty of succulence, than she will without it, and she will digest and pay for it in an increased production of milk. The most liberal feeders of protein foods, also feed large quantities of succulent material. Many progressive dairymen feed as high as forty pounds of corn silage to each cow every morning, to which is added during the day from sixteen to eighteen pounds of concentrated feed. The cow that can take a large portion of concentrated food and assimilate it, is generally the largest milk and butter producer.

“One hundred American Dairy Rations,” arranged by Prof. Woll of the Wisconsin Experiment Station, is a compilation of one hundred rations actually fed, by one hundred successful dairymen throughout the country. Over sixty of these dairymen feed silage. A significant fact connected with this is, that every one of these sixty or more farmers are making, on an average, over three hundred pounds of butter per year from each cow in their herds. It goes without saying that the highest production of milk and butter can only be obtained when the cows receive a highly nitrogenous ration, one containing a large quantity of digestible protein. This is necessary for the rapid building up of the cells of the milk glands, the raw material of the milk; the more liberal supply of protein, therefore, up to the limit of the capacity of the glands of each cow, the greater the flow of milk. Any system of feeding, therefore, that tends to stimulate the cow's appetite until she will readily consume the requisite quantity of these foods to accomplish this result, is beneficial. Experience has demonstrated that the liberal feeding of succulent foods has this effect.

WATER FOR DAIRY STOCK.

When we consider the fact that only about fourteen per cent of milk is solids, the remaining eighty-six per cent being water, we will realize the importance of providing dairy cows with pure water to drink. Impure water not only affects the quality of milk and its products, but it imperils the health of the animal. The evil results arising from the use of impure water by man is fully realized; and millions of dollars are spent each year, in this country, in order that this menace to life and health may be removed. No intelligent reason exists for believing the physiological effects of impure water different on man than on the lower orders of animal creation. A herd of dairy cows that is

compelled to get its drink supply, during the hot summer months, from stagnant pools and quagmires, cannot be as healthy, other conditions being the same, as the animals that are provided with pure water. The deleterious effect on the quality of milk, produced by impure water, while no more important than its effect on health, is the more readily observed. It is safe to say that no product manufactured from milk is exempt from the injurious consequences resulting from the use of impure drinking water. It is then, of the greatest importance to the dairy farmer, that his cows should have only pure water to drink. If stagnant pools exist in his pasture, they should be drained if possible, if not, they should be surrounded by a fence, so the cows cannot reach them. Cows not only need pure water to drink, but they should have free access to it. They will drink often during the day where the opportunity is afforded them. The importance of pure water as a factor in milk production, does not receive due consideration from a large number of farmers. They seem to think if the food supply is all right, the rest does not matter. This is a great and expensive mistake; as much of the advantage gained by right feeding, may be neutralized by giving cows impure water to drink.

WARM THE WATER.

In the winter season care should be taken that the water is not too cold. If drawn from the well immediately before the cows are allowed to drink, the temperature may not be too low. But, if allowed to stand any length of time in the winter atmosphere, the chill should be taken off before the cows are permitted to drink it. The temperature should not be below fifty-eight or sixty degrees.

MISCELLANEOUS.

Potatoes may be fed to dairy cows with beneficial results,

if not fed in too large quantities. When fed, they should be washed and cut up, but not cooked. It is not considered practical, by our best dairymen, to cook any kind of feed for dairy stock.

ROOTS.

It is not believed the feeding of roots in large quantities to dairy cows, is economically desirable in most cases. Many of our best educators, however, advise their growing by the farmer who has no silage, and has not sufficient stock to pay to build a silo.

FEEDING DRY COWS.

It is considered practical economy to feed cows liberally, even when dry. If in good flesh, but not too fat at the time of coming in, they possess a reserved force which will be applied to an increased production of milk.

CARE OF DAIRY STOCK.

Proper care must go hand in hand with wise selection and judicious feeding, if the best results obtainable are realized in dairy farming. A little neglect in this direction will neutralize many of the benefits arising from good breeding and feeding. The true dairy cow usually possesses a highly nervous temperament that rebels against harsh treatment. In view of this fact, it is ill-advised economy for the dairyman to share with the the farm dog the duty of caring for her; for if he does, she will in all probability even up with him, by giving an ever-diminishing quantity of milk. Cowboy tactics are not calculated to bring out the best functions of a dairy cow, and they should never be practiced.

The writer has seen carloads of so-called dairy cows brought into the town where he resides, which, as soon as the car was placed on the siding, were kicked and hustled to

the ground. Then, with yells that would excite the envy of an Indian; whip-snappings and profanity, the frightened animals were driven at high speed to the yards, where they were auctioned off to the farmers, as choice dairy stock. Often the same tactics were repeated in driving them out to the farms of the dairymen who purchased them, where amid unfamiliar surroundings, they were expected to prove themselves good dairy cows. Is it any wonder these farmers fail to realize their expectations? Cows treated in this manner are sure to be destroyed for dairy purposes, however high bred they may be, or however numerous may be their natural qualities. Gentle treatment is about as important as good feeding, and must be the practice of dairymen if they would succeed.

SHELTER.

Dairy cows, to do well, must be kept comfortable. Winter dairying will not pay if the cows are housed in cold and ill ventilated stables. The mercury in the cow barn should never reach the freezing point; it should never drop below forty-five or fifty degrees. A cow cannot long maintain the vital force necessary for profitable dairy work, if exposed to the rigors of a winter climate. Economy in feeding, if nothing else, would dictate that she be kept warm.

Strip the jacket from the locomotive and send it out in a zero temperature, and it will be found to require a large increase in coal consumption to keep up a full head of steam. So it is with the cow. The same elements that are used up in maintaining heat in her body are necessary to the production of milk. If kept in a cold stable, she will apply the carbonaceous feed given her, to the generation of bodily heat, and will take a like amount out of the butter fat. A practical dairyman says that, though his cow barn is comfortably warm, he has in very severe weather thrown a

blanket over his cows, and by so doing, increased the yield of butter fat from nine to fourteen ounces per cow per week.

Another dairyman tells of a cow in his herd that was testing from five to five and a half per cent right along. By some means she was left out of the barn one night, when the weather was quite cold, and the next day her milk tested only two per cent and fell off considerably in quantity. When returned to her comfortable quarters in the barn, she gradually regained her normal condition. Comfort, then, is imperative, if we would have cows do their best work.

It is claimed by some dairymen that they cannot maintain so high a temperature in their barns, without applying artificial heat, which would be both inconvenient and expensive. Of course, the temperature would depend very much upon the construction of the barn, its location, etc.; but if the dairyman will arrange to have his barn well filled with hay, straw or other fodder, during the inclement months, it is doubtful if he will need any artificial heat to render his stock comfortable. In this case, the barn will keep the cows warm and the cows will keep the barn warm.

The question of comfort, however, does not all hinge on the single element of heat; there are other features of much importance that require consideration. The old-fashioned custom of fastening cows in stanchions is now considered both cruel and unprofitable. The cows should be so tied as to give them sufficient latitude to turn their heads, and to allow them to reach any part of their bodies. The platform upon which they stand should be made wider at one end of the stable than at the other, so as to insure plenty of room for animals of different sizes. They should be supplied with plenty of bedding; straw if you have it, if not, any refuse fodder material will do, providing it is clean and dry.

The cows, as well as the stable, should be kept clean;

not only as a source of health and comfort to the animals, but as a precaution against impregnating the milk with foul odors and unfavorable germs. Special care should be taken to keep the mangers clean to prevent the accumulation of distasteful and health-destroying ferments. This matter should be given special attention, as it is very important. It has been demonstrated beyond dispute that the quality of milk a cow gives is affected by the air she breathes; therefore, if you would have pure milk, as well as healthy animals keep the mangers clean. The writer knows of an instance in Kane county, Illinois, where fifty out of a herd of ninety-five cows were lost during the winter of 1897, from causes directly attributable, according to the best veterinary talent, to the accumulation of unwholesome and disease-breeding germs in the mangers. If it can be done, it is a good plan to have a separate box for each cow, so arranged that it can be removed and thoroughly cleaned with scalding water as occasion demands.

VENTILATION.

Another important contributor to the comfort, healthfulness and productive resources of the dairy cow, is proper ventilation. There are many systems of ventilation in use, some of which are good, while others are worse than useless.

Of course the location of ventilating shafts depends very much upon the construction of the barn and the arrangements of the cow stables. If the platforms are on each side of the feeding hall, so that the cows face toward the center of the barn, the ventilating shafts may be constructed behind the cows, as follows: Beginning about six inches from the floor, extend the shafts opposite each other, up the sides of the barn between the studding to the roof; then along the rafters to the ridge of the roof, where they intersect and are carried up through the roof about three feet above the ridge; spike two by four joist about two feet long in each

corner of the shaft extending about six inches above the top. Plate with the same material and roof over. This will leave a six inch opening between the sides and the roof of the shaft. Allow the roof to extend well over the sides of the shaft to keep out snow and rain. If there is a cupola on the barn, the shafts may connect with it, but must not be carried up into it, as to do so will destroy the circulation of air. The ventilating shaft should end just below the cupola.

Many ventilating shafts are constructed with a single flue, and are generally very unsatisfactory if not entirely useless. They let in so much cold air that they have to be entirely closed during severe winter weather, the very time they are most needed. This condition can be overcome by constructing two flues in each shaft, thus insuring perfect circulation. Make the shaft eighteen by thirty-six inches in size with a partition through the center. This will afford two flues eighteen inches square in each shaft. Near the bottom of each flue place a slide or damper by the adjustment of which the circulation of air can be regulated. The shafts can be best made of matched flooring running lengthwise of the shaft. The number of shafts required will depend on the size of the barn and the number of cows kept in it. If the construction of the barn will not admit of the shafts being built up the sides and along the roof, they may be brought down on each side of the driveway, out of the way of the hay-fork, and may terminate just below the ceiling of the cow-barn. Here the slides or dampers should be placed in easy reach. The most perfect ventilation, however, is secured by extending the shafts down nearly to the floor.

CARE AT CALVING.

H. C. Taylor, of Orfordville, Wisconsin, the well known breeder of full-blood Jersey stock, and the original

owner of the world-famed "Brown Bessie," has the following to say on this subject:

"After having used all possible care in selecting a cow, and after you have religiously resolved to treat her with kindness and consideration, your profit for the year will depend on the treatment you give her for thirty days after freshening. Give special attention to her general condition and health prior to this time—a prosperous, thriving, upgrade condition preferred. It is after freshening that all the judgment and skill of the dairyman is called for. She should have a boxed stall, and, in winter weather, should be kept blanketed and absolutely free from draughts of cold air. All water given her should have the chill taken off and she should receive small quantities frequently, especially for a few days after freshening. Remember, the cow has more or less fever at this time; her temperature ranging from 103 to 104 degrees, is often reached without any apparent disturbance. For this reason, coupled with the fact that she is a mother, performing the functions of maternity, she is a sick cow, and in all cases should be treated as such. Twenty-four hours previous to calving administer one-half ounce of nitrate of potash in one pound of salts. After freshening she should receive ten drops of aconite, twice a day, to counteract the fever. If she is a heavy milker give no slop food for a week, or until the danger period has passed. Do not expect an increased flow of milk until the fever subsides and she resumes a normal condition. Then give increased rations three times a day, gradually bringing her up to her full capacity, which should not be reached under two months. Remember that the more a cow produces the more she is able to produce, and that a cow well wintered is half summered. If you have made a wise selection in this cow, and do your duty to her as your interests demand, you will soon become an enthusiastic dairyman."

It is not usual to give salts before calving if there is no tendency to constipation. If silage is fed, or carrots, it will perhaps not be necessary. The cow should not be milked before calving, neither is it deemed advisable to draw all the milk from the udder for several days after. Men who have made this a study advise not to do it; as it is apt to collapse the udder to such an extent as to invite inflammation, which might run into milk fever.

While no heavy feed, such as corn meal, should be given a cow after calving until the fever has subsided, carrots or potatoes, with a little oil meal, is considered an excellent ration for her.

CARE OF THE CALF.

If the calf is a female and you wish to raise it for a dairy cow, its development to this end should begin with the first day of its life. It should receive a care calculated to insure a strong vitality, be liberally but not over fed, and if it comes in the winter, kept constantly in the barn until the opening of mild weather in the spring. Its development should never be retarded by any cause that intelligent care and handling can avoid. Milk is its natural nourishment, and for some time should be its principal food. It should be early taught to drink and gradually brought to a skim milk ration, supplemented by clover hay or hay and silage, oat meal and other feeds rich in protein elements. The old adage, "As the twig is bent the tree is inclined," is very applicable in this connection; for it must be remembered, the true dairy cow has been trained for generations with the distinctive purpose of converting farm products into milk, and a perpetuation of these qualities should be the end attained in rearing the calf.

EXERCISE.

The question of exercise for dairy cows has received considerable attention from advanced dairymen. Can cows

be kept in the barn throughout the long winter months and fed on rich feeds up to the limit of their digestive capacity and still retain their vital force or energy? Or, if no immediate effects are noticable in the cows themselves, will it not result in the production of less vigorous animals in the future? Dairymen of the widest experience claim that cows can be thus housed without any deleterious effects resulting to themselves or their posterity. The correctness of this view is pretty well established by the cows themselves when left to their own volition. The dairy cow is never in a hurry; all her movements are slow and deliberate. If left to herself, she will make the journey out to the pasture lot in short, infrequent stages, and after arriving there, will proceed to fill herself up on the smallest area possible. When this is accomplished she will seek the shade of the nearest tree where she will lie hours and chew her cud. We are told that the Jersey cow, Oslip Lennox, when making her famous year's record of 712.5 pounds of butter, was never out of the stable from the middle of October to the first of the following May. In the Minnesota herd, where she was then owned, all cattle were handled in the same way without any deleterious results. An intelligent dairyman says on this subject: "Domestic animals need to be trained and handled with an eye single to the service we require of them. We give our horses exercise and plenty of it. Their usefulness depends on their ability to go along; whereas the usefulness of the cow largely depends on her ability to stand still. The dairy cows from the channel islands have been trained in this direction for generations. They seek their food at home within short distances, and that under the immediate guidance of the country maid and the tether."

When a cow lies down and chews her cud she is working. That is the specific work for which she is fitted. She will

stand still all winter, and do exactly that work on the pasture the next summer. This seems to be the concensus of opinion among experienced dairymen everywhere. They may turn their cows into the yard a short time in the middle of the day, while the stables are being cleaned, but they are not permitted to remain out long at a time, and not at all if the weather is stormy or unusually severe. When cows are stabled in this way, the barn should be provided with a system of ventilation that will insure them pure air to breathe. This is imperative and should never be neglected. Care must be taken, however, that the cows are not exposed to a draught.

Under the old system of dairying little was expected from the cows during the winter months. It is different now. With many dairymen the best results are obtained during this season of the year. To do this it is necessary to conform as nearly as possible to summer conditions. Silage has proven a good substitute for green pasture, and the warm, well ventilated stable, takes the place of summer weather; thus enabling the thrifty dairyman to pursue his vocation with profit at all seasons and under all climatic conditions.

Chapter III.

Corn and Clover Culture.

Dairying in the central west is so dependent on the corn and clover crops for its success, that a discussion of the subject which omitted a consideration of these important factors would necessarily be incomplete. Corn is the chief food product of the western dairyman, and clover is the best coarse food with which to make a balanced ration where corn is fed. The latter crop is not only important as a food product, but the fertility it brings to the over-taxed soil renders its culture an indispensable factor in successful farming. In view of these facts, a brief review of the more successful methods employed in corn and clover production, will not be considered out of place in a book treating of the dairy industry.

CORN RAISING.

No food product raised from the soil is so important to the dairy farmer as the corn crop; and, while the numerous factors entering into its production have been widely discussed for many years, there yet remains much to be learned by the average farmer, before it can be said of him, he has mastered the subject of corn cultivation. The following pages are largely made up of extracts from the writings of men having wide experience and great success in corn growing. It is therefore believed a knowledge of their methods will prove of much value to the average farmer, if he will apply them in the prosecution of his own efforts in this direction.

SELECTING SEED CORN.

Prof. Henry.—I saw seed corn that had grown for fifty

years not only on one farm, but almost on one spot. If there is any plant that can be grown over and over on the same soil as long as there is fertility, it is the corn plant. It is particularly a home-loving plant, and like the Indian, it pines away and never does so well when removed from its native spot. If you have a good kind of corn, stick to it, If your neighbor right by you, on the same kind of soil practically, has a better variety, then I would take his; but I would not go more than a few miles from home for my seed corn, if I could possibly avoid it. As for silage corn it does not matter so much. You want a large variety, that does not always mature.

The attention of farmers living in the colder latitudes of the corn belt is called to the following suggestions offered by Prof. Henry as to the importance of making a thorough test of the flint varieties of corn. He says: "We get our corn in this section largely from points to the south of us where dent corn mostly prevails. Farther north, flint corn only should be grown. This year, at the Experiment Station, we grew from seventy-three to seventy-eight bushels of shelled flint corn per acre. Many have an idea that the flint corn does not yield as much as the dent. This is incorrect for this section (central Wisconsin), and I urge the farmers, especially those having a somewhat cold soil, to try flint corn."

Farmers following the above suggestions should be careful to give the crop a more shallow cultivation, than is the case where dent corn is planted. The flint varieties do not grow deeply, consequently a shallow culture of from one inch to an inch and a half is sufficient.

George Howard.—The first thing required for a good corn crop is good, well-bred seed. The difference between the seed that will throw out strong, healthy sprouts, and that which has merely life enough to grow, will make a far

greater difference in the yield than is realized by most farmers. Choose the type of corn that you think will do the best on your farm, and then select the ears that come as near your ideal of perfection as possible; always avoiding ears containing smutty kernels. To insure good seed, pick it either before or at the time the corn is cut, and place it where it will become thoroughly dried as soon as possible. Fire-dried corn usually gives the most satisfactory results.

W. C. Bradley.—Seed corn should be selected from standing corn, hung up to dry in a room where there is a fire, and then it should be tested before planting. Corn taken from a crib at planting time may grow, but poor seed has caused more loss in the crop than any other thing I know of.

Mr. Todd.—We made a test of seed cured in different ways, and we found that we got ten bushels more to the acre in the same field, planted the same day and cultivated the same, from fire-dried seed. It seems a pretty small thing to talk about, but when we look at the corn crop in the United States, we must remember that the loss of ten per cent in the crop means about one hundred and seventy-five millions bushels, and about half that many dollars.

Mr. Brown.—For thirty-five years we have grown corn upon our farm, and we find that the fire-dried corn is the best every time. We fire-dry about one hundred bushels every year, and in every case it has paid. There is only about one year in a half dozen that you can take corn out of the crib and be sure that it will germinate.

Mr. McKerrow.—Some ten years ago a neighbor of mine said to me: "I am going to show you something about corn." Outside, growing under natural conditions quite early in the spring, he had four lots of corn in four boxes, where he had tested his seed corn. One of these samples was three inches above the soil, the next box about

an inch and a half to two inches, the next about an inch high, and in the last about an inch high also, but finer in stem. These different samples were all planted on the same day, in the same kind of soil, at the same depth, and had been attended to in the same way, and were all the same kind of corn. The first lot that was growing so rank and strong was fire-dried, the second lot was sun-dried on the outside of the building, and taken in whenever it rained, third lot was put up in racks and allowed to dry out in the workshop, and the last was taken out of the corn crib.

PROPER SOIL FOR CORN.

George L. Howard.—By a soil adapted to the crop is meant, not only a fertile soil, but one that is well drained yet sufficiently moist, and lying in a position to be well warmed by the sun's rays, for corn is a crop that requires a large amount of heat. There is nothing better for corn than a clover sod that has not been down over two years, with a top dressing of manure.

W. C. Bradley.—We like a clover or timothy sod for corn, because this is the best place to put the manure during the winter and spring. We believe there is no time when the manure is of more value than when first made, and there will be less waste when applied on sod, as the fine, short grass and stubble, and abundance of roots in the earth, will take up and hold more of the manure than if put on the bare ground; and we believe in putting the manure on thinner than is often done, that the first crop may take most of the value, for when ground is manured very heavily there is a loss by leaching downward that cannot be returned.

PLOWING FOR CORN.

Plow your corn ground in the spring after the grass is started, and drag each way thoroughly each evening while

the plowing is being done; as this will keep the ground from drying out, and the surface from becoming hard and lumpy. If, however, the weather is moist, let it be until the sun begins to dry it up, and cracks begin to form in the soil, when it should be dragged at once. When through plowing, cultivate thoroughly with the disc and drag, finishing with a plank, so as to have a smooth surface to plant on.

George L. Howard.—I prefer to plow for corn in the spring for two reasons: One is that it enables us to manure the ground with manure direct from the stables during the winter and early spring, thus avoiding the losses that would occur by its being left around the barn; and another reason is that, if the land is sandy, its fertility is easily lost by percolation, and it is preferable to have a growing crop upon it as many days of the year as possible. We plow about four inches deep. The plowing should be well done, using a jointer to turn under all the grass and weeds at the edge of the furrow. The preparation of the soil before planting should be thorough, as a good seed-bed will give the corn a start in the spring that it will maintain throughout the season. Timothy or blue-grass sod especially should be well pulverized to a depth of at least three inches.

It is claimed by some that fall plowing for corn is preferable, especially in clay soil, as it is easier to work into a perfect seed-bed. Men of the largest experience and success as corn producers, however, prefer spring plowing; claiming that it gives more satisfactory results in clay, as well as in other kinds of soil.

PLANTING CORN.

In planting corn, especially with hand planters on sandy soil, care must be taken not to get the seed in too deep.

Mr. McKerrow.—We plant with a two-horse planter, in rows three feet eight inches apart, and one to two kernels in a place, every eight or ten inches in the row. We do not

believe in husking much corn, and by planting in drills we get more pounds of feed than if planted in checks. We have also found it just as easy to keep clean. We run the planter just as shallow as we can and cover the seed.

It is held by some farmers that you can get larger ears and a better yield from a given area of land, if the corn is planted in hills instead of in drills. Experience has fully demonstrated, however, that where dairy cattle are fed the drill corn is preferable; as it produces much more fodder than is the case when planted in hills. It has been further shown that, where the corn is properly cared for, neither the quality nor the yield is impaired by drilling. The Michigan Experiment Station experimented along this line with the following results: A given piece of land was planted in hills three feet ten inches apart each way, and a similar plat was drilled three feet ten inches between the drills. The results both as to quality of grain and yield was nearly twenty per cent in favor of the drill corn. Similar results have been obtained by nearly all the extensive corn growers of the west.

Mr. Todd.—We made three experiments with drilled and hilled corn, and the result was that the drilled corn was about ten per cent better than the hilled corn, right side by side in the same field. Consequently we put corn in with the drill every time.

Prof. Henry.—As far as my observation goes, the question of hills and drills depends upon the man. Our most advanced, successful farmers will put a field in the condition that it should be, and fertilize it as it should be, and put it all into drills and get the largest crop of corn, while a less aggressive farmer who does not have his land in as good condition, will plant his corn in hills because with less care he gets a partial crop.

CULTIVATION OF THE CROP.

George L. Howard.—The objects of cultivation are the destruction of weeds, the preservation of soil moisture, improving the texture and friability of the soil, and aeration of the soil. The question of soil moisture is coming to be recognized as one of the most important factors in growing a good crop.

Prof. King, of the Wisconsin Experiment Station, has found by a series of experiments that it requires something over three hundred pounds of water to produce one pound of dry matter in corn. In his field experiments this amounted to a rain fall of from twelve to fourteen inches. But in growing the corn in galvanized iron cylinders, and supplying water enough to amount to twenty-five inches of rainfall, he more than doubled the computed yield per acre on the same kind of soil, and under as nearly the same conditions as possible. This would lead us to believe that we naturally have too little water in our soils to produce the largest crop. As the normal rainfall for this section of country, during the growing season is only about twenty-five inches, it is plain that we must carefully preserve what water we do get if we would obtain the best results. This can best be done by keeping the surface soil in a fine pulverized condition, thereby making a dry mulch which effectually prevents the evaporation of the water that is being brought up from below by capillary attraction.

HARROWING CORN.

Before the corn comes up, and before it has attained a height of six inches, the quickest and most economical form of cultivator to use is a light, straight-toothed harrow. Harrow as the weeds begin to start or the surface soil becomes compact by rains. Harrow only on warm, sunshiny days, never when the corn is wet either with dew or rain, as it is then much more brittle and easily injured.

Mr. Heath.—The secret of success in harrowing corn depends upon getting the surface of the ground smooth before you harrow. I think it is quite detrimental to try to harrow corn where the seed-bed has not been properly prepared. Some farmers complain that they lose a great deal of corn by harrowing, and that is where the trouble is.

Mr. Goodrich.—In my experience I find there is no time to wait in harrowing corn. You must commence before it is up and harrow very often, especially if the ground is very dry. I desire to keep the harrow going to prevent the weeds from starting, for when they once come up, you cannot kill them with the harrow. I consider the afternoon is the preferable time to harrow; as the corn is then more limp, and less liable to break by the harrow passing over it. Corn can be harrowed in this way until it is six and even eight inches high without injuring the crop.

HOW TO USE THE CULTIVATOR.

After the corn has attained a growth of from six to eight inches, the harrow must be put aside and the cultivator substituted. The question then to determine is, which is productive of the most satisfactory results, shallow or deep cultivation. Among farmers of experience the concensus of opinion is favorable to shallow cultivation; as the following extracts go to show:

George L. Howard.—While it is true that a dry mulch of earth four inches deep will preserve more moisture than a mulch one inch deep, another factor comes in here, the corn plant throws out, even in the early stages of its growth, a large number of feeders near the surface of the soil. It was found by examining corn twenty-seven days after planting, that the roots extended laterally to a distance of twenty-four inches; and their tips were only four inches below the surface, sloping gradually upward toward the hill where they were only two inches below the surface. In

cultivating with the old-fashioned four or six shovel plow, four or five inches deep, close to the hill, so many of these feeding roots are cut off as to injure the crop. Many of the best farmers testify that, by changing to shallow cultivation they have materially increased the yield. I would recommend cultivating about three or four inches deep in the center of the row, and two inches deep near the hill, in the fore part of the season, lessening the depth to two inches in the center, and one inch and a half near the hill at the close of the cultivating season. Use a cultivator that will leave the ground as near level as possible, as the throwing up of ridges increases the surface exposed and likewise the amount of evaporation.

W. C. Bradley.—It is important to cultivate as soon after a rain as possible, so as to cut off the capillary tubes that have been formed by the ground being wet and becoming packed. Cultivate now, making a dust blanket on the surface that will prevent evaporation. It has been thoroughly proven by weighing a cubic foot of earth from a corn field, a part of which had been cultivated after a heavy rain and a part left uncultivated for several days, that the soil from the cultivated part contained much more moisture than did that from the other part that was not cultivated. We use the weeder until the corn is about two feet high, then a small tooth cultivator run as shallow as we can, stirring the ground not over two inches deep so as not to cut off the corn roots that are near the surface. We keep up the cultivating until the grain harvest claims our attention.

Mr. Todd.—Many of the feeding roots of corn are within three inches of the top of the ground; and there would be danger of too much pruning if cultivated deeper than two inches. In soil that is very fertile in producing corn, over half the roots that feed the corn are within three inches of the top of the ground. We have experiments, I

think, from five different experiment stations showing this to be the fact. There are very few roots above two inches from the surface.

HARVESTING THE CORN.

Corn should be put up in large shocks and tied near the top. If tied lower down the band becomes loose as the shock shrinks, the top spreads apart, twists out of shape and will be damaged by rain. A great deal of corn fodder is damaged by being put into shocks that are too small. In stacking it is advisable to wait until the corn stalks are thoroughly dry, then stack in narrow ricks or small round stacks, keeping the center full as in a grain stack; as heavy rains often occur in the winter. The best way to feed it is to cut it up, corn and stalks together, and feed in the manger in the cow barn; as a great deal of good fodder is wasted by feeding in the yard.

IMPORTANT FACTS.

Where you have a corn crop, the growing season extends throughout the larger portion of the season of rain-fall, and the season of high temperature, when the plant food is more largely developed. It takes up the fertility and stores it in the crop, instead of allowing it to percolate through the soil and be lost. Therefore, corn production improves the mechanical condition of the soil, when well cultivated, destroys weeds and allows no fertility to go to waste.

RECAPITULATION.

The following are a few of the more salient points brought out in the foregoing pages of this chapter.

SEED.

(1) Select your seed from corn raised on your own farm or in the immediate vicinity, where the soil and climatic conditions are the same; as experience has proven

corn to be a home-loving plant that does not thrive if far removed from its native soil.

(2) Gather the seed ears just before or at the time of cutting, when the corn is thoroughly dented and matured.

(3) Select only perfectly developed ears, being careful that they contain no smutty kernels.

(4) Dry the seed corn in a room where there is a fire; as it has been demonstrated that fire-dried seed invariably insures the quickest, most vigorous growth and largest yield.

VARIETIES TO SELECT.

(1) Dent corn is the variety usually planted throughout the middle west, where grain production is an important object.

(2) It is sometimes claimed that white dent is more productive than yellow dent, but as far as chemical analysis has shown there is no practical difference. Of course, the deeper the root of the corn the better it will withstand drouth, and there are, no doubt, some varieties of dent corn that root deeper than others.

(3) Flint varieties are recommended as the most satisfactory in the north, where the soil is likely to be cold;

WHERE TO PLANT.

(1) Clover sod that has received a thin top dressing of manure during the preceding winter, is considered the best land for corn.

(2) Plow in the spring and cultivate into a well pulverized and level seed bed before planting.

HOW TO PLANT.

(1) A majority of the most experienced corn growers favor drilling in preference to planting in hills. This method produces more fodder, which is an important item where dairying is extensively followed.

(2) Corn should be planted shallow; at most, not over

an inch and a half deep. Plant when the soil is neither too wet nor too dry, but is in the most suitable condition to work nicely. Never, because you may be a little behind with your work, plant corn in wet soil.

HARROWING.

(1) The object in harrowing corn is two fold: first to keep down the weeds, and second to preserve the moisture in the soil.

(2) Harrowing should begin soon after the corn is planted, before it is up, and should be continued until it is four to six inches high.

(3) Never harrow corn when the surface of the soil is wet, nor in the morning, or forenoon, after the corn has attained a growth of one or two inches; do the harrowing in the afternoon, when the corn is partially wilted and is less liable to break.

CULTIVATING.

(1) Shallow cultivation is recommended. By this is meant a cultivation of about two and a half inches deep.

(2) The reason for cultivating no deeper, is to avoid pruning the roots of the growing corn. Many of these roots are within three inches of the surface, and the only way to avoid cutting them off, thereby injuring the growth of the corn, is by shallow cultivation.

CLOVER CULTURE.

Clover is the best crop with which to make a balanced ration where corn is largely fed. Its value in a rotation of crops is also an additional reason for its increased production.

CLOVER AS A FERTILIZER.

The ability of the different varieties of clover to restore fertility to impoverished soils is universally recognized by progressive farmers. It is known these fertilizing properties are due to the minute bacteria that are enclosed in the tiny

swellings on the clover roots. Recognition of this fact, and the study of these organisms, and the conditions under which they grow and multiply, has enabled scientists to intelligently instruct the farmer as to the best method to pursue, that he may secure the largest benefits from these fertilizing properties. We therefore give, in the following pages, a brief outline of the methods employed and their attending results, by men of wide experience and information along the line of clover production,

*Henry Wallace.—If the ancients had known what we know about clover, of its power of obtaining its supply of the costliest elements in stock food, and food for the human family from the free winds of heaven, it would have been regarded, like the lotus of Egypt, a sacred plant. Had it not been for the fact that, so far back as we have any knowledge of agriculture, clover has been regarded as a great soil renovator, the discoveries of later years, with reference to the sources from which the plant obtains its fertility, and the particular kind of fertility it supplies, would have been received with utter incredulity, not only by the farmers, but by scientists. We believe, however, that no agricultural discovery that has been made during the last hundred years has been so important and valuable to the tillers of the soil. By the use of clover we draw upon the atmosphere for fertility in the form of nitrogen, which enters into all the flesh-making compounds. The draft will not be honored, however, unless countersigned by a legume. If we draw off and sell the product in the shape of hay, then plow under the roots, grow grain, sell it off the farm and repeat the process, it is only a question of time when we will have land so poor that only commercial

*Henry Wallace, of Des Moines, Iowa, is the author of a book on clover culture that is considered one of the best authorities on this subject. The extracts herein given are from a paper read by him before a Farmers' Institute meeting held at Menominee, Wisconsin.

fertilizers, costing in a very few years more than the land is worth, will restore it. The land may perhaps be saved but the owner will be bankrupt. On the other hand, if the clover growth is rightly applied we need never complain of a barren soil, or of abandoned farms.

C. E. Chapman.—I do not advocate the expenditure of money in buying expensive fertilizers. It is not necessary to use anything but what can be produced on the farm. To get the largest benefits from clover as a fertilizer, I recommend plowing it under in the fall, especially on sandy soil; for the reason that the clover turns into decayed vegetable matter or humus. The difference between a sandy and a fertile field is the amount of humus in it; the office of humus in the soil is to draw in and hold potash and nitrogen until the plants can use them. The clover, when plowed under, is decaying and giving off nitrogen in a form that can be used by the growing crops. You have to set your fertility traps in the field, and humus is the best kind. Nitrogen is the most expensive fertilizer if you have to buy it. It will cost if purchased, about seventeen cents a pound; whereas, if the farmer raises a good clover crop, he will not only save this expense, but he will also obtain the benefit of the mechanical effects of clover upon the soil, in raising it up, loosening it, etc.

Mr. Chapman is a New York State farmer, where the need of fertility in the soil is more extensively felt than it has yet been in the west; but much of the land in the west is out of condition for want of a special kind of organic matter in the soil. The clover crop very largely supplies this deficiency. It facilitates the absorption of moisture, because it takes up the rainfall when it comes, much more readily than a more compact soil will do. It affords a warmer soil for the corn crop, because a soil containing a large amount of organic matter is always darker colored,

and a dark colored soil has a greater power of absorption of heat.

VARIETIES OF CLOVER TO RAISE.

Henry Wallace.—To the farmer who has adopted a rotation of crops, and who is engaged in stock-growing or dairying, and who wishes to raise clover for fertility, for hay and for pasture, with a seed-crop in favorable seasons, the common red variety is recommended. If the rotation is a short one, for example; clover, corn, oats, and then back to clover, it is usually preferable to sow the clover alone. If, however, it is intended to mow two years, or to mow one, then pasture one or more years, it is better to sow timothy with the clover. If the land is thin and needs building up, there is no objection to sowing the mammoth variety for clover hay. If the land is rich and will produce a rank growth, I would not. However, if a large amount of hay is required, I would sow a part of the meadows to mammoth, sowing the thinner land with the object of prolonging the hay harvest, for the reason that mammoth comes into its best estate along with timothy. There is a class of farmers who desire to obtain an abundance of pasture, and of such a variety as will furnish a stand, with a succession of bloom from spring until fall. In this case I would recommend sowing the mammoth and the common red in equal proportions. Care should be taken, however, not to get these varieties mixed where the object is to procure seed from either, for the reason that their period of maturity is so far apart, that either one or the other will have to be sacrificed. There is about as much difference between the seed maturing period of these, as there is between that of winter and spring wheat.

