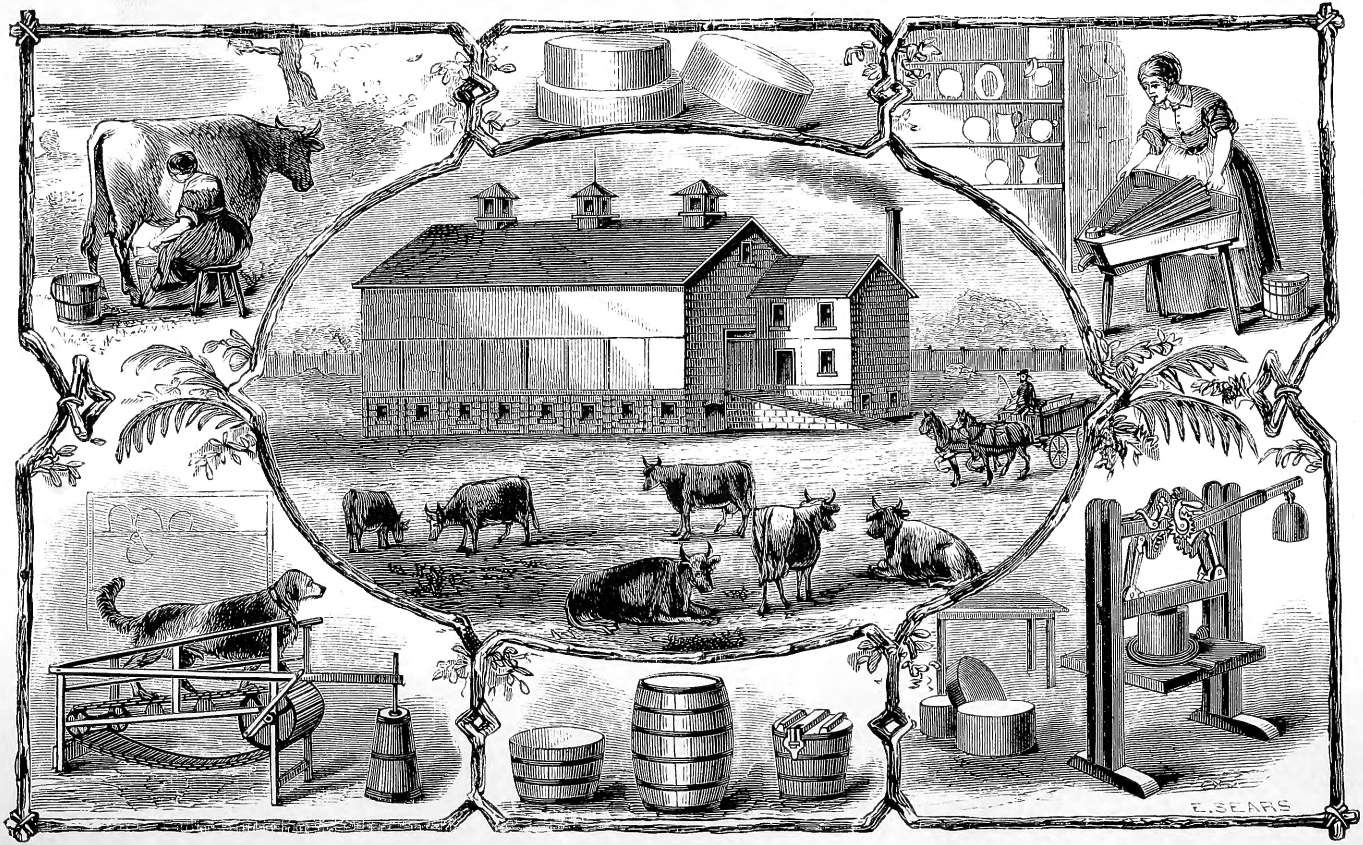
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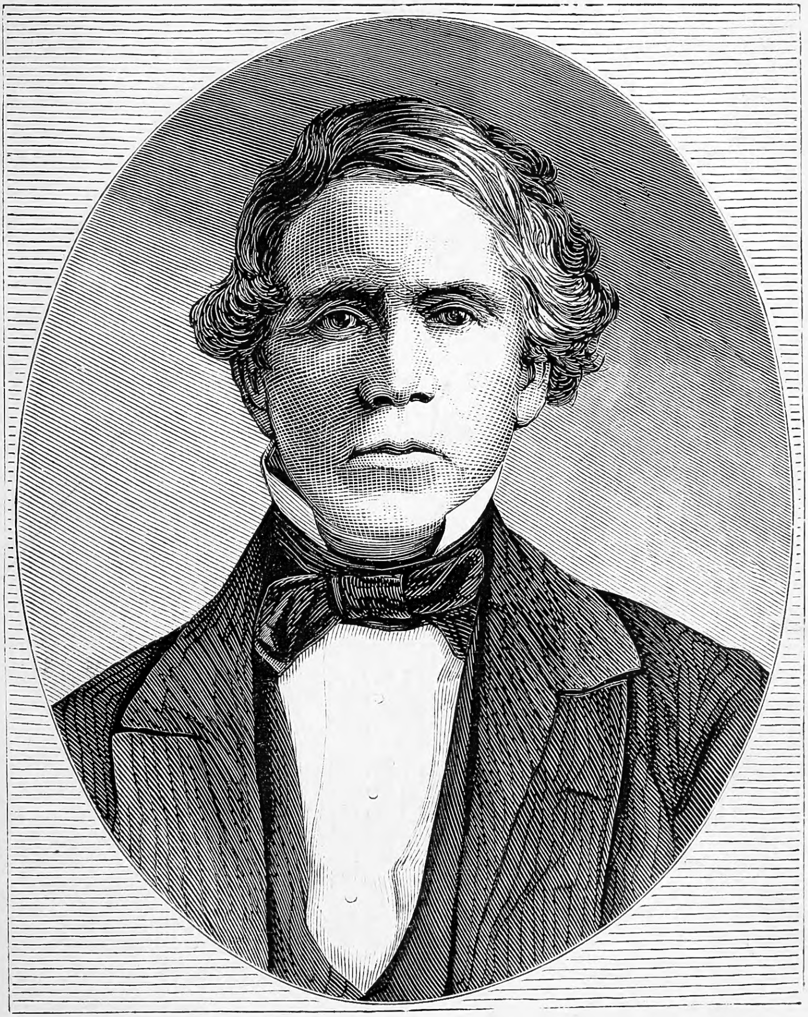

JESSE WILLIAMS,

ORIGINATOR OF THE AMERICAN CHEESE FACTORY SYSTEM.

WILLARD'S

PRACTICAL DAIRY HUSBANDRY:

A COMPLETE TREATISE ON

DAIRY FARMS AND FARMING,—DAIRY STOCK AND STOCK FEEDING,—MILK, ITS MANAGEMENT AND MANUFACTURE INTO BUTTER AND CHEESE,—HISTORY AND MODE OF ORGANIZATION OF BUTTER AND CHEESE FACTORIES,—DAIRY UTENSILS, ETC., ETC.

BY

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PREFACE.

Up to the present time there has been no Standard Work on Practical Dairy Husbandry, or upon the improved American methods of manufacturing Butter and Cheese. A book treating of these topics has long been needed, and this work is designed to meet the wants of those who are looking for a safe, practical Dairy Manual.

With more than twenty years' experience in Dairy Farming, and an acquaintance from extensive personal observation with the best methods of dairy management in this Country and Europe—accustomed to the practical handling of Milk and the manufacture of its products—in fine, having made a specialty of this branch of industry, the writer ought to be able to discriminate between the practical and merely theoretical in dairy management.

Dairy Farming in this country is no holiday affair. The men who engage in it are, for the most part, seeking useful information—such knowledge as may be turned to a good account in their business. In other words, they seek to learn how Dairying in its several branches can best be made to pay. With this standpoint in view, no theories have been recommended which cannot stand the practical test of usefulness. I am not insensible to the favor with which the results of my experiments and observations have been received, or to the confidence reposed in me by American Dairymen. I can only say that I have been earnest for improvement in this branch of industry, and have labored heartily for the advancement of the whole Dairy Interest throughout the whole dairy districts of our country.

The work here presented is not a compilation—though I have not hesitated to quote from other writers whenever their statements seemed to be useful. In making such quotations I have aimed to give proper credit, since nothing seems to me more reprehensible in a writer than the appropriation of another's labor and brains without due acknowledgment. Among the papers to which special attention is called are those of Dr. Voelcker on the "Composition of Cheese" and "Cheese Experiments;" also on "Recent English Dairy Improvements," by Mr. Harding of Marksbury, England. These papers hitherto have not been in an available form for the American reader, and will be found, it is believed, both interesting and valuable. In a few instances I have selected matter from my own pen which has appeared in the *Rural New-Yorker*, *Western Rural*, and other publications; but for the most part the work has been freshly written, and gives the most approved practice in dairying as conducted at the present day.

I trust it will not be deemed out of place here to say that I feel under deep obligations to the Press for the uniform courtesy extended to my various contributions to Agricultural Literature, through a long series of years. Profoundly grateful for these favors, I can only hope in the present instance that this volume may be worthy a candid criticism. And that it may prove useful to the class for whom it is intended is the sincere wish of the Author.

X. A. W.

Little Falls, Herkimer Co., N. Y., 1871.

INTRODUCTORY.

THE AMERICAN DAIRY BELT.

The great American dairy belt lies between the fortieth and forty-fifth parallels of latitude. It stretches from the Atlantic to the Mississippi, and possibly to the Pacific. Within its limits are New England, New York, Pennsylvania, the Northern parts of Ohio, Illinois and Indiana, the greater portion of Michigan, Wisconsin, Iowa and Minnesota, and a part of the Canadas. Of all this belt probably not more than a third of the land is adapted to dairying. The dairy lands are quite irregular in outline, lying not always continuously together, but often detached, and not unfrequently, if represented on the map, would have the appearance of islands.

THE CHARACTERISTICS OF A GOOD DAIRY COUNTRY

are, high, undulating surfaces; numerous springs and streams of never failing water; a soil retentive of moisture; a sweet and nutritious herbage, that springs up spontaneously and continues to grow with great tenacity; a rather low average temperature; frequent showers, rather than periodical drouths, and sufficient covering of the ground in winter to protect grass roots, so that the herbage may be permanent or enduring.

Doubtless within the limits of the United States, on high table lands, or on the lower slopes of mountainous ranges, there are soils eminently adapted to dairying; but we have no large and continuous stretch of country, like that to which we have referred, where the business naturally would develop itself into a specialty.