ALSIKE CLOVER.

The main place for alsike is in sloughs in the prairie sections, or river bottoms subject to overflow, and cheap

lands too wet for cultivation, and too low in price to drain. We know of no grass its equal for this class of lands. Alsike will grow on land that is too wet to plow nine years out of ten. If sown in the slough, or on lands of the above description, or on the sod in the spring without plowing, and if the growth of wild grass is kept down, either by frequent mowing or pasturing, to give the young alsike plants access to sunlight and air, there will usually be no difficulty in securing, not only a stand, but a profitable crop. It is absolutely necessary, however, that the wild grass be kept down in some way. If it is allowed to grow until the usual hay harvest, and then the land mowed, the hot sun and the dry period likely to follow the hay season, will either scorch the young and tender alsike, or kill it from lack of moisture. It is essential that the young plants have every opportunity for development. It is remarkable how rapidly alsike will dry out lands of this kind, mainly, I think, by occupying the ground when given the above advantages to the exclusion of the wild grasses. In time the roots of these grasses decay allowing the water to sink away. If the field is pastured instead of mowed, the tramping of stock will greatly force the water into narrow channels, in case of sloughs or swales with any perceptible fall. The alsike then naturally gives way to white clover and blue grass, if these grasses are established in the neighborhood, and in time we have a mixed, permanent pasture. I know of many farmers in Iowa, where sloughs have been converted by this method from unsightly wastes to exceedingly profitable pastures or meadows. This, however, is not the only place for alsike clover. It does fairly well on good corn land, as a mixture in a permanent pasture, not yielding the quantity either of pasture or hay, but of superior quality. In sections where the insects peculiar to the common red clover prevail, it may be substituted for it on any land, for the time being; as also

in sections of the country where the winter climate is so severe that the common red or mammoth varieties are in danger of winter killing.

WHITE CLOVER,

Of white clover it is not necessary to speak, further than to say that, as a rule, farmers do not appreciate its value. It is their good friend, although like many other friends, it has its disagreeable traits. It is blamed for causing horses to slobber, justly perhaps, but other clovers may well share part of the blame, at the period at least when the seed is ripening. It is blamed for bloating cattle, and sometimes does; so do the other clovers when not properly handled. I will hazard the opinion, however, that were it not for white clover, blue grass would not be much of a success in many sections. These two are married; and no priest can forbid the bans, and no courts dissolve the bonds of union. The white clover feeds the blue grass with nitrogen, and thus it is growing while the blue grass is taking its natural two months siesta or midsummer nap. Then it modestly falls in the background, when the fall rains come and the blue grass begins to grow, and stretch out, and cover the ground.

ALFALFA CLOVER.

Alfalfa land is land that has a light soil of good depth, and a porous subsoil, resting on water-bearing sand. It requires a climate for growing, so hot and dry that when the clover is cut one-fourth in bloom, it can be cured readily. As regards crimson clover, it has not yet been developed to a point where it can be safely sown as far north as southern Wisconsin, nor even as southern Iowa and central Illinois. In time it may become acclimated, and have a gradual northward extension, but at present it fits into southern conditions and the light sandy soils of New Jersey.

ANOTHER CLASS OF GROWERS.

Reference has already been made to the kind of clover best adapted to the needs of the farmer who adopts a rotation of crops. I will refer to another class of farmers: the ones who are brought to realize, what they did not believe years ago, would ever happen, that their land has lost much of its virgin fertility, and who now wish to grow clover for fertility and if possible for seed, and ask what kind they shall sow, how much seed, and how they shall manage it. The plain answer to this is, sow the mammoth. Ten pounds of seed per acre, sown with spring grain and well covered; or on winter grain before the frost begins to leave the ground, or on dryer land and in dryer sections, sow alone without a nurse crop, and harrow in. A stand can be secured, usually, in any of these ways. If secured, it should not be pastured very closely in the fall, and on dryer land not at all. It may be pastured in the spring up to the first of June, and even later, in wet seasons, up to July first, provided sufficient stock is turned on to eat it down even. Or it may be mowed off, provided the mowing is done early and often enough, up to the first of June.

THE SEED CROPS

Treated in this way, mammoth clover will furnish a seed crop in August with reasonable certainty. It should be cut and threshed when ripe, and it is better not to wait for the late heads to ripen. It should not be allowed to stand until the haulm is rotten, but should be threshed as soon as it is dry enough, which in hot, dry weather, will be in from three to five days. If it is intended to follow this crop with winter wheat the land should be plowed as soon as possible. If with corn, it may be pastured as closely as desired until late in the fall. There is no better place, we may here remark, to apply manure than on clover sod

intended for corn. The reason the land should be plowed as soon as possible for wheat is, to give time to prepare a solid seed-bed. The reason the plowing should be delayed as long as possible for corn is, to keep the soil filled with live roots, in order to arrest the waste of nitrogen during the fall rains.

COVERING SEED.

A few words as to the method of covering seed. Western clover growers brought with them from the east, the practice of sowing on the surface on spring grain, and allowing the first rain to cover it, and also the practice of sowing on the last snow in March. Farmers are very conservative, and do not change their methods, especially when they are taught, as they have been by European and eastern authorities, that clover seed will not grow when covered one-fourth, or, at most, one-half inch deep. Some two years ago I requested the Iowa Experiment Station to make some experiments in covering clover from one-half to four inches deep. While the clover that was covered one-half inch deep came up the quickest, and for a time looked the best, that covered two inches deep was, on the whole, the best, while that covered three inches deep stood the severe drouth better than any other.

ON SPRING GRAIN.

If sown on spring grain, the depth of the covering will depend on the character of the soil; if it is light, we would give the clover the same covering that we give spring grain; if heavy clay soil, we would cover it more lightly. It should be noted that self-sown clover is always sown in the fall when the seed ripens; that it lies on the ground all winter, having the advantage, however, of the haulm for protection. Farmers have often noted, by the way, that clover sown in chaff is sure to grow. An important question arises

in connection with the sowing of any of these clovers, as to the character of the companion crop, or, as it is ordinarily called, the nurse crop with which it is sown. The term, "nurse crop," is misleading. Any grain sown with clover and allowed to mature, is always a damage and never a benefit. It nourishes the clover to its death. Nevertheless, to save a year's use of the land, farmers nearly always sow a companion crop, and hence treat clover as a catch crop. The best companion crop is rye, sown in the fall and pastured off in the spring; thus giving the clover the full use of the land as fast as it can occupy it. I have never known a failure of clover managed in this way, even in the dryest seasons. The pasturing of rye, when the land is in fit condition, with small cattle or with hogs, is a positive benefit in itself, as their treading compacts the soil and enables it the more readily to withstand moisture. If pastured when the land is wet, it of course will be injurious.

EARLY SOWING THE BEST.

Clover seldom fails, except on spongy and undrained land, if sown in the spring on winter wheat, and the earlier it is sown after the snow is off the ground, and before freezing and thawing begins, the better. It is dangerous to wait until freezing and thawing are well nigh over, for the reason that if the clover is not deeply covered by this process, it may spring up too quickly, get into the third leaf, and catch a frost that occasionally proves fatal. Of the grains, barley or spring wheat are preferable to oats. The broad leaf of oats shades the ground so thoroughly that the clover has little chance to become hardy, or to grow vigorously. Hence, when the oat crop is removed in harvest, a few hot days or a prolonged dry spell will in all probability kill the clover.

ON WILD LAND.

Red and mammoth clover, and alsike, may be estab-

lished on wild lands, whether prairie or newly cleared timber, land by sowing on the surface in the spring, and then keeping the native grasses closely pastured during the period of their most rapid growth. The stand is, however, difficult to maintain when blue grass is sown with it, for the reason that clover is a biennial, and the farmer is not likely to allow it to go to seed. I have, however, maintained a clover pasture of this kind for eight years by simply spreading over it in the fall of the year, second crop clover that was too light in yield for threshing; allowing the cattle to eat it, and then not pasturing it so closely as to prevent more or less of it going to seed.

ON OLD PASTURES.

Do not hesitate to introduce clover on old timothy pasture. It will be noticed when clover and timothy are sown together, the first crop is mainly clover, the second timothy, and in the third clover comes in again. It can only do so by self-seeding; and if clover, by self-seeding, can hold its own among timothy, why can it not when sown by hand on bare ground in the latter part of winter?

VITALITY OF SEED.

It will be noted that clover will lie two or three years in a manure pile, and then grow when the manure is spread on the ground. It can be inferred from this that three conditions are essential to the growth of the clover plant, moisture, heat and more or less light; not one or two of these conditions, but all three. If you will lift up the edge of a stack of clover in the month of June, and notice how far in the clover has sprouted, you will get an object-lesson as to the conditions under which clover seed grows. It should always be borne in mind that the mammoth clover and the common red are, speaking in a loose way, biennials: that is, they grow one year, mature seed the next, and then die.

Strictly speaking, however, they are not biennials; for the reason that the common red will mature seed the first year, and the mammoth in all probability would if the season was long enough. They can by pasturing be continued to three years; they are, therefore, strictly speaking, perennials. From lack of correct knowledge on this point a great many farmers make mistakes. They conclude if they sow mammoth clover one spring and have a fine crop of seed the next year, and the stand seems good, they will take another crop of seed the third year. In this they will be mistaken. They will get but from one-third to half a crop the third year, and that mainly from seed that failed to come up the spring it was sown, but came up the second year. It is evident, therefore, that if half the sowing were made in the spring or first fall, crops of clover might be taken from year to year, if desirable, providing that there was always enough scatterings to reseed the land

SEED PER ACRE.

Another point is the amount of seed to be sown to the acre. This again varies greatly under different conditions. On land sown to clover for the first time, there should not be sown less than ten pounds of the mammoth or common red clover seed to the acre, and four pounds of the alsike. On lands that have been growing clover it is not necessary to sow so much for two reasons; first, there is more or less clover seed in the ground, and second, the clover-root microbe is abundant.

CLOVER SICKNESS.

The only sense in which the term "clover sickness" is applicable in this country is when the potash and phosphoric acid in the soil is exhausted and the clover will not grow. Prof. Phelps, of the Storrs Agricultural school, gives a very interesting account of his experience with

clover. He found that on land where clover refused to grow, that by taking soil from land that did produce it, and scattering it over the unproductive soil, the latter became inoculated with the bacteria that belongs to clover, and in that way clover production was established. When land refuses to grow clover, therefore, it usually means that it is not inoculated with the clover microbe, and by sowing it with soil from land that is, the difficulty is removed. In Germany they successfully follow this practice.

CLOVER HAY.

The greatest difficulty encountered in gathering the clover hay crop, is in properly curing it. In curing clover hay it is essential to avoid the presence of any wet bunches, and also handling it after sundown, or under unfavorable atmospheric conditions, for an hour before sundown. If the clover is put into large mows, or large stacks, with wet bunches in it, or when it is moist from dew or other causes, there is great danger of spontaneous combustion. It is due to say that under prevailing conditions, much of the clover hay put up is greatly damaged. It is often allowed to become too ripe before it is cut. It should be cut when the more advanced heads are beginning to turn brown. It is also often allowed to lie too long in the swath and become sunburnt; thus losing the leaves and involving a large excess of woody matter in the stalk.

TESTING CLOVER SEED.

How much the "catch," as it is termed, depends on the seed sown, cannot be determined unless the seed has been tested. We should test that we may know the germinating quality of all seeds sown, for if we know what per cent of the seed will grow, we can determine what amount to sow on a given area of land.

HOW TO TEST.

In testing clover, or any other seed, use sawdust as the material to hold moisture. For clover, fill a plate or shallow dish of any kind with wet sawdust; cover this with a cloth, on which the seed should be placed, when the cloth should be folded back over the seed. The seed is out of the water but will get moisture sufficient for germinating if kept in a warm room. It is easy to count off all or a portion of the seed, to get the percentage of growth after three or four days.

Chapter 4.

Milk and Cream Testing.

THE BABCOCK TEST.

Though nearly a decade has passed since the introduction of the Babcock test, a majority of the dairy farmers throughout the country have never used it on their farms. This is the more remarkable when we consider that this test is the only method yet discovered, by which the actual value of the dairy cow can be determined. It would scarcely be believed, if we did not know it to be so, that so important a factor in progressive dairy work would be so neglected. It is difficult to assign a reason for this neglect, on the part of so many farmers, to apply in their business a system that carries with it so many advantages. Whether it is lack of appreciation of the real merits of the test, or some other cause, that breeds this indifference it is difficult to assert. The truth is apparent, however, that hundreds of dairy farmers who would insure to themselves innumerable benefits, by using the test in their herds, are totally neglectful of it. All dairymen, though, are not thus indifferent. Many today, are using the test right along, and are reaping the fruits of their progressiveness, in the possession of more valuable herds and larger returns in milk production. To the dairyman, therefore, who would keep up with the procession its use is a necessity.

BENEFITS OF THE TEST.

There are many farmers in this country who will tell you that their success as dairymen, dates from the time they began using the Babcock test. Before that time it

was largely guess work with them. They judged a cow by the quantity of milk she gave, and by so doing, were often misled as to her real value. This not infrequently led to their keeping cows, year after year, that did not pay for the feed they consumed; while lighter milkers that were really paying a profit, were disposed of. The first important lesson taught them by using the test, was that their former methods of determining a cow's fitness for a place in the

"No-Tin" Babcock Tester for Dairymen. The Sharples Co., Chicago.

dairy, were absolutely valueless. Animals they had once believed to be good were shown to possess little merit; while others, before considered unprofitable, unmistakably demonstrated that they possessed superior dairy qualities. This truth was a revelation to the dairy farmers; and by taking advantage of the light thus gained, they were enabled to transform a discouraging, poor-paying business into one of pleasure and profit. The painstaking, practical farmer, experiences no difficulty in determining the actual value of his cows, when he uses the test. It enables him to distinguish the good from the medium, and the medium from the poor; thus rendering it easy for him to get rid of the unprofitable animals, watch the development of the doubtful

ones, and push to the limit of their capacity those shown to possess superior dairy qualities. It not only shows him what cows to keep and what ones to reject, but it teaches him the secret of economical feeding. Where he before fed all cows in his herd the same ration, without regard to results, the test enables him to detect the physiological peculiarities of the different animals, and to provide a ration, both in kind and quantity adapted to their individual requirements. We do not mean by this that he can increase the amount of fat in a given quantity of milk by the quality or amount of feed given the cow, but the quality of milk produced by each animal being determined by the test, he will know to what cows expensive feeds can be fed with a profit, and what ones will not warrant such feeding. To illustrate: If it is shown by the test that a certain cow is producing milk, right along, that contains from four and one-half to five per cent of fat, the farmer will know that it will pay to feed that cow, up to the limit of her capacity, on feeds rich in milk-producing elements, because the quality of her milk will warrant him in doing so. If, on the other hand, the test shows her to be giving milk containing only three and one-half per cent, or less, of fat, it will not always be advisable to feed her large quantities of high-priced feeds; as the money-producing content of her milk will not pay for the increased outlay. In this regard, the farmer who uses the test, and is guided by the lessons it teaches, has an immeasurable advantage over the one who never employs it. He has an accurate knowledge of the existence of certain conditions, which the other, at best, can only guess at. He not only knows to a certainty what ones are his best cows, but he is enabled to tell just how much better one is than another, and by intelligent experiment, can learn just how much, and what kinds of feed to

give each cow to secure from her the most profitable returns.

What useful knowledge this is for the dairyman to have, and how important it is to the welfare of his business that he possess it. It removes the veil of uncertainty from every detail in milk production, and enables him to be guided, at all times, by facts and conditions, of the existence of which there is no doubt. Then, if the

The Ideal Babcock Tester. The Creamery Package Mfg. Co., Chicago, Ill.

farmer would know the value of his cows he must test them. If he would know whether they are a source of profit or of loss to him, he must test them. If he would know the secret of economical feeding, he must test them. If he would be a wide-awake, successful dairy farmer, he must learn the secrets of the business, revealed only by the constant use of the Babcock test.

The farmer who tests his cows is in a better position to know the physical condition of his stock, as regards healthfulness, than is the one who does not. The test is sensitive to very slight changes in the physical condition of stock. If a cow is feverish, she will usually show an abnormally high test. If exposed to severe cold the test will be low. If roughly handled or unduly excited, the unfavorable results will always be recorded by the test.

Therefore, if a cow that is receiving good care, and regular and proper feed, is found to vary frequently in her test, it is a pretty sure indication that something is wrong with her. It indicates that she is not in a healthy condition, and needs the services of a competent veterinarian. The test may thus reveal the presence of physical complications in their incipient stage, that would not otherwise be detected.

Another benefit arising from the use of the test by the farmer is, he is not wholly dependent upon the creamery

Standard Babcock Tester. Turbine style. The Sharples Co., Chicago.

proprietor for a knowledge of what his cows are doing. Nearly all creameries now pay for milk on a butter fat basis; the farmer receiving pay in proportion to the fat his milk contains. It is wise for the farmer to know of himself how much this is. We do not wish to infer by these statements that creamerymen are dishonest; for as a general thing we do not believe they are. It must be admitted, however, it is unwise and impractical to entrust knowledge of the most important feature of a man's business to another, while he, himself remains in absolute ignorance of it. Unpleasant complications are often avoided by the farmer keeping a record of what his cows are doing, by testing them himself. The creameryman may be strictly honest in his dealings with a patron, yet the

latter may think his cows are testing too low. Such a condition is apt to breed suspicion and discontent, which would not exist, was the patron testing his cows at home. As a general thing creamerymen prefer to have their patrons test their herds; as by so doing a prolific source of dissatisfaction is removed.

Another advantage in taking tests at home is, it enables the farmer to early determine the

VALUE OF YOUNG STOCK.

Young heifers should be watched closely the first season they give milk. The older cow that has been tried and proven, may not need as close attention; but the young animal should be tested often, and the character of the work she is doing carefully noted. Remember that she is only partially developed, and in order that her best qualities may be brought into full vigor, careful feeding and handling are necessary. Frequent tests will show the effects of such feeding and care. If she possesses the true dairy instinct, and is properly handled, the test will show a gradual improvement in the quality of her milk. It may also suggest to the careful farmer changes in the ration given her. Remember the young heifer is an untried proposition; an unsolved problem of cause and effect. The feed and care given her are causes that should produce certain desirable effects. The test shows whether or not these effects are realized.

LABOR IN TESTING.

Some farmers may say, "all this testing and record keeping involves too much labor, and we have not the time to devote to it without neglecting other work on the farm." True, it takes time, some labor, and a good deal of intelligent thought and judgment; but for what purpose are you dairying? Is it for profit, or do you view it as a

mere incident in farm life, secondary to every other duty that life involves, and entitled to no time or attention that can be otherwise employed? If this is all the importance a farmer attaches to the dairy branch of his farm labors, it is surely of minor consideration how little time he devotes to it, or how soon he abandons it altogether. On the other hand, if he wishes to make dairying profitable, he must devote to it the time and attention necessary for the accomplishment of this purpose. Any labor necessary to a right understanding of his business, cannot be withheld from it without injurious effects. The importance of every detail must be fully recognized, and given proper attention.

MAKING TEST ON THE FARM.

In making tests on the farm the first thing necessary is the test machine. This may vary in size, according to the number of cows in the herd to be tested. A machine holding from ten to fifteen bottles is large enough for a herd of from twenty to forty cows. If the farmer desires to test each of his cows but once a month, a small machine will answer his purpose, as he can divide his herd into groups, testing one group each week, or as often as necessary to test all the cows during the month. The cost of such a machine is not great, perhaps from eight to ten dollars; a very small outlay when the benefits resulting from its use are considered. Though a description of the methods employed in making the test have been published many times, the fact remains that not one farmer out of ten knows how it is done, for the reason that they have never given the matter any attention. Therefore, as this book is especially intended for the dairy farmer, we will endeavor to give in detail the manner of making the test.

DESCRIPTION OF THE MACHINE.

The gear of the machine is so proportioned that the wheel that carries the test bottles makes about ten revolutions to one of the crank; with this it is easy to impart from seven hundred to eight hundred revolutions per minute to the horizontal. Within the horizontal wheel are placed holders made from heavy sheet copper, to which are soldered cups or tubes, inclined so as to make an angle of about thirty degrees with the horizontal, for the support of the test bottles. The horizontal is surrounded with a copper jacket with a cover. This serves the double purpose of supplying heat for the test, by pouring hot water into it, and of arresting the hot acid should a bottle break while the machine is in motion. Of course the details of construction differ in different machines, but the general plan is the same.

TEST BOTTLES.

These should contain up to the neck, not less than forty nor more than fifty cubic centimeters. Each division of the graduated scale, upon the neck of the bottle, represents .04 of a cubic centimeter, and in order to facilitate the reading, the neck is made of such a diameter that the marks of the scale are about one and one-half millimeters apart. Five of these divisions representing one per cent.

The pipette for measuring milk may be of any form, but one with a rather wide opening at the lower end, to allow the milk to run out rapidly, is to be preferred. It should contain, when filled to the mark, 17.6 cubic centimeters.

The best measure for acid is a graduate or cylinder made of glass, with a lip to pour from, and a single mark at 17.5 cubic centimeters; the quantity of acid required to be put into each test bottle. Commercial

sulphuric acid having a specific gravity of 1.82, or about ninety per cent pure is used in making the test.

SAMPLING THE MILK.

Every precaution should be taken to have the sample represent, as nearly as possible, the whole lot of milk from which it is taken. Milk fresh from the cow, while still warm, and before the cream is separated in a layer, may be thoroughly mixed by pouring three or four times from one vessel to another. Samples taken at once from milk mixed in this way are the most satisfactory. Milk that has stood until a layer of cream has formed should be poured more times, or until the cream is thoroughly broken up and the whole appears homogeneous. No clots of cream should appear upon the surface when the milk is left quiet for a moment. With proper care any milk that has not coagulated, or that has not been exposed to the air until the surface of the cream has become dried, may be mixed so that a representative sample may be taken. Milk should not be poured more times than is necessary; as continual mixing in this way is liable to churn the cream, forming little granules of butter that quickly rise to the surface. When this occurs it is impossible to obtain a fair sample.

It is impractical to sample a large amount of sour milk; but a small sample, of a pint or a quart, may be thoroughly mixed by adding five per cent of ammonia water, which will dissolve the curd and permit a uniform mixture being made. When ammonia is added the final result should be increased five per cent. Samples from milk that has become coagulated are, however, never as satisfactory as those taken when the milk is in proper condition.

MEASURING THE MILK.

When the milk has been sufficiently mixed, the

pipette is filled by placing the lower end in the milk and sucking at the upper end until the milk rises above the mark on the stem. Then remove the pipette from the mouth, and quickly close the tube at the upper end, by pressing the end of the index finger upon it to prevent access of air; so long as this is done the milk cannot flow from the pipette. Holding the pipette in a perpendicular position, with the mark on the level with the eye, carefully relieve the pressure on the finger, so as to admit air slowly to the space above the milk. When the upper surface of the milk coincides with the mark upon the stem, the pressure should be renewed to stop the flow of milk. Next place the point of the pipette in the mouth of one of the test bottles and remove the finger, allowing the milk to flow into the bottle. The test bottle should be held in a slightly inclined position so that the milk will flow down the side of the tube, leaving a space for the air to escape without clogging the neck. After waiting a short time for the pipette to drain, blow in the upper end to expel the milk held by capillary attraction in the point. If the pipette is not dry when used, it should be filled with the milk to be tested and this thrown away before taking the test sample. If several samples of the same milk are taken for comparison, the milk should be poured once from one vessel to another after each sample is measured. Neglect of this precaution may make a perceptible difference in the results, through the separation of cream, especially when the milk examined is rich. Persons who have had no experience in the use of a pipette will do well to practice a short time, by measuring water into a test bottle before attempting to make an analysis. The manipulation is easily acquired, and, with a little practice, milk may be measured nearly as rapidly with a pipette as with a graduate, and with much greater accuracy.

ADDING THE ACID.

When the milk has been measured into the test bottle the necessary amount of sulphuric acid may be added immediately, or the bottles may be left for a considerable time without materially changing the result. Samples that have remained in the test bottles more than a week have given the same amount of fat as those tested immediately after being measured. If the milk has become coagulated, the curd should be broken up, by shaking the test bottle before the acid is added.

The volume of commercial sulphuric acid required for a test is approximately the same as that of the milk, 17.5 cubic centimeters for the ordinary test. If too little acid is added the casein is not all held in solution throughout the test, and an imperfect separation of the fat results. On the other hand, if too much acid is used, the fat itself is attacked. The acid need not be measured with great accuracy, any quantity between seventeen and eighteen cubic centimeters will answer the purpose. This can usually be determined by observation. If the fat in the tube contains white specks the acid is either too weak or too little has been added; if black specks appear the acid is either too strong or too much has been added. The volume of fat when the test has been properly made, is perfectly clear.

Care must be taken in handling the acid, to avoid getting any of it upon the skin or clothing, as it is very corrosive. If by accident any is spilled upon the hands or clothes, it should be washed off immediately. A prompt application of ammonia water to clothing upon which acid is spilled, may prevent the destruction of the fabric and restore the color.

When all the samples of the milk to be tested are measured, ready for the test, the acid measure is filled to

the 17.5 cubic centimeter mark with sulphuric acid, and from this it is carefully poured into a test bottle containing milk. The test bottle should be held in a slightly inclined position while the acid is being poured into it, for reasons given in directions for measuring milk. The acid being much heavier than milk, sinks directly to the bottom of the test bottle without mixing with the milk which floats upon it. The acid and milk should be thoroughly mixed together by gently shaking the test bottle with a rotary motion. At first there is a precipitation of curd from the milk, but this rapidly dissolves. There is a large amount of heat evolved by the chemical action of the acid upon the milk, and the solution, at first nearly colorless, soon changes to a very dark brown. This change of color is caused by the charring of the milk sugar and, perhaps, some other constituents of the milk. Upon standing a short time the fat begins to collect upon the surface, not in a clear layer, but having at first the appearance of a dirty cream. The separation of fat by gravity alone is not complete, even when the bottles are left standing for several hours; with the centrifuge, however, a perfect separation is accomplished in a few minutes.

WHIRLING THE BOTTLES.

The test bottles containing the mixture of milk and acid may be placed in the machine directly after the acid is added, or they may stand several hours without harm. An even number of bottles should be whirled at the same time, and they should be placed in the wheel opposite to each other, so that the equilibrium of the machine will not be disturbed. When all of the test bottles are placed in the apparatus the cover is put upon the copper jacket, and the machine is turned at such a rate that the wheel carrying the bottles will make from six hundred to eight hundred revolutions per minute; this

motion being sustained for at least five minutes. If the wheel is less than twenty inches in diameter the speed should be proportionately increased, or the whirling should be continued for a longer time. When the bottles are placed in the machine directly after the acid is added, the separation may be effected without any extra heat; as that caused by chemical action is sufficient to keep the fat liquid. If the bottles have stood after the acid is added until the contents are cooled below one hundred degrees, boiling water should be poured into the jacket before putting the bottles into the machine. The proper degree of heat may also be obtained by setting the bottles for a time, in water heated to nearly the boiling point before putting them in the machine. If the machine is stopped after about five minutes a layer of fat will be found upon the upper surface of the liquid in the tube. This fat will not usually be clear; this, however, will make no difference in the result, as the subsequent treatment will clarify it.

As soon as the bottles have been sufficiently whirled they should be filled to the neck with hot water. This may be done with a pipette, but a more convenient method is to place a vessel, containing boiling water, above the machine, and by means of a syphon made from a small rubber tube, run the water directly into the bottles without removing them from the wheel. The syphon should be provided with a glass tip and also with a pinch-cock with which to control the flow of water. If only a few tests are to be made, however, the use of the pipette will be found sufficiently convenient. After putting in the water the cover should be replaced, and the machine turned for one or two minutes, when more hot water is added, filling the tube to about the seven per cent mark, when the machine should be turned again for a short time. During this process the fat will slowly rise into the graduated tube, losing its cloudy

appearance as it passes through the water. While this work is being accomplished the water in the machine should be kept hot. If the fat in some of the tubes still has a cloudy appearance after completing the turning, the cover should be replaced upon the machine and heat applied for a few minutes, when the fat should become clear and in condition to be measured. When the bottles are allowed to cool to a point where the fat will crystalize, and then warmed again the fat will usually be much clearer than before, but as this does not materially change the volume of fat, it is considered unnecessary.

MEASURING THE FAT.

The fat, when measured, should be warm enough to flow readily, so that the line between the acid liquid and the column of fat will quickly assume a horizontal position when the bottles are removed from the machine. Any temperature between one hundred and ten and one hundred and fifty degrees will answer; but the higher temperature is to be preferred. The slight difference in the volume of fat due to this difference in temperature is not sufficient to materially affect results; as a difference of forty degrees has been found to make less than .1 per cent difference in milk containing five per cent of fat.

To measure the fat, take a bottle from its socket, and holding it in a perpendicular position, with the scale on a level with the eye, observe the divisions which mark the highest and lowest limits of the fat. The difference between these divisions is the per cent of fat. The reading can easily be taken to half divisions or to one-tenth of one per cent. If the column of fat is less than one division, as will sometimes happen with skim milk, buttermilk or whey, it may assume a globular form instead of of a uniform layer across the tube. When this occurs, the fat can usually be estimated with sufficient accuracy by simple inspection.

If, however, an accurate reading is desired, a special test bottle should be used holding three or four times as much as the ordinary bottle; or a test bottle of the ordinary size, having a tube of less diameter, so graduated that hundredths of one per cent may be read. One or the other of these bottles should always be used when testing skim milk, buttermilk or whey.

TESTING CREAM.

The chief difficulty in testing cream lies in the sampling. Cream that is sour, or that has been exposed to the air until the surface has dried, cannot be accurately sampled. The same is true of cream from the separator that is badly frothed. The latter should be allowed to stand for a time, or until the froth has gathered on the surface, when a more satisfactory sample may be procured. Sweet cream that is not frothy, nor too thick to flow readily from the pipette, may be tested with very accurate results. The process, however, must be modified slightly from that used with milk; as the amount of fat in cream is so large that it cannot be measured in the ordinary test bottle, if the usual quantity is taken for the test. A much greater error also results from the cream which adheres to the pipette, than does when milk is tested. Both of these difficulties may be overcome by taking three test bottles, and dividing the test sample into three equal parts, as nearly as can be judged by the eye. The pipette is then twice filled with water and run into the tubes, in the same way as the cream. This serves to rinse the cream from the pipette, and at the same time, to dilute it to a point where it can be tested in the same way as milk. The bottles are then treated in the usual manner, and the reading of the tubes added together to ascertain the per cent of fat in the cream. For example: If the reading on the first bottle is ten per cent; on the second bottle nine and five-tenths

per cent, and on the third eleven and two-tenths per cent, the per cent of fat in the cream from which the sample was taken is thirty and seven-tenths per cent.

Owing to the low specific gravity of cream, the test sample, if of the same volume, will weigh less than that of milk; consequently the per cent of fat as shown by the scale will be less than is found by gravimetric analysis; if, however, 17.6 cubic centimeters of cream is taken, and the portion adhering to the pipette is rinsed into the test bottle, a close approximation of the true result may be obtained without weighing by correcting the scale reading as follows: "For a scale reading of twenty per cent add twenty-five per cent; for a scale reading of fifteen per cent, add 0.1 per cent. Readings between these may be corrected in proportion. Below ten per cent no correction is necessary.

HOW TO TEST A COW.

In testing a cow always take a sample of both the morning's and night's milk, as there is usually quite a difference in the per cent of fat they contain. To do this, either of two methods may be employed. A half-sized pipette may be used taking a sample from the morning's milk, which is poured at once into a test bottle and set away until evening; then another sample is taken in the same manner, from the night's milk and added to the milk in the bottle, when the test may be made in the usual way. If the farmer does not have a half-sized pipette he may take a sample of the morning's, milk say half an ounce, and pour it into a pint Mason fruit jar, covering the jar tightly to prevent evaporation. This is set aside until evening, when a half ounce sample from the night's milk is added to it. Mix well together by gently stirring the milk, fill the pipette to the 17.6 cubic centimeter mark, pour it into the test bottle and proceed to make the test as usual.

In testing a cow to ascertain whether the per cent

of fat in her milk is increasing or diminishing, care must be taken that the same methods are employed and the same conditions are observed in taking each test; otherwise the variations noted may be due to a change in the manner of testing rather than to a difference in the fat content of her milk. Be sure that the temperature of the milk at the time the test is made, is the same in each instance, and also, that the samples have been taken in the same way.

THE COMPOSITE TEST.

A composite test is one made from a mixture of several samples taken at different times from the milk of a single cow, or of a herd. It is considered by many to be more satisfactory than a single day test. As it covers a longer period of time, it is more likely to contain samples of the cow's milk, taken when different physical conditions are present, and a test made from it represents more nearly the actual work she is doing. When a composite test is to be made, the farmer should provide himself with a number of one pint Mason fruit jars, and a rack or shelf suitable for holding them. Place on each jar the name or number of a cow to be tested. From each milking, say for a period of one week, take a sample of each cow's milk and put it into the jar assigned to her, covering the jar after the addition of each sample, to prevent evaporation. Care must be taken that each sample contains the same volume of milk. To insure this have your tinner make you a small dipper holding about one-half ounce, with the opening at the top of the cup at right angles with the handle. This will enable you to dip straight down into a pail or can of milk and draw your sample from any part of the vessel. Before the test is taken the milk should be warmed to about one hundred degrees, by setting the jars in hot water. If the milk is

sour, add ammonia as before directed. Coagulation can be prevented by putting into each jar before the samples are collected a small quantity (about what will lay on the end of the blade of a pocket knife) of the yellow bichromate of potassium. As this is a deadly poison great care should be taken in using it. A safer and equally as satisfactory composite test preservative is the corrosive sublimate tablets which can be purchased of any dealer in dairy supplies. Lewis lye is sometimes used to cut coagulated samples of milk and make it fit for testing; in this case it is not necessary to use any kind of a preservative.