DAIRY COMPARED WITH OTHER HUSBANDRIES.

In my opinion, upon this Northern belt of dairy lands, there is no description of farming that promises better prospect of remuneration than the dairy. I refer now to farming in the broadest sense of the word, where thousands grow certain products, and compete with each other in the great markets of the world. If one happens to be possessed of land in the immediate vicinity of towns and cities, upon which market gardening may be conducted with facility, that land may without doubt be put to more profit in growing vegetables than in dairying. Fruit lands, eligibly situated and intelligently managed, may also be a source of greater profit.

Limited specialties of this kind, in which only the few comparatively can engage, must not be embraced in the statement. Compared with other great interests of the country, such as the production of wheat or corn, and other cereals, the raising and fattening of stock for the shambles, sheep husbandry, hop growing, and the like; each and all are inferior in their remunerative prospects to the dairy.

In the first place, the milk producer enters the great markets of the world, with less competition than he who is engaged in almost any other branch of farming. He has a wider range and a more diversified product to dispose of. The milk farmer may be a breeder to some extent of thorough-bred cattle. After the first outlay, (and that may be on a small scale at the commencement,) the expense of raising a thorough-bred cow will be no more than the raising of the meanest scrub of our common stock. Then, if there is any profit in fattening stock for the shambles, animals which fail in milk for the dairy, and are to be "turned," can be employed for this purpose. Both of these specialties are in the line, and connected with the dairy, as is also the fattening of swine on dairy slops.

Again, the yield of his cows takes three forms of a commercial product, each of which enters into universal consumption, and is regarded both as a luxury and a necessity—Milk, Butter, and Cheese. The last two are highly concentrated forms of food, and less bulky of transport than other articles of food of the same value—for, two hundred pounds of butter, costing eighty dollars, will occupy no more space in a railroad car than a barrel of flour costing but six dollars. In other words, the eighty dollars' worth of butter can be carried as cheaply to market as the six dollars' worth of flour.

This alone is an immense advantage, for when the farmer comes to deduct freights on a low-priced, bulky product, together with commission to the middle men for handling, and there will remain often but little profit for the producer. In New York we have studied this question of

THE DAIRY AND ITS RELATIVE ADVANTAGES,

for many years. We cannot afford to grow corn, for the West, with its rich prairie and bottom lands, easy of cultivation by machinery, can undersell us. Look at the average price of wheat for a series of years, and consider whether the hard, tenacious soil of New York and New England can produce it at a profit. How is it with wool? The immense plains of Texas and the West are competing with us, and can always afford to sell for less money than it costs us to produce it. We have no chance to enter European markets with our wool, for Australia and South America stand in the way.

A GOOD DAIRY FARM,

is a good Stock Farm, but stock farms are not necessarily good dairy farms. It is doubtful whether the great stock farms of the Southwest will ever be employed largely for dairying. The lands are not so well provided with water, and the climate is too warm to secure the finest flavored goods. Besides, the stock farmer of the West and Southwest can at present make more money in raising stock than by dairying. With the great railroad facilities being developed in these directions, the New York and New England farmer will find it more and more difficult as a specialty to compete with these people in raising fat cattle for the shambles. On the other hand, there has been for the past few years a gradual but constant increase in the demand and price of dairy products. If you take

THE GOLD PRICES FOR DIFFERENT KINDS OF FOOD

in London for a series of years, the statistics present the remarkable fact that dairy products have remained steady, while other products have fluctuated in prices, and at times become very much depressed. The reason of this is that the whole world is not competing in this class of production. The supply being uniformly within the limits of consumption,

A GOOD ARTICLE IS ALWAYS NEEDED,

and prices do not fall so low, comparatively, as for other products. It must be observed, too, that upon dairy lands the milk product, year after year, is pretty uniform as to quantity. Upon natural grazing lands there is no crop so reliable as grass. Grain, fruit, hops, and the like, are liable to numerous accidents that lessen or destroy the yield, but which do not obtain in the grass crop. Hence, the dairyman can count pretty accurately upon what his farm will yield, if stocked with an average lot of cows. Again, his lands are not so liable to be exhausted as those devoted to grain growing, and with an abundant source of manure at his command should be growing more and more productive from year to year. The great question with dairy farmers has been in regard to

OVER-PRODUCTION OF DAIRY GOODS.

Since the inauguration of the Associated Dairy System, fears have been entertained that the cheese and butter product of the country would be beyond a healthy consumptive demand. Dairy products are so liable to decay that dealers do not care to take the risk of storing and holding in large quantities. They must go into quick consumption, and hence, any considerable surplus, accumulating from year to year, would so depreciate prices that the business could not be carried on with profit. Statistics thus far show that in Europe production does not keep pace with consumption, and this difference is every year growing wider and wider. In the United States the

HOME CONSUMPTION OF BUTTER AND CHEESE,

of late years, has more than kept pace with production, notwithstanding the extraordinary development of dairying under the associated system. Previous to the war of the Rebellion we exported butter; but for some years past the home consumption has taken all our make, and at a price which consumers denounce as extortionate.

The best Normandy butter sells in London to-day at about 150 shillings per cwt., or thirty-two cents gold per pound. Deducting freight and commissions, and turning the gold into currency, it would net the shipper in the States a price below what the best grades are worth at home. In 1860

THE PRODUCTION OF BUTTER IN THE UNITED STATES AND TERRITORIES

was nearly four hundred and sixty millions of pounds. It is, perhaps, to-day over six hundred millions of pounds, and if we were over-producing prices would decline, so that shippers could afford to export. Wherever you go among consumers in towns and cities you hear loud complaints of the difficulty of getting good butter, and the monstrous price which they are forced to pay. They talk bitterly against the cheese factories, charging them with the crime of absorbing the butter makers, and thus cutting off production. They forget that the rapid increase of population and the gormandizing habits of our people in the use of butter, are the causes which have led to this condition of things. There are

NO SUCH BUTTER EATERS

on the globe as we Americans. Everything that we cook must be swimming in butter. Our Irish domestics, many of whom never ate a pound of butter during their whole lives before reaching these shores, seem never able to get enough of this unctuous food. The waste of butter among all classes is enormous, and, in an economic point of view, is truly alarming. To those who have traveled in Europe and contrasted the difference in the habits of people there and here in the use of butter, it need be no surprise that our dairies are taxed to their utmost to satisfy the craving demands of our butter eaters. If the habit increases with our constantly increasing population, the prospects of butter dairying cannot be considered at all discouraging. If we take the article of cheese, our people are evidently beginning to follow English tastes in their appreciation of this nutritious article of food. We are exporting now but little more cheese, comparatively, than in 1861, perhaps twenty millions of pounds more, and yet our production has increased from one hundred and three millions of pounds, in 1860, to two hundred and forty millions of pounds in 1869. Notwithstanding the war of the rebellion, and the consequent poverty of the Southern States, which cut off

THE CHEESE TRADE

in that direction, the home consumption has gone on increasing from sixty-three millions of pounds, in 1860, to one hundred and eighty millions of pounds, in 1869. The average increase of home consumption has been at the rate of thirteen millions of pounds per year. When the Southern States get into a healthy, prosperous condition, with the wonderful development of railroad facilities, the opening of the Southern Pacific Railroad, the influx of Chinese laborers, and a direct trade with China, it is doubtful whether the dairies in this country can be developed sufficiently to supply the demands.

But there must always be a large dairy interest employed in supplying fresh milk to our cities and manufacturing towns. This is more apparent from year to year, and the real question of the dairy interest to-day should be, to so equalize the supply of

MILK, BUTTER AND CHEESE,

that the highest prices may be reached for each. The difficulty is not so much the fear that dairying will be overdone, as that the equilibrium will be disturbed, and either one or the other of these products be increased beyond its proper proportion. If a large proportion of the cheese makers were to go to making butter, the butter interest would be overdone and prices decline; and the same would result to the cheese interest from a large change from butter to cheese dairying; while the milk interest would be greatly injured if a large proportion of dairymen should enter into that branch, either by furnishing condensed milk, or fresh milk, for city consumption. When Jesse Williams, the unpretending farmer of Rome, in 1850 conceived the idea of

ASSOCIATED DAIRIES,

it was forced upon him as a necessary means for accommodating members of his own family. He had not the remotest idea that he had hit upon a great principle—a principle that was of wide application, and which was destined, in all coming time, to be the means of lifting heavy burthens from the arms of toil. It is estimated there are now more than a thousand factories in the State of New York alone, and they are extending rapidly in other States. They have been carried to the Canadas and across the Atlantic; and wherever cheese-making shall be known in after times, it will be inseparably connected with the name of Jessie Williams. But aside from the burthens of toil and the drudgery from which this system operates to relieve our farmers, it has developed another great economic principle,

THE MEANS OF PRODUCING FOOD CHEAPLY,

a principle which the Creator, in His infinite wisdom it seems, is now impressing upon the minds of people, by the establishment and wide-spread dissemination of this system. The question of food in all densely populated communities is one that underlies all others. No nation can rise to the highest civilization and power without her people are supplied with an abundance of

CHEAP AND NUTRITIOUS FOOD.

Where food is scarce, or is wanting in nutrition, there you will find poverty, squalid wretchedness, demoralization and crime—elements of weakness, opposed to progress and civilization. Food nourishes not only the body but the brain, and the cheapness and abundance of good food has had much to do in the rapid progress and active development of mind among the American people. But our population is increasing with wonderful rapidity, and already the supply of meats in the Atlantic States is becoming comparatively scarce. They are to-day at such a price that poor people have difficulty in obtaining them. As our population increases there will be a still further scarcity of meats for the supply of our people. Some other form of animal food must be substituted in part, at least, for beef, and the question is becoming every year more and more urgent, as to how it can be produced cheaply. And, in my opinion, we must look to the dairy as the chief means of solving this difficulty. I can illustrate this more satisfactorily, perhaps, by drawing a comparison between

THE RELATIVE COST OF PRODUCING BEEF AND CHEESE.

A steer which will weigh one thousand five hundred pounds at four years must be a good animal, and will yield say one thousand pounds of meat. Three steers at four years, on the above assumption, would produce three thousands pounds of beef. Now, a good cow will yield from five hundred to six hundred pounds of cheese per year; if we take her product for twelve years at four hundred and fifty pounds per year, deducting the first two years in which, as a heifer, she yields nothing, we have four thousand five hundred pounds of good, wholesome animal food. In other words, three steers at four years old, representing twelve years' growth for beef, amounts to three thousand pounds, while one cow, twelve years for cheese, four thousand five hundred pounds. But a pound of cheese, equal in nutrition to two pounds of beef, would make the difference still greater, giving for the dairy nine thousand pounds of food on the one hand, against three thousand pounds of meat on the other. Then there is cost of cooking, and the bone to be charged against the beef, which, as will be seen, adds further to the expense of that kind of food.