Before testing, stir the contents of each jar thoroughly making sure that all particles of curd are dissolved and the cream well mixed with the milk; after which fill the pipette and proceed to take the test in the usual way. Sulphuric acid used for testing should not be left standing in an open vessel for any length of time, as it rapidly loses its strength if exposed to the air. The strength of the acid can be readily determined by observation. If when mixed with the milk in the test bottle the color is light, instead of a very dark brown, it indicates that the acid used is too weak, and a reliable test will not result. If, on the other hand, the fat in the tube after the test is taken contains numerous black specks, it indicates that the acid used is too strong and has charred or burned a portion of the sugar. Either of these defects can be corrected by using a greater or less quantity of acid as the case requires.

HEAT REQUIRED IN TESTING.

Reference has already been made to the degree of heat required in making a test. This may lead some to believe that the greater the heat generated in the test machine the more accurate the test. This is a mistake. Too great a heat causes the fat to expand in the tube of the test bottle

and renders the reading too high. The error this occasions varies in amount according to the richness of the milk or cream tested. Prof. Woll, of the Wisconsin Experiment station estimates that if the readings in hot turbine testers are taken at a temperature of two hundred degrees, the fat column will have expanded so as to fill a space that is .16 per cent too high in testing five per cent milks and .11 per cent too high in testing three per cent milk. Readings made at this high temperature in cream testing, present a much greater error than they do in milk.

The following comparisons are given to show the difference in tests made by hand testers and turbine testers in which the heat generated was about two hundred degrees. Cream that tested 22.85 per cent in the turbine tester showed but 21.8 per cent in the hand tester; cream showing 23.04 per cent in the turbine tester showed but 22.36 per cent in the hand tester; cream testing 36.10 per cent in the turbine machine showed 34.30 per cent in the hand tester. These samples were not measured with the pipette but the weight of the cream was accurately determined by gravimetric analysis. It is estimated therefore, that cream tests read at a temperature of two hundred degrees, are .80 per cent too high for twenty-five per cent cream, .96 per cent for a thirty per cent cream, and 1.12 per cent for thirty-five per cent cream.

In testing milk or cream in creameries where turbine machines are used, due allowance should be made for this expansion of the fat column, or the reading should be deferred until the bottles have cooled to a temperature of about one hundred and forty degrees, or until they can be held in the hand.

The amount of fat in any quantity of milk, from one to five thousand pounds, can be readily ascertained by consulting the following tables. In the left hand column is

given the pounds of milk. Over each column to the right is given the per cent of fat represented by the amounts recorded in that column. For example, during the month of March a cow gave 1080 pounds of milk, showing an average test of 3.60 per cent. How many pounds of fat did her milk contain?

Find 1000 pounds in the left hand column, then move the finger to the right to column 13, which represents 3.60 per cent; and you find the amount of fat to be 36 pounds. In like manner go to the right from 80 pounds to column 13 and you will find the amount of fat to be 2.90 pounds; which added to 36 pounds gives 38.90 pounds, the amount of fat in 1080 pounds of milk testing 3.60 per cent.

$$36 + 2.90 = 38.90.$$

EXAMPLE.

Find the amount of fat in 7000 pounds of milk testing four per cent.

From 5000 pounds, found in the left-hand column, move to the right to column 21 and you find 200 pounds. From 2000 pounds move to the right to column 21, and you find 80 pounds, which added to 200 pounds gives 280 pounds; the amount of fat in 7000 pounds of milk testing four per cent.

To find the number of pounds of commercial butter in a given amount of fat, add one-sixth of itself to the amount of fat to cover the churn over-run, and the result will very nearly represent the actual butter yield.

EXAMPLE.

How many pounds of commercial butter in 42 pounds of fat?

Divide 42 pounds by 6, and it gives you 7 pounds, which added to 42 pounds, gives 49 pounds. The estimated amount of commercial butter in 42 pounds of fat.

Pounds of fat in milk from 1 to 5000 pounds of milk testing from 3 to 5 per cent.

[illegible]

Pounds of fat in milk from 1 to 5000 pounds of milk testing from 3 to 5 per cent.

	25	26	27	28	29	30	31	32	33	34	35	36	
TEST.	4.20	4.25	4.30	4.35	4.40	4.45	4.50	4.55	4.60	4.65	4.70	4.75	TEST.
5,000	210	213	215	218	220	223	225	228	230	233	235	238	5,000
4,000	168	170	172	174	176	178	180	182	184	186	188	190	4,000
3,000	126	128	129	131	132	134	135	137	138	140	141	143	3,000
2,000	84.0	85.0	86.0	87.0	88.0	89.0	90.0	91.0	92.0	93.0	94.0	95.0	2,000
1,000	42.0	42.5	43.0	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5	1,000
900	37.8	38.3	38.7	39.2	39.6	40.1	40.5	41.0	41.4	41.8	42.3	42.8	900
800	33.6	34.0	34.4	34.8	35.2	35.6	36.0	36.4	36.8	37.2	37.6	38.0	800
700	29.4	29.8	30.1	30.5	30.8	31.2	31.5	31.9	32.2	32.6	32.9	33.3	700
600	25.2	25.5	25.8	26.1	26.4	26.7	27.0	27.3	27.6	27.9	28.2	28.5	600
500	21.0	21.3	21.5	21.8	22.0	22.3	22.5	22.8	23.0	23.3	23.5	23.8	500
400	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.4	18.6	18.8	19.0	400
300	12.6	12.8	12.9	13.1	13.2	13.4	13.5	13.7	13.8	14.0	14.1	14.3	300
200	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	200
100	4.2	4.3	4.3	4.4	4.4	4.5	4.5	4.6	4.6	4.7	4.7	4.8	100
90	3.8	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	4.2	4.2	4.3	90
80	3.4	3.4	3.4	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.8	3.8	80
70	2.9	3.0	3.0	3.0	3.1	3.1	3.2	3.2	3.2	3.3	3.3	3.3	70
60	2.5	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8	2.9	60
50	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.4	2.4	50
40	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9	40
30	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	30
20	.8	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	1.0	20
10	.4	.4	.4	.4	.4	.4	.5	.5	.5	.5	.5	.5	10
....													
9	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	9
8	.3	.3	.3	.3	.4	.4	.4	.4	.4	.4	.4	.4	8
7	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	7
6	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	6
5	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	5
4	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	4
3	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	3
2	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	2
1	—	—	—	—	—	—	—	—	—	—	—	—	1

Pounds of fat in milk from 1 to 5,000 pounds of milk testing from 3 to 5 per cent,

	37	38	39	40	41
TRIST.	4.80	4.85	4.90	4.95	5.00
5,000	.240	.243	.245	.248	.250
4,000	.192	.194	.196	.198	.200
3,000	.144	.146	.147	.149	.150
2,000	96.0	97.0	98.0	99.0	100
1,000	48.0	48.5	49.0	49.5	50.0
900	43.2	43.7	44.1	44.6	45.0
800	38.4	38.8	39.2	39.6	40.0
700	33.6	34.0	34.3	34.7	35.0
600	28.8	29.1	29.4	29.7	30.0
500	24.0	24.3	24.5	24.8	25.0
400	19.2	19.4	19.6	19.8	20.0
300	14.4	14.6	14.7	14.9	15.0
200	9.6	9.7	9.8	9.9	10.0
100	4.8	4.9	4.9	5.0	5.0
90	4.3	4.4	4.4	4.5	4.5
80	3.8	3.9	3.9	4.0	4.0
70	3.4	3.4	3.4	3.5	3.5
60	2.9	2.9	2.9	3.0	3.0
50	2.4	2.4	2.5	2.5	2.5
40	1.9	1.9	2.0	2.0	2.0
30	1.4	1.5	1.5	1.5	1.5
20	1.0	1.0	1.0	1.0	1.0
10	.5	.5	.5	.5	.5
9	.4	.4	.4	.4	.5
8	.4	.4	.4	.4	.4
7	.3	.3	.3	.3	.4
6	.3	.3	.3	.3	.3
5	.2	.2	.2	.2	.3
4	.2	.2	.2	.2	.2
3	.1	.1	.1	.1	.2
2	.1	.1	.1	.1	.1
1	—	—	—	—	.1

Chapter 5.

Care of Milk.

The necessity of properly caring for milk is recognized by every practical dairyman. It is a factor equal in importance with selection and feeding. A dairyman's cows may be the best that wise selection can procure, and the methods he employs in handling and feeding them, above criticism, yet if the necessary precautions in caring for his milk are neglected, he may lose all the advantages these conditions bring to him.

Pure milk is absolutely essential to the production of high grade dairy products. Butter and cheese that will pass may be made from milk of questionable purity; but the goods that meet with the highest favor and bring the best prices on the market must be manufactured from pure milk. Then, to insure the best results obtainable, great care in handling the milk is necessary. The first lesson for the farmer to know is, what constitutes good care? To understand this question fully he must know what conditions to avoid and what to accept. This of necessity involves some little knowledge of cause and effect; you may call it scientific information if you please,

It is one thing to know that certain facts exist, and another to know *why* they exist. To know a thing is so, does not require so wide a range of information as it does to know *why* it is so. A great many people can recognize effects readily enough, who have no understanding whatever of causes. To possess a knowledge of cause and effect broadens the conception, and enables the individual to intelligently

and successfully work toward the end he wishes to attain. It has been wisely said that "a scientific explanation of an ascertained truth enlarges the basis of its application, and allows the investigator as well as the practical worker to approach his work in a much more satisfactory way." No business calls for a wider range of knowledge of effects and their causes, than does the dairy industry. If one link in a chain is defective the strength of the whole is impaired. So if the importance of a single detail of the dairymen's work is misunderstood it may lead to unprofitable results. He will learn to know effects from experience; but a knowledge of causes can only be acquired by careful investigation. Then in the case of milk it is not enough for the dairyman to know that certain conditions exist, but he should learn *why* they exist. If he is making butter on the farm he finds it difficult to get as good an article at one time as he does at another; as without any perceptible change in the condition of his stock, or the methods employed in feeding or handling them, his milk suddenly becomes bad; and if taken to the factory it is found to be sour or tainted. It is easy enough for him to see the effects, but what he wants to know most is, what are the causes and how can they be removed? Had he a knowledge of why milk becomes sour or why it is tainted, stringy, etc., the causes might readily be detected and their influence destroyed.

GERMS IN MILK.

Scientific research has established beyond question that all the varied conditions of milk are due to the presence in it of bacterial life. Every housewife knows that if she boils the milk the length of time it remains sweet is prolonged. Why is this? Simply the germs that cause milk to turn sour have been greatly diminished by the effect of heat, and it takes a longer time for the remaining germs to multiply in sufficient numbers to produce a sour condition. Cooling

milk to a low temperature will keep it sweet a greater length of time, not because the germs it contains have been destroyed by the cooling, but their development has been retarded; hence the length of time the milk will remain sweet has been increased in like proportion. Cooling milk, say to a temperature of forty-five or fifty degrees, does not destroy the bacterial life it contains, but it partially suspends its development. On the other hand, if milk is sterilized or boiled for a sufficient length of time, the germs it contains can be totally destroyed. Cooling milk to any degree above freezing does not injure it for any purpose for which it may be used; therefore it is always safe and beneficial to cool milk to a low temperature. We cannot, however, sterilize milk without impairing or destroying its usefulness for many purposes; consequently this method of preserving milk is not practical on the farm. It is wise though for the farmer to sterilize the skim milk fed to calves, as neither its palatableness or feed value are impaired by the process; and it will remain sweet for a much longer time. While it is useful to know how to retard the development of many forms of bacterial life in milk, it is not nearly so important as it is to learn how to prevent their presence. Scientists tell us that milk in the udder of a healthy cow is free from germ life. It follows, therefore, that the milk is inoculated with these organisms after or during the process of drawing it from the udder. It is of paramount importance, then, that the dairyman familiarize himself with the causes of contamination, that he may successfully combat them.

CLEANLINESS.

Every dairyman knows, or should know, that cleanliness is a cardinal factor in the milk business. He may realize this, however, and yet fail to give to it the importance it merits. Conditions, as they are found to exist by an

inspection of the different dairies in a community, prove beyond question that all dairymen do not attach the same degree of importance to this subject. One dairy and its surroundings will be found to be the embodiment of neatness and order, while another will convey the impression that the word cleanliness cannot be found in that dairyman's vocabulary. The accumulation of dirt in the cowbarn, on the bodies of the cows, or in the place where milk is kept, are all prolific sources of infection. Another, and perhaps the most fruitful source of germ production, is the use of improperly cleaned milk cans and pails. A professor in one of our dairy schools says: "While vessels in which milk is received and is stored, may be clean so far as the visible dirt is concerned, by far the greater majority of dairymen do not clean their dairy utensils so that the bacterial germs are entirely gotten rid of. Consequently, when milk is milked into such pails, the germ life that adheres to the walls and is inclosed in the cracks and joints of the pail find in this warm, rich, nutritive food medium the very best conditions for growth.

HOW TO CLEAN CANS.

The cans, pails, dippers, in short every utensil that comes in contact with the milk, should not only be thoroughly washed, but they should be immersed in boiling water for several minutes. The seams and joints in all utensils used should be filled with solder plumb with the surface of the vessel, as these small receptacles form excellent breeding places for all kinds of germs.

To many these precautions may seem unnecessary, but they are not; for analysis has shown that milk put into cans that have been treated in this manner, contains a much smaller number of bacteria per cubic centimeter than does milk from the same lot put into cans washed in the usual

way: and it will remain sweet from six to twelve hours longer. In many communities the same cans in which milk is taken to the factory are used in carrying home sour milk and whey. While this is a custom that should not be encouraged, it cannot always be avoided; but when practiced it is doubly important that the cans should be thoroughly boiled before they are again used for milk. Milk is often taken to the factory in cans covered with a green coating inside of the neck and along the seams; such cans are alive with destructive organisms; and to have them in such a condition shows unpardonable neglect. Milk put into such a receptacle cannot retain its purity for a single moment; besides, its mixing at the factory with other milk is sure to infect the whole lot, often resulting in much inconvenience and pecuniary loss.

Where the cans are taken home empty, it is advisable to wash them at the factory where steam can be used in sterilizing them. It should not be necessary for the creamery management to employ an extra man to do this work; a wash box and steam jet can be provided, and the farmers permitted to wash their own cans. When this is done, the cans should be closely covered with a canvass to keep out the dirt while returning from the factory.

It is wise to adopt this system when it is possible to do so, as it insures a uniform method of cleaning all the cans in which milk is brought to the factory. A little tact may be necessary on the part of the creamery foreman in seeing that the work is rightly done; but the improved condition of the milk he receives will amply repay him for any extra labor this may occasion.

Pails made of wood should never be used in which to hold milk, as it is impossible to keep them clean and pure. Always use a galvanized or tin pail, and observe the same care in keeping it clean that you do with the cans. When

pouring milk from the pails into the cans run it through a metal gauze and cloth strainer. The milk should not be allowed to stand in the barn or cow stable for any length of time. While it is true that milk will not be affected by odors so long as its temperature is higher than that of the surrounding atmosphere, the same is not true of germs. Therefore it is necessary to remove the milk at once to a place where the atmosphere is pure and the surroundings clean and free from flying dust.

AVOID DUST.

Dust and bacterial life are inseparably connected. Therefore dusty or mouldy hay or straw should never be used in bedding cows; neither should dirt be allowed to accumulate in or about the stables, as it furnishes a breeding place for all sorts of germs. When disturbed this dirt floats in the air in the form of dust, which settles into the milk cans and pails carrying innumerable germs with it. To note how thoroughly impregnated is the air with dust, even when special care has been taken to have all the surroundings clean and pure, it is but necessary to stand at right angles with a ray of sunlight as it streams through a crack or a crevice, and notice the innumerable minute particles of dust as they float through the ray of light. When we consider that each of these atoms is the abiding place of numerous organisms, we are impressed by a more thorough realization of the difficulties that stand in the way of complete immunity from germ infection. This knowledge emphasizes the necessity for taking every precaution within our power that we may reduce to a minimum the presence of germ life. As dust-particles are the transporting mediums of all kinds of germs, it reasonably follows that whatever tends to free the air from dust, reduces in like proportion the dangers from bacterial infection. A proper appreciation of the unfavorable

conditions attributable to the presence of germ life in milk, will prompt the thrifty dairyman to keep his cow barn as free from dust as possible. A damp surface is one of the most effectual preventives. If in summer the cows are only stabled during milking hours night and morning, it is wise to wet down the stable floor with a hose or sprinkler before turning the cows in. It may be difficult to do this during the season when the cows are kept constantly in the barn, but then the ceiling, walls and floor should be swept often with the broom, and an occasional coat of whitewash should be given to the walls. The manure should never be piled close to the barn, but should be drawn at once onto the land or deposited a considerable distance from the stable. The cows should not be fed hay or be bedded just previous to milking, as this tends to create a dust in the air. Neither should they be milked immediately after being put into the barn, as their tramping on the floor causes a great deal of dust to rise. In short, whatever tends to impregnate the air with dust should be avoided as far as possible. We wish to impress upon the farmer's mind the fact that this is one of the most prolific sources of contamination. When he realizes this he knows a cause, and it is for him to employ such means for its removal as good judgment and circumstances may dictate.

KEEP THE COWS CLEAN.

Myriads of germs find a lodgement in the coat and on the skin of the cow. In wading through stagnant water or soft, marshy soil, the animal comes in contact with germs of all sorts, which find a lodgment in the coat, on the udder and on the under parts of the body. When the surface becomes dry the dirt is easily dislodged, and if the cow is milked while in this condition, germ-laden dirt is being constantly sifted into the milk. This can be corrected to a

considerable degree by washing the udder, the teats and flanks, before milking. It is well to dampen these parts, even when no dirt is visible; as by so doing the displacement of minute particles, always present in the coat and on the skin of the cow, will be avoided. It is erroneous to believe this precaution unnecessary because the strainer removes all particles of dirt. Remember germs are not a part of the dirt particles, but merely find a lodgement upon them. When these particles are deposited in the pail during the process of milking, the germs at once leave them to mingle and multiply in the more nutritive element, and no strainer can remove them. The only safe and sure way to avoid germ infection is to prevent as far as possible their getting into the milk. The real importance of preventing hairs and dust from the cow's body from getting into the milk is not generally realized by the farmer. Hence he is inclined to look upon the precautions recommended as visionary, and to attempt to put them into practice as so much time and labor thrown away. The result of the following experiments made by Prof. Russell of the Wisconsin experiment station, clearly demonstrates, however, that all these precautions are well worthy the farmer's most careful consideration. Prof. Russell says: "Experience has taught many dairymen that thoroughly washing the udder of the cow is of value in keeping the milk pure and clean. This process is to be thoroughly commended and the application of warm water to the udder and to the under parts and flanks of the cow, is a most effectual means of preventing the dislodgement of bacteria in the hair. We cannot prevent entirely the hairs from being rubbed off, but actual experiment shows that the number of germs may be greatly diminished. We have experimented on this point in order to determine just exactly what influence was to be noted when milk was received in these two ways. Covered glass dishes containing

a thin layer of gelatine, were exposed for sixty seconds underneath the cow during milking, and then protected so that the germs which were deposited on the moist surfaces developed into little patches that were visible to the eye. By actual count the number of germs was determined, and the result was as follows: Under a cow with a thoroughly washed udder and belly, five hundred germs per minute would fall into a ten-inch pail. Under ordinary conditions,

INKA, 6th

Three-year-old record, 72 pounds of milk a day; 20 pounds of butter in 7 days.

Four-year-old record, 15,197 pounds of milk in nine months.

Owned by S. N. Wright, Elgin, Ill.

the cultures revealed the presence of seventeen hundred per minute as deposited. Taking the average length of a milking as five minutes, there were in this instance two thousand eight hundred organisms introduced when precautionary measures were used, against eight thousand five hundred under ordinary conditions.

Of course this number is not constant and would vary greatly, depending on many conditions, but there can be no doubt but that the actual number of germs may be diminished from one-half to two-thirds by the exercise of this simple precaution."

GERMS IN THE FORE MILK.

However pains-taking a milker may be, it is impossible to extract all the milk from the udder; a small quantity is sure to be left in the lower part of the milk ducts. The danger of contamination from this source is clearly explained by Prof. Russell in the following paragraph:

"We have in the lower end of the milk duct a veritable incubator, in which the bacteria have the best possible conditions for growth. There is warmth, food and moisture, so that they increase greatly, and are in a rapidly developing condition at the time of the next milking. When the cow is next milked these bacterial masses are milked into the pail and consequently infect the whole milking. These forms being in a rapidly growing condition, on account of their excellent surroundings, are able to increase much faster than those germs which gain access in a resting or spore condition; such as those from hay or straw. The milking of the first few streams from the teat washes out a great majority of them."

This being true, it is not good policy to milk the first two or three streams into the pail into which the whole milk of the cow is to be drawn. To pursue this course will cause but little waste in the quantity of milk, and it will materially improve its quality.

COOLING MILK.

It has already been mentioned that cooling milk retards the development of bacterial life. The degree of temperature to which it is necessary to cool milk, depends very much upon when and for what purpose it is to be used. Milk for shipping usually requires a lower temperature than does milk that is taken to the creamery. The reason for this is obvious. Milk that is shipped is required to retain its quality until it is consumed, which may necessitate

its remaining sweet from sixty to seventy-two hours ; while milk delivered at the factory is usually made into cheese at once, or the cream is separated from it and is made into butter within twenty-four hours from the time the milk is drawn from the cow. In the former case it should be cooled to a temperature below the germinating point of the organisms it may contain. All bacterial forms that are introduced into milk, through the several mediums referred to in this chapter, excepting those in the fore milk, are in a state of suspended growth or the spore stage. If milk is cooled to a temperature of forty to forty-five degrees it is below the germinating point, and the development of the spore into living organisms is almost suspended; and if held at this low temperature, the milk will remain sweet for a considerable length of time. Of course in time it will become sour, even at this low temperature; as all the germs introduced at the time of milking are not held at the rest or spore stage until the cooling of the milk is affected, consequently their development will eventually produce a sour condition. In cooling milk for delivery at the creamery or cheese factory, a temperature of sixty degrees is usually found satisfactory, as germ development is sufficiently retarded at this temperature to admit of the milk being made into cheese or butter before any unfavorable conditions result.

To cool milk, the cans should be placed as soon as filled in a tank filled with fresh cold water, up to the necks of the cans. If possible, a continuous influx and outflow of water should be maintained until the required temperature is reached. Of course if as low a temperature as forty degrees is required, ice will have to be used; but for factory delivery water will answer every purpose.

The milk should be aerated while cooling, for the purpose of throwing off bad odors, and also to insure a uniform temperature of all the milk in the can. Care should

be taken in aerating milk that it be not stirred too roughly nor too long; as there is danger of churning the milk until small granules of butter are formed. This will not occur, however, if proper care is observed in performing the work.

A very convenient stirrer can be made by soldering a piece of heavy tin, about three inches in diameter, to the end of a three-sixteenth inch wire; soldering the wire to the center of the plate, and at right angles with it, after the manner of the old fashioned churn dasher. Cut the wire of sufficient length so that when standing on the bottom of the can it will extend about six inches above the top. Curve the upper end of the wire into a ring sufficiently large to admit two fingers, and you have an ideal stirrer. It is well to have a number of these stirrers; one for each can. When the milk is placed in the water tank drop the stirrers into the cans, when it will be found both easy and expeditious to pass from can to can, giving each a short agitation before proceeding to the next.

KEEP THE TANK CLEAN.

It is imperative that the tank in which the milk is cooled be kept clean. Never allow the water to stand in the tank after the milk has been removed from it. It takes water but a short time, especially in summer, to become stagnant and bad smelling. These offensive odors will enter the milk as soon as its temperature is the same, or falls below that of the surrounding atmosphere, detracting much from its purity.

Slime should not be allowed to collect on the sides and bottom of the tank. In emptying the tank a conveyor should be used that the water may be carried away a considerable distance. If the surroundings will permit its construction an underground drain is to be preferred. Stale

water should never be allowed to collect, nor sink into the ground near the cooling tank; as such conditions provide fertile fields for the germination of objectionable organisms.

A FEW DON'TS.

Don't think because the weather is cold in winter the milk will not require cooling; it should be given the same care that it receives during the hot season.

Don't leave your milk standing in the cow stable or horse barn in winter, believing that as the weather is cold it will do no harm. This is a mistake, as it will be sure to become infected with germs and foul odors if so left. The butter and cheese maker often has more difficulty with milk in winter than he does in the summer because of this practice on the part of his patrons.

Don't put the covers on your cans, neither in the winter nor the summer, until the milk is cooled to the required temperature; and not then unless you are going to take it at once to the factory.

Don't mix the night's and morning's milk until the latter has been thoroughly cooled. This is sometimes done to avoid the trouble and time necessary for cooling the morning's milk. Such a practice should never be followed. The experienced cheese and butter maker would much rather receive your milk without its being cooled at all than in this condition; as mixing milk in this manner often results in off-grade butter and cheese.

Don't leave the milk wagon canvas, nor the frock you wear while milking, in the cow stable or horse barn. When not in use, hang them in a place where the atmosphere is pure, that they may not become contaminated with germs and barn-yard odors to be subsequently conveyed to the milk.

Don't milk the cows after you have cleaned the stables, curried the horses or cleaned the horse barn, until you have washed your hands, cleaned your feet and brushed your clothes; as milk is often infected by germs conveyed from the person of the milker.

Don't put anything into the milk to keep it from souring, as any substance sufficiently powerful to retard germ development is necessarily injurious to health. Thorough aerating and cooling are the only preventives required. Always fill the cans to the neck, as this will prevent the milk from churning while being conveyed to the factory or station.

IMPORTANCE OF DIFFERENT FACTORS.

A brief reference to the relative importance of the several factors considered in this chapter may not be amiss.

First in importance is contamination from milk vessels. More milk is rendered impure from being handled and stored in unclean vessels than from any other cause. Hence the urgent necessity for thorough cleanliness in this regard cannot be too emphatically presented. This is a factor wholly under the control of the milk producer, consequently its unfavorable influence can and should be entirely removed. Farmers should recognize its importance by exercising the greatest care in the cleaning of all utensils that come in contact with the milk.

The second factor in importance, so far as its contaminating influence is concerned, is cleanliness in milking. This factor, like the first, is almost if not altogether under the control of the milker. Keep the udder and under part of the body of the cow clean and dampened when milking. Do the work with clean hands and in clean clothes, and all danger of infecting the milk is arrested or greatly minimized.

The third factor in importance is perhaps the germs in the fore milk. This condition is not wholly under the control of the milker, and consequently is more difficult to regulate. However, by rejecting a small quantity of the first milk drawn from the udder, the danger of contamination from this source is greatly lessened.

The remaining factors of dust and odors in the cow barn can be largely controlled if not wholly removed.

WILL IT PAY?

It will not be denied that to properly attend to all these details involves considerable labor and time. The question to determine then is, does it render the milk enough better to make up for this extra time? An affirmative answer can only be given in reply to this question. It not only pays, but if the best results obtainable in the manufacture of dairy products are realized, it becomes absolutely imperative.

Pure milk is as necessary to the production of high-grade dairy goods as is perfect seed to the bountiful growth of corn or clover. Like begets like is clearly exemplified in an analysis of milk and its products; hence the necessity of having pure milk.

High grade goods not only insure high prices but they create an increased demand. Then it logically follows that whatever contributes toward the establishment of these two conditions is beneficial to the producer. "But," says a dairyman, "What good does it accomplish for me to care for my milk while other patrons of the same factory are indifferent as to the condition of theirs?" At first thought it is admitted the benefits resulting appear remote, when these conditions exist, but in truth they are not. Do your own work well, then you have a right to insist that others associated with you in such a manner as to affect the benefits resulting from your endeavor, do the same. Nevertheless,

however this may be, the question might be asked with equal propriety; why should one man do right when so many do wrong? or, why should one conform to the rules of health when so many violate them? It is not so much a question of general results as it is one of individual achievement, and no loss was ever incurred from the right performance of any labor.

Chapter 6.

Buttermakers and Buttermaking.

Few if any industries have made such marked advancement, during the last twenty-five years, as butter-making. In fact butter production did not rise to the dignity of an industry that long ago. At that time it was a mere incident in farm life. The average farmer did not look for an increase of revenue from this source, consequently but little attention was given, either to the kind of cows kept on the farm, or the amount or quality of butter made. The chief object sought was to secure a sufficient quantity for home consumption, exchanging the surplus, if any, for commodities at the nearest grocery store. The result of these prevailing conditions was to throttle any desire for improvement. Few, if any, farmers cared to break away from the chaotic conditions with which they had become accustomed, and try to introduce new and improved methods in butter-making. As a result the same monotonous routine was carried out from year to year, and from generation to generation. The daughter made butter just as her mother and her grandmother made it, and was as jealous of the peculiar system she had inherited as she was of her religious faith. She did so and so because her mother did so; and any deviation from the maternal instructions would have been considered sacrilege. In consequence of this devotion to time-honored methods, the quality of butter produced was as varied as were the profiles of the makers. There was one point, however, on which there seemed to be a universal agreement; and that was a

total disregard for conditions. The chief object appeared to be to gather the cream in the least troublesome way possible, and at irregular intervals, churn it into butter. It would have seemed a grave departure from time-honored customs, to have postponed any other work to look after the butter. The time that could be rightfully devoted to this purpose, was considered to be the brief intervals between other lines of labor; and if for any reason these intervals did not occur the cream or butter was neglected until they did. The effect of temperature on final results was not even dreamed of, and to use a thermometer in connection with butter-making would have been considered an acknowledgment of uncertainty and ignorance that could not be tolerated. When churning day arrived, as it was sure to in the course of ever-changing events, it was a time of unusual activity in the average household. The old barrel churn was brought out, the cream dumped into it, and the magic transformation into butter was at once entered upon. Often it was no idle undertaking, as the cream was sometimes stubborn and refused to yield to the seductive influence of prolonged agitation. When this occurred each member of the household took a turn at the dasher, and frequently when the transformation had not been consummated by evening, the assistance of the hired man was enlisted during the interval between chore-doing and bed time. It was not at all uncommon for the process to extend over to the next day before the butter appeared, and the united efforts of the family were crowned with success. This protracted labor however was not always necessary, there being occasions when a few strokes of the dasher brought results that at other times hours were required to accomplish. These instances were occasions for congratulation and favorable comment; but it is not recorded that the causes for these vast differences in the time required

to do a churning were ever understood or sought after. They seem to have been looked upon as inevitable conditions that should be met without murmur or complaint.

FARM CREAMERY.
[Cut kindly furnished by F. B. Fargo & Co., Lake Mills, Wis.]

The thrifty housewife never dreamed that a slight change of method might bring improvement; but was resigned to conditions as she found them. As little attention was paid

to the kind of cows kept, and how they were fed and cared for, as was to the subsequent details of butter-making. Nearly all the details of cow-management were left to the animals themselves and to the dog. To the latter was usually assigned the duty of escorting the herd to and from the pasture; and he was generally permitted to employ such methods in accomplishing this work as appeared to him best suited to the purpose. As a result of his training the cows often developed better qualities as sprinters than they did as milkers. In winter they were often housed beneath the broad canopy of the skies, with perhaps a strawstack for shelter from the storm. They were kindly permitted to pick a large portion of their living from the surrounding fields, even in the coldest weather; and were generally as unaccustomed to comfortable quarters in a barn or stable as the polar bear. The season of the year at which they freshened was seldom regulated by the farmer; but, like all the other details of his dairy work, was left to chance. As a result, the cows came in at all times; and it was not unusual to have a fresh milker every month in the year. Breed or natural adaptation to dairy work, was not considered in selecting cows by the general run of farmers; and the man who showed an inclination to give some attention to this subject was looked upon by many as a dreamer who in pursuit of an idle fancy was becoming neglectful of the necessary duties of farm life. The quality of butter that was produced under these conditions can be better imagined than explained. Little was known in relation to the several qualities of excellence an expert judgment requires butter to possess. About all the knowledge possessed or required seemed to be an ability to understand that, whereas it once was cream now it is butter; but what kind of butter was not a matter under consideration. Of course it was believed to be good by the maker, and was acknowledged to be so,

after a time, at least, by those who were brought into daily contact with it. What at first perhaps was accepted with heroic endurance was through the influence of constant familiarity accepted with a relish. That it possessed many

FARM CREAMERY.
Interior view, showing location of apparatus.
[Cut kindly furnished by F. B. Fargo & Co., Lake Mills, Wis.]

qualities that would at this day be looked upon as excellent is extremely doubtful. It was never uniform in any particular, as it was seldom made twice under the same

conditions. The importance of grain, flavor, color, etc., was little understood. Butter that was at all palatable was designated by the general term "good butter"; while the rancid and odorous specimens were denominated "bad butter." It was put up in all forms and in no forms. The country merchant, with much sorrow and anguish of spirit, received daily his regular allotment of prints, rolls and jars, for which he gave in exchange the various commodities of life. These daily receipts, the product of one community, when viewed collectively, often presented a unique appearance. The different parcels would be kaleidoscopic in form and color, and equally unlike in flavor, representing the different methods employed in production. From this heterogeneous mass the public was compelled to draw its supply. To purchase the commodity was to indulge in a game of chance, where the blanks far exceeded in number the prizes. There was no particular flavor demanded by the purchaser; if on trial he found he could eat it, no higher

degree of excellence was expected or required. Protracted use of a certain brand of any commodity creates a taste for that specific article; and if this taste is acquired by a majority of the people, a public demand is created for it. In order to meet this demand the trade requires the goods it handles to possess the peculiar qualities that the public requires. In this way grades are established and a series of prices corresponding to the several grades. In the butter market these grades are known as extras, firsts, seconds, etc. Goods

FARM SEPARATOR

Cut furnished by Vermont
Farm Machine Co., Bellows
Falls, Vt.

possessing the qualities that meet the greatest public favor are graded the highest, those next in favor are graded a little lower, and so on down until rejected qualities are reached. It will be seen therefore that public taste creates public demand, and public demand establishes grade. These two extremes are dependent upon each other; therefore if no public taste exists no grade can be established. This was the condition under the primitive system of buttermaking in vogue a quarter of a century ago. There being no uniformity of method employed in the production of butter the quality was constantly varying; scarcely ever being twice alike. This lack of uniformity precluded the possibility of a public taste being acquired; consequently a series of grades could not be established. The country merchant therefore was compelled to smother his wrath and pay a uniform price for all qualities offered. To have done otherwise would have been suicidal; his business existence depended on it. His patrons were his neighbors, and neighbors to each other; and for him to discriminate in favor of one and against another would have been to invite financial ruin. No matter how much superior Mrs. A.'s butter may have been to Mrs. B.'s, both must be paid the same price or a social upheaval would have been created terminating in social ostracism and business failure for the merchant. The best he could do, therefore, was to pay one price to all, and fervently wish for the day when variegated and ill-flavored butter would cease to be a legal-tender for good sugar, tea and tobacco. Country merchants disposed of the butter thus received to city dealers, and by them the public was supplied. The uncertain quality of nearly all butter on the market tended to curtail demand and diminish consumption. The result was over-supply and low prices. Even comparatively good butter, if placed on the general market, brought such low prices as to destroy all incentive for its production.