THE ECONOMICAL USE OF FOOD

is not well understood by the majority of people, and perhaps there is no food in general use the nutritive value of which is more under-estimated than that of milk. Indeed, many people regard it more as a luxury than as affording any substantial nourishment like that obtained from meats or vegetables. Milk is often used sparingly, under the impression that it must always be an expensive article of food, when in fact it is generally cheaper than any meats that can be had in the market; and we believe if its relative nutritive value, as compared with beef, was more generally understood, it would be more largely consumed, as a matter of economy.

Good beef contains from fifty to sixty per cent. of water, and milk about eighty-seven per cent. On an average, then, three pounds and a half of milk, or a little more than three pints by measure, are equal in nutrition to a pound of beef. If the beef is worth twenty cents per pound, the milk, at ten cents per quart, would be the cheaper food of the two. Dr. BELLOWS gives the following analysis of several articles of food, in their natural state, from which

THE RELATIVE NUTRITIVE VALUE OF MILK

may be readily compared. We place them in a table, as more convenient for reference and comparison:

	Nitrates.	Carbonates.	Phosphates.	Water.
Milk of Cow	5.0	8.0	1.0	86.0
Beef	15.0	30.0	5.0	50.0
Lamb	11.0	35.0	3.5	50.5
Mutton	12.5	40.0	3.5	44.0
Pork	10.0	50.0	1.5	38.5
Codfish	14	very little.	5 to 6	79
Trout	17	very little.	5 to 6	75
White of eggs	15½	none.	4½	80

Of the nitrates, or flesh-forming elements, the beef contains just three times that of the milk, while the carbonates, or respiratory and fat-producing elements in the beef, are three and three-fourth times richer than the milk. The solid constituents of the two, in a hundred parts, would be in milk fourteen, and in beef fifty, or very nearly as one to three and one-half. Consequently, if both be represented in pounds, it would take three and one-half pounds of milk to give the same amount of nutrition that is contained in one pound of beef. In fish and eggs the difference would not be so great. Now a quart of milk will weigh about thirty-six ounces, consequently the three pints of milk by measure will weigh three pounds six ounces, representing very nearly the equivalent in nutrition for a pound of beef. As there is always more or less waste in beef, even after it is separated from the bone, on account of muscle, tendons, cartilage and the like, which cannot be consumed, the three pints of milk may be considered to represent a fair equivalent in nutrition for a pound of beef, exclusive of bone. On this assumption, if a pound of beef, exclusive of bone, is worth twenty cents, milk should be counted at a little over thirteen cents per quart, the exact figures being thirteen and one-third cents. But if we reckon the loss from bone which the consumer takes with the meat, it will be seen the cost is considerably more, which would by so much farther enhance the value of the milk. When milk is selling at six cents per quart, beef, exclusive of bone, at nine cents per pound would be the equivalent. It will be seen by carefully comparing the analysis of milk and meats, and making the proper deductions on the latter on account of waste, of bones, etc., that there is less difference between the economical value of milk and beefsteak, or fish and eggs, than is commonly supposed. Milk contains all the elements of nutrition, and is more wholesome than meats like pork and veal, which are justly regarded with suspicion. It should be more largely used in hot weather than it is, and especially in the diet of children, as it supplies material for building up the bones and muscles, which superfine flour, and butter and sugar, do not. It may not be advisable to substitute milk wholly for meat in any system of diet. Still by using smaller quantities of meat with which to make up the requisite proportion of animal food, health would doubtless be greatly promoted, and at much less expense, than where meat is exclusively used. The market value of milk is generally very much below its nutritive equivalent in beef; and those who are looking to economy in foods will do well to give this question attention.

MILK AS A FOOD.

Professor LYON PLAYFAIR, in speaking of milk as a food, says:—"We see how carefully nature has provided for the growth of the infant. In the casein there is abundance of structural food for the building up of organs; in the highly combustible fat or butter, and in the less carbonaceous sugars we have a full supply of heat givers; while in the mineral substances, bone earth for the building up of the young skeleton, besides common salt, potash salts, iron, silica, and every mineral ingredient that we find in the body. It may be interesting to inquire with regard to the typical food, what proportion the structural materials bear to the respiratory or heat-giving substances. For this purpose, we must convert both the butter and sugar into a common value, and calculate them as if they were starch, which is the most common heat-giving body in different kinds of food. Estimated in this way, the quantity of heat-givers is three times greater than that of flesh-formers. But the nutrition of the young animal is in many respects different from that of the adult. In the case of the latter it is only necessary to supply the daily waste of the tissues; in the former it is also requisite to furnish materials for the growing body, and also abundant fuel to maintain the higher temperature of the infant. With this difference kept in view, all our efforts in diet appear to aim at imitating the typical food, milk, by adjusting a proper balance between the flesh-formers, heat-givers, and mineral bodies. Thus with a flesh-forming aliment like beef or mutton, we take a rich heat-giving one like potatoes or rice. To fat bacon, abounding already in heat-givers, we add beans, which compensate for its poverty in flesh-formers. With fowls, poor in fat, we consume ham, rich in this combustible. Our appetites and tastes become the regulators of food, and adjust the relative proportions of its several ingredients; and until the appetite becomes depraved by indulgence or disease, it is a safe guide in the selection of aliments."