Like Old Dog Tray, it was often judged by the company it kept and made to suffer for their short-comings. The man who wished to profit from a production of good butter, was compelled to make special contract for its sale, and even then the extremely low prices prevailing for the general supply tended to bring the prices he received for his butter far below its real value. The prevailing over-stocked condition of the market was often interpreted by the producer as indicating that too much butter was being made; therefore, instead of seeking to improve upon prevailing methods of manufacture, he often disposed of his cows and abandoned dairy pursuits. Thus for years was the dairy industry of this country carried on without either thought or method. Farmers failed to understand that it was quality rather than quantity that limited demand. They failed to comprehend the truth that the public would consume one pound of high-grade butter, if it could be procured, for every ounce consumed under existing conditions. Hence, dairying at best was considered by the average farmer to be an industry of minor importance; and the most sanguine minded failed to realize its capability as a wealth-producer. A few there were, however, who caught a glimpse at least of what might be accomplished by right thought and well-directed effort. These few came up out of the slough of despond and made a start on the highway of progress. They made a diligent search after better conditions and improved methods. They began to study the laws of cause and effect, and to apply the knowledge this study revealed to them. They grasped the fact that the butter then produced was not eaten because it was not fit to eat; and that the price for which it was sold was low, because its value was low. They conceived the idea that if the people were provided with a superior article, and assured that it always could be found when wanted, they would consume

many times the quantity then being used, and would willingly pay better prices for it. This was a valuable revelation; it shifted the entire responsibility for unprofitable dairying from consumer to producer. It plainly said to the farmer, learn how to conduct your business, change your methods, and you will be rewarded according to your merit. The result was, he began to look about him to learn the cause of his failure. He thought over the methods he was employing in his work, and the more he thought the plainer it was revealed to him that his whole system was a failure. This man was reformed. The scales had fallen from his eyes and the new light had broken in upon his intellect. He had found the key to the door of progress, and he now stood at the beginning of the highway of improvement. In struggling up from chaos toward perfection, the dairyman had to confront many difficulties; difficulties from without and difficulties from within. He had to learn how to improve upon himself as well as upon his methods. He was forced to a realization of the truth that thought must precede action; and that no detail was so trivial as to be unworthy of notice. He learned the essential lesson that butter-making does not begin at the churn, but many important factors enter into its production before it reaches that stage. He also found that each one of these factors had a more or less important effect upon final results; and that to overlook or neglect any one of them was prejudicial to success. In his search for causes he found that right butter-making begins with the cow, and ends with the package in which it reaches the consumer; all intervening factors so interlapping that none can be neglected or left out. Fortified by this newly acquired knowledge, he entered upon progressive dairy work by first improving the quality of his cows. Then the question of feed was given attention; the effects of different food elements on butter production were

carefully noted, and those giving the more satisfactory results were used. The care given to stock, never before considered, was also found to be a factor of much importance.

SEPARATOR CREAMERY.
[Cut kindly furnished by F. B. Fargo & Co., Lake Mills, Wis.]

Thus, step by step, the dairy industry grew; the imperfections that marked its early history vanished before the onward march of improved thought and method, until the

present high stage of development was attained. The end, however, has not yet been reached; vast possibilities still stretch out before the American dairyman. While he has accomplished much in the past, great opportunities still await him. The same intelligent devotion that has led his chosen industry up from the chaotic conditions of the past, to its present advanced stage of improvement, will still point out the way to greater achievements in the future. A contemplation of what has been accomplished provides ample incentive for future exertion. Let us then draw a brief comparison between old and new methods. The prime factor in modern dairying is thought. Thought must precede action in any pursuit, if success would be attained. Thought, then, may be justly considered the first distinguishing feature between past and present methods of butter making. The old time butter-maker did not think toward expression; the modern butter-maker does. The one performed his work without regard to conflicting conditions; the other regulates every detail in accordance with scientific truth. With the first all milk and cream was handled in the same way from month to month and from year to year; the other has learned that this cannot be done successfully. He knows that the milk from the same cows is subject to many changes; that cream from the milk of cows far along in lactation cannot be handled the same as the cream from fresh milkers and similar results be obtained. The old-time butter-maker knew nothing of bacterial life, or its influence upon milk and cream; his cream was gathered from milk infected with various germs, and set at various temperatures. It was held until a prescribed quantity had been collected before it was churned; without regard to the stage of development reached. The modern butter maker does not do this; he has learned the secret of germ infection and the results attending it. This knowledge has broadened his

conception and brought to light other facts. It has taught him the importance of keeping milk pure and free from contamination; the influence of temperature on germ development is also understood by him, and so regulated as to bring satisfactory results; the finer points of flavor, grain, etc., were quite unknown to the butter maker of the past. His modern successor, however, realizes that these are prime qualities, consequently his aim is to so regulate conditions as to insure their presence in the butter he produces. To do this he must possess a knowledge of the many details leading up to the desired result, and just how to regulate and apply them. The butter maker of long ago was an unskilled laborer; he brought into exercise no higher talent in handling milk and cream, and transforming the same into butter, than he did in digging a post-hole. What are today recognized as the more important factors entering into the production of high-grade butter were wholly unknown to him; and the result of his achievements usually corresponded with his want of knowledge. All this has changed, however. The butter maker of today must be a skilled artisan; able to bring an expert judgment to bear upon every detail of his work. He must not only know a certain condition exists, but he should be able to tell *why* it exists and know how to regulate and control it. This superior knowledge is not gained in a day, or even in a year but is the result of diligent study and more or less extended experience. The successful butter-maker of today can neither jump at conclusions, nor guess at results. The methods he employs in his work must be founded on previously ascertained facts; and each successive step made to conform to conditions fully recognized and understood. This involves a knowledge of causes and effects in so far as it pertains to milk and its butter product. To be full master of the situation his labors must not begin in the butter

room; to do so would be like beginning in the middle of a book to read, with the hope of understanding its contents. The ideas gained by such reading would necessarily be incomplete. So the butter-maker, to possess a full comprehension of his work, must extend his knowledge to the herds of his patrons, and learn the conditions existing there; ascertain what kind of cows are kept, the stage of lactation reached, the care given to the herds, the quality and kind of feed they eat and the quality of water they drink. He should know more; he should have a knowledge of how each farmer cares for his milk; the condition of the barn or stable in which the milking is done, and the attention given to cleanliness in the care of cans, pails and other utensils, liable to come in contact with the milk. He should further ascertain how each patron cools his milk; know when and where it is done, and to what temperature it is brought. With this knowledge in his possession, he is prepared to take the milk when it is delivered to him at the creamery, and continue the work of preparing it for the production of butter according to methods suited to its condition; he does not have to presume or guess at anything. Some may suppose it impossible for a butter-maker to gain all this knowledge in regard to the methods pursued by his patrons, without appearing over-officious, and therefore becoming obnoxious to them. Such, however, is not the case. The real butter-maker, the one who has the true qualifications, the intelligence and energy necessary to bring success, will find no difficulty in gaining all of this knowledge he requires. Of course if he assumes an air of superiority in his intercourse with his patrons, and tries to gain knowledge as an army would storm a fortress, he will no doubt meet with a resistance that will tend to cool his ardor, and dampen his ambition; but if he seeks information as one desiring to learn, his efforts will create no resentment, but on the

contrary will be encouraged. Patrons, as a general thing, are pleased to have the creamery manager show an interest in their work, and are not disposed to take offense at any reasonable inquiries he may make. As a class, the patrons of a creamery realize that their interests and those of the butter-maker are identical; and are usually ready and willing to assist him in any way possible. They know their success largely depends upon his success; and if his butter is off grade it will bring a lower price; and if prices are low dividends will be cut in proportion. All that is needed, therefore, is to convince the patron that his co-operation is a necessary factor in the production of good butter, and he will not only listen to advice, but will show his willingness to modify his methods, if by so doing conditions can be improved. To be sure exceptions will be found; there are kickers and know-alls among farmers as well as men engaged in other lines of business; but fortunately they are largely in the minority and exert but little influence. In dealing with such patrons the butter-maker should point out the defects in their milk and suggest remedies; then if his counsel is unheeded, it is his duty to himself, to the other patrons and to the creamery proprietor to reject his milk. There are instances when this is the only way a patron will receive instruction. In dealing with this kind of a man, the butter-maker should not be abusive, but firm; he should point out the necessity for making the changes he suggests, and when sure their importance is understood by the patron, insist on his complying with them. There is little danger of losing his patronage. If he knows your requests are just and reasonable, his judgment will finally get the better of his stubbornness and he will conform to the methods suggested. If he will not, it is better to lose than retain his patronage, for it is far more desirable that one patron should

withdraw his milk than that the good qualities of the entire output of the creamery should be imperiled by receiving it.

HOW TO DETECT POOR MILK.

However watchful the butter-maker may be regarding the methods employed by his patrons in caring for their milk, it will not do for him to relax his vigilance on the weigh-stand. Impure milk is sure to be presented from time to time, and the only way to intercept it is by constant watchfulness. The question then is, how can it be detected? It is not a difficult matter to determine whether milk is sweet or sour. Anybody with the sense of taste unimpaired can detect sour milk; but there are other and far more objectionable conditions that are not so easily detected. The presence of these impurities is best detected by the peculiar odor given off by the milk; however, if the milk has been cooled to a low temperature these odors cannot be detected. Milk, especially in winter, is often kept where it takes on a multitude of objectionable flavors. These cannot be detected while the milk is cold. When it is suspected that a patron's milk is being exposed to infection, heat a sample, say half a pint, to a temperature of one hundred and five to one hundred and ten degrees, when any bad odor, if it is present, can readily be detected. It is often possible in this way to distinguish one objectionable odor from another, and to determine correctly the source of contamination. Too much care cannot be exercised in this direction: as a positive knowledge of the condition of the milk when received will greatly aid the butter-maker in determining what methods to adopt in its subsequent handling.

SEPARATING THE CREAM.

Too little attention is often given to this branch of creamery work. The fact is not always recognized that the condition of the milk when run through the separator and

the manner of feeding and running the machine, has a direct bearing upon the quality of butter produced. Experienced butter-makers, however, recognize this truth, and

give these matters careful attention. In cases where a large per centage of the milk received is from cows far advanced in the period of lactation, the fat globules are small, and a

high speed and slow feed are necessary to do clean work; the temperature of the milk when it enters the machine should be higher when these conditions are present; eighty-eight or ninety degrees is not too high. In the earlier stages of lactation the globules are larger and separate more easily from the milk, consequently under these conditions a larger quantity of milk can be run through the machine in a given time, with satisfactory results. The cream can also be separated at a lower temperature, say at about eighty or eighty-two degrees. The skim-milk should be often tested and if more than a trace of fat shows in the tube of the test bottle, a change in the method of skimming should be made at once. If this condition is found; either the machines are being run at too low a speed, the feed is too heavy, or the milk is not heated to a high enough temperature. Be careful not to run milk in with the cream. Right here is where the quality of butter may be affected by the method employed in running the separators. If run too slow, while a full feed is given, if the milk is too cold, or if the separators are so dirty that the milk tubes become clogged, a greater or less quantity of milk is likely to run in with the cream. The effect of this is to produce unfavorable results in the butter, especially in hot weather. It is usually safer to run a heavy cream, as this precludes the possibility for it to contain milk and renders the ripening more uniform. A thirty or thirty-two per cent cream is none too heavy, especially in summer; it will ripen better, churn more readily and produce a better flavored butter. Butter produced from such cream will keep longer and better; also there will be a smaller loss in the buttermilk. A cream containing but eighteen or twenty per cent of fat often brings very unsatisfactory results; it is liable to become too sour, thus injuring the flavor of the butter, besides a greater amount of fat is left in the buttermilk, where the cream is so light. There is less danger of

affecting the quality of the butter from running a light cream in winter than there is in summer; the process of ripening is slower, consequently there is less danger of developing too much acid in the cream. Cream should be cooled as soon as it comes from the separator to a temperature of about fifty-five degrees. This is very important, and a little neglect here may greatly impair the flavor of the butter especially if the milk from which the cream is taken is at all tainted or bad flavored. Cream from milk in this condition should always be ripened at as low a temperature as possible; as the development of bad flavors is greatly retarded by pursuing this course. This is a point worth remembering; as a very fair quality of butter is often obtained from badly tainted milk if this precaution is observed. Never cool cream by putting ice into it; if the water used does not lower the temperature to the point desired, put the ice into the water surrounding the cream, and stir the latter frequently while cooling, that a uniform temperature throughout the whole mass may be maintained.

RIPENING THE CREAM.

This is perhaps the most important factor in butter-making and the one most difficult to explain; as no method of procedure can be recommended, that will be found applicable to all conditions. On ripening cream properly, much depends upon the experience and judgement of the butter-maker. Methods that may bring the best results obtainable at one time, may be altogether unsatisfactory at another; therefore an understanding of all conditions present is necessary, before any particular system of ripening can be recommended. Here is where the best qualifications of the buttermaker are brought into requisition. A failure at this point in buttermaking can never be entirely remedied; the influence of impure milk, improper cooling, etc., may be at least partially corrected; but an error in ripening the cream,

is sure to manifest itself in the impaired quality of the butter produced. The chief factor in good butter is the flavor. Other defects may be, to a certain extent, condoned or passed by; but a bad flavor never. It is by the proper ripening of cream more than anything else that good flavor is obtained; to be sure other factors exert an influence, but the flavor of butter, whether good or bad, is largely controlled by the acidity of the cream at the time of churning. Acid, like charity, covers a multitude of sins. Therefore many of the defects resulting from impure milk, quality and kind of feed, stage of lactation, etc., can be covered up, or in other words neutralized, by the system practised in ripening, and the degree of acid developed. If unfavorable forms are present in the milk, and consequently, are carried forward in the cream, a more rapid system of ripening should be adopted than is necessary when perfectly normal conditions exist. The reason for this is by the introduction of favorable forms that produce lactic acid, the development of objectional organisms is neutralized; or to use a more familiar expression, we get ahead of the taint, and the desired flavor is obtained. To successfully accomplish this result it is desirable to ripen the cream ready for churning, within from twenty to twenty-four hours after it is separated from the milk. The use of a starter is often necessary to accomplish this result. In fact its use is imperative where the cream is tainted and bad flavored, as will readily be seen when the purpose for which it is introduced is understood. The reason for the cream being off flavor, is due to the presence in it of unfavorable organisms, which have far exceeded in number and rapidity of development the favorable forms desired. The reason for putting in the starter is to inoculate the cream with these desired germs, and by aiding their development outstrip the growth of bad forms. To accomplish this, we must be sure the starter used

contains the forms desired. It follows then, that great care must be observed in preparing

THE STARTER.

Never use sour cream taken from one churning to ripen the cream for the next; neither use the buttermilk for this purpose. By so doing, any unfavorable germs present in the cream or buttermilk are carried forward from one churning to another; and as these germs are constantly multiplying, the conditions will continue to grow worse instead of better. In preparing starter, select milk which experiment has shown to be free from objectionable taint or odor; heat this to a temperature of from ninety to ninety-six degrees; then covering it closely, to avoid infection from any impurities that may be in the air, allow it to sour. This starter should be just clabbered when used; and in mixing it with the cream should be run through a fine sieve to insure the breaking up of all pieces of curd. Add enough to produce the required acidity in the time desired, say about twenty hours. A half a pint to a gallon of cream will generally be found a large enough quantity to produce this result. Of course the temperature at which the cream is held, will have much to do with the rapidity of its ripening; but in cases where the cream is tainted, as has already been observed, it is advisable to ripen at as low a temperature as possible, as the flavor of the butter is much improved by so doing. If half a pint of starter to each gallon of cream does not cause it to ripen fast enough, a little more may be added without working harm to the butter. In ripening cream that is tainted or off flavor, the following method of handling will in most instances bring good results: Cool the cream in the morning, as fast as it comes from the separators, to a temperature of about fifty degrees. If it is desired to churn it the next morning, as it should be if the cream is tainted, in the afternoon or evening add the

starter, and raise the temperature to about seventy degrees, stirring the cream gently in the meantime. When the desired temperature is reached run the hot water from under the vat at once. After the acid begins to develop, the cream may be cooled gradually by running cold water under it, until the desired temperature for churning is reached. Care must be taken that the cooling is done at the right time that the exact acidity required may be reached when the time for churning arrives. These conditions can be properly adjusted in a very short time by an observant buttermaker. To decide, however, by the sense of taste or smell alone, just when cream has attained the required degree of ripeness for churning is a pretty fine point; and in determining it the buttermaker should be aided if possible, by some mechanical means that will correctly show the degree of acid development. Prof. Mann's Acid Test, for testing the acidity of cream, is very reliable and its use is recommended. The sour or ripened condition of cream is due to the presence of a lactic ferment. After the cream has attained a certain degree of acidity the lactic fermentation ceases, and the putrefactive fermentation begins. In other words the cream commences to rot. If the cream is not churned before this fermentation begins the quality of the butter is much impaired; and the greater the degree of putrefactive fermentation attained, the poorer the butter will be. It will be observed then how necessary it is to churn the cream when the exact acidity required has been developed. This is a delicate point, the determination of which is greatly aided by the use of Mann's acid test.

HOW TO USE THE TEST.

The necessary apparatus consists of a burette, a burette stand, a pinch-cock and clamp. A pipette holding fifty cubic centimeters, a beaker glass, stirring rod and funnel.

When making a test, stir the cream from which a sample is to be taken thoroughly, after which insert the small end of the pipette in the cream and draw until nearly full; then put the index finger over the upper end of the pipette, as in

THE ELGIN HEATER VAT.
[D. F. Barclay, Elgin, Ill.]

sampling milk, to exclude the air that the cream may not run out. Admit sufficient air to allow the cream to escape slowly until the mark on the stem of the pipette is reached.

This will provide the required quantity (fifty centimeters) for making the test. Empty the cream from the pipette into a tumbler, then rinse the pipette two or three times with luke-warm water, to make sure all the cream is washed from the tube, and add the rinsings to the cream in the tumbler. Now add to the contents of the tumbler three drops of the solution marked "Indicator." You now fill the burette up to the mark indicated by "O" with the solution marked "Neutralizer." While constantly stirring the cream with the glass rod, allow the liquid to flow from the burette into the tumbler, until the entire contents of the tumbler show a tinge of pink. Stop adding the solution from the burette the moment the color is permanent. Read the level of the liquid remaining in the burette which reading shows the degree of acid present in the cream. It has been found, when the usual normal conditions are present, that the acidity of the cream is right to secure the best results in yield and flavor of butter when from thirty-eight to forty-two cubic centimeters of the "Neutralizer" is required to make the test. It is, however, a simple matter for any buttermaker to determine by experience, the exact acidity suited to the best results, and with this as a standard, reduce the process of buttermaking to almost a certainty. By testing his cream in the afternoon he will be able to so gauge the temperature and amount of starter required, as to insure the right degree of acidity for churning the next morning. The solution marked "Neutralizer" is prepared of a certain strength, and should be kept securely corked. The whole outfit, including a two ounce bottle of "Indicator" solution, and one gallon of "Neutralizer", can be purchased for about five dollars. A small sum when the benefits resulting from its use are considered.

WHEN TO CHURN.

When the milk received is badly tainted, or even in a

doubtful condition, it is better to churn the cream every day; as by inoculating it with the desired germs by the addition of starter, the ripening process is hastened and the development of bad germs is diminished. On the other hand, if the cream is held for forty-eight hours; the ripening process must necessarily be slower; thereby affording more favorable conditions for objectional germs to develop and multiply. It is therefore generally advisable, especially during the hot season, to churn every day. During the winter months, if the cream is in good condition when first separated from the milk, it can, with proper care, be held forty-eight hours, or even longer with no unfavorable results; but even in winter it is not always safe to pursue this course, as many farmers only deliver their milk at the the factory once in two days, and as their system for caring for it, especially during cold weather is not always the best, it is generally safer to churn the cream every twenty-four hours. The custom of receiving milk that is two days old, at the creamery, is a bad one; and while it cannot be wholly avoided, it should never be encouraged. In cases where it is unavoidable, the farmers practicing it should receive special instruction in regard to cooling and stirring their milk. It should never be covered until by aerating it, all animal heat has been removed; then it should be stored where it will not freeze or be exposed to objectionable odors. As a general rule, however, better results will be obtained if the cream from all milk held for two days is churned every twenty-four hours.

CHURNING THE CREAM.

We now come to the consideration of the next factor in buttermaking, that of churning the cream; and first, before we remove the cream from the vat, let us look into the churn. A great deal depends upon its condition. The cream may have been properly handled, and ripened exactly

to the degree required, and all conditions up to this point may be most favorable to the production of a high grade of butter; yet every desirable feature may be destroyed in a few minutes, by churning it in a germ infected and foul-odored churn. The churn must be carefully cleansed immediately after having been used; not only the visible, but the invisible dirt must be removed by a thorough and prolonged scalding. This should be done so completely, that no musty or unpleasant odor can be detected. The cover should never be left on the churn when not in use; but the opening should be covered with cheese cloth to admit the air, while it excludes any dust particles that may be floating in the room. Run cold water into the churn and give it a few turns in the morning before putting the cream into it. The temperature at which cream should be churned varies somewhat, according to conditions. Ripened cream that will test from thirty-three to thirty-five per cent of fat should be churned at quite a low temperature; say about fifty-four degrees. So rich a cream will be very heavy when ripened, and if churned at a low temperature the separation will be slower and more exhaustive; whereas if churned at a higher temperature the separation will be effected so quickly that considerable fat is likely to be lost in the butter-milk. If churned at a low temperature less foreign substances will be left in the butter, in consequence of which it will keep much better. Another advantage is, it will form a more even granule, requiring less washing to remove the butter-milk. This is a factor that should receive due attention, as too much washing has a very injurious effect upon flavor. The process of churning should not require more than thirty or forty minutes; neither should it be accomplished in less time; the butter-maker should so gauge the temperature as to insure this result. Another question is, when should the churn be

stopped? There is little diversity of opinion among expert buttermakers on this point; all agreeing that the churn should be stopped when the granules are a little larger than wheat kernels. The chief object sought in doing this is to preserve the grain, and at the same time, leave no butter-milk in the butter. If churned until the butter forms in a mass, it requires more washing, which injures the flavor, and more working, which affects the grain, to remove the milk from the butter. These are two very important

SQUEEZER COMBINED CHURN AND BUTTERWORKER.
The Sharples Co., Chicago, Ill.

features and should be remembered. When the granules are formed as stated above, let the churn rest a short time, that all particles of butter may rise to the surface; after which draw off the butter-milk. When thoroughly drained float the butter in water and wash it, by giving the churn a few revolutions. Care should be taken that the water used is pure and clean; never run water onto the butter that has stood in the pipes leading to the churn for any length of time. If taken from a tank overhead, the latter should be filled with fresh water from the well just before using; be sure to keep the tank clean and free from odors, as it is an easy

matter to greatly impair the flavor of the butter by using impure or bad smelling water. A better way is to draw the water for washing the butter directly from the well, where it can be done; having a steam connection with the water pipe so the temperature can be controled. Cover the end of the water pipe with cheese cloth so that no scales or particles of dirt can get into the butter. The water should run nearly clear when drawn from the butter; if the butter-milk has been well drained off and plenty of water used, this can usually be accomplished with one washing. Remember you are now rinsing the butter, not churning, and care should be taken not to turn the churn any longer than is necessary to separate the butter-milk from it. In order to preserve the butter in a granular form until it is salted the churn should be well filled with water, to prevent the butter from beating into a solid mass while washing.

SALTING THE BUTTER.

After it has been washed and thoroughly drained, it is ready for salting. In the first place, be sure the salt is pure. Salt readily absorbs any odor to which it is exposed, and before using should be tested by taking a small quantity and pouring boiling water over it; this will reveal any odor that may be present. If you are using a combination churn and worker, the amount of salt necessary will have to be determined by experiment. This can be calculated very nearly, by noting the per cent of fat in the cream, and the quantity put into the churn. When the butter is worked in the churn, about twelve or fifteen per cent should be added to the amount of salt, to allow for extra moisture and what is lost by adhering to the sides of the churn. In salting on a worker greater accuracy is possible; in consequence of which, the results obtained are usually more satisfactory. In either case, the salt should be run through a fine sieve to make sure it contains no lumps; this will

insure an even distribution of salt over the surface of the butter, and it will require less working. If the butter is worked but once, care must be taken to have it spread a uniform thickness on the worker before the salt is added, in order that too much working may not be required to secure an even distribution of the salt; thereby avoiding the danger of destroying the grain. The final results are often more satisfactory when the butter is given two workings; there is not so great danger of destroying the grain to avoid the presence of mottles. When worked twice, the first working should only continue long enough to distribute the salt through the butter; then allow it to stand from one and one-half to two hours, when it should be worked just enough more to take the streaks out. It is well understood that mottles in butter are chiefly due to an uneven distribution of salt; the salt is not dissolved in places and its action destroys the color. This effect is easier to control when the butter is given two workings as just described. There are four factors then, of more than ordinary importance that enter into buttermaking, between the ripening of the cream and packing the butter in tubs. These are first, temperature which should be low enough to insure an exhaustive churning, that is to leave no fat in the butter-milk. Second, granules; the churn should be stopped when the butter is in the granular form, that the butter-milk may be the more easily separated from it and to preserve the grain. Third, salting; a uniform distribution of the salt, to facilitate the process of working and to guard against mottles. Fourth, working; taking care not to over-work the butter, thereby destroying the grain and rendering it salvy.

PACKING THE BUTTER.

In discussing this feature of buttermaking we will begin with the preparation of the tubs. These should be first

washed so that the outside is perfectly clean; after which place them over a steam jet and steam them until heated through; this renders them water-tight, and what is of more importance, removes all odor and taste from the wood. After this has been attended to they should be filled with water, the covers put on, and allowed to soak for at least four hours before the butter is packed in them. The better way is to prepare the tubs the previous evening; then they will be thoroughly soaked and ready for use in the morning.

LINE THE TUBS.

The practice of lining butter tubs with parchment paper is widely spreading and will soon be universal. It not only improves the appearance of the package but there are other gains, that far exceed the small extra cost and labor occasioned by using the lining. It keeps the butter cleaner, prevents the absorption of woody flavors from the tub, aids in keeping out mold, assists in stripping and helps to hold the moisture in the butter. Using the lining must not be construed as removing the necessity for soaking the tubs; this should be done just as thoroughly as if no paper were used. In putting the lining in the tub have it extend about three-quarters of an inch above the top. Have a pail of strong brine at hand and with a brush, wet the paper with the brine and smooth it against the inside surface of the tub. In packing, put a little butter in at a time, and be sure to pack solid; as the butter will keep better, and appear much better should it be turned out of the tub or stripped. In finishing the butter on the top, cut off level with the top of the tub in such a way as will give a smooth unbroken surface; turn in the margin of the lining then put on a circle; cover this with a thin layer of salt made into paste by wetting it, and the tub is ready for the cover. Butter put up in this way, if of good quality when packed, will usually give entire satisfaction when it reaches the

market. The same care is necessary in packing butter in bail boxes or in prints as is observed when packing in tubs; the latter being the usual package found on the general market, its use is more universal than other kinds. Butter is not usually put up in prints, and other special forms, unless on special orders; in such cases the particular kind of package desired is usually described in the order. Cleanliness and close attention to small details are the winning points in butter packing. Remember an attractive exterior materially aids in disposing of the contents at satisfactory prices; besides it adds much to the business reputation of the buttermaker. The prime factors in buttermaking *must* be attended to; those of less importance *may* be. It is the buttermaker who carefully attends to these minor details, who wins the approbation of the trade, and an increase of salary from his employer. Buttermaking is not hard labor, but it does require adaptability; to one who possesses this qualification, the care and close attention his work demands is a source of pleasure rather than of fatigue. A laudable ambition prompts him to be satisfied with nothing short of the best and he derives a pleasure from working toward that end. He knows that the butter he makes must run the gauntlet of an expert judgment; to do this successfully it is required to possess not one, but many qualities of excellence, each one of which demands special attention.

UNIFORMITY DEMANDED.

There is no more important feature in buttermaking than uniformity. Even if the quality is not the very highest attainable, it should be alike from day to day. A dealer receives a shipment of butter from a creamery; it may not score quite so high as some, but it meets the requirements of a certain demand. He orders another shipment, requesting that the butter be made just like that previously

received. When it arrives, he finds his request has not been complied with; the flavor may be as good as in the first instance, but the color is different, it contains more or less salt, and the whole or part of it is mottled. What is the result? The butter may score as high as the first shipment, but it does not meet the conditions required and it is rejected. Each feature of this difference is the result of carelessness on the part of the buttermaker. Had he been careful in attending to the details of coloring, salting, and working, the character of his butter would have been uniform and satisfactory. The defects mentioned are mechanical and with proper care can easily be controlled; indifference therefore can be the only apology for their existence. Uniformity then, is one of the chief requisites of successful buttermaking; and a knowledge of how to maintain it, should be among the first qualifications of the buttermaker.

HOW BUTTER IS SCORED.

When butter is put on the market it is judged by an expert, and classified according to quality. This is about the way he determines the quality. He puts his trier into a tub of butter and draws out a sample, which he puts to his nose and smells. If the flavor is good, he can tell it; if it is bad, no further investigation is required. If good, he will continue; examining the grain and the color, and will taste it to ascertain how salty it is. For example: He takes a sample from a tub and finds the flavor very fine; the cream had been properly handled and ripened just right. He next examines the grain, and he finds that the churn was allowed to run too long, so the butter was churned into a mass, then in order to expel the buttermilk, it had been over-worked a little, injuring the grain. So he scores it off on grain. He finds the color lighter than the market requires, so he scores

it off on color. In tasting it, he finds it contains too little salt for the general market, and it is scored off in this particular. In this way he proceeds from tub to tub, noting the good qualities and the defects of each, and classifying them according to merit. There, Mr. Buttermaker, is a man who never saw you, and who perhaps lives a thousand miles from the creamery where you are working, that knows a great deal about your qualifications as a buttermaker. Reasoning from the effects, as portrayed in your butter, back to the causes that must necessarily exist to produce these effects, he can estimate very closely what kind of a buttermaker you are; and just about how much attention you are giving to the business. You record the facts yourself in every tub of butter you send out, and all the expert has to do, is to read the record you have written. The buttermaker therefore, should have a care how he slights the little, and seemingly unimportant details; for as it was the little foxes that destroyed the vines, so the small neglects may accumulate, until the road to success is hopelessly obstructed.

BUTTERMAKING ON THE FARM.

The question is often asked: "Does it pay to make butter on the farm"? This depends upon a combination of circumstances and conditions. If the farm is large enough to support a herd of from fifteen to twenty-five, or more cows, it can be made to pay, providing you conform to the methods necessary to make any system of dairying profitable. Buttermaking on the farm, in some respects, possesses advantages over creamery buttermaking. The farmer is in a position, where it is easy to acquire an exact knowledge of all existing conditions, and to adopt methods suited to them. He knows, or should know, the individual qualities of each cow in his herd, just how they are handled, and what

they are fed. He has a knowledge of how his milk is cared for, how the cream is prepared for the churn, and numerous other details of more or less importance, some of which it is impossible for the creamery buttermaker to possess or understand. He has the advantage of manufacturing butter from milk, all of which has been treated in the same way; thereby rendering it less difficult to maintain a uniformity in quality. In short, he has every detail of the work under his personal supervision, from the breed of cows kept to the marketing of the butter. It would seem therefore, that with so many opportunities for acquiring accurate knowledge, and such an advantage in understanding conditions, the farmer who is properly equipped for the work, ought to be able to make good butter and have it uniform all the time. The question then is, will it pay him to do it? Can he realize enough more from the sale of his butter to pay for the extra time and labor required, and the cost and maintenance of the necessary equipment for carrying on the work? Mr. Linse, of La Crosse, Wisconsin, who made butter on his farm that scored one hundred points at the Columbian Exposition, has the following to say on this subject: "While I would advise the general farmer to stay with the creamery, I can also safely say that many an intelligent farmer might find a productive field to cultivate, in making it a specialty to produce fine butter on the farm. The farmer is just the man who can accomplish this far easier than the creameries, which are depending partly upon the honesty and skill of others; but he should never lose sight of the fact that he can only be crowned with success, if he is exerting all his energy to produce only the best that can be produced." This is the testimony of a man who has made a success of buttermaking on the farm, and it should be given the consideration always due to knowledge obtained by experience. We find then that enthusiasm is an

essential factor of success. In other words it requires adaptability first, then energy and application to render home buttermaking profitable. If a farmer possesses these requisite qualifications he can undoubtedly make it pay, notwithstanding the extra labor and expense incurred. If, however, he has any doubts regarding his fitness for the work, or willingness to devote to it the time and attention it requires, he had much better remain with the creamery; for while some have succeeded in making home dairying pay, better than even they themselves expected or hoped for, a great many more have tried it and failed; while hundreds of others who have not tried it, would be found wholly unfitted for the work should they enter upon it. There are a great many factors in buttermaking that must be understood before they can be satisfactorily controlled; for the farmer to acquire this necessary knowledge by experiment is apt to be expensive, and there is no other way to acquire it. It is, therefore, wise for him to consider carefully all conditions bearing upon the subject, before he leaves the creamery to begin buttermaking on the farm; if, however, he believes himself equal to the undertaking, he should properly equip himself for the work before beginning it. First, he should know that his cows are what they should be; a herd may be carried along in creamery work quite successfully, that would make an unsatisfactory showing in the home dairy. It is well understood that while some cows may test high and give a large quantity of milk, they fail to produce quite so fine a quality of butter as other animals testing no higher and giving no more milk than they do. In a creamery where a large quantity of milk is received and mixed together, this peculiarity in one, or in quite a number of cows may not be noticable; but in the home dairy where the quantity of milk handled is comparatively small these little defects are likely to reveal them-

selves in the butter. In farm dairying, when buttermaking is the chief object in view, no better cows can be kept for the purpose than thoroughbred or grade Jerseys. The butter they produce, if properly made, is not only superior in flavor, but it is usually firmer and has a finer grain. Next in importance to good cows, is the character of the place where the milk and cream are kept and the butter is made. Pure air is necessary to the production of fine flavored butter; it is difficult, if not impossible, to maintain this condition at all times if the cream is kept and the butter is made in a dwelling house. It is advisable then to have a

CREAMERY BUILDING

Separated from the dwelling. This building should be constructed with the double purpose in view of having it cool in summer and warm in winter. To insure these conditions it should be built of stone, in a shady place if possible, and partially under ground. Its size must be determined by the quantity of cream to be taken care of. To insure pure air and also warmth in winter, the building should be equipped with a stove and also with an air draught. Mr. Linse, who has already been quoted, has a building 16 x 16 feet on the inside; this will accommodate the milk of twenty cows. His system of ventilation is as follows: A shaft ten inches in diameter begins at the level of the floor outside of the building and extends upward about six feet above the ground, entering the wall under the floor, it terminates and opens directly under the stove. The stove is enclosed in a jacket made of tin, leaving a space of about four inches between the stove and the jacket. On the opposite

MAN'S ACID TEST
APPARATUS.

side of the room from the stove, is a brick chimney about ten inches square on the inside and extending down to the floor, with a six inch opening at the bottom. The pipe from the stove enters the chimney at the proper height and is extended up on the inside, to the top of the chimney. In this way a circulation of fresh air is secured. The principle on which this theory is founded need not be explained, as nearly all modern houses are provided with ventilation on this plan. Proper drainage should be provided for in constructing a milk house, also plenty of fresh, pure water.

SEPARATING THE CREAM.

The best and most effective method for obtaining the cream is with the separator. The proper time to separate is in the morning; the night's milk being held over. If the farmer does not have a separator, very satisfactory results can be obtained by setting the milk in Cooley cans, in cold water. To do this properly the milk should not be below a temperature of ninety degrees when set, and the water in which the cans are placed should be held at a temperature of from forty to forty-five degrees. The centrifugal machine however, will give the best results and if possible should be the method employed. The other factors in buttermaking on the farm are similar to those employed in the creamery and need not be explained here. In concluding this brief reference to home dairying we will only add that success largely depends upon the intelligence and energy applied in carrying on the work. The scientific dairyman is the only practical dairyman, and success is likely to attend his efforts in whatever direction he may deem fit to apply them.

Miscellaneous Suggestions.

TEMPERING THE MILK.

In tempering milk for separating, care should be taken not to get it too hot. The temperature is easier to control

when a large or medium sized tempering pan is used. The so-called heaters, having a perforated pipe through which the steam passes into the milk, cannot be recommended; they are sure to subject that portion of the milk coming in direct contact with the steam to too great a heat, which injures the globules and consequently the grain of the butter. Steam entering the milk is also liable to carry with it impurities from the boiler which will impair the flavor of the butter.

SALTING.

Use only the best grade of dairy salt in your butter; in salting for the general market about three-fourths of an ounce to each pound of butter should be used. In determining this, however, you must be guided to some extent by the condition of your butter; if it has been churned into a mass and contains considerable buttermilk, more salt is needed as more working will be required, which will carry off a considerable portion of the salt with the milk. Where the granule has been preserved and the butter is well drained, from one-half to three-fourths of an ounce of salt, per pound of butter, is about the right proportion.

USING ICE.

It is not a commendable practice to put ice into the cream when it is churned if it can be avoided. It is much better to reduce the cream to the required temperature while in the vat, by putting ice in the water that is around it. When ice is put into the cream the butter will not remain as firm, when subjected to a higher temperature as it will when it is not used; neither is it as waxy or so fine grained.

HANDLING THE BUTTER.

Never handle butter with your hands if it can be avoided; as it affects the grain and is liable to impair the flavor. Always use a ladle in taking the butter from the

churn and be careful not to destroy the granules; as they should be preserved if possible until the salt is added. Observe the same care in regard to handling with the hands when removing the butter from the worker to the tubs.

GRASS FLAVOR.

The flavor imparted to butter by early pasture is sometimes distasteful. While it may not be possible for the creamery buttermaker to change this flavor, the farm dairyman may modify it to some extent by continuing to feed the cows a grain ration for a short time after turning them out in the spring. This peculiar flavor is due to the green pasture, and as the grass matures, will become less marked.

Chapter 7.

Cheesemaking.

It is difficult to determine just where to begin discussing the question of cheesemaking; for notwithstanding the excellent facilities afforded by our dairy schools and dairy associations for instruction along this line, the results are not altogether satisfactory. Young men attend the dairy schools, where they receive instruction in the right methods to apply in the manufacture of good cheese; but when they go out from the schools to begin practical work, they find in many of the cheese factories of the west, much of the instruction they have received of little use to them. They soon discover that the instructors in the dairy schools and some of the factory proprietors entertain different ideas as to what constitutes a good cheese. The instructors have led them to believe a good cheese to be one in which all of the fat in the milk is retained, has been well cured and is fine flavored; in short is good to eat. Some of the factory men seek to remove this delusion by imparting the information that the really good cheese is the one that can be sold at the largest profit to the manufacturer, and that it may not contain a great deal of fat, or be properly cured, or necessarily be fit to eat. So they have to begin all over again and learn to apply other methods than those taught in the schools

QUALITY OF WESTERN CHEESE.

If the above statements are not true, why is it the cheese made in the middle northwest are, as a general rule, inferior in quality to those made in the states farther east,

or in the Canadian provinces? It is obvious that this inferiority is not due to the existence of less favorable natural conditions in the west. Its atmosphere is as salubrious and its soil as productive as that of any dairy country in the world. Neither is it attributable to a want of knowledge as to how good cheese are made; for the opportunities for acquiring information on all questions pertaining to the dairy industry are as good, if not better in the west, than they are in any other part of the country. Then wherein lies the difficulty? Is it the result of keeping an inferior grade of dairy cows? The time was when this might have been a factor of influence; but that day has gone by. The quality of dairy stock found on the western farms today will compare favorably with those kept for similar purposes anywhere in the United States; and the methods employed in feeding and caring for them are unsurpassed anywhere in the country. While these conditions then, have been steadily improving during the past twenty or more years, has the quality of cheese produced improved? Is it, as a general thing, as good as it used to be? It is conceded by dairymen of judgement and experience that, while in the west every other feature of dairying has steadily improved, the cheese produced has depreciated in quality. Of course this is not true of all cheese made in the west, but the product considered as a whole, is not as good as it was twenty years ago.

WHY IT IS INFERIOR?

There appears to be two prime causes for this decadence in the quality of western cheese. The first is, a perversion of superior methods of making cheese, by a considerable number of our manufacturers, for selfish purposes, and second, inadequate state and national laws regulating the manufacture and sale of dairy products. The first con-

dition alluded to, is no doubt the principal cause; while the the second, may be justly considered an accessory after the fact.

SKIM CHEESE.

This affiant knows that in the early history of factory made cheese in Wisconsin, and the same conditions prevail in neighboring states, the principal object in view was to make good cheese. Factory proprietor and cheesemaker were alike actuated by a desire to reach the highest degree of excellence attainable. Every other consideration was made subservient to this one object—quality. It was not so much a question with them, how large a profit can be realized from it, as how good can we make it; and they really did make good cheese. When we consider the light possessed and the crude materials with which they had to work, it is remarkable that they succeeded as well as they did; and if all the manufacturers of today would but emulate the laudable example set by the early cheese producer the quality of his goods would be unsurpassed in excellence by any cheese made. Thus would the high character of the output become the pride, rather than the shame of the progressive dairymen of the middle northwest. Many of the cheese manufacturers of today, however, are not doing business in this way. They will admit that the course pursued by their early predecessors was laudable and, no doubt, well suited to the time in which they made cheeses; but not at all applicable to more modern business methods. They argue that in these days of close competition the manufacturer must give more thought to his margins than to the quality of his product, if he would not be left behind in the headlong race after wealth. Satisfied with this course of reasoning, the cheese manufacturer began, a few years ago, to look for ways and means by which he might increase his profits; and after some thought

and reflection, decided upon the production of skim cheese as the most available resource for the accomplishment of this purpose. He reasoned that the extraction of a small quantity of fat from the milk would make no perceptible difference in the quality of the cheese, but that it would materially increase the profits of the business. So he began to make skim cheese. At first he did not skim very closely; he was satisfied with taking about a pound of butter from each one hundred pounds of milk. In fact this was about all he could take at that time, for as centrifugal separators were not then in general use, the cream had to be gathered in the old way, and it was difficult, especially in warm weather, to hold the milk long enough to secure a larger amount of butter fat, without its souring, thus becoming unfit for cheese production. So he took his pound of butter and continued, so far as the customer knew, to make full cream cheese. For a time his cheese, disguised as full creams, continued to sell for the old price; while the pound of butter he had filched from each one hundred pounds of milk brought him, say twenty-five cents. Thus it will be seen he was getting twenty-five cents, assuming that to be the average market price per pound for butter, more for every one hundred pounds of milk he made up, than was the manufacturer who continued to do business in the old way. He at once realized that he had hit upon a paying scheme, and he congratulated himself on his wisdom and sagacity. Like every one who has found a good thing he wanted more of it; so he at once began to devise means whereby he could increase his number of patrons and thus procure more milk and larger profits. To accomplish this end he gave the farmers a small portion of the twenty-five cents received for the fat unrighteously withheld from the cheese consumer, by advancing the price of milk a few cents per hundred pounds. This was an attractive bait,

well suited to the accomplishment of the purpose for which it was thrown out. The result was, the farmers withdrew their patronage from the factories whose proprietors were not yet onto the scheme, and flocked to him. They not only sold him their milk, but they praised his liberality and spoke admiringly of his superior business talent; thus, unconsciously becoming parties to a fraudulent practice. Other factory men, however, soon learned the secret of his success and were not slow in adopting his methods. Thus, like Jack's famous bean stalk, the skim cheese industry grew, as it were in a single night, from a small beginning to gigantic proportions. Some manufacturers engaged in its production willingly; while others were forced into it by the strong arm of competition. The wide spread introduction of the centrifugal cream separator rendered skimming more easy, which fact, coupled with an ever growing spirit of avarice, and an active competition led to closer and closer skimming; until at length the whole of the butter fat was taken and a foreign and less expensive fat substituted. This marked the beginning of the era of

FILLED CHEESE.

The light skim was father to the hard skim, and the hard skim was father to filled cheese. It can be readily seen that if skim cheese had never been manufactured the filled article would never have existed. It is an open question which has worked the greatest injury to the cheese industry, the skim cheese or the filled cheese; both are inferior to the genuine article and both are manufactured with a view to deceiving the consumer. It is designed that when he purchases either, he shall pay for something he does not receive. This statement is generally denied by the manufacturers of these goods; but no better proof of its truthfulness is needed than is afforded by the action of

the Wisconsin manufacturers after the passage of the dairy law, at present in force in that state. It was claimed by them while this measure was under consideration by the legislature, that neither skim nor filled cheese were sold for what they were not. They contended that their cheese was branded and sold for just what it was, and so long as it was not injurious to health, they doubted very much the right of the state to legislate it out of existence. Bear in mind the fact that this law does not prohibit the making of skim cheese, but only regulates its manufacture. It provides that skim cheese shall be made a prescribed size and shape, so that anyone familiar with the law can easily distinguish it from other grades. If the manufacturers were sincere in their protestations, why did they not continue to make skim cheese? The fact remains, however, that not a skim cheese has been made in that state since this law went into effect, which is over five years ago. There being no longer an opportunity to deceive the consumer as to the quality of this cheese, its production at once became unprofitable and was immediately abandoned. The next question to consider is, was, or is the

FARMER BENEFITED

By the production of skim or filled cheese? No doubt, for a time the making of these goods resulted in a small increase in the price obtained by the farmer for his milk. As has already been stated he was given a small portion of the extra profits received by the manufacturers, but only enough to keep him in line. If he showed unmistakable signs of dissatisfaction with the price he received, and threatened to assume control of the manufacturing of his own milk, a sop was tendered him in the shape of a small increase in the price he obtained for it. To fully comprehend how this was accomplished it is necessary to understand the system employed by the factorymen in paying the

farmer for his milk. In a large majority of creameries and cheese factories throughout the country, the farmer is paid by what is known as the dividend system; the factory-man manufactures the milk into butter and cheese and looks after the sale of the products for a certain price per pound; which is usually four cents a pound for butter and one and one-half cents per pound for cheese. What remains after deducting the cost of making is divided pro-rata among the patrons. This apportionment was formerly based upon quantity. Each patron receiving such a proportion of the whole dividend as the quantity of milk he delivered during a certain period, sustained to the whole quantity received at the factory during the same period. Since the introduction of the Babcock test a more equitable system of division has been established; the dividend a patron now receives being based upon the relation of the fat content of his milk, to the fat content of all the milk received at the factory for a given time. Therefore all money received from the sale of cheese as well as from the sale of butter is divided on a butter fat basis, and the price the patron receives for a pound of fat is determined by dividing the sum realized from the sale of both these products for a given time, usually one month, less the cost for making, by the whole number of pounds of fat obtained during the same time. Now if the money received from the sale of all the butter produced, and all the cheese produced was honestly divided among the patrons after deducting the price for making, the only advantage resulting to the manufacturer from the making of either skim or filled cheese would be from the increased number of pounds produced. Thus if he was making only butter, and received four cents a pound for making it, and got a yield of four and one-half pounds per hundred weight of milk, he would be getting eighteen cents for every hundred pounds of milk he made

up; but if he were skimming three pounds to the hundred and was making eight pounds of skim cheese out of the milk remaining, he would receive twelve cents for making the butter, and at one and one-half cents a pound would receive twelve cents for making the cheese; thus receiving twenty-four cents for every hundred pounds of milk made up. This would give him an increase of six cents when butter and cheese were made, over what he obtained when butter alone was produced. This is all the increase he would be entitled to; the balance being the property of the patrons. Let us see what this would be, estimating the market value of butter at twenty-five cents a pound and of three pounds skim cheese at nine cents a pound. When butter alone was made, and the yield was four and one-half pounds per hundred, and the market price of butter twenty-five cents per pound, the patron would receive, after paying eighteen cents for making, ninety-four and one-half cents per hundred for his milk. When three pounds of butter were taken out of his milk, and eight pounds of skim cheese made out of the balance, he ought to receive one dollar and twenty-three and one-half cents for each hundred pounds of milk after paying for the making. He should therefore receive twenty-eight and one-half cents more for each hundred pounds of milk when both butter and cheese were made than he did when only butter was made. In other words, when the prices and yields given above prevailed, the patron of the creamery should have received twenty-eight and one-half cents less in cash per hundred for his milk, than had the patron of the factory where three pounds of butter was taken from the milk and both butter and skim cheese were made. Of course it is understood this difference would vary, being dependent upon the yield obtained and the prices received. Our purpose, however, is to show that there is a difference, which may be greater or less than that

given in the foregoing illustration. To be sure it can be argued that the creamery patron has his skim milk returned to him while the cheese factory patron does not; and its feed value should be taken into consideration in estimating the price the former receives for his milk. This is very true but we are only dealing here with the cash receipts; and and we merely asked the question, Is it usual for the skim cheese factory patron to receive so much more per hundred for his milk in cash than does the creamery patron? Is the difference between the prices they obtain more than eight or twelve cents per hundred pounds of milk? Is it not a fact that the difference is often much less than that given above? Does this difference ever rise above a closely estimated feed value for the skim milk, and if not, why not? Is it because the making of skim cheese will not produce a larger increase in the money receipts of the factory? Is it urged that the factory expenses are increased by the making of them? Is claimed that the yield quoted above is too large, and the prices named cannot be obtained? If these unfavorable factors exist, then why make then at all? Why not make only butter when the price of that product is satisfactory, and when the price of cheese promises better returns then make only full cream cheese? This is the only proper and legitimate course to pursue. We are not, however, discussing this feature of the question; but are endeavoring to learn whether or no the immediate profits of the business are increased by the making of skim cheese, and if so

WHO GETS THE PROFITS?

It is reasonable to believe the profits are materially increased, otherwise skim cheese would not be made; therefore, the unfavorable factors brought forward in the above queries cannot exist. The yield given in the foregoing illustration is not too large. The methods at present

employed in making skim cheese renders it comparatively easy to obtain a yield of nine pounds per hundred pounds of milk when making three pounds skims, while the system of curing employed renders the per cent of loss from shrinkage less with this class of goods than with full cream cheese. As to the price received for them, if properly made, they often bring within two cents of as much per pound as full creams. During the winter of 1899 and 1900 the writer knows for a certainty that one factory in northern Illinois sold thousands of pounds of skim cheese, containing but eight-tenths of one per cent of fat, for nine cents a pound. At the same time quotations for full cream cheese ranged from ten to eleven and one-half cents a pound. As to the cost of making, there is no greater outlay required in the production of skim cheese than there is in making full creams, and but little more than where butter alone is made. It is obvious then, that when a market can be obtained for the product, the making of skim cheese does, under ordinary conditions materially increase the money obtained for each one hundred pounds of milk made up, over what is received for a like amount when either butter or full cream cheese alone is made. The source of this increased revenue, it will be readily seen, is the small difference in the price received for full cream cheese and skim cheese, and the money obtained for the butter taken out of the milk. The question then is, who gets this increased revenue, the farmer or the manufacturer? To be sure, where the factoryman buys the milk from the farmer at a price agreed upon per can or per hundred pounds, it belongs to him, and all right of the farmer in either the milk or its product ceases. The conditions, however, are altogether different when dividends are paid. This system gives the manufacturer no proprietary right either in the milk delivered at his factory or its products. He is merely an agent for the farmer who, for a

stipulated price per pound, agrees to receive the farmer's milk, make it into butter and cheese, and sell it for him; then, after deducting the price agreed upon for making, turn the balance of the proceeds over to him. As such agent, it is his duty to consult the best interests of the farmer at all times, and to so manufacture and dispose of his butter and cheese, as to bring to him the largest legitimate returns obtainable for his milk. Are these conditions always complied with? Does the manufacturer usually provide the farmer with a statement showing the amount of product made and the price for which it was sold? On the other hand, does the farmer who takes his milk to the factory where dividends are paid, generally insist on being provided with reliable information as to the disposition made of his milk, where its products are sold, and the prices received for them? It is not our purpose to answer the question we have asked as to who gets the larger share of the profits resulting from the making of skim cheese, the manufacturer or the farmer. We leave the settlement of this proposition to the farmer himself. It would seem, however, as though good business management would dictate to the farmer the necessity for knowing what disposition his agent, the manufacturer, makes of the milk entrusted to him. Then questions of this character would never have to be asked or answered. We do not wish to convey the impression that all manufacturers of skim cheese are dishonest, or desirous of taking an undue advantage of the farmers who entrust them with their milk. Such is not the case; but the making of this class of goods, by a few unscrupulous manufacturers, has forced hundreds of honest factorymen to adopt like methods or be driven out of business. The farmers themselves have unconsciously aided in establishing these conditions. If they heard of a factoryman giving a few cents more for milk than they were

receiving, they did not endeavor to learn the character of the methods he adopted that enabled him to do this, but at once demanded that their own manufacturer meet the competition or lose their patronage. A little investigation on their part at this time would have disclosed the fact, that what appeared to be a benefit to the milk producers was in reality a hindrance to their progression. Had they realized this truth they would undoubtedly have refused to sacrifice, for a small temporal advance in the price of milk, the future healthful development of their chosen industry; for whatever immediate advantage the making of skim and filled cheese may have afforded them, even had they at all times received all that was rightfully their due, in the end it was sure to work injury to the dairy business.

WHY DOES IT NOT PAY?

The question might suggest itself here, if skim cheese can be sold so near the price received for full creams, how can it be claimed it does not pay to make it? There are several potent reasons why it does not pay. In the first place, as has been previously affirmed, it is deceptive and no business is entitled to recognition, the prosperity of which is dependent upon its ability to deceive. Skim cheese could never be sold for the prices often obtained for it if the consumer knew what he was purchasing; consequently every cent it costs him above its actual value is obtained from him by false pretense; and any business that can only succeed by such practices cannot be said to pay. Another reason why it does not pay is, its production curtails demand while it increases supply. It is well understood that when supply increases and demand decreases prices go down. By manufacturing skim cheese more cheese is produced. By selling skim cheese less cheese is consumed. More cheese is produced because more milk is available for its production.

When full cream cheese is made only milk in which all the fat retained enters into its composition; consequently full cream cheese and butter cannot both be obtained from the same milk. Therefore when the butter supply increases the full cream cheese supply diminishes, and the more full cream cheese made the less butter can be produced. It is different, however, when skim cheese is made; the milk from which the fat has been taken and made into butter is utilized in its production and the cheese supply is proportionately increased. The demand is lessened by the production of skim cheese because a smaller quantity of it is eaten. The reason for this is simple enough. If an article of food is palatable we eat more of it than we do when it is not. The consumer may be deceived into paying full cream cheese price for a wedge of skim cheese, but he cannot be fooled into eating it with the same relish; therefore he eats less of it, and the result is he buys less of it. Contrast this result with the conditions likely to prevail if only high grade full cream cheese was made. Mr. H. C. Adams, Wisconsin's efficient dairy and food commissioner, says the following in regard to cheese consumption: "If all the cheese which is consumed on American tables could be made strictly first class and well ripened, and as good as cheese can be made, inside of a week there would not be half cheese enough to feed the American people." Mr. Adams is not a man who indulges in idle or extravagant assertions. This quality, coupled with a comprehensive mind and unexcelled facilities for obtaining accurate information on all problems connected with dairying, lends additional weight to his conclusions. Yet if the results he anticipates were only half realized the cheese industry would be greatly benefited by the production of only high grade goods; increased consumption would lead to greater demand and better and more uniform prices. The production of skim cheese is injurious, in that it lowers

the price of the genuine article, not only by increasing the supply, but its inferior quality tends to a general lowering of values; for this the full cream product is made to suffer. The small margin, so often existing between its price and that of skim cheese, is largely the result of these conditions.

REPUTATION NECESSARY.

An untarnished reputation is as essential to the growth and prosperity of a business as it is to the advancement of an individual. Neither can win perfect success without it. They may appear, for a time, to achieve success while recklessly disregarding the character of methods by which it is attained; but if these methods are deceptive, or dishonest, like a boomerang they will sooner or later react upon themselves, when disaster is sure to follow. So a single departure from legitimate management may, in a very brief space of time, work an injury to a business or industry that it will require years of honest and unremitting effort to overcome. It cannot be denied that this has been the effect produced upon the cheese industry of the west by the making of skim and filled cheese. To verify this assumption you have but to review the past and present conditions in Wisconsin. Not many years ago that state enjoyed a reputation for the production of cheese, the superior quality of which was unsurpassed anywhere in the United States, with the single exception, perhaps, of the state of New York; and Wisconsin was rapidly plucking the laurels from this, her only rival. Wisconsin-made cheese had won such a reputation on the market, that occasionally some unscrupulous and dishonest manufacturer in a neighboring state, would endeavor to disguise his own counterfeit product by putting upon it the Wisconsin brand. Wisconsin cheese was sought after everywhere, and, at all times, brought the highest price obtainable for any goods on the market. This

was the advanced position the state had reached when the making of skim cheese was introduced. Only a few manufacturers made them at the beginning; but, one by one they fell into line, until nearly every factory in the southern portion of the state was making them. These in a short time were superseded by the filled cheese, and as a result, Wisconsin's high prestige faded like a rainbow. Her cheese product at once dropped to the level of the spurious commodity made in other states. A few manufacturers built up ample fortunes upon the wrecked reputation of their state; but the milk producer gained nothing. When the opportunity to further enrich themselves was taken away from them by the enactment of prohibitory and restrictive laws the manufacturers could tear the machinery from their factories and move on to more fertile and unworked fields. The producer, however, could not do this. He could not carry his farm away with him, so the only alternative left him was, either to abandon the dairy business or to bravely meet the adverse conditions that confronted him, and begin again the slow work of reestablishing it upon a legitimate foundation. We have made only casual reference in these pages to the making of filled cheese. Not because its influence, as a destructive factor in the dairy business, is under estimated or misunderstood, but for the reason that its power to work further harm has been destroyed by legislation that is practically prohibitory. When unrestricted, it was a more formidable obstacle in the way of legitimate advancement than was the skim cheese. It afforded larger returns, and consequently made a stronger appeal to avaricious desire. While it cannot be said that the injury to the cheese industry in the west was made any more certain by the making of filled cheese than it is by the existence of the skim cheese, the ultimate ruin of this branch of the dairy industry would no doubt have been

hastened, if its continued production was allowed. Its menacing influence, however, has been neutralized by legal enactment; but its less formidable appearing though scarcely less dangerous companion, the skim cheese, is still with us and is given unrestricted license in nearly all the western states, to menace and retard the growth of the cheese industry.

We now come to a consideration of the second cause for the production of inferior grades of cheese.

INADEQUATE LAWS.

While the enactment of a law to meet every anticipated evil, which may have no existence outside of the brain of some zealous reformer, is neither to be commended or advised, yet when an evil does exist and its operation threatens either the moral or material interests of society, it is the people's duty as a self protecting measure, to adopt such legislation as will curtail or destroy the wrong, and secure the safety of their interests. We have referred to the general want of adequate legislation to properly protect the dairy interests of the country, as being an accessory after the fact. It is so regarded, because of its tardiness in affording relief from fraudulent practices, long after existing conditions showed the necessity for such protection. The dairy industry has been retarded in its growth by the presence of adverse conditions, which might have been long since removed, had the remedy of efficient legislation been applied. What has been accomplished by the few really wise and properly enforced enactments of the national and some of the state governments, bearing upon this question, prove conclusively the potency of well directed law to eliminate from our dairy system the last vestige of illegitimate methods. Then why not have the necessary laws? The farmers of the country are vested with power to remove

the obstructions by which greed and avarice have retarded the progress of legitimate dairying; therefore, the responsibility for success or failure rests with them. Let us consider what has been accomplished in this direction by competent legislation. In 1895 Wisconsin passed a law prohibiting the manufacturing of filled cheese and regulating the manufacturing of skim cheese. This was not her first legislation on this question, but it was the first from which any permanent benefits were derived; and why? Simply because, in framing previous laws, she listened to the counsels of men whose personal interests would have been imperiled by the operation of effectual measures. These men always succeeded in having a weak link left in the chain, or a gap in the fence; thereby deluding the uninitiated into the belief that there was strength where there was only weakness, and that their interests were baricaded against fraud and deception, when in reality these interests were wholly unprotected. The law of 1895 was different, in that it was never out of the hands of its friends, and was really as strong at every point as its appearance indicated. The farmers, the milk producers of the state, arose in their might and demanded in uncompromising terms, relief from the counterfeit methods that were sapping the life of the state's most important industry. What was the result? In a single day the filled and skim cheese business was wiped out and has never since been re-instated. This illustrates what can be accomplished when the people are sincere and insist upon securing their rights. So much for state legislation. Now let us see what has been accomplished by U. S. law. On Sept. 1st, 1896, the national enactment, regulating the manufacture of filled cheese went into effect. This measure not only requires the manufacturer of filled cheese to pay a license for the privilege of making it, but it provides for the collection of a revenue on every pound manufactured.

These requirements made such an inroad upon the profits of the business that but few factorymen have continued to make it. Therefore the operation of the law is really prohibitory in its effects.

NATIONAL VERSUS STATE LEGISLATION.

While state laws may have a wholesome effect in retarding the growth of objectionable factors in dairy pursuits, they are not far enough reaching to totally eradicate them. This fact was forcibly illustrated by the prevailing conditions immediately after the enactment of the Wisconsin filled cheese law. Nearly eighteen months elapsed after the passage of that measure before the national law went into effect. During that year and a half, though the enormous quantity of filled cheese previously made in Wisconsin was cut off, there was no perceptible lessening in the quantity of this cheese put upon the market. The reason for this was that many factorymen in adjoining states who had not previously made filled cheese, were induced to engage in its manufacture; believing that the withdrawal of the Wisconsin product from the market would create a scarcity, and a consequent raise in prices. Thus the benefits resulting from the state law were confined by state lines, and had little influence on outside conditions. How was it though, when the national law went into effect? As has already been stated, nearly all the manufacturers of filled cheese stopped making it, and one of the two most powerful enemies of American cheese production disappeared in a day.

When the cheese product of a state is composed of various qualities, the lower grades usually fix the standard by which its output is judged. To illustrate: If one-half the cheese made in Illinois was high grade full cream, and the other half skim, and both were sold, we will say in

England, it would be found that the skim cheese regulated the standard by which the grade of Illinois cheese was determined. So again, if one or two states are producing only high grade cheese, and other states are making inferior qualities, and all are marketed in Europe, as American goods, the poorer grades will in all probability, determine the standard of American cheese on the European market; there being no discrimination made in favor of the good product over the poorer qualities. It is evident therefore, that no single state, or limited number of states can raise the standard of the dairy products of the United States as they go abroad; but the United states can, and should establish this standard. Ontario alone could not raise the standard of Canadian cheese, if the other provinces were allowed to make inferior goods and brand them the same as the genuine; but as the laws regulating the manufacture and sale of Canadian cheese, are made and enforced by the Dominion government, there is a uniform standard throughout the provinces. Hence the uniform excellence of Canadian cheese. The cheese producing states of the Union will always be more or less handicapped in their efforts to raise the standard of their product, unless the general government affords the necessary relief by the adoption of such measures as will establish a uniform grade of excellence, that will be alike operative in all the states.

STANDARD OF QUALITY.

Another obstacle in the way of improved cheese production in the dairy states, is the absence of any graded standard of excellence by which quality and value can be determined. The term "full cream cheese", does not convey any accurate information as to quality, further than that the cheese is made of milk from which no fat has been aken. What the quality of the milk may have been is

seldom asked and is as seldom known. Thus, the milk received at one factory may show an average of four and one-half pounds of fat to each one hundred pounds of milk. If no part of this fat is taken out of the milk, the cheese made from it is called "full cream". Another factory may take in milk that only contains an average of three and one-half pounds of fat to each one hundred pounds received. If this milk is made into cheese without removing any of the fat, the product is also called "full cream cheese". The output of each of these factories is placed upon the market under a brand representing the same quality; yet the cheese made in one of them contains nearly twenty-nine per cent more fat than does that made in the other. It will be readily seen therefore, the mere fact that a cheese is branded "full cream" does not insure its being of the first quality, though it may have been properly made and cured; as its name conveys no accurate knowledge of its fat content. There is little doubt, therefore, that the absence of any measure whereby actual quality is determined, had much to do with the origin of skim cheese. For instance, "A" discovers that the milk delivered at his factory contains a larger amount of fat than that received at "B's" factory; both are making full cream cheese, and both are receiving about the same price for their product. "A" does not see that he will be robbing anyone if he takes enough fat out of his milk to bring it down to the quality of "B's" and makes a little butter. Surely his cheese, if made and cured as carefully, will still be as good as "B's," and he will be ahead just the value of the fat he has taken out. This reasoning does not seem to be altogether devoid of logic; but it is rendered logical only by the inefficiency of the methods employed in determining the degree of quality cheese contains. Would it not be more equitable if the money value of cheese was determined by its actual fat

content? If cheese is dry and hard, or off in flavor, the purchaser does not have to be an expert judge to discover these defects. He cannot, however, determine whether all the fat was retained in the milk of which it was made, or just how much fat has been taken out of it. If a national law were enacted providing for the inspection of cheese, and for grading it according to the fat it contains, it seems as though many of the hindrances that now stand in the way of legitimate cheese production would be removed. If all the cheese made was required to undergo inspection and its grade determined before being placed on the market, prices would soon adjust themselves to the several qualities produced, and not only would the rights of the consumer be protected, but the chief incentive for producing inferior qualities would be taken away.

HOW CHEESE IS MADE.

We now come to a consideration of the mechanical process by which cheese is made. It requires considerable adaptability, and close application to details to make good cheese. It also requires pure and rich milk. The idea seems to prevail among some farmers and factory proprietors that milk of any quality or in any condition that is not actually sour will do to make into cheese. This is a very erroneous conclusion; for it is doubtful if any article made from milk is more susceptible to unfavorable conditions in the latter, than is cheese. Then if your aim is to make cheese that is strictly first class in every particular, the first important requirement is to have milk that is rich in fat, and has been properly cared for. The two principal qualities to be sought for in cheese production, are

FLAVOR AND TEXTURE.

The first named is the most important quality, and requires the greater skill and care to obtain. There are a

great many factors entering into the production of right flavor, none of which can be overlooked or neglected without adversely affecting final results. Chief among these factors, as has been stated, is the quality and condition of the milk from which the cheese is made. An influential source of flavor in cheese is perhaps from the feed given to the stock. This effect may be favorable or it may be unfavorable. If the cows are feeding on rich pasture and are drinking only pure water, or if they are fed on well preserved silage or properly cured clover hay, the effect on

CHEESE VAT.

cheese flavor will be good; but if they are given potatoes in large quantities, or turnips, mouldy silage, in short any kind of feed that is not pure and wholesome, the effect on flavor will be bad. The more fertile source, however, of bad effects in this direction is from the decomposition of the constituents of the milk, brought about by improper care in cooling, and in neglecting to guard against contamination from dust, foul odors, etc. How to prevent this infection is fully explained in another chapter. The methods employed in scalding the curd, acid development, and curing

are also influential factors in the production of flavor. The texture of cheese may be said to depend largely upon the following conditions, viz: The fat content of the milk, the degree of acid developed in the milk at the time the rennet is added, the temperature at which the curd is cooked, the length of time and manner in which it is stirred while in the whey, the degree of acid developed in the curd while matting, and the quantity of salt used in the cheese.

We will now give a few general directions as to how to proceed in the making of full cream cheese, from the time the milk is received in the vat, until the cheese is ready to put on the shelves in the curing room. The process of curing will be treated under another heading.

PREPARING THE MILK FOR THE RENNET.

Assuming that the milk is received in good condition, the first thing a good cheesemaker will seek to accomplish is to develop a certain degree of lactic acid before coagulating the milk with rennet. To do this, he should add about five per cent of starter to the sweet milk in the vat. In preparing this starter employ the method suggested in the chapter on buttermaking. After putting in the starter, the milk should be heated to a temperature of about eighty-four degrees, then allowed to ripen. In heating, never apply the steam directly to the milk, but secure the required temperature by heating water in the wooden vat surrounding the tin one containing the milk. During the process of ripening stir the milk frequently to prevent the cream from gathering on the surface. Cream allowed to remain on the surface of the milk, for any length of time, becomes dry and cannot be again distributed; this cream will not enter into the cheese, but will be carried off with the whey. The degree of acid to develop in the milk before setting depends upon many conditions; but assuming the character of the

milk to be normal, it should be ripened to such a degree of acidity as will require about two and a half hours, from the time of setting, for the curd to string one-fourth of an inch when tested on a hot iron. In determining the degree of acid to which the milk is ripened, use the rennet test which will be explained a little further along.

ADDING THE RENNET.