MUSCLE-MAKING FOOD.

The importance of using food containing a due proportion of muscle-making elements, or albuminoids, has been demonstrated in repeated experiments, when loss of vigor and health has followed a continual use of food lacking in these elements. The experiments made in five prisons in Scotland bear upon this point. They were made to ascertain the smallest amount of food, and the proportion of nitrates and carbonates, that would keep the prisoner up to his weight while doing nothing, when it was found that by reducing the proportion of nitrates in the food from four ounces to two and three-quarter ounces daily the prisoners lost weight rapidly. Dr. BELLOWS, in commenting upon these experiments, which he gives in detail, says:

"It is a remarkable fact which shows the importance of connecting science with practice, that the deterioration in the quality of the diet in Dundee prison consisted in substituting molasses for milk, which had been previously used with oatmeal porridge and oatmeal cakes, molasses being entirely destitute of muscle-making material, while milk contains a full proportion of these important principles. This one experiment and its results are worthy of study by every mother and every housekeeper in the land. If any class of persons would suffer less than others from the use of too much carbonaceous and too little nitrogenous food, it would be that class who are idle; and yet the one hundred prisoners of Dundee, with an ounce more of the fat and heat-making principle than those of Edinburgh, lost two hundred and seventeen and one-half pounds, while the same number in Edinburgh lost only twenty-seven pounds; the difference in their diet being, as stated in the report, that the prisoners of Edinburgh had milk with their porridge and cakes, while those of Dundee had molasses instead."

And he remarks further:—"If the same experiment had been tried on men in active life, or on children who are never still except when asleep, the result would have been more remarkable, in proportion to the greater waste of muscle in those who are active, and the greater demand for nitrogenous food; and yet how few mothers stop to consider or take pains to know, whether gingerbread made of fine flour, which has but a trace of food for muscle or brain, and sugar or molasses, and perhaps butter, which have none, or cakes made with unbolted wheat mixed with milk or buttermilk, all of which abound in muscle and brain-feeding materials, is the best food for a growing, active child; indeed, the whole food of the child is given with the same want of knowledge or consideration.

"But in view of these simple experiments in the Scotch prisons, who can doubt that a want of consideration of these principles of diet is the means of consigning to the tomb many of our most promising children. An intelligent farmer knows how to feed his land, his horses, his cattle and his pigs, but not how to feed his children. He knows that fine flour is not good for pigs, and he gives them the whole of the grain, or, perhaps, takes out the bran and coarser part, which contains food for muscles and brains, and gives them to his pigs, while the fine flour, which contains neither food for muscle or brain, he gives to his children. He separates, also, the milk, and gives his pigs the skim milk and buttermilk, in which are found all the elements for muscle and brain, and gives his children the butter, which only heats them and makes them inactive, without furnishing a particle of the nutriment which they need."

Milk and cheese are doubtless the cheapest forms of animal food that can be had in our markets. They deserve to be more extensively used, and it is very likely they would enter more largely into consumption were it not from mistaken notions of economy, which exclude them from the table on the supposition that they are costly luxuries rather than healthful and nutritious articles of food.

Our country is vast, and of great diversity in soil and climate. New England and the Middle States have long since ceased to be regarded as the most favorable sections in which men of moderate means may engage in grain farming. There is a tide of emigration sweeping westward; there is another tide ebbing to the cities, and so the rural population in these States is constantly decreasing. We live in an age of intense competitive industry; our people are impatient for gain; and with a natural fondness for adventure, and an eagerness for any change that holds out prospect of betterment, it is not strange that old landmarks are dying out among the farming population of the North Atlantic States. I shall not stop now to discuss all the causes which have led to this condition of things. It will suffice for the present to name one,

THE MISDIRECTION OF THE USE OF LAND,

by failing to adopt the kind of farming suited to the peculiarities of soil and climate. With a favorable climate, and the proper expenditure of money, by the aid of science you may force an unpropitious soil to yield ample returns in crops to which originally it was not well adapted. But temperature, moisture and climatic influence are in a measure beyond our control. Hence, with many disadvantages facing us at every step, we cannot compete successfully in growing grain with those sections which have none of these to contend with, but have everything in their favor. If we propose to grow corn and make it a specialty, the rugged lands of New York and New England will not present equal advantages with the fertile bottom and prairie soils of the West. From the natural fertility of these soils, and from the ease with which they may be cultivated, the Western farmer can put his surplus grain in our markets at a price which compels us to sell at meager profits. If we grow grain, therefore, it must be as an adjunct to some specialty, which gives us decided advantages over other sections. The dairy is one of those branches from which the great bulk of lands in the United States by natural causes is excluded. To the farmer, then, whose lands are adapted to dairying, it presents one of the most remunerative branches of agriculture in which he can engage; and it may well be a question whether the older States, lying within the dairy belt we have named, and especially those of New England, with their established institutions and nearness to the best markets in the world, may not now present inducements to the agriculturist through the channels of dairying second to no other sections in the Union.