When ripe enough to set, the milk should be thoroughly stirred, so as to distribute the cream evenly throughout the whole mass, and it should be kept at the same temperature as during the process of ripening—about eighty-four degrees. In setting, use such a quantity of rennet as will produce perfect coagulation in about sixteen or eighteen minutes. If the rennet used is of normal strength, to secure this result, will require about four fluid ounces of rennet to each one thousand pounds of milk. Of course the temperature and acidity of the milk will greatly influence the time it requires to obtain a perfect coagulation; both of these conditions should, however, be regulated as directed above. In preparing the rennet for the milk dilute it with water, using about twelve parts water to one part rennet, and heat it to about the same temperature as that of the milk in the vat. When putting in the rennet, pour it along the center the whole length of the vat, after which stir the milk gently but thoroughly with a rake, in order that the rennet may be evenly distributed. It is advisable to continue to agitate the surface of the milk by moving a scoop, or some other utensil, lightly over it until coagulation begins, in order that no cream may rise; for any fat that is permitted to gather on the surface of the milk during the process of setting is lost to the cheese. Care must be taken, however, to cease this agitation the moment the milk begins to thicken, or a perfect coagulation will not be obtained.

CUTTING THE CURD.

To determine when the milk is sufficiently coagulated to apply the knife, press the finger gently on its surface and if the indentation made remains after removing the finger, it is ready to cut. Another way of determining is, to press the finger on the curd near the side of the vat, and if the curd breaks clean from the tin for about one inch, it is ready for the knife. In making full cream cheese always use the perpendicular and horizontal knives in cutting the curd. Cut first lengthwise of the vat with the perpendicular knife, being careful to reach to the bottom and to move slowly, that the curd may be cut clean and not torn apart. After cutting the curd lengthwise of the vat as directed, wait until the whey begins to rise to the surface, through the seams made by the knife, before cutting the other way. After cutting the curd both lengthwise and across the vat with the perpendicular knife, cut it one way with the horizontal knife, preferably across the vat, as this affords a better opportunity to cut the curd close to the sides. If the cutting is properly done the curd will be left in cubes about three-fourths of an inch square on each side.

STIRRING THE CURD.

This is a very important feature in the mechanical part of cheese making. It is quite an easy matter for a careless or indifferent cheesemaker to waste more than his wages amount to while performing this work. Great care must be taken not to tear or break the cubes when the process of stirring is begun, as this involves a greater or less loss by the small particles that are broken off and distributed through the whey. As soon as the curd is cut, the operator should begin stirring it gently with his arms; passing completely around the vat, several times in this way, before turning on the heat. The object for this is, to keep the cubes from

matting together while the whey is separating from the curd. As this separation proceeds, the cubes shrink and gradually become firmer, until the heat can be applied, when the rapidity in stirring can be increased without causing any loss. As has been stated, the heat should be applied to the water under and around the vat and the temperature raised slowly at first, while stirring with the arms should be continued for several minutes. When the curd becomes sufficiently firm, so as not to break easily, the heat may be increased and a rake substituted for the arms in continuing the stirring. As the temperature rises and and the whey continues to separate from the curd, the granules become globular in form and continue to harden and shrink until they become about the size of peas. Right here is where the cheesemaker's judgement and general knowledge of his work must be brought into play, that he may know when the process of cooking should cease and at what temperature the heat should be withdrawn. Ordinarily, the temperature for full cream cheese should not be below one hundred, nor above one hundred and four degrees, depending somewhat on the season of the year, the time allowed for curing, and the condition of the milk as regards taint, gas, etc. The time devoted to stirring and heating the curd to the required temperature should be, under normal conditions, from fifty minutes to one hour. After the cooking is completed, the hot water under the curd should be withdrawn or cooled to a temperature corresponding to the whey in the vat, by running cold water into it so that the temperature of the curd will not rise above the required limit. The curd should be allowed to remain in the whey until it has developed enough acid to string about one-fourth of an inch when tried on a hot iron. This development of acid should be reached in from one hour to an hour and thirty minutes after the cooking or scalding

has been completed. If more time is required to develop the acid, the milk should be ripened a little more before the rennet is put in. While the curd is lying in the whey it should be broken up occasionally with the hands, to insure the maintenance of a uniform temperature throughout the mass.

MATTING THE CURD.

If a homogeneous development of required conditions is being realized, it will be observed that when one-fourth of an inch of acid shows on the hot iron, the curd granules will have shrunk until nearly all the whey has been expelled from them, and they will appear firm and elastic to the touch. When these two conditions appear simultaneously, it indicates very satisfactory results up to this point. The curd should now be pushed back, until it forms an even layer in the rear half of the vat, when the whey should be drawn at once. After the whey has run off, a channel about one foot in width should be cut through the center of the curd lengthwise of the vat, the curd removed being evenly distributed over that remaining on either side. After draining a few minutes, the strips of curd along each side of the vat should be cut into blocks about one foot wide, care being taken to have them of uniform width, to facilitate piling. These blocks should then be turned over and allowed to lay until the granules are well knit together; after which the process of matting should begin. In matting, begin by putting two blocks one on another, then three, and so on, increasing the number of blocks in each pile as the curd expands and becomes thinner, until all the blocks are put in a single pile. When this is accomplished, cut the pile directly through the center, and repile the blocks; being careful to place in the center, the edges that have been previously on the outside. The object for doing this being, to give to all parts of the curd the same pressure,

that a uniform thinning of the blocks may be obtained, and also to maintain an even temperature. As the curd continues to spread out over the bottom of the vat it should be cut again in the opposite direction from that in which it was first cut. This, it will be observed, divides each original block into quarters, and enables the person doing the matting to turn all the original outside edges to the center of the pile. If the curd becomes very thin, as is likely to be the case when all the cream is retained in the milk, the blocks, which have now become thin sheets of curd may be folded; always observing to put the thicker edges to the center when repiling. Care should be taken not to expose the curd to a draught while matting it; as it dries and discolors the surface, and is likely to lower the temperature below the point desired. The matter of temperature should not be disregarded; as an uneven degree of heat in different parts of the mat will cause like variations in the degree of acid developed. A temperature of at least seventy degrees should be maintained in the cheese room.

WHY CURD IS MATTED.

In the early days of cheese production the matting or cheddar system of making was not practiced. The curd was never out of the granular form until it was salted and put to press. The curd was dipped from the vat into a shallow sink, having a perforated bottom, and after stirring briefly, that the whey might drain from it, it was salted and at once put into the hoops, and to press. It will be seen that the curd lying in the whey during the whole process of acid development, was excluded from the air, and any unfavorable organisms that might have been present in the milk were almost certain to be retained in the cheese. Pure air is the inveterate enemy of all objectional forms of bacterial life and its free circulation through the curd, during the

process of matting, has a beneficial effect in getting rid of unfavorable germs. Another advantage gained by matting is, a more complete expulsion of the whey is secured. Perfect flavor cannot be developed in a whey-soaked cheese; therefore, the more free the curd is from whey, the more favorable the conditions for obtaining fine flavor. When pin-holes are present in the curd they cannot be gotten rid of in any other way than by matting.

DEVELOPMENT OF ACID.

The requisite degree of acid to develop in the curd before salting, varies according to existing conditions. What would be too much at one season of the year, might be too little at another. In the spring and early summer, when pastures are green, more acid should be run than during the later months. The condition of the milk must also be taken into account in developing acid. If the milk is fairly good, less acid will be required than when it is badly tainted, and the curd is gassy and full of pin-holes. To determine just the degree of acid required, the judgment and experience of the cheesemaker must be exercised, as it is impossible to formulate a standard that will be exactly suited to all conditions. Where milk is normally pure, the acid developed in making full cream cheese should vary from about an inch and one-half in the late spring and early summer months, to an inch later in the season, when the pastures are drier and more matured, down, to perhaps half an inch in the winter, if only dry feed is given to the cows. There are several methods employed whereby the degree of acid development in the curd is determined; the most reliable of which is the hot iron test. This is the method referred to above where the length of acid drawn is mentioned. The process of making the test is simple: An iron is heated nearly to the point when it begins to turn red; a

small piece of curd is taken and the whey expelled from it by squeezing it in the hand. It is then brought in contact with the iron for a moment, when it is slowly withdrawn; if acid is present, the curd will adhere to the iron and when the piece held in the hand is withdrawn, it will string out in fine, silk-like threads. The length to which the threads can be drawn before breaking, indicates the degree of acid developed in the curd. Another method is, in noting the smooth, glossy appearance, and the grain of the curd. When considerable acid is present the curd will not tear, but will string apart, revealing a grain very similar to that noted in boiled corned beef. The acid is also noted by the appearance of fat on the surface of the curd. If, by squeezing a small

CURD MILL.

piece, grease adheres to the hand, it indicates the presence of acid in considerable quantity. As it is seldom any two curds develop exactly alike, the efficient cheesemaker will carefully note all these factors, and will be governed by those which experience has shown to be indicative of the conditions desired.

SALTING AND PRESSING.

When the acid development desired has been reached, the curd should at once be cut, salted and put to press. If convenient, it is preferable to have the curd mill attached to a sink, having a perforated bottom, where the curd should be cut and salted. Such a sink affords better facilities for getting rid of the whey that is released from the curd by the process of cutting. Satisfactory results, however, can

be obtained by cutting and salting in the vat. When the vat is used, the curd should be ditched through the center after it is cut, and time given for the whey to drain out. It should then be thoroughly aerated by stirring it briskly for several minutes; after which it should be rinsed, by pouring two or three pails of water, from which the chill has been taken, over it. Stir the water through it, after which drain again; then spread out evenly over the bottom of the vat and add the salt. The quantity of salt required varies with the season of the year. Too much salt has a tendency to harden the cheese, and too little may result in giving to it a sweet, or fruity flavor. In the summer, three pounds of salt to one hundred

CHEESE HOOP AND FOLLOWER.

pounds of curd is about the right proportion; later in the season the amount of salt used may be reduced to two and one-half pounds. A more uniform distribution of the salt will be obtained, if only a part of it is sprinkled over the curd at a time; then, after stirring this in, add the rest and stir again. After the salting is completed the curd should be allowed to lie a few minutes, before putting it into the hoops, in order that all the salt may dissolve and enter the curd, before it is subjected to pressure. When this is accomplished and the curd is put into the press, care should be taken not to press too hard at first. Tighten the screw until the whey starts, then wait a short time for the curd to compress, then tighten again; repeat this process, at intervals, until the screw is perfectly tight. The cheese

should remain in the press at least an hour, or until the curd is thoroughly compact, before they are bandaged. In doing this work, be sure no wrinkles are left in the bandage, as their presence detracts very much from the appearance of the cheese. Cut the bandages of sufficient depth to allow about an inch, but no more, to turn over on the ends of the cheese. Keep the head cloths soft and flexible, so as to insure a perfect closing; but do not leave them on the cheese after they are taken to the curing room. A better way is, to put circles on under the head cloths which should be

GANG CHEESE PRESS.

allowed to remain on the cheese. After adjusting the bandages, the cheese should be returned to the press and allowed to remain from fourteen to sixteen hours, when they will be ready for the curing room.

COLORING CHEESE.

In the foregoing description as to how cheese is made the question of color has not been mentioned. This factor was omitted as the directions given are for making full cream cheese, and in its production the use of coloring is not usually considered necessary; however, if it is desired

to use it the following proportions may be observed: Assuming the color used to be of medium strength, if a deep color is desired, about one fluid ounce to each thousand pounds of milk should be used. If, however, the milk is largely from cows recently freshened, or is produced from pasture feed, a smaller quantity will answer the purpose. A richer tinge is given to white cheese by putting half an ounce of color into each vat of milk.

MAKING SKIM CHEESE.

The foregoing directions are for making full cream cheese, and would have to be materially modified in the production of skims. While the making of skim cheese can not be recommended, so long as it is manufactured it is essential for the cheesemaker to know how to make it. Very little full cream cheese is made during the winter months, but a great deal of skim cheese is, and, in order for the cheesemaker to obtain employment at his trade the year round, he must be able to make skims as well as full creams. Perhaps when the stanch friends of the dairy industry become thoroughly awakened to a realization of the benefits that would certainly accrue to the milk producer, the manufacturer and consumer, if skim cheese was relegated to the realms of memory, they may devise means by which its overthrow will be effected. When that day arrives, no cheesemaker will be anxious to have it known that he is versed in the art of skim cheesemaking; but until then he will have to yield to expediency and continue to put forth his best efforts in making it. The first thing required of a skim cheesemaker is, to be able to produce a cheese containing the least amount of fat possible, and have it appear in texture at least, like a full cream. If he cannot do this, the manufacturer will have no use for him. Consequently, he is kept busy devising means

whereby this end can be attained; for, if he succeeds in giving a fine texture to cheese containing one and a half per cent of fat, the chances are, he will be asked to produce it in cheese containing one per cent of fat; and so on down to the limit of possibility. It is easy to understand then, that his position admits of neither mental nor physical inactivity. He has constantly to contend with obstacles that never confront the maker of full cream cheese. The latter has access to schools, established and supported by the state, where expert instructors point out to him the scientific relation of all factors entering into his business. He is then provided with the necessary material for the acquirement of desired results, which he has only to combine in harmonious relation to achieve success. Not so with the skim cheesemaker. There are no schools established for his benefit, nor is there a standard built up, by scientific experiment, to guide him in his work. He is compelled therefore, to work out his own salvation as best he can. He must make a cheese "that will pass," without having the ingredients necessary for its construction. He must maintain the appearance without the substance. Realizing then, that the employe is in no way responsible for the components of the article he makes, any assistance afforded him in the accomplishment of his work is justifiable. Hence the following directions for making skim cheese:

RIPENING THE MILK.

The following directions are for making cheese from milk containing but one per cent of fat. If the milk received is perfectly sweet and untainted, add about the same quantity of starter as in making full creams, if clabbered milk is used; but if fresh buttermilk is used—which is preferable in skim cheese, add about ten per cent of starter. Heat the milk to about eighty-six degrees, and

allow it to ripen. In making skim cheese the milk should be ripened considerably lower than it is for full creams; as on this factor largely depends the texture obtained. For example: where milk for full cream cheese should be ripened to, we will say, ten seconds, by the rennet test, for skims it should be ripened to six or seven seconds. Of course the degree of ripening required will vary, according to the condition of the milk. What you want to obtain is such a degree of ripening as will cause the curd to show about one-fourth of an inch of acid, immediately after the scalding is completed.

SETTING THE MILK.

When the milk is sufficiently ripened, heat at once to the temperature required for scalding, which is usually from one hundred to one hundred and two degrees. After which, add the rennet as in the case of full creams, using about five fluid ounces of rennet to each one thousand pounds of milk. When properly coagulated, cut the curd both ways of the vat with the perpendicular knife, and stir at once with the rake.

COOKING THE CURD.

The quality most desired in making this cheese is texture; and a quick, high cook is the most satisfactory. Therefore, as the milk is heated to the highest temperature required, before the rennet is added, brisk stirring is necessary to prevent the curd from matting together. To insure this, it is advisable to have two persons stir the vat. Stir the curd for from eighteen to twenty minutes, when it should be pushed to the rear end of the vat and the whey drawn at once. As has been stated, the curd, at this time should draw about one fourth of an inch of acid on the hot iron. Employ the same methods in draining, blocking and matting as with full creams; only the work must be done

very briskly, as the acid is developing rapidly, and it is desirable to expel the whey from the curd as soon as possible. The same means that are employed in determining the acid development in full cream curds should be applied to the skims, excepting, in the latter, a higher degree of acid is required. Where an inch and a half is drawn, when full cream cheese is made, at least two and a half inches is required in making skims, maintaining about the same relative difference throughout the year. When the required acid is obtained, cut the curd as in making full creams.

PREPARING THE CURD FOR THE HOOPS.

After the curd has been run through the mill, it should be spread out over the bottom of the vat and submersed with cold water, stirring it all the time to avoid matting. Do not leave the water on the curd too long; often all that is required is to cover the curd, then run off immediately; as too much soaking will render the cheese waxy. After draining off the water, spread out the curd and salt as before directed, using from two to two and one-half pounds of salt to each one hundred pounds of curd. Let the curd lie for at least ten minutes after salting before filling the hoops, and employ the same methods in pressing and bandaging as before given. In coloring, use one fluid ounce of color to each one thousand pounds of milk, when a deep color is desired. If you are making white cheese put about three-fourths of an ounce of color in each vat to remove the blue tinge from the milk. In making skim cheese, the secret of success is in getting the required cook in as brief a time as possible, that the curd may be gotten out of the whey before becoming too hard. This is also one reason for ripening the milk to such a degree of acidity before setting; in order that the acid may have a good start when the cooking is completed. When the milk is in normal

condition, not over one hour and forty or fifty minutes should elapse from the time the rennet is put into it, until the curd is salted.

FLOATING CURDS.

It sometimes occurs, both in making full cream and skim cheese that the milk is so badly tainted that the curd rises to the top of the whey, during the process, or soon after the cooking is completed; when this happens, it is called a floating curd. The cause for this is the presence of gas in the curd, rendering it lighter than the surrounding whey; consequently, it rises to the surface. The better way to proceed when this occurs, is to get the whey off the curd as soon as possible. When making full creams, and the condition of the milk is known before it is set, ripen considerably lower than when the milk is in good condition. If you are ripening the latter to ten seconds by the rennet test, ripen the tainted milk to six or seven seconds. In cooking, run the temperature from two to four degrees higher than with normal milk, that the same shrinkage of the curd may be obtained in a much shorter time. For example: If the temperature at which you usually scald milk that is in good condition, is one hundred degrees, when the milk is tainted increase it to one hundred and two, four, or even one hundred and six degrees. Draw the whey as soon as possible, and mat in the usual way. If the curd is full of pin-holes, as it undoubtedly will be, it should be kept warm, by covering the vat with a canvas, and turning steam into it. If the pin-holes are large and the curd spongy, it indicates the presence of bacteria which have developed sufficient gas to float the curd. Continue to develop acid until the holes, which at first were round, become oblong in shape; this indicates that the acid has expelled the gas from the cells in the curd. It should not be put through the curd

mill and aerated until the putrefactive smell is superceded by an acid odor; after which rinse well with luke-warm water, drain, salt and put to press in the usual way. All curds having pin-holes do not float. Some of the worst impurities in milk are indicated by small, almost imperceptible pin-holes, in an apparently firm curd. The best, and only really effectual remedy, when pin-holes are present, is to search out the cause and remove it; for, though we may succeed in getting rid of their presence in the curd, the flavor of the cheese is irrevocably impaired. An experienced cheesemaker can tell, by the peculiar odor given off by the milk when it is heated, whether or no pin-holes will develop in the curd made from it. Thus, by heating samples of the milk suspected, he may be enabled to locate their source, and by causing a change in conditions, succeed in removing them. To do this, take a pint Mason fruit jar and fill it half full with the suspected milk; then put on the cover and place the jar in water heated to about one hundred and four degrees. After the milk becomes heated, shake the jar slightly, remove the cover, and smell the milk. If the pin-hole producing bacteria are present, the fact will at once be revealed to the experienced cheesemaker, by the peculiar odor given off. The "Wisconsin curd test" is the more reliable method for the inexperienced operator to adopt; but for the cheesemaker who is handling the same milk every day, the test given above is equally as reliable, and is much easier and more quickly accomplished.

MOTTLES IN CHEESE.

Mottles sometimes appear in cheese as well as in butter. They are usually caused by whey collecting in depressions in the curd while lying in the pile, during the process of matting. The whey destroys the color in spots, giving the cheese a mottled appearance. When matting curd, it should

be handled almost continuously during the first thirty or forty minutes, or until nearly all the whey is expelled; by pursuing this course the danger of having mottled cheese is greatly lessened. The writer's experience has led him to believe an uneven cook is also a source of mottles. In cooking, especially at a high temperature, it sometimes occurs that the curd is not properly broken up; a portion of it being left in chunks varying in size. When this condition exists it is impossible to secure an even scald. When the smaller granules are sufficiently cooked, the center of the larger chunks will still be comparatively raw; in consequence of which, the whey is not expelled by shrinkage and mottles are produced. This, however, is only one of many ill effects resulting from uneven cooking.

YIELD OBTAINED.

A factor of much importance in cheese production is the yield obtained. This point has already been briefly referred to under another heading, but there are other conditions affecting the yield, that have not been mentioned. The constituents of milk that enter into cheese are chiefly casein and fat, and any condition that causes a loss of either diminishes the yield. If the curd is cut before a firm setting is obtained, a loss results from the small particles of curd that are broken off and carried away with the whey. Losses resulting from harsh stirring have been considered and need not be referred to again. A loss of fat is often caused by running too much acid. The tendency of acid, beyond a certain point of development, is to expel the fat from the curd, and, when too much is run considerable fat is lost during the process of pressing; this not only effects the yield but the quality of the cheese. Special care should be exercised in this direction, as it is estimated that, even when ordinary precautions are observed, in four per cent

milk, nearly four-tenths of one per cent of fat runs off with the whey. While all unnecessary waste should be avoided, do not strive to obtain an abnormally large yield, for this cannot be affected without injury to the quality. The custom prevails, in some sections of the country where full cream cheese is produced, of graduating the cheesemaker's wages according to the yield he obtains. The required yield is often so high that no cheesemaker can reach it, without resorting to methods that materially detract from the quality of the cheese he produces, factory proprietors often demanding as high as twelve pounds of cheese to each one hundred pounds of milk. When the fact is considered that the standards established by several of the states only require milk to contain twelve per cent of solids, it is evident the states ask too little or the factorymen too much. When cheese is made, the sugar and most of the albumen is left in the whey; therefore, to procure a cheese yield so near the combined weight of all the solids in the milk, it is evident some foreign substance must be introduced, to take the place of these ingredients. The chief element depended upon to accomplish this purpose is moisture. Therefore the cheesemaker, in order to get the required yield, retains as much moisture in his cheese as possible. To do this, he has to modify his cook so as not to shrink the curd until all the whey is expelled; as the whey he leaves in the cheese is the element depended upon to help him out in the weight. The result of all this is, the cheese he makes is not as good as it ought to be, and the price for which it sells is proportionately reduced. It is difficult to see where any advantage is gained by pursuing this course. While every cheesemaker should be required to obtain as high a yield from the milk he makes into cheese as is compatible with the right methods of making, to ask more of him, is to place a premium on perverted ability or actual incompetency; for almost any

kind of a cheesemaker can produce a whey-soaked article, but it requires ability and real merit to make a rich, fine flavored cheese. The best and most economical rule to adopt is, to engage only cheesemakers who are competent to do the work as it should be done; requiring them to obtain no higher yield than is consistent with a careful and correct system of making. The question of yield, and other conditions besides those already mentioned that affect it, will be further considered under another heading at the close of this chapter.

CURING CHEESE.

It has been said, cultivated taste is required to like strong, well-cured cheese; but this is the kind of cheese that is the most nourishing and the easiest to digest. New cheese, having neither strength nor flavor is the hardest. In the production of good cheese that is cheese that is palatable, nourishing and digestible—as much depends upon the curing as upon the ingredients that enter into its composition. The American manufacturer is frequently in too great a hurry to realize returns on his investment, to allow time for the cheese he makes to cure. To cure cheese properly, requires unremitting care and a good deal of time. It may be said of most of the skim cheese that is made that it is not cured at all, as it is generally offered for sale on the market within from ten days to two weeks after it is taken from the press. Such cheese is neither wholesome nor digestible, and possesses no quality that recommends it as a desirable article of food. A writer on this subject says, “In connection with the curing of cheese there is an important dietary principle to consider, and it is a point not usually considered by epicures. When we eat cheese only partly cured, we take into our system bacteria in the process of fermentation, which are sure to do more or less injury to the stomach. They retard digestion, and tend to counteract

all the good qualities of the cheese. People who say that cheese does not agree with them, have special reference to poorly cured cheese, and they may not know that properly cured cheese would not only be good for them but easily digested as well. Cheese, therefore, comes late in the meal after the heavy meats and deserts, for a purpose. Good imported cheese or home-made cheese that has been thoroughly cured helps digestion. This is commonly believed by good diners-out, and they love to think so because of their acquired taste for the article. If the cheese is of the right sort it does promote digestion, for the bacteria in it are all productive of the right kind of fermentation, which is similar to that which takes place in our stomach when food is introduced. Cheese of the right kind is partly digested food, and the digestion is generally in slow progress all the time. When acted upon by the warmth and moisture of the stomach, the bacteria in the cheese immediately multiply and renew their activity thereby producing a digestive effect that helps along the assimilation of all our food. We need good cheese with a good meal; in fact we need to eat more of it, for it is nourishing and wholesome. The old idea that cheese is difficult of digestion, and bad for us, applies to only poorly and partly cured cheap cheese. Use the right kind of cheese and there will be no deleterious results. It is well known that Englishmen are great lovers of cheese; but they do not want the new, uncured article. They eat cheese in the old stage, and it has to be cured a long time before it takes on the fine flavor they desire. With them, the use of cheese as an article of food is largely substituted for meat, which they consider not only more wholesome but cheaper than the latter. As a result, when the Englishman buys cheese he gets a large wedge of it, and he eats it with his bread in almost equal proportions. When the American buys cheese

he gets one or two pounds and eats an occasional dice-like cube of it with his pie. The reason for this difference is, the Englishman insists on having his cheese well cured; as a consequence it is fine flavored, palatable and nutritious. The American, on the contrary, is often compelled to accept, if he has any cheese at all, of the whey-soaked, under-cured article, which possesses no feature belonging to really good cheese except the name and shape. No wonder he buys and eats but little of it. If he could get good, wholesome, well-cured cheese, he would soon learn to consume as large a quantity of it, and with as much relish, as does his English cousin. Good, fine flavored cheese used to be made by the wives and daughters of American farmers. They knew little of the scientific methods now employed in cheesemaking but the time and attention they gave to its curing largely made up for any errors they may have committed in the previous stages of its production. We are told the Swiss take milk that is inferior to the milk found on the average American farm, and, by deft manipulation, convert it into the fine flavored and nutritious Swiss cheese that is so justly celebrated. This superb development is the result of perfect curing. They do it, not by secret processes, but after methods that are well known. The first important factor in the process is time, whereby a chemical change or development goes on in the cheese analogous to that of digestion in the human stomach. The curing is usually done in caves, where the cheese is turned and scraped many times a day. The air is kept dry and at a uniform temperature; by this means the desired forms of bacteria are constantly kept at the proper degree of development. The curing room found in the average modern cheese factory is wholly unsuited to the purpose for which it is designed. It is usually located in the second story of the factory, where the heat of summer and the cold of winter are each, in their

turn, sure to penetrate; thereby rendering it next to impossible to maintain a uniform temperature. It is also, because of its location, often exposed to contamination from soot from the smoke-stack, and other forms of dust and dirt. It would be more productive of satisfactory results if the curing room were located on the ground, and, if possible, built partially under ground, say from one third to one half its height from floor to ceiling. It should be protected, as far as possible, from dust and unfavorable odors; it should also be provided with convenient facilities for ventilating and heating. The room should be darkened and the shelves, on which the cheese are placed, should be kept clean. A temperature of from sixty-five to seventy degrees should be maintained in the room at all times, that the development of the cheese may be neither hastened nor retarded. The cheese should be turned at least once a day, and thoroughly rubbed with the hand. It is customary, in some factories, to leave the head cloths on the cheese until near the time they are ready to ship. The utility of this practice is doubtful. It is better to remove the cloths when the cheese are put on the shelves, and at once cover the faces with cheese dressing, applied very hot; smooth the dressing over the surface of the cheese with the hand and not with the cloth. At the first application, sufficient dressing should be used to insure a smooth, even surface; after which, the cloth used should only be dampened in the hot dressing, and passed over the face of the cheese, when they should again be thoroughly rubbed with the hand. Never allow mould to collect on the bandage of the cheese. At first appearance of mould go over the sides of the cheese with a cloth that has been previously dampened—not wet—with water. The air in the curing room should never be damp, neither should it be too dry. To avoid this latter condition, keep a tub of water in the center of the room,

the evaporation from which renders the surrounding atmosphere sufficiently moist. When the atmosphere is humid as it often is after showers, during the summer months, exclude it from the curing room as far as possible, as its presence is a fruitful source of mould. Never allow the faces of the cheese to become coated or discolored by the accumulation of dressing on the surface. This condition can be avoided by being careful not to apply too much dressing to the cheese, and by keeping the shelves well cleaned. If, from any cause, the cheese do become in this condition, scrape them thoroughly, being careful not to injure the rind; after which apply a small quantity of dressing and rub again with the hand. It is a good practice to turn the cheese, while new, twice every day, and never turn a cheese without thoroughly rubbing both faces. We refer to rubbing thus often, that sufficient emphasis may be given to its importance as a factor in right curing. When rubbing the cheese always use the hand. We acknowledge it is less troublesome, and requires less time to use a cloth in performing this labor; but the result is not nearly as satisfactory.

GENERAL SUGGESTIONS.

Be careful not to allow the dressing to drip on the sides of the cheese, but keep the bandages clean as it adds much to the appearance of the stock and materially aids in its sale.

Never leave the cheese exposed to a current of air, as it is liable to check them.

In pressing, be sure to keep the cheese straight, as a crooked cheese is an abomination to the eye of the purchaser; also make them uniform in size.

Do not plug all the cheese in the curing room to ascertain their quality. Never plug but one cheese from the same vat, and that one no oftener than is absolutely

necessary to ascertain its stage of development. Do not insert the trier through the bandage of the cheese, but draw the plug from the face, where it can be returned and all openings closed by the application of a small quantity of dressing.

When boxing, cut the rim of the box a little lower than the top of the cheese, and when two cheese are put into the same box place two scale-boards between them.

MAKING BRICK CHEESE.

Do not attempt to make brick cheese from gassy or badly tainted milk. Be sure that the milk is sweet and free from infection, as in the production of brick cheese, little opportunity is afforded for counteracting these unfavorable conditions. Use about the same quantity of starter as with cheddar cheese, and heat and ripen in the same way. Be sure to obtain a firm and uniform coagulation of the milk before cutting, and observe the necessary care in stirring the curd with the arms and with the rake. Cook to a temperature of about one hundred degrees, and run the whey as soon as possible after the process of cooking is completed. Be careful not to run too much acid. This is a general fault, especially with makers who are only occasionally required to make brick cheese. When the condition of the milk is normal—and no other kind should be used in making brick cheese—run only about one-fourth of an inch of acid before putting the curd into the moulds. In running off the whey keep the curd well broken up by stirring it constantly with the arms. Some makers run off a part of the whey, then run cold water into the vat until the temperature is reduced to about eighty degrees, before putting the curd into the moulds. While this practice will aid materially in preventing the curd from matting, there are reasons why it should not be recommended. The better way, is to run off the

wey until the curd appears above the surface, then dip at once into the moulds. Do not make the cheese too large; from four and one-half to five pounds being heavy enough. If made too deep, the salt will not penetrate through the cheese and the flavor will be impaired. In pressing, use two fire-bricks on each mould, and turn the cheese, at least twice after being put to press before taking them up, in order that a close rind may be formed on both faces. When the cheese are taken from the moulds in the morning, dip each one into a pail of luke-warm water, then rub well with cheese salt, being careful to rub the ends and sides as thoroughly as the faces; after which pile them, two deep, on the salting table. In the afternoon rub and salt again, but do not dip them again into the water as sufficient moisture will be on the cheese to cause the salt to adhere to the surface. The cheese should be salted and rubbed in this manner for at least five times—twice a day—before being placed on the shelves. After the last two saltings, they may be piled three or four deep on the salting table. When ready for the curing room, wash the salt from the surface of the cheese, with luke-warm water; then place them on the shelf on their edges with the faces together. Turn and rub well every day, and if inclined to check moisten the surface by rubbing them over with a cloth, dampened in brine. Be sure to keep the temperature of the room as near sixty-five degrees as possible.

It seems as though brick cheese would be the most desirable kind to make on the farm for the following reasons: It is small, thereby enabling the farmer to make all of his milk into cheese every day, be it much or little. The outfit for making it would be less expensive than for making many other kinds of cheese; as it would not be necessary to purchase either hoops or press. The yield is usually better, and if good, the price it brings is generally

higher than that received for many other kinds of cheese, and a home market can almost always be found for it.

NECESSARY OUTFIT.

For making brick cheese, the farmer would require the following outfit.

One two-horse Ideal boiler.

One two hundred gallon milk vat, with steam pipe connecting it with the boiler.

One horizontal curd knife and one perpendicular curd knife; also a curd pail, scoop and dipper.

This is all the outfit he would have to buy, and its cost would not be far from sixty-five dollars. The salting table, press table, and moulds, he could make himself. The moulds should be made of half-inch planed boards six inches wide. Cut the sides and ends so the moulds when made, will measure about four and one-half inches by ten, inches inside; the depth, of course, would be six inches. Joint the corners, nail or screw together, and your moulds are made. Make the pressing table wide enough to accommodate two moulds, standing end to end, and about ten feet long. Nail strips, extending about an inch and a half above the surface, along one end and both sides of the table. Slightly elevate the end of the table along which the strip is nailed, so as to cause the whey to run off at the other end, making the elevation as slight as possible, as too much of an incline will render the cheese crooked. Cover the table with gunny-sacking, drawing it taut, and tacking it along the edges. Beginning at the upper end, place the moulds, close together, in two rows down the table. Make covers that will just fit inside of the moulds, from the same material of which they are made, and provide two fire-bricks as a weight for each cheese, and your pressing outfit is complete. The table for salting will have to be considerably

larger than the press table, as it will have to accommodate three days' cheese at one time. If you have a cool dry cellar no better curing room could be provided. If a farmer desires to make what is commonly known as American cheese, the above outfit will have to be increased by the purchase of one two-screw standing cheese press, the necessary number of cheese-hoops of the size and kind desired, and one Harris curd-cutter. There is, no doubt, a large field for home made cheese as well as for butter, and the farmer who goes about its production in the right way will find the business remunerative.

RENNET TEST.

The rennet test is a process for determining the acidity of milk, by the time it requires a given quantity, heated to a certain temperature, to coagulate, when a given amount of rennet is added to it. It will readily be seen that any number of proportions may be used in obtaining the same result. The method of making the test, followed for years by the writer, is as follows: Take eight ounces of milk, heated to a temperature of eighty-six degrees and stir into it sixty minims or one fluid dram of rennet. Note the time in seconds, it takes for the milk to coagulate, and the result indicates the degree of acid development it has reached. Of course, experience in handling the milk is necessary that you may know just how much acid is required. For example: The writer found, that in making full cream cheese from fairly pure milk, the required degree of acid was reached when eight ounces of milk, heated to eighty-six degrees, would coagulate in ten seconds after sixty minims of rennet had been stirred into it. These are the proportions used in all the tests referred to in the preceeding pages of this chapter.

HOW TO MAKE THE TEST.

Take a common pint tin cup ridged around the center, and fill it to the ridge with the milk to be tested. Fill a pan or basin with hot or cold water, according to whether the temperature of the sample is too high or too low; then holding the cup in the water, stir the milk with a thermometer until a temperature of eighty-six degrees is reached. Place one or more small splints of wood in the milk, so that its rotary motion may the more readily be observed. Then stir into it sixty minims of rennet, that have previously been measured into a small graduate, and watch the splints. Count the time, in seconds, from the time the rennet enters the milk, until the splints cease to turn and the acidity or ripeness of the milk is determined. A minim is about one drop; sixty minims is one dram. The process of making this test is simple; requiring, after a little practice, less time to make it than it does to explain the method. The benefits resulting from its use are many; as it enables the cheesemaker to know the exact condition of his milk at all times. This insures method and uniformity in his work from day to day, and enables him to maintain the degree of ripeness required in the milk he is handling, to insure the best flavor and texture in the cheese.