THE PROGRESS AND PRESENT MAGNITUDE OF THE DAIRY INTEREST OF THE UNITED STATES

will be shown from the figures in the following tables, made up from official sources, some of which have been printed in the Patent Office reports, and reports of the Department of Agriculture:

The following statement shows the number of Milch Cows, for the years 1840, 1850 and 1860, and their relations to the total population for each period:

STATES AND TERRITORIES.	1840.	RATIO.	1850.	RATIO.	1860.	RATIO.
Alabama	189,042	.32	227,791	.30	230,537	.24
Arkansas	40,981	.42	93,151	.45	171,003	.36
California	4,280	.05	4,280	.05	205,407	.65
Connecticut	74,395	.24	85,461	.23	98,877	.21
Delaware	17,189	.22	19,248	.21	22,595	.20
Florida	47,395	.87	72,876	.83	92,974	.66
Georgia	276,557	.40	334,223	.37	299,688	.28
Illinois	157,140	.33	294,671	.35	522,634	.31
Indiana	212,618	.31	284,554	.29	363,553	.36
Iowa	9,485	.22	45,704	.24	189,802	.28
Kansas	....	..	....	..	28,550	.25
Kentucky	210,554	.27	247,475	.25	269,215	.23
Louisiana	74,006	.21	105,576	.20	129,662	.18
Maine	120,430	.24	133,556	.23	147,314	.23
Maryland	75,203	.16	86,856	.15	99,463	.14
Massachusetts	110,655	.15	130,099	.13	144,492	.12
Michigan	55,189	.26	99,676	.25	179,543	.27
Minnesota	....	..	607	.10	40,344	.23
Mississippi	127,721	.34	214,231	.35	207,646	.26
Missouri	126,622	.33	230,169	.34	345,243	.29
New Hampshire	88,218	.31	94,277	.30	94,880	.29
New Jersey	97,060	.26	118,736	.24	138,818	.21
New York	752,966	.31	931,324	.30	1,123,634	.29
North Carolina	188,355	.25	221,799	.25	228,623	.23
Ohio	486,229	.32	544,499	.28	676,585	.30
Oregon	....	..	9,427	.71	53,170	1.01
Pennsylvania	431,008	.25	530,224	.23	673,547	.23
Rhode Island	15,236	.14	18,698	.13	19,700	.11
South Carolina	184,263	.31	193,244	.29	163,938	.23
Tennessee	223,887	.27	250,456	.25	249,514	.22
Texas	....	..	217,811	1.02	601,540	.99
Vermont	151,814	.52	146,128	.47	174,667	.54
Virginia	285,153	.23	317,619	.22	330,713	.21
Wisconsin	6,808	.22	64,339	.21	303,001	.25
District of Columbia	874	.02	813	.02	639	.01
Dakota	....	..	....	..	286	.11
Nebraska	....	..	....	..	6,995	.25
New Mexico	....	..	10,635	.17	34,369	.42
Utah	....	..	4,861	.43	11,967	.32
Washington	....	..	....	..	9,660	.90
Nevada	....	..	....	..	947	..
Total	4,837,043	—.28	6,385,094	—|—27	8,581,735	—.28

ARE THE FIGURES CORRECT?

In absence of the last official census report, not yet printed for distribution, we take the statistics of 1870 from abstract of census returns of 1869, as given in the Tribune Almanac, and which purports to be a correct copy of the official returns. It must be evident, however, that the butter and cheese products are here put very much below the actual make, for it will be observed that the amounts are but little in excess of those made in 1860. Now it is well known that the increase in Dairy Farming since 1860 has been very large, and has been carried into new districts, while the increase of more than two millions two hundred and eighty thousand cows must plainly indicate a larger increase in dairy products than is here represented. In the last of the two subjoined tables the statistics are given in such form that the whole may be readily understood and compared.

The following table shows the number of Milch Cows, and the quantity of Butter and Cheese, made in the United States, in the year 1869, according to the census of 1870:

States.	Milch Cows.	Pounds of Cheese.	Pounds Butter.
Alabama	270,537	15,923	6,028,478
Arkansas	190,500	16,810	4,067,556
California	1,330,800	1,343,689	3,095,035
Connecticut	99,350	3,898,411	7,620,912
Delaware	24,198	6,579	1,430,502
Florida	99,108	5,280	408,855
Georgia	301,180	15,578	5,439,765
Illinois	850,340	1,848,557	28,052,551
Indiana	390,450	605,795	18,306,651
Iowa	201,740	918,635	11,953,666
Kansas	41,310	29,045	1,093,497
Kentucky	280,191	190,400	11,716,609
Louisiana	148,320	6,153	1,444,742
Maine	190,110	1,799,862	11,687,781
Maryland	100,030	8,342	5,265,295
Massachusetts	160,220	5,294,090	8,297,936
Michigan	198,580	1,641,897	15,503,482
Minnesota	60,740	199,314	2,957,673
Mississippi	300,101	4,427	5,006,610
Missouri	390,120	259,633	12,704,837
Nebraska	....	24,342	604,541
New Hampshire	99,540	2,323,092	6,956,764
New Jersey	149,450	182,172	10,714,447
New York	1,980,300	48,548,289	103,097,280
North Carolina	301,102	51,119	4,735,495
Ohio	960,322	21,618,893	48,543,162
Oregon	79,312	105,379	1,000,157
Pennsylvania	873,212	2,508,556	58,653,511
Rhode Island	23,180	181,511	1,021,767
South Carolina	171,480	1,543	3,177,934
Tennessee	260,190	135,575	10,017,787
Texas	640,302	275,128	5,850,583
Vermont	190,420	8,215,030	15,900,359
Virginia	401,860	280,852	13,464,722
West Virginia	....	Included in Va.	Included in Va.
Wisconsin	250,312	1,104,300	13,611,328
Nevada and Territories	....	10,500,000	11,100,000
Total	11,008,925	114,154,211	470,536,468