RELATION OF FAT TO YIELD OF CHEESE.

The Secretary of Agriculture, in discussing the question of Cheese production, brings out some very interesting facts regarding the influence of the fat content of milk, upon the yield of cheese obtained. His deductions are based upon numerous experiments made along this line, by a large number of Experiment Stations throughout the country. Milk of varying richness, from skim milk to milk made abnormally rich by the addition of cream, has been used in these experiments, and the details of manufacture have been

varied to include a very wide range of treatment of the milk, the rennet, the curd, and the green cheese. It is found that the proportion of fat in the milk lost during the process of manufacture varies considerably, but averages between seven and one-half and eight per cent, or about one-third of a pound of fat for each one hundred pounds of milk used. The loss is fully as small, if not smaller, than the losses sustained in buttermaking, even with the most approved appliances. In normal milk the loss seems to be independent of the percentage of fat in milk, that is, it is very nearly the same from normally rich milk and from poor milk. The variations in loss of fat are due, either to the condition of the milk, or to some special conditions employed in the manufacture. In the case of partially skimmed milk the proportion of fat lost is greater, and in the case of milk to which cream has been added the loss is less than from normal milk.

The loss of casein and albumen, or the cheesy constituents of the milk, do not appear to be affected by the percentage of these constituents in the milk. It is practically the same whether skim milk, normal milk, or milk to which cream has been added is used. It amounts to about twenty-four per cent of the entire amount contained in the milk, or about twelve and one-half ounces per hundred pounds of milk. As to the effect of the composition of the milk on the yield of cheese, investigation has shown the fat to be by far the most prominent factor in determining the yield. In nearly all the experiments made the yield of cheese has been proportional to the percentage of fat in the milk, being higher with milk rich in fat. This holds true in the case of cheese made from partially skimmed milk, and from milk to which cream has been added. This is not entirely due to the additional amount of fat which the richer milk adds to the cheese, for it is found as a rule that

more water is retained in the cheese when the milk is richer in fat. The fat appears, in most cases, to have considerable influence on all the milk constituents recovered in the cheese. Experiments have established the fact that, for every increased pound of fat in the cheese there is also from one-third to one pound more water, and about nine and one-half ounces more casein and albumen. This brings out in a striking manner the desirability of using milk rich in fat for cheesemaking, and indicates that rich milk is as desirable in cheesemaking as it is in buttermaking. It has proven that the so-called cheese cow, that is, the cow that is good for cheese production rather than for butter, does not exist, and that whenever a cow is found that is good for cheesemaking purposes, the milk of that cow is equally good for the manufacture of butter; for, as a general thing, the fat in the milk exercises a greater influence upon the composition of the cheese than any other constituent of the milk. The fact then, is pretty well established that the amount of fat in the milk used for cheesemaking has very little effect on the loss of fat, except in the case of partially skimmed milk or milk to which cream has been added; but it affects the per cent of fat in the cheese as well as the proportion of other ingredients recovered in the cheese, and very materially affects the yield of cheese both from normal milk, skim milk, and milk to which cream has been added. The amount of casein and albumen in the milk, on the other hand, have no effect on the loss of these ingredients, no definite effect on the composition of the cheese, and only a slight effect on the yield of cheese. From these deductions therefore, there can be little doubt that the percentage of fat in milk is a good indication of its value for cheesemaking and may properly serve as the basis for paying for milk at the cheese factories as well as at the creameries.

Chapter 8.

CREAMERY BUILDING.

One is often impressed by the total disregard for convenience and general utility, both as to location and internal arrangement, that characterizes a large proportion of the creameries throughout the country. Many of them are little better than pine board shanties, erected at the least possible cost in money but at the expense of all convenience and fitness for buttermaking.

The same genius that planned and built the school houses of early days seems to have been exercised in the construction of many of our creameries; as the same want of adaptation to the purpose designed is the most noticeable feature in each instance. While some are small, others are great, cumbersome, two-story barns; their size all out of proportion with the needs of the community in which they are located. It appears as though the chief object in view in building them was to maintain as far as possible, a uniformity of magnificent distances between the different pieces of machinery that comprise their equipment. Unwise construction, however, is not their only fault. They are often located in places in no way adapted to the purpose for which they are intended. The necessity for adequate draining facilities, one of the most important factors in creamery construction, is often disregarded; as is also the matter of convenience in receiving and handling the milk.

An able writer on this subject says: "Good drainage is of the utmost importance in creamery construction, yet in many cases evidently the last thing thought of. The creamery should be located near some live stream, where the outlet of the drain can be placed under water, or the

drain should be conducted not less than fifty rods from the building. The longer the drain the better. The drain may consist of glazed tile for the first fifteen rods from the creamery and be not less than fifteen inches in diameter, and for the remainder common tile of the same size may be used."

Good drainage is indispensable to the securing of satisfactory results in creamery work. If the slops from the creamery are permitted to sink into the ground under and around the building, the whole plant will soon become a veritable hot-bed of impurities. Bad odors and objectionable bacteria will invade every part of the building and its surroundings, rendering the production of first class butter impossible. In addition to water tight conveyors, perfect drainage necessitates the construction of the building upon ground that is slightly elevated above its surroundings, that ample fall may be obtained for carrying off the sewage.

Next to perfect drainage is a plentiful supply of pure, cold water. It is a wise plan on selecting a location for a creamery to sink the well first, that you may be assured of an ample supply of good water before proceeding to the construction of the building. If the water is found to be of scant supply or of poor quality build the creamery at some other place. Do not allow any other advantage of location, however propitious it may be, to out-weigh this important deficiency. Pure, cold water is about as necessary to the making of good butter as is milk and cream; therefore never build a creamery where it cannot be obtained. Another point to consider is, however perfect may be the system of drainage, neglect no precaution in constructing the well so to keep the water free from all surface impurities. Remember if pure water and perfect drainage are secured all other features of the work of creamery construction will be easily controlled.

In writing on this subject Professor Erf of Urbana, Illinois, gives some most excellent suggestions in relation to how a creamery should be built and the kind and quality of material that should be used in its construction, which we quote in part.

DIMENSIONS.

"The dimensions of the creamery building depend on the amount of butter to be manufactured and somewhat on the arrangement. A creamery handling the milk from 400 to 600 cows should contain about 1,200 to 1,500 square feet of floor space, not including store and cool room. It is more desirable to have the plant in a compact form rather than to have it spread over a large area for two reasons. First, it saves labor in keeping a creamery clean; and second, it teaches the operator to put utensils back in place after using them, as it is necessary for him to have the required room."

CONSTRUCTION OF BUILDING.

"The building should be placed on solid foundation walls, rather than upon pins. This, besides keeping the building warm in winter and cool in summer, adds decidedly to the appearance. The foundation should not be less than one foot in depth and eighteen inches in width. This must be grouted well with crushed stone and cement. Upon this foundation a wall can be built not less than twenty-four inches high. And the width depends on the material used. If common wall stone are used about fifteen to eighteen inches would be the proper width; if range stone eight inches; and if made of glazed hollow brick twelve inches would be ample in width. Sills may be of hemlock 6x6 or it may be a box sill made of 2x8 Norway pine. In case a wooden floor is wanted cross sills are necessary to support the joist. These cross sills should in turn be supported by

eighteen inch square abutments, not more than six feet apart. Studding may be of yellow pine or hemlock, need never be more than 2x4 inches in size, and twelve or fourteen feet long according to the desired height of the building. Studding fourteen feet high make a more attractive building and, at the same time, gives more room for building the ice box higher in the refrigerator, increasing its capacity."

CEMENT FLOOR.

"If a cement floor is preferred it should be put down in the very best shape. A cheap cement floor is next to no floor in a creamery. A cement floor should be made as follows: First, fill it with small cobble or broken stone, then put on dry sand mixed with a little common cement, and pour on water and wash the mixture down among the stones so as to firmly imbed them. Then puddle on a mixture of common cement and sand, half and half, and apply it two inches thick. On top of this spread a thick coat from two to two and one-half inches of Portland cement and fine sand mixed half and half. Let this harden thoroughly and a good floor can be assured if the Portland cement is of the best kind. This makes a rather expensive floor, but one cannot afford to put a cheaper floor in a creamery in the line of cement.

A WOOD FLOOR.

"In putting down a wood floor one should see that the joist are of Norway pine or good white oak not less than 2x8 inch size, laid full straight on sills sixteen inches from centers. The length of the joist should not exceed two feet without having a support. The flooring may be of good white oak or Georgia pine. If the very best white oak cannot be obtained, Georgia pine is to be preferred. The flooring should be well dressed and matched, one and a half to two inches in thickness and secretly spiked to each joist. The tongue and groove should be painted with white

lead and when completed should be covered with a coat of boiled linseed oil applied hot and thoroughly brushed in. The refrigerator floor should be made the same except that the space underneath should be filled with cinders to the joist, leaving a dead air space between the cinders and flooring. The boiler room floor may be made of cement or of hard brick laid in cement."

STUDDING AND RAFTERS.

"The studding may be set sixteen inches apart from centers, toe-nailed to sill below and also firmly nailed to roof plate which is of the same material. Rafters can also be of the same material as the studding, but not less than 2x5 inches size for a shingle, steel or galvanized roof, and 2x6 if slate is used for roofing, depending somewhat on the width of the building. A shingle roof seems to give the best service for a creamery. It keeps the building cool in summer and warm in winter. As far as durability or being fire proof is concerned, a slate roof is far superior."

SIDING AND CEILING.

"Siding may be five-inch poplar lath, or pine drop siding, the lath being the cheaper. The building should be ceiled entirely on the inside with yellow pine ceiling except the boiler room, which should be lined with corrugated iron or made of brick. Two dead air spaces can be cheaply constructed on the entire building, by putting building paper up and down on the studding, nailing over this $\frac{1}{8}$ x2 inch strips and ceil on strips. The paper must be secured at top and bottom so that a perfect dead air space is the result. Lath and plaster may be used as a substitute for paper but at a greater expense."

THE DRAIN.

"If a cement floor is used the floor should slant one fourth of an inch to every foot from all directions toward

one point, the inlet to the underground drain; at which point a trap should connect; to prevent odors from the sewer from coming up into the factory. If a creamery is to be built with wood floors it is always best to use a gutter set into the floor from the drain. This can be constructed by placing two joist about four inches apart and letting them extend the full length or width of the building. Cut the floor flush with the edge of each joist. Rabbit these ends one half inch on each side and paint with white lead, then lay in a coating of putty and form the gutter of galvanized iron, or preferably copper, so that it will set down in between the joist, and turn over where the floor is rabbited, nail into the floor, driving the nails close together, then give it another coat of white lead and putty again. The slant of a wood floor should be the same as that of a cement floor, and the gutter itself should also have the same slant toward the trap.

THE REFRIGERATOR.

“The refrigerator for a creamery handling three thousand to six thousand pounds of milk per day needs to be about 8x10 feet including a cold room. The refrigerator room proper should be at least six and one-half feet high and the ice box above as high as it can be made under the rafters, never less than six feet. Three dead air spaces are necessary for a refrigerator if the partitions are made of double boards with paper between, If made of paper alone five dead air spaces are necessary. The latter is the cheaper where simply the paper serves as the partitions, and fastened with $\frac{7}{8}$ x2 inch strips every sixteen inches. Care must be taken in securing the best building paper and see that it is not less than thirty-two inches wide so as to fit the studding when placed sixteen inches apart. The inside should be ceiled and shellaced. The doors must be made the same as

walls, beveled and packed, with canvas at the edges. The ice box must be connected with the room below by flues constructed in the walls. These flues may be the spaces between the studs and joist. One flue must receive the warm air at the ceiling in one side of the room and conduct it to the top of the ice box while the cold air flue on the opposite side extends down from the bottom of the ice box in all the spaces between the studs to within six inches of the floor, where it should enter the refrigerator room. These flues carry the air after it is cooled in the ice box to the room below. Thus a circulation is kept up by the air coming in contact with the ice where it is cooled, becomes heavy and returns by its own weight to the room below; at the same time it drives the warm air at the top of the refrigerator into the ice box ready to start circulating when cooled. A double circulation may be provided in this way, by converting all four sides into flues, making the refrigerator more effectual. The air flues leaving the ice box near the bottom must be arranged so that no ice or water can enter them. The bottoms should be galvanized iron turned up three inches on all sides and have a drip pipe to carry off the water. The cold room should be tightly ceiled, and not connected with the ice box. In passing in and out of the refrigerator through the cold room, one of the two doors should always be closed in order to prevent the cold air from rushing out."

ICE HOUSE.

"It is generally necessary to have an ice house connected with the creamery. An ice house may be built of single or double walls, depending more or less on the ease and cheapness with which ice can be secured in winter. The dimensions of the ice house can easily be determined from a standard. A cubic foot of ice weighs fifty-five pounds and an average creamery should have an ice house

of 150 tons capacity. It is generally advisable to have the ice house connected with the creamery building."

DOORS AND WINDOWS.

"All the doors in a creamery should be not less than three feet eight inches wide and six feet eight inches high, except the door to the receiving room, one door in the churn room, and a boiler room door, each of which should not be less than five feet in width. Windows should be large, each having not less than four 14x28 inch lights; and should be arranged so as to drop from above as well as below in order to secure a means for good ventilation. Creameries should be provided with ventilators on the roof and passages connecting with the rooms below so as to carry off the heat and steam."

BOILER AND ENGINE.

"Not less than a fifteen horse power boiler should be put in a creamery. A large boiler saves fuel and labor. It should always be at least one-half greater capacity than the engine. The horizontal boiler is preferable to the upright style. If the boiler is to be bricked, care must be taken in setting it up. See that the foundation is at least two and one-half feet deep and grouted well. The furnace walls should not be less than sixteen inches thick, fire box lined with fire-brick and stayed with three sets of wall stays. The smoke stack should never be less than thirty feet in height to insure good draught. The engine should be set on a good solid foundation fastened with four anchor bolts. The horizontal style is always preferable to the vertical. The size depends on the kind and amount of machinery to be used. It should be as simple as possible.

PUMPS.

"Never purchase a horizontal steam or other surface cylinder pump, without measuring or knowing the height to

which the column of water is to be lifted. The limit of suction for an ordinary pump is practically twenty-seven feet."

SKIM MILK TANK.

"The skim milk tank should be lined or made of galvanized iron and be placed high enough for a wagon to drive under and draw off the milk by simply opening a valve. The ground around this place should be paved in such a way that the drip will run off into the sewer. It is necessary to flush this place every day, for sanitary purposes. The milk can be elevated by means of a pump or steam jet. If a check pump is used this is not necessary. The exhaust steam of the engine should be utilized for scalding the skim milk in order to keep it sweet until fed. The arrangement must be convenient so that the person in charge can easily steam and clean it every day."

DIMENSIONS AND COST.

The dimensions of a creamery large enough to handle the milk from 300 to 500 cows should not be less than 22x40 feet for the main building and 20x20 feet for the wing containing the boiler, engine and coal room. The cost of such a creamery is all the way from \$2,500 to \$3,500; depending on the cost of material and the character of its equipment. In addition to the machinery already mentioned the following is a very fair estimate of the outfit required.

One 600 gallon milk vat; one 300 gallon cream vat; one, and perhaps two separators; one 600 pound two-beam scale; one creamery suspension salting scale; one combined churn and worker, or one box churn and Mason worker. One tempering pan; one 80 gallon weigh can; two common milk pumps in addition to the suction or force steam pump for the well. To this must be added the necessary pipe and steam fittings with which to pipe water and steam to the

churn, sink, skim milk tank and all vats in the creamery. This will require at least twenty feet, two inch exhaust pipe, twenty feet one and one-half inch, and twenty feet one and one-fourth inch steam pipe, and two hundred feet three-fourth inch, and thirty feet one-half inch steam pipe. To this must be added the requisite number of elbows, check-valves, nipples, unions, bushings and tees necessary to the proper piping of the creamery.

There will further be required about twenty feet of shafting with the necessary number of hangers, pulleys, etc., together with belting, pails, cream and milk spouts, steam tester, thermometers and numerous other small articles that go to make up a complete creamery equipment. It is well, when contemplating the construction of a creamery, to correspond with some reliable creamery supply company and get their estimates on the necessary articles of equipment and their cost. It is also advisable to purchase the outfit on sixty or thirty day's trial, when if there are any flaws in the apparatus bought they will undoubtedly be discovered.

Chapter 9.

FARMERS' DAIRY CLUBS.

All experience has demonstrated that a union of effort in any undertaking is usually productive of success. The healthful growth of all human enterprises depends more on the harmonious relation of what are generally considered minor details, than it does on the more conspicuous factors that outline the specific work in hand. The reason for this is not that the little details, considered singly, are more important than are fundamental principles, but because they are so much more easily overlooked.

We have all heard of the wealthy individual who planned the building of a palatial residence; demanding that the artisans engaged in its construction should neither add to nor take from the plans and specifications furnished them. When the work was completed and she was called in to accept it, she was both surprised and chagrined to discover that the building contained neither stairs nor staircase; no provision having been made for them in the plans she had drawn. Thus her magnificent dwelling, complete in every important feature, was rendered practically useless by the omission of a single minor detail.

So it often happens that in the prosecution of a certain work, we become so absorbed in a contemplation of its main characteristics, that we pass unnoticed some little detail, the neglect of which, either detracts from or wholly prevents successful achievement. Errors of this nature are so common that no man, however proficient he may be in a knowledge of his work, is entirely free from them.

It is safe to conclude; therefore, that no man can depend on himself alone in the successful prosecution of any

work. It requires the thought of other minds, and the result of a knowledge gained by other experiences, united with his own, to attain faultless completion. "In union there is strength," applies with equal force to all forms and kinds of human endeavor; and the power of united effort is today recognized as the controlling influence in almost every undertaking.

The dairy industry is no exception to the general rule. The first real and permanent advancement of its interests, dates from the organization of dairymen's associations. Dairymen came together at the meetings of these associations for the purpose of exchanging ideas and experiences, and at their close returned to their farms enriched by an ample store of information, which was at once applied in the prosecution of advanced methods in their work. So the Farmers' Institutes, held each winter in several of the states, are gradually lifting all features of the agricultural industry to a higher plane of excellence; demonstrating conclusively, that the trend of united effort is in the direction of success.

The advantages afforded by these county and state organizations are greatly enlarged upon, by the formation of similar associations in each community where agriculture or dairying is the chief industry.

In referring to the benefits resulting from these local associations, George McKerrów, superintendent of Farmers' Institutes in Wisconsin, says: "In holding Farmers' Institutes in the different sections of Wisconsin, we have found that in those localities where farmers' clubs have been maintained for some time, there the most intelligent and best meetings are conducted, and the thrift, intelligence and morality of the people are above the average."

Mr. McKerrów was so impressed by these evidences of the benefits resulting from these local organizations that he

compiled a constitution and set of by-laws from those of some of the best working clubs in the state, and published them in the Farmers' Institute Bulletin as an aid to other communities in establishing like organizations.

A similar form of constitution, by-laws and rules of order, are given in this chapter, for the organization of Dairy Clubs. Every community where dairying is the chief, or even an important industry, should have its Dairy Club. A good plan being for the patrons of each cheese factory or creamery to form an organization of their own.

It is needless, perhaps, to outline any particular plan to be adopted in organizing a club, though a few general suggestions will not be out of place. As an initiatory movement, let one or more persons interested in the advancement of dairy pursuits in the community, solicit the cooperation of their neighbors in effecting an organization. Point out to them the advantages resulting from united effort, both as a promoter of closer social relations in the neighborhood, and as a disseminator of a more comprehensive knowledge of dairying.

It will not be found difficult, if properly undertaken, to awaken an interest in such a movement in the average community. The American people are generally ready to promote the advancement of every enterprise which involves their interests, by every rational means; and any suggested movement, the utility of which, on examination, appeals to their reason and convinces their judgment, will receive their most liberal support and cooperation. For this reason it will not be difficult to establish a dairy club in almost any community where the right enthusiasm characterizes the efforts of the promoters.

INTEREST THE YOUNG.

At the very outset strive to enlist the cooperation of the young men and women of the community in the work.

If the sons and daughters of the farmers are thus brought together in social union, and for a discussion of the numerous topics connected with successful farming, they will grow to love farm life, as they acquire a scientific knowledge of the many problems it presents for study and solution. As a result a less number of them will leave the old home to seek a fortune in professional or commercial pursuits. The study and thought found necessary to master the questions pertaining to progressive dairying will lend dignity to the vocation and teach them that energy and brains are as essential here, as they are in any other of the many pursuits of life.

Such an organization will be sure to bring to the front, in every community, business tact and ability, which otherwise might have lain dormant forever. The different methods discussed at the meetings will also tend to create a friendly rivalry among the members, in their endeavor to produce the most milk per cow or the largest amount of butter from a herd. This will eventually lead to the keeping of better stock, to improved methods of feeding and care, and ultimately, to the realization of larger profits from the business.

Every dairy community should have such an association; and that the work of organization may be facilitated, we append the following constitution, by-laws, and rules of order for dairy clubs:

CONSTITUTION AND BY LAWS
OF THE

.....
DAIRY CLUB,
OF

.....
TOGETHER WITH
RULES OF ORDER AND ORDER OF BUSINESS.

CONSTITUTION.

PREAMBLE.

We, the undersigned, interested in Dairying, and desirous to secure the benefits to be derived from organization, for the purpose of practical discussion and the promotion of the common interests of our pursuit, do subscribe the following Constitution:

ARTICLE I—NAME.

This association shall be styled and known as the
..... Dairy Club.

ARTICLE II—OBJECTS.

The objects of this Club are to advance the knowledge and promote the general interests of dairying in this community.

ARTICLE III—OFFICERS.

The officers shall consist of a President, Vice President, Recording Secretary, Corresponding Secretary, Treasurer, and Librarian.

ARTICLE IV—DUTIES OF OFFICERS.

Section 1. It shall be the duty of the President to preside at all meetings of the Club; to enforce a due observance of the constitution, by-laws, and rules of order; to assign topics for discussion, at the suggestion of members.

He shall neither make nor second any motion, but shall have the privilege of taking part in debate; and while he has the floor, the meeting, for the time being, shall be in charge of the Vice President; but the President shall have no vote unless the Club shall be equally divided.

Section 2. It shall be the duty of the Vice President to preside at all times when the President is absent, and while he shall have temporarily vacated the chair.

Section 3. The Recording Secretary shall keep a record of the proceedings of the Club, also the name of each member, and shall, on the last regular meeting of each year, prepare and read the names of all members, and he shall have charge of the archives of the Club.

Section 4. The Corresponding Secretary shall conduct the correspondence of the Club and act as Recording Secretary in the absence of that officer. He shall render such assistance to the Recording Secretary as that officer may require in the performance of his duties.

Section 5. The Treasurer shall keep all money belonging to the Club, and disburse the same under the direction of the Club, according to its laws. He shall collect all fines dues of members, and shall, sometime during the month of December of each year, notify such as are in arrears and request their dues. He shall keep a correct account of all moneys received and expended.

Section 6. The Librarian shall have charge of the Library and its appurtenances, regulating the use of the same by the members, according to the rules and regulations prescribed. He shall make a written report of the condition of the library, at the annual meeting, and at such other times as the Club may direct. He shall, within one week, deliver to his successor in office, the library and its appurtenances, and all books, papers and documents in his possession, belonging to the Club.

ARTICLE V—ELECTIONS.

All elections for officers shall be by ballot, and shall be held at the first regular meeting in January of each, year; and their terms shall commence immediately after their election, to continue for one year, or until others are elected to fill their places. In the case of vacancy occurring in any office, the Club shall go immediately into an election to fill the same. A majority of all the votes cast shall be necessary to a choice.

ARTICLE VI—MEMBERSHIP.

Section 1. Any person interested in dairying, and of good moral standing, may become a member of this Club by signing this constitution, agreeing to support all laws and regulations made in pursuance thereof, and paying fifty cents annually into the treasury.

Section 2. Honorary membership may be conferred in consideration of eminent character and services in behalf of dairying, and shall be conferred without fee or dues. The recipient shall not be entitled to hold office, but may take part in all discussions and vote on all questions.

ARTICLE VII—AMENDMENTS.

No alteration, amendment or addition can be made to this Constitution, neither can a part of it be repealed, without a vote of two-thirds of the members present. Any proposed alteration, amendment, addition or repeal must be submitted in writing, filed with the Recording Secretary, and read at the two regular meetings next preceeding that on which the vote is taken.

BY-LAWS.

ARTICLE I.

This Club shall assemble weekly on..... evenings, from November 1 to April 1, and at such intervals thereafter as may be agreed upon by the Club, or appointed

by the President. The time and place of meeting may be altered at any regular meeting of the Club by a vote of two-thirds of all the members present.

ARTICLE II.

Section 1. Seven members shall constitute a quorum for the transaction of business of the Club. A less number may meet, maintain a discussion on any topic, and adjourn to any given time.

Section 2. Persons present, not members of the Club, may be invited to take part in all discussions of dairy topics; but they shall take no part in the business of the Club.

ARTICLE III.

Section 1. If the funds of the Club should at any time be exhausted, or inadequate to meet the demands contemplated by the constitution, there shall be an equal assessment upon each member to make up the deficiency.

Section 2. No appropriation of money from the funds of the Club shall be lawful, except in furtherance of the objects contemplated by the Constitution, as stated in Article 2, or specially provided by these By-Laws.

ARTICLE IV.

Section 1. There shall be a library established for the use of the Club in furtherance of the objects contemplated in Article 2, of the Constitution.

Section 2. The library shall be open to the free use of the members of the club, who shall not be more than three months indebted to the treasury, subject to the prescribed rules and regulations.

Section 3. The library shall be maintained by the surplus fund, after defraying the expenses of the club, and by the voluntary contributions and donations of the members, to be duly accredited to such contributor and donor.

Section 4. The library shall be in charge of the Librarian, as provided in Article 4, Section 6, of the Constitution. There shall be a standing Library Committee of three members, appointed at each Annual Meeting, of whom the Librarian shall be one, and *ex-officio* chairman, who shall have charge of the purchase and collection of books, papers and pamphlets for the library, and perform such other duties as may be ordained.

SECTION V—RULES.

Rule 1. No member shall have from the library more than one book at a time.

Rule 2. No volume shall be retained longer than two weeks, under penalty of a fine of ten cents for the first week of detention and five cents for each week thereafter.

Rule 3. There shall be assessed for injuries as follows: First, for an injury beyond ordinary wear, an amount appropriate to the injury, ascertained by the Librarian. Second, for the loss of a volume, the cost of the book; and if one of a set, an amount sufficient to replace it or purchase a new set.

Rule 4. No person having incurred a fine shall be permitted to take books from the library until the fine is paid.

ARTICLE V.

A vote of two-thirds of all the members present shall be required to pass any appropriation of money by the club other than for its necessary contingent expenses.

ARTICLE VI.

Section 1. Any member who shall suffer his account with the Treasurer to go unsettled for more than one year shall cease to be considered as belonging to the club, and his name shall be stricken from the roll accordingly.

Section 2. Any member who shall be guilty of any gross violation of the rules of order, or of profane or

indecent language or conduct at any of the meetings of the club, shall be fined, reprimanded, or expelled, as the club may, by a two-thirds vote, decide.

Section 3. Any member who shall become guilty of any heinous offence or disgraceful practice, such as to render him unfit as an associate, shall on conviction thereof, be expelled by the club.

ARTICLE VII.

These By-Laws may be amended in the same manner as the Constitution.

STANDING RESOLUTIONS.

Resolved, That, after this date, the weekly meetings of this club shall be held on....., at....., or at the residence of the members of the club, at..... o'clock.

Resolved, That there shall be an Executive Committee consisting of the President, Recording Secretary and Treasurer, having power to transact the necessary business of the club during the term when the meetings are not held.

RULES OF ORDER.

Rule 1. No question shall be stated unless moved by two members, nor open for discussion unless stated by the President.

Rule 2. When a member intends to speak on a question he shall rise in his place and respectfully address his remarks to the chair, confine his remarks to the question, and avoid personalities. Should more than one person rise at a time, the President shall determine who is entitled to the floor.

Rule 3. When a member is called to order by the President, or any other member, he shall at once take his seat, and every point of order shall be decided by the President, without debate, subject to an appeal to the club.

Rule 4. In case of an appeal from the decision of the chair, the question shall be put to the club, thus: "Shall the decision of the chair be sustained?" which shall be decided without debate.

Rule 5. No member shall interrupt another while he is speaking, except to call to order.

Rule 6. Any member may call for a division of the question, when the sense will admit of it.

Rule 7. When any three members call for the ayes and nays, they shall be taken and recorded on the minutes.

Rule 8. All resolutions shall, when required by the President or any member, be submitted in writing, and signed by the member offering the same.

Rule 9. Cushing's Manual of Parliamentary Practice shall be adopted as authority in all matters pertaining to parliamentary order in the club.

Rule 10. These rules may be amended in the same manner as the Constitution and By-Laws.

ORDER OF BUSINESS.

1. Calling the roll of officers and necessary filling of vacancies.
2. Reading the minutes of last meeting.
3. Reports of committees.
4. Unfinished business.
5. New business.
6. Reception of new members.
7. Has any member any question to ask for information in regard to his farm, stock, etc.?
8. Reading of communications and essays.
9. Discussion of regular topic.
10. Assignment of subject for next discussion.
11. Adjournment.

The following topics for discussion, and subjects for essays may be profitably considered by clubs, together with numerous others that will suggest themselves from time to time:

TOPICS FOR DISCUSSION.

1. Which should receive first consideration in selecting a cow for the dairy, individual merit or breed?
2. Which is the more important, the quality or quantity of milk a cow gives.
3. Does it pay to feed dairy stock liberally, on feeds rich in protein elements?
4. Does the feeding of silage injure the quality of dairy products?
5. Does it pay to feed silage to dairy stock?
6. Which is the more economical feed, corn or clover silage?
7. Is the type or shape of a cow an index of dairy qualities?
8. Which is the more desirable quality in a dairy cow, the quantity of milk she gives or the persistence with which she gives it?
9. Can a cow, inclined to apply the food she eats to the production of fat, be rendered profitable in a dairy?
10. Is it more profitable for the dairy farmer to raise his dairy stock than it is to purchase them?
11. Which has the greater influence on the productiveness of the dairy cow, the kind and quantity of feed she eats or the care and training she receives?
12. Does the want of physical exercise impair the vitality of the dairy cow?
13. Can the fat content of milk be increased by the kind, quality or quantity of feed given her?
14. Does it pay to make cheese and butter on the farm?

15. Which is the more profitable for the dairy farmer, the cooperative or the proprietary system of butter and cheese production?

16. Is the manufacture and sale of skim cheese injurious to the milk producer?

17. Should the manufacture and sale of oleomargarine be prohibited?

18. Should the dairy farmer plant his corn in hills or in drills?

19. Does it pay to plough corn ground in the fall?

20. Does it pay to feed dairy cows a grain ration when they are not giving milk?

SUBJECTS FOR ESSAYS.

1. Points by which to judge a dairy cow.
2. Benefits resulting from milking at regular intervals.

3. Where the Jersey cow excels.
4. The Holstein-Friesian cow in the dairy.
5. Influence of type on milk production.
6. Influence of different feeds on milk production.
7. Influence of care on milk production.
8. How to ventilate the cow barn.
9. How to care for milk.
10. Home testing; its benefits.
11. Value of milk records.
12. How to keep a herd book.
13. Buttermaking on the farm.
14. Ripening cream.
15. Cheesemaking on the farm.
16. Feed value of skim milk.
17. How to raise a calf.
18. How milk should be tested.
19. How to train dairy stock.

20. How to detect points of excellence in a dairy cow.
21. How to keep the most dairy stock on a farm.
22. Feeds rich in protein elements.
23. Value of corn as a feed for dairy stock.
24. The creamery and the farmer's wife.
25. An ideal home dairy.
26. What dairying has done for our farms.
27. Teach the girls to milk and make butter.
28. The cow versus wheat; cash versus credit.
29. Marketing butter and cheese.
30. Science in dairying.

Chapter 10.

Miscellaneous Facts.

Under the above caption will be considered briefly, a few factors of more or less importance in dairy work, that have not been discussed in the preceding chapters; first of which will be the relations which ought to exist between the

PATRON AND FACTORYMAN.

The two central figures in the producing problem of dairy work are the patron and the factory man. The man who produces the milk and the one who manufactures it into commercial products. That there is a unity of interests existing between these two goes without saying; therefore, a singleness of purpose and a uniformity of action, on their part, is indispensable to success. The patron should understand that, whenever by legitimate means he renders substantial aid to the factoryman he, by the same act, promotes his own business interests. The factoryman should likewise comprehend that, whatever adds to the patron's prosperity has a corresponding effect upon his own. If this similarity of interests and mutual dependence was better understood, or being understood, was more generally acted upon by both patron and factoryman, not only would it render their relations to each other more harmonious, but it would contribute much to the financial advantage of both parties. The patron should be careful not to overestimate his rights. He must not reason that, as the factoryman must have milk or close up his factory, he, the patron, is privileged to manage his end of the business any way he pleases; for by so doing, he may saw off the limb that is

supporting him. He has no right to expect the highest market price for his milk, if it is inferior in quality or is in bad condition; neither has he the right to dictate to the factoryman what the required quality and condition of the milk shall be. This is a prerogative belonging to the factoryman's end of the business, and he is entitled to its full control within reasonable limits. The patron should not neglect necessary precautions in caring for his milk, trusting to the good management of his brother patrons to carry him through; for by so doing he not only imperils his own but their interests, thereby infringing on their and the factoryman's rights.

He should listen to all reasonable suggestions made by the factoryman in relation to the feed and water given to his cows, and as far as possible conform to them. He must not, however, consider a suggestion unreasonable simply because it may conflict with some of his pet theories regarding the management of a dairy. If he observes these requirements, he has a right to demand from the factoryman the prevailing market price for his milk. It is his right also to receive courteous and impartial treatment in all necessary transactions with the factoryman, and such information regarding the general management of the business as is his rightful privilege to know.

Chief among these rights, perhaps, is the privilege of knowing how his milk is tested. In a large majority of factories the price paid for milk is regulated by its fat content, and the patron has the same right to know how this is determined and to witness, if he desires to do so, the process of testing his milk, that he has to know the scales are rightly balanced on which the feed he purchases is weighed. It is the factoryman's duty, therefore, to recognize this privilege and not only permit the patron to witness the testing of his milk, but to explain to him the details of

the process by which the final result is obtained. The existence of "strained relations" between patron and factory man, is more often attributable to a misunderstanding regarding the milk test than to any other cause. It would seem as though dissatisfaction from this source could be greatly lessened, if not wholly removed, by the adoption of more frank and open methods by the factory man.

If he is exercising proper care in taking the test, and if there is no irregularity in its manipulation, he certainly has nothing to conceal from the patron. Therefore, he should always show a willingness to explain how the testing is done, and the patron should be made to feel that he is at all times welcome to be present and see his milk tested. We fear there are occasions when methods are practiced by factorymen, that afford ample grounds for dissatisfaction on the part of the patron. Sometimes if a patron's milk is testing above the average he is cut down a little, and another patron, whose milk is testing low, is raised a few points. A factoryman sometimes does this, not to gain an unfair advantage himself, but to avoid the creation of jealousies among the patrons, occasioned by wide differences in the per cent of their several tests. He also reasons that, if a patron's milk is testing what he considers as abnormally high at one season of the year, and the patron knows it, he will be dissatisfied when at another period it may test quite low. So rather than take the trouble to explain to the patron the conditions which may cause this wide difference in the test of his cows, he takes off a little at one time and adds a little at another, that the test may be nearly uniform throughout the year. While a factoryman may see little harm resulting from this practice, the fact remains it is not right and cannot be justified by any correct system of reasoning. It is far better to give the patrons what belongs to them at all times be it much or little. Then if jealousies

arise between them because of differences in their tests, let the foreman show them, by making a test in their presence, that the differences actually exist and all cause for dissatisfaction will be removed.

Further, it is sometimes customary for two or more factorymen operating factories or creameries in adjacent communities, to agree, without their patrons' knowledge, upon the price they will pay for fat for a given time. This price is generally a little below the values warranted by market conditions. When the dividends are received by the patrons they may be dissatisfied with the prices obtained, but, in the language of Tweed "What are they going to do about it?" Factoryman "A" is paying as much as factoryman "B" or "C", and though the patrons may believe they are not receiving fair treatment, they have no remedy, unless they assume control of the whole business and establish cooperative factories.

A few years ago, for the farmers to do this successfully was considered next to impossible. It was forcibly urged, until the farmers sometimes believed it themselves, that cooperative factories or creameries could not succeed, because the farmers could not, and would not if they could, agree among themselves. It was further argued that, though they should succeed in manufacturing butter and cheese, they were so unskilled in the methods of trade, that they could not sell these products to advantage. Consequently, should they try the cooperative plan, it was only a question of a few months or a year when they would be forced to return to the proprietary factory, poorer but wiser men.

The fallacy of these claims has been conclusively proven during the last few years, by the large number of cooperative factories and creameries that have sprung into existence and the permanency that seems to characterize their

growth. We very seldom hear now-a-days of a cooperative creamery failing; and when one does fail, it is as often attributable to some other causes, as it is either to a lack of unity among the farmers composing its patrons, or a want of thenecessary ability to conduct the business.

Another significant fact has been demonstrated in recent years, and that is, where a cooperative creamery springs up in opposition to a proprietary creamery, the latter usually suffers most from the competition. The truth has also been established that the farmer does, when put to the test, possess the tact and business sagacity necessary to the proper management of a cheese factory or creamery. In almost every community where cooperative creameries have been established, business ability has been brought to the front that heretofore lay hidden and dormant. Thus illustrating the truth that, there can be no contingency in human affairs but someone is found able to meet and successfully cope with it.

Should the cooperative factory then, supersede the proprietary factory? Yes and no. If the management of the proprietary creameries shows a disposition to take advantage of their patrons, by trickery and deception withholding from them a portion of what is their rightful dues, then it is not only the patrons' privilege but it is their duty to sever all relations with such proprietors and assume control of the manufacture of their own dairy products. When such conditions exist the dishonest creamery proprietor has no just cause for complaint; as the competition which thus springs up and overwhelms him is the result of his own avarice and he deserves to be pushed to the wall.

On the other hand, when a creamery proprietor deals fairly and honestly with his patrons, as many of them do, it is not good business policy for the farmers to try the cooperative plan. The average dairy farmer has enough to

attend to if he gives proper attention to the selection of his herd and the many factors which enter into its feeding and care, without assuming the additional responsibility of manufacturing and selling butter and cheese. Under these conditions he had much better stay with the proprietary creamery and aid, by every legitimate means in his power, in building it up and rendering its business prosperous.

In justice to his judgement it must be admitted this is the course he usually pursues; often staying with the proprietary factory or creamery long after he has sufficient provocation to leave it and assume the management of the business himself. In this regard he illustrates the truism set forth in the Declaration of Independence that "all experience has shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed."

QUALIFICATIONS OF A FOREMAN.

It is not only necessary for a foreman to know how to make butter and cheese but he should be equally competent in the care and management of machinery. Many a cheese-factory and creamery has been driven to the wall through the incompetency of the man in charge of it. A man is often engaged to assume the management of a creamery whose only qualification for the position, if it can be called a qualification, is that he works for small wages. He, perhaps, has worked as second man for a few months in in some factory, and imagines he knows all about the business; when in fact, he is ignorant of every important principle involved in butter and cheesemaking, and general factory management. The low price he asks for his services sometimes secures a position for this kind of an operator. Nevertheless, his engagement, at however low a price, often proves to be ill-advised economy; as the damage to machinery resulting from his incompetency, added to the

loss sustained through the making of poor butter and cheese, often renders his services very expensive.

Following are a few of the many short-comings which characterize the work of the incompetent foreman:

He will accept milk wholly unfit to make into butter and cheese because he does not know anything is the matter with it. He may be able to tell if milk is sour but at this point his knowledge of its condition ends.

He handles his cream as a parrot does words, never changing to meet altered conditions.

His separators, usually out of balance, bewail their condition in hoarse rumblings when run at high speed. To save time and trouble, he usually throws them on while the engine is in full motion. He never cleans them during the process of separating, and it is often difficult to determine which is the larger stream, the one flowing from the cream spout or the one flowing from the milk spout.

To economize in time and labor, he will sometimes throw away the samples of milk saved, from which to make a composite test, and make out his report to the management from the test taken the month before.

It is no unusual thing for him to become so proficient in a knowledge of the business, that he finds it unnecessary to weigh the salt for his butter, or even take the temperature of the cream before churning it.

Enter the factory where he presides, when the steam is up and the machinery in motion and you will be confronted by fresh evidences of his superior talent, in the clattering of shafts in loose boxes and the hissing of steam as it escapes from imperfect valves

Look into the fire box under the boiler, and you will find the grates clogged with clinkers, and if the investigation is carried farther, the interior of the boiler will most likely be found coated with lime.

The uncertain condition of the machinery renders the copious use of oil necessary; which is frequently evidenced by the small pools on the floor under the shaft-hangers, and the tiny rivulets flowing out in different directions from the separators.

But why comment farther on his various qualifications? Factory proprietors and cooperative creamery managers all know him. Some of them to their sorrow, have had business dealings with him. These latter ought to know him best, for his genius is often the child of their creation. Had they not been looking for something cheap he, perhaps, would never have been heard of. They were economical men who believed in curtailing expenses in all departments of their business; consequently they demanded cheap help and he filled the requirement exactly, for he is cheap in any sense the term implies.

Compare this weak apology for a man with the wide awake, energetic, up-to-date foreman. The man who is competent in every department of creamery work, knows it, and demands adequate pay for his services. Go on the weigh-stand where he is receiving milk and note the care he exercises in determining its condition. See how readily he notes defects, points them out to the patron, and suggests methods whereby they may be avoided in the future. Go into the butter room and no stale or ancient odors will meet you at the door. Neither will you observe little heaps of dirt, peeping out from half hidden corners, nor see cobwebs hanging in festoons from the ceiling.

There are no creaking shafts or leaky valves to jar your nerves, nor oil drippings from shaft-hangers, to destroy your clothes. The engine runs smoothly and is free from grease and cinders, while the fire in the fire-box burns brightly; showing that everything is in order and under the control of a master hand.

The separators run without a jar, and every belt and piece of machinery is perfectly performing the service for for which it is intended. His cream is properly cooled and ripened and his butter is extras every time.

Such a foreman is not backward in pointing out to patrons their short-comings, or in requesting them to improve their methods. This, however, is done in a courteous manner but in a way that carries conviction with it. The patrons soon learn that his heart is in his work, and that he fully understands what he is doing. For this they respect him, have confidence in him and willingly carry out any change of method he may suggest.

The life of such a foreman is not one round of drudgery as some may suppose; for by keeping everything in order, there is never a hitch in his work to hold him over hours. By having all things properly adjusted at the beginning, a little attention every day keeps them so; thereby affording ample opportunity for pleasant diversion.

The actual value of such a foreman as the one just described is not always appreciated by his employers. His usefulness does not end with his ability to make good butter and cheese and properly manage the general details of factory work. There is another feature equal in importance with those mentioned, where his services are of great value. He is, so to speak, the coupling link that holds together in harmonious relation the factory proprietor and his patrons. The owner or manager of a number of cheese factories and creameries, can give but little time to the every day affairs that enter into the operation of each of them. He is seldom brought into close personal relation with his numerous patrons; being obliged to deal with them as combinations, rather than as individuals. Therefore the adjustment of numerous details of a personal nature, must be left to the foremen in charge or the several factories. To them the

patrons come with their real or imaginary grievances, with numerous requests and suggestions, and the thousand and one questions that constantly present themselves from day to day. The really competent foreman is always ready to meet and satisfactorily adjust all these conditions. He is quick to perceive individual characteristics, and adapts the method he employs in business transactions to their several requirements. In short, he is a successful arbiter, always standing between his employer and the patrons, to avert contention and prevent dissatisfaction.

His services in this direction should not be disregarded nor underestimated by the creamery proprietor. Men who possess these valuable qualities are finer grained than is the indifferent, incompetent shirk, and they feel keenly any lack of appreciation of their efforts. The creamery man then, who is so fortunate as to have in his employ, men of this calibre and efficiency, will further his own interests by according them the treatment their superior qualities merit. Provide them with every facility necessary for the proper accomplishment of their work, pay them liberally for their services and do not lay them off or cut their wages if business happens to be slack for a short time. Show them by your demeanor that you appreciate their efforts. Not by fulsome praise, for this is always distasteful to a man of spirit, but by considerate acts, such as giving them an occasional holiday or a two weeks' vacation without any loss of time. The employer who pursues this course in his dealings with his competent, painstaking employes, whether it be in the creamery, or any other business, is not only insuring to himself the best service they can give him, but what is of equal value, he wins their sincere respect and esteem.

WASTES IN THE FACTORY.

The importance of this factor is closely related to the one just considered, the competency of the man in charge of the creamery. One of the most fruitful sources of loss in the creamery is a failure to separate cleanly. It is an easy matter for an indifferent operator to throw away at this one point more than his salary amounts to. Did you never figure out what it amounts to in a year, in a factory receiving ten thousand pounds of milk daily, to leave one-tenth of one per cent of fat in the milk? It means a loss of nearly ten pounds of butter fat each day. If you add twenty per cent to this, to cover the churn overrun, it shows a loss of twelve pounds of commercial butter, amounting, at twenty-five cents a pound, to three dollars every twenty-four hours; or one thousand ninety-five dollars every year. This sum represents a five per cent income on a capital investment of twenty-one thousand nine hundred dollars. Quite an item is it not? It is not, however, likely to end here; for the operator who will lose that amount of fat in the skim milk, will in all probability, leave more of it in the buttermilk.

This loss in separating, can be largely overcome if the machines are run at high speed, and the milk is properly tempered, and not fed too fast into the separators. Another thing, the separators must be kept clean. It is so easy to run them just a little while longer, though we know they are dirty, in order to get all the milk through without stopping. Right here is where the greatest loss is sustained. For example, the separators may do comparatively clean work while running through the first eight thousand pounds of milk, then become so clogged with dirt as to leave sufficient fat in the remaining two thousand pounds, to cause an average loss of one-tenth of one per cent of fat, or even more. When the flow of cream from a machine

indicates that it is becoming dirty it should be stopped at once, taken apart, and the tins rinsed without removing them from the standard, and the inside of the bowl and milk tubes cleaned. The whole labor will not occupy over fifteen minutes for each machine, and it should never be neglected. When several machines are used, one should be stopped, cleaned and started, then another, until all the machines have been over-hauled. By pursuing this course only one separator is idle at a time.

Other sources of waste are from improperly ripened cream and churning at the wrong temperature, both of which have been referred to in another place and need not be discussed here.

In cheesemaking the greatest waste is occasioned by losing the casein and fat in the whey. This loss can be greatly lessened by securing a firm set at not too high a temperature, and by careful handling in the first stages of scalding. Much loss can also be avoided by keeping the curing room at the right temperature, and by avoiding the presence of skippers in the cheese.

Waste is also caused, in both cheese factories and creameries by having leaky conveyor pipes and vats, and leaky tempering pans. The latter is perhaps the most common, consequently it deserves special mention. Nothing looks more slouchy and wasteful than to see milk flowing in tiny streams, like water from a street sprinkler, from the sides and bottom of a tempering pan. The tempering pan is an article of creamery equipment that soon wears out, and is often made to do service long after it is totally useless. Tempering pans are often destroyed by neglecting to keep water in them while in use. This should be avoided; as it not only injures the pan but the dry steam over heats the milk, causing it to burn on the tin. The operator should not only exercise care in this direction but he should

provide himself with solder and a soldering iron, and fill up the holes as fast as they appear. He should also order a new pan and insist on getting it, before the waste occasioned by the continued use of the old one amounts to many times its cost; and when he gets it he should take care of it.

Loss is also sustained by allowing the machinery to remain constantly out of order. Outlays for repairs, often represented by three figures, could be materially lessened if the machinery was properly looked after. Keep the separators balanced, and the bushings properly set and free from dirt and grit. See that the shafts are level and the hangers firm. Keep all bearings clean and well oiled and many dollars of useless expenditure can be saved every year.

Much waste is also occasioned by failure to take proper care of the boiler. This causes a waste in two directions; damage to the boiler and increased consumption of fuel. If a boiler is used for too long a time without blowing the water out of it and removing the lime scales that have accumulated on the bottom, it is liable to burn out. The lime will gather on the flues and on the inside of the boiler, then scale off and settle on the bottom over the fire box; keeping the water away from the boiler plate causing it to burn through. This condition also necessitates the consumption of more fuel; as the action of heat upon the water is retarded by the lime coating on the inside of the boiler.

Do not blow off the boiler when a full pressure of steam is on. It is not necessary to have even half the usual pressure to accomplish the purpose desired. Again, do not after cleaning the boiler, refill it with cold water while very hot. It is well understood by almost everybody that iron or steel expands when subjected to heat and contracts when cold. Therefore, the transition from one of these

conditions to the other should always be slow and gradual in using a steam boiler. This is necessary that the rivets holding together the plates may not be loosened or broken by a too rapid contraction or expansion. The better way is, to blow off and clean the boiler after the day's work is completed, then let it stand and cool until early the next morning before filling it with cold water. Of course this cannot be done in winter, when steam is needed to keep the factory at a proper temperature. But if, as is usually the case, the boiler is refilled from an over-head tank, the water in this should be heated before blowing off the boiler; then, after letting the boiler cool as long as possible after cleaning, fill it with the hot water from the tank.

Fuel is not only wasted by allowing the boiler to become lime coated, but much is consumed unnecessarily by improper firing. In the first place, the grates are often allowed to become clogged with clinkers. This impairs the draught and produces a smouldering fire, that consumes large quantities of coal without generating much heat. Again, the grates may be kept clean but if the coal is thrown into the furnace in heaps the draught will be impaired and much waste of fuel will result. Therefore too much coal injures the fire instead of improving it. To obtain the best results fire often, spreading the coal thinly over the grates and putting in but little at a time. In this way a lively blaze can be maintained all the time, and all the heat generated by the combustion will be utilized in making steam. Fuel is often indirectly wasted by having leaky steam pipes and valves. In this way nearly half the steam generated is sometimes lost.

Another, and the most fruitful source of waste, one which includes those named and many that have not been mentioned, is to give the factory into the charge of an incompetent, heedless, lazy operator. One who neither

knows nor cares how the factory should be run as long as he gets in his time and draws his salary. Therefore, the most effectual means for stopping these numerous leaks, that absorb such a large portion of the profits of the business is to engage only competent, energetic men to take charge of the work.

ADVANTAGE IN DAIRYING.

Farmers are often slow in realizing some of the most substantial benefits resulting from dairying; overlooking many of the real advantages which the establishment of the creamery or cheese factory has brought and is still bringing to their community. The fact is, the general improvement brought about through the influence of the dairy industry is so gradual that, by the time the farmer realizes that conditions with him have grown better, he is apt to lose sight of the source from whence sprung his greater advancement. Therefore, it might be well enough to call him back for a moment, that he may scrutinize first causes, and, perhaps, pick up the trail which leads directly from these causes to the higher plane of material prosperity he now occupies. In the first place, dairying

IMPROVES THE FARM.

By enriching the soil. It leads to the abandonment of the old system of single crop production. That system which constantly drains the land of its elements of fertility but never gives anything back, until it is so impoverished as to be almost sterile. A condition of the soil that is constantly producing poorer crops, which in turn leads to smaller revenues and larger debts; until the mortgage, like an octopus, catches the farmer in its death grip and in thousands of instances bears him down to financial ruin. Dairying is changing all this. It is leading the farmer to adopt a system of diversified farming which requires

thought and research to understand. The result is, while he is seeking information in a single direction, new truths, relating to all features of agriculture constantly reveal themselves until, almost before he knows it, he is applying scientific principles in the management of his farm. Thus greater and more uniform success is moving parallel with his increased knowledge, until the sterile soil is becoming rich, the crops more bountiful, the debts are vanishing and the mortgage octopus is releasing its hold upon him. Dairying is also leading to the keeping of

IMPROVED STOCK.

A cow was a cow with the old time farmer. He knew nothing of the influence of type or breed on the development of specific qualities, and he never troubled himself by giving the subject any attention. When, however, he enters the dairy field necessity compels him to change his tactics. He is fast learning that he cannot succeed with the scrub stock he has been keeping. Others, a little more progressive, perhaps, than himself, preceeded him in giving attention to the quality of their cows. They began, at first to talk about the influence of breed on the real value of a cow and about the effect of type on milk production. Then they began to make changes in their herds along these lines, with beneficial results. This has inspired our farmer to try like methods, and so the good influence is spreading until the successful dairy farmer is becoming well versed in a knowledge of the cow, and will soon be, if he is not already, an expert judge of all kinds of stock. Again where dairying is successfully followed,

THE CREDIT SYSTEM

Of doing business has almost vanished. This system was formerly the farmers' greatest hindrance. The chief product of his farm was wheat with perhaps a few hogs or sheep,

which were marketed once a year. As a result he traded throughout the year on credit. The merchant who carried him through charged double margins on all the goods the farmer purchased, and, when payday arrived, it often required more than the farm had produced to wipe out the debt; rendering it necessary for him to borrow money with which to pay the balance and meet his taxes.

Dairying has improved these conditions. The dairy farmer receives cash returns from his investment every thirty days, and in many instances every fifteen days. This enables him to pay cash for every thing he purchases, buying it where it can be procured for the least money, and select just the kind and quality of goods he wants. This one feature alone is saving millions of dollars to the farmers of the country every year. There are numerous other advantages which dairying has, and is bringing to the American farmer but we will not take space to mention them here. It is needless to do so; as the benefits, both immediate and remote, that are resulting from this industry can be readily understood by the farmers themselves.

Dairying is increasing the farmer's store of knowledge, thereby imparting a greater dignity to his vocation. It is rendering him more thrifty and consequently more prosperous. It is putting better improvements on his farm. It is building better school houses and providing better teachers, thereby aiding in the dissemination of a broader and more comprehensive knowledge among the young. In short, it is bringing to the American farmer increased prosperity, which means greater opportunity for improvement in the moral and intellectual as well as the material affairs of life.

OLEOMARGARINE.

Following are the ingredients used in the production

of oleomargarine and the percentage each ingredient bears to the whole quantity:

Neutral lard.....	34.27 per cent.
Oleo oil.....	26.82 per cent.
Cottonseed oil.....	4.77 per cent.
Sesame	0.53 per cent.
Coloring matter.....	0.16 per cent.
Glycerine	0.01 per cent.
Stearine	0.07 per cent.
Glucose.....	0.03 per cent.
Milk.....	15.55 per cent.
Salt.....	7.42 per cent.
Butter oil.....	4.76 per cent.
Butter	1.72 per cent.
Cream.....	3.86 per cent.

The following are the number of pounds of the different ingredients used in the production of oleomargarine, for the fiscal year ended June 30, 1899; as reported to Congress by the United States Secretary of the Treasury:

Neutral lard.....	31,297,251 pounds.
Oleo oil.....	24,491,769 pounds.
Cottonseed oil.....	4,357,514 pounds.
Sesame	486,310 pounds.
Coloring matter.....	148,970 pounds.
Glycerine	8,963 pounds.
Stearine	5,890 pounds.
Glucose.....	2,550 pounds.
Milk	14,200,576 pounds.
Salt	6,773,670 pounds.
Butter oil	4,342,904 pounds.
Butter	1,568,319 pounds.
Cream	3,527,410 pounds.

Total..... 92,322,260 pounds.

The above will give the dairy farmers of the country some idea of the powerful competition this spurious article brings to bear upon legitimate butter production.

Milk Standards.

The following are the milk standards established in several of the states:

NEW YORK.

By the law of 1893 New York requires twelve per cent of solids, three per cent of fat, and nine per cent of solids not fat.

MAINE.

By the law of 1893 Maine requires twelve per cent of solids, three per cent of fat, and nine per cent of solids not fat.

VERMONT.

By the law of 1888 Vermont requires twelve and one-half per cent of solids, three and one-fourth per cent of fat, and nine and one-fourth per cent of solids not fat.

NEW HAMPSHIRE.

By the law of 1893 the state of New Hampshire requires thirteen per cent of solids. There is no standard fixing the per cent of fat.

RHODE ISLAND.

By the law of 1893 Rhode Island requires twelve per cent of solids, two and one-half per cent of fat and nine and one-half per cent of solids not fat.

NEW JERSEY.

By the law of 1882 New Jersey requires twelve per cent of solids. There is no standard fixing the per cent of fat.

PENNSYLVANIA.

By the law of 1885 Pennsylvania requires twelve and one-half per cent of solids, three per cent of fat, and nine and one-half per cent of solids not fat.

IOWA.

By the law of 1892 Iowa requires three per cent of fat. There is no standard fixing the per cent of other solids.

MINNESOTA.

By the law of 1889 Minnesota requires thirteen per cent of solids, three and one-half per cent of fat and nine and one-half per cent of solids not fat.

OREGON.

By the law of 1893 Oregon requires twelve and one-half per cent of solids, three and two-tenths per cent of fat, and nine and three-tenths per cent of solids not fat.

MICHIGAN.

By the law of 1889 Michigan requires twelve and one-half per cent of solids, three per cent of fat, and nine and one-half per cent of solids not fat.

WISCONSIN.

By the law of 1889 Wisconsin requires three per cent of fat. There is no standard fixing the per cent of other solids.

OHIO.

By the law of 1889 Ohio requires twelve and one-half per cent of solids, three per cent of fat, and nine and one-half per cent of solids not fat.

Oregon requires butter to contain not more than fourteen per cent of water.

Minnesota requires cheese to contain forty per cent of fat in the solids.

ABORTION IN MILK COWS.

The Royal Agricultural Society and Professor Williams, of the Edinburgh University have successfully tested the carbolic acid treatment. Mr N. A. Lind, of Rolfe, Iowa, gives his experience as follows:

“ I had found abortion the most difficult disease to control. In the winter of 1894-1895 I had thirty-six head of thoroughbred Shorthorn cows all in calf by my herd bull, Wild Eyes Duke 2d. In less than four months eighteen out of the thirty-six aborted. I tried everything. I saw a report of the carbolic acid treatment and concluded to give it a trial.

“ Knowing it to be a deadly poison I feared to use it on my whole herd, but tried it on one cow first, and with good results. I gave her an eighth of an ounce every day in bran mash. She was showing strong symptoms of abortion at the time. She kept looking well and eating well; the milk in the udder decreased, and all other appearance of coming abortion passed away. I was now satisfied that it would at least do no harm, and I at once began feeding the whole herd, both those that had aborted and those that had not, commencing with one-eighth of an ounce doses and increasing gradually to one-half an ounce, giving it in bran mash to each one every other day. The disease at once stopped. The cow that I first treated produced a fine, strong, healthy calf at the full time, and so did all the rest. This was in March, 1895, and I have not had a single cow abort since.

“ There is no risk in giving an eighth of an ounce dose and increasing the dose to the full amount of half an ounce to a cow every other day. They do not like it at first, but soon learn to eat it. I disinfect the stables around the stalls thoroughly every night before bed-time with a solution of bichloride of mercury made by dissolving two tablets in a

quart of warm water. I also washed the vulva, tail, hind legs and back of udder of all the cows that had aborted, with the same solution, and continued this until they were served again, about the time they would have been served had they carried their calves to the full period."

Index.

	Page.
Acid, Adding the.....	109
Acid, Development of.....	205
Ayrshire Cows, Points of Excellence for.....	32
Belle, (Illustration).....	34
Bottles, Whirling the	110
Boiler, and Engine.....	236
Breeds, Results of Experiments with.....	20
Brick Cheese, How to Make	222
Building, Creamery, Dimensions of.....	231
Creamery, Construction of.....	231
Butter, Salting.....	165
Packing	166
How to Score.....	169
Making on the Farm.....	170
Handling the.....	175
Calf, Care of.....	72
Calving, Care at	70
Calves, Feeding.....	47
Cans, How to Clean.....	126
Chart, Showing Result of Two Days Tests.....	37
Showing Result of Several Days Tests.....	39
Chapter I—Selection of Dairy Stock.....	15
II—Feeding and Care of Dairy Stock.....	51
III—Corn and Clover Culture.....	75
IV—Milk and Cream Testing.....	99
V—Care of Milk.....	123
VI—Buttermakers and Buttermaking.....	139
VII—Cheesemaking.....	177
VIII—Creamery Building.....	229

Chapter IX—Farmers' Dairy Clubs.....	239
X—Miscellaneous Facts.....	253
Cheese, Quality of Western.....	177
Skim.....	179
Filled.....	181
How to Make.....	197
Flavor and Texture of.....	197
Vat, (Illustration).....	198
Salting and Pressing.....	206
Hoops and Follower, (Illustration).....	207
Press, (Illustration).....	208
Making Skim.....	209
Mottles in.....	214
Yield Obtained of.....	215
Curing.....	217
Churn, When to.....	161
Churn and Butterworker Combined, (Illustration).....	164
Clover, Analysis of.....	60
Hay, and Clover Silage.....	60
Culture.....	86
As a Fertilizer.....	86
On Spring Grain.....	93
On Wild Land.....	94
On Old Pastures.....	95
Sickness... ..	96
Varieties to Raise.....	89
Alsike.....	89
White.....	91
Alfalfa.....	91
Mammoth.....	89
Growers of.....	92
Seed, Crops of.....	92
Covering Seed.....	93
Early Sowing of.....	94

Clover, Vitality of Seed.....	95
Seed per Acre.....	96
Hay.....	97
Testing Seed	97
Corn, Analysis of.....	58
Raising.....	75
Selecting Seed.....	75
Proper Soil for.....	78
Plowing for	78
Planting.....	79
Cultivation of	81
Sown Broadcast, Value of.....	58
Silage	56
Harrowing.....	81
Harvesting	84
Cows, Comparison of Two Types of.....	25
Cow Barn, Ventilation of.....	69
Cow, How to Test a..	114
Cream Testing.....	113
Cream, Separating the.....	153
Ripening the	156
Starter for.....	158
Churning the.....	162
Creamery Buildings, (Illustrations).....	148, 154
Creamery building, Dimensions and Cost of.....	237
Creamery Foreman, Qualifications of a.....	258
Cultivator, How to Use a ...	82
Curd, Cutting the.....	201
Stirring the.....	201
Matting the	203
Why We Mat.....	204
Scalding the	211
Floating.....	213
Curd Mill, (Illustration)	206

Dairy Cows, Exercise for	72
Care of.....	66
Shelter for.....	67
Water for.....	64
Potatoes as Feed for.....	65
Roots as Feed for.....	66
Feeds to Raise for.....	65
Qualifications of the.....	15
Dairy Herd, Grading a.....	46
Individual Tests in.....	33
Dairy Stock, Advantage in Raising.....	47
Raise Your Own.....	44
Dairying, Progressive.....	9
Success in.....	11
Dairy Industry, Trend of the.....	14
Dairying in Winter.....	74
Dairy Clubs, Constitution for.....	243
By-Laws for.....	245
Rules of Order for.....	248
Order of Business for.....	249
Topics for Discussion in ...	250
Subjects for Essays in.....	251
Dido, (Illustration)	49
Drain, How to Make a.....	233
Dust, Avoid.....	128
Elgin Heater Vat, (Illustration).....	160
Ethel, (Illustration)	26
Factors, Importance of Different.....	136
Factory, Wastes in the.....	263
Farm Creameries, (Illustrations)	141, 143
Farm Creamery, How to Construct a.....	173
Farm Separator, (Illustration)	144
Fat, Measuring the.....	112

Feeds for Different Animals, Different.....	54
Comparative Value of.....	53
Feeding Dry Cows.....	66
Floor, Cement.....	232
Wood.....	232
Fortune, (Illustration).....	23
Guernsey Cows, Points of Excellence for.....	32
Haecker's Method of Judging a Cow.....	28
Home Breeding Pays.....	49
Holstein Friesian Cows, Points of Excellence for.....	32
Houston, (Illustration).....	40
Ice House.....	235
Individual Merit versus Breed.....	19
Individual Animals, Product of.....	17
Inka, (Illustration).....	131
Introduction.....	9
Jersey Cows, Points of Excellence for.....	29
Katy Spofford Corona, (Illustration).....	31
Laws, Inadequate.....	192
Legislation, National versus State.....	194
Lily Ella, (Illustration).....	30
Lydia, (Illustration).....	36
Mann's Acid Test, How to Use the.....	159
Apparatus.....	173
Milk, Comparison of Quantity Given of.....	38
Chemical Composition of.....	59
Records, How to Keep.....	41
Standards in the Several States.....	271
Quality of.....	16
Sampling.....	107
Measuring.....	107
Germs in.....	124
Cleanliness in Handling.....	125

Milk, Germs in the Fore.....	132
How to Detect Tainted.....	153
Tempering the.....	174
How to Prepare for the Rennet.....	199
Ripening the.....	210
Setting the... ..	211
Sheet, Forms for.....	42
Production, Effects of Contentment on.....	46
Cooling.....	132
Oleomargarine, Ingredients in.....	269
Olive, (Illustration).....	21
Onwa, (Illustration).....	29
Patron and Factoryman, Relation Between.....	253
Protein Foods.....	51
Cost of.....	52
Pumps in the Creamery.....	236
Quality, Standard of.....	195
Recapitulation.....	84
Relation of Fat to Yield of Cheese.....	225
Refrigerator.....	234
Rennet, Adding the.....	200
Test, How to Make the.....	226
Silage Corn, When to Cut.....	57
Versus Dry Corn.	59
Silos, A Word About.....	61
Skim Cheese, Why it Does not Pay to Make....	188
Soiling.....	61
Stock-book, Form for Page in.....	43
How to Keep a.....	44
Succulent Feed.....	63
Sweet Briar (Illustration).....	20
Tables, Showing Fat in Various Quantities of Milk.....	119
Test, The Babcock.....	99

Test, Benefits of the	99
The Composite	115
Rennet.....	225
Machine, Description of.....	106
Bottles.....	106
Machines, (Illustrations).....	100, 102, 103
Testing Young Stock	104
Testing on the Farm.....	105
Labor in.....	104
Heat Required in.....	116
Care in.....	39
Tubs, Line the.....	167
Types, Experiments with.....	20

DAIRYMEN

In order to successfully carry out the ideas suggested in this book you need modern dairy appliances. We are the largest manufacturers in this line in the world. We publish a catalogue of dairy goods called, "A Book for Dairymen." We have a catalogue also for milk dealers, named, "A Book for Milk Dealers." In these books will be found everything required for dairy plants. We mail these books free to all interested. We are always glad to answer inquiries. Do not hesitate to write us about anything you need.

CREAMERY PACKAGE MFG. CO.

1, 3 and 5 W. Washington Street, CHICAGO, ILL.

Branches: Kansas City, Mo.; Minneapolis, Minn.; Waterloo, Iowa;
Omaha, Neb.; St. Louis, Mo.; Philadelphia, Pa.

A. H. Barber Mfg. Co.

229 South Water Street,

Chicago, Ill.

Creamery and Dairy Machinery.

Alpha Cream Separators,

Combined Churns and Workers,

Babcock Milk Testers,

Pasteurizers for Milk and Cream,

“Kieckhefer” Milk Cans,

W. & R. Butter Color,

Hansen’s Rennet Extract,

Seamless Bandages,

Butter and Cheese Salt,

Butter Tubs, Butter Boxes, and Packages of
every description. Send for price list.

THE BEST DAIRYMEN

Demand the best dairy machinery. We have at all times recognized that fact, and we pride ourselves upon our ability to furnish a line of dairy specialties strictly high

grade in every particular. Among other things we would call attention to the famous

SHARPLES

CREAM SEPARATORS

We show here but one of our different patterns. We manufacture the largest variety of any one in the business, Write for free catalogue, also circulars descriptive of our line of

Churns,
Cream Vats,
Butter Printers,
Cheese Vats,
Tread Powers,
Butter Workers,
Milk Heaters,
Babcock Testers,
Cheese Presses,
Etc., Etc., Etc.

THE SHARPLES COMPANY,

28, 30 and 32 So. Canal Street, Chicago, Illinois.

Established 1891.

THE ELGIN DAIRY REPORT,

The Dairy-Market Paper.

Issued immediately after the close of the Elgin Board of Trade every Monday afternoon. Contains full account of the Board transactions and market reports from the principal Butter, Cheese and Egg centers of the country.

Subscription Price \$1.00 Per Year.

PARCHMENT BUTTER WRAPS

Our Inks are thoroughly tested. We print in Red, Green, Blue, Brown, or any two of the colors. Send for prices, and sample book printed in colors.

HIGH CLASS PRINTING

Stationery for the Creamery, Cheese Factory and Dairy. Blank books to order. Special ruling. Estimates furnished. Address

THE ELGIN DAIRY REPORT, Elgin, Illinois.

Mar-23 1901

(M2)

LIBRARY OF CONGRESS

0 002 859 490 2