The following table gives the number of Milch Cows, and the quantity of Butter and Cheese, manufactured during each of the years ending the successive decades, according to the United States census reports of 1840, 1850, 1860 and 1870:

	Milch Cows.	Value of Dairy Products.	
1840	4,837,043	$33,787,008	
	Milch Cows.	Pounds Butter.	Pounds Cheese.
1850	6,385,094	313,345,306	105,535,893
1860	8,581,735	459,681,372	103,663,927
1870	11,008,925	470,536,468	114,154,211

Table showing the number of Milch Cows, quantity of Butter made and amount of Cheese and Milk sold in the State of New York, according to Census of 1865:

COUNTIES.	MILCH COWS. 1864.	MILCH COWS. 1865.	POUNDS OF BUTTER MADE. 1864.	POUNDS OF CHEESE SOLD. 1864.	GALLONS OF MILK SOLD. 1864.
Albany	11,080	10,615	1,066,196	20,763	464,885
Allegany	20,798	18,525	1,655,776	1,325,748	250
Broome	22,178	20,696	2,291,268	113,922	41,385
Cattaraugus	34,208	30,559	2,412,223	3,635,356	12,513
Cayuga	21,291	21,794	2,208,049	205,155	91,511
Chautauqua	42,703	40,008	105,205	2,105,642	73,085
Chemung	10,889	9,647	105,345	21,747	84,449
Chenango	46,734	41,459	4,042,336	2,552,066	11,652
Clinton	12 603	13,968	946,725	100,020	6,300
Columbia	12,266	11,942	965,064	23,447	231,130
Cortland	29,295	31,920	2,683,773	2,074,155	715
Delaware	45,217	38,525	5,052,295	35,519	6,046
Dutchess	20,114	20,014	1,358,573	11,599	8,964,574
Erie	34,441	31,851	1,558,573	3,344,734	489,206
Essex	9,004	9,219	654,174	96,255	970
Franklin	15,847	15,804	1,226,598	125,732	1,100
Fulton	10,234	9,974	706,612	991,002	1,084
Genesee	9,193	9,009	763,082⅞	80,263	104,622
Greene	13,350	12,059	1,327,054	16,961	2,192
Hamilton	1,082	1,043	96,174	1,855	100
Herkimer	46,627	45,461	953,118	13,893,801	17,686
Jefferson	56,551	55,198	3,100,234	5,348,615	278,237
Kings	4,023	4,030	16,315	......	444,530
Lewis	30,848	30,639	1,663,950	4,755,043	138,126
Livingston	10,880	10,605	1,052,804	101,417	33,233
Madison	29,093	28,995	1,569,342	3,452,682	13,506
Monroe	15,058	14,962	1,374,890	69,044	358,400
Montgomery	20,269	19,903	1,035,731½	4,207,006	7,885
New York	79	86	......	......	12,650
Niagara	11,793	11,860	966,286	52,260	25,889
Oneida	60,648	58,417	2,868,740	8,108,540	191,698
Onondaga	24,861	23,730	2,149,141	1,844,326	262,946
Ontario	13,634	13,411	1,110,592	119,357	32,020
Orange	40,021	40,096	2,363,661¼	132,575	8,835,052½
Orleans	7,136	7,197	804,209¼	59,598	75
Oswego	29,503	28,393	1,988,060½	2,383,806	69,151
Otsego	41,226	36,040	2,811,199	3,335,144	18,279
Putnam	8,336	8,426	272,924	1,155	2,841,453
Queens	7,628	7,893	424,063¾		929,131
Rensselaer	15,405	14,302	1,144,726	528,133	556,638
Richmond	1,195	1,191	23,575		4,793
Rockland	3,610	3,658	231,231	650	215,384
St. Lawrence	65,262	65,286	5,417,779	2,922,001	119,187
Saratoga	15,148	14,583	1,323,024	185,161	115,556
Schenectady	5,374	5,118	514,607	82,064	118,094
Schoharie	19,461	16,506	1,978,640	143,641	4,235
Schuyler	7,320	6,897	737,673	32,948	8,500
Seneca	6,496	6,470	690,428	12,331	21,394
Stuben	24,172	22,785	2,261,034	291,185	22,485
Suffolk	8,538	9,057	596,189	1,030	22,330
Sullivan	13,487	12,667	1,195,868	12,316	89,928
Tioga	14,109	12,672	1,432,650	49,655	604
Tompkins	15,878	14,575	1,676,823	385,697	31,167
Ulster	18,561	18,226	1,547,217	1,060	134,099
Warren	6,016	5,874	478,085½	71,139	17,485
Washington	17,315	16,863	1,817,397	807,374	21,819
Wayne	14,256	14,229	1,320,004	90,591	47,305
Westchester	16,719	17,154	525,032	186	2,928,845
Wyoming	19,499	18,329	1,279,761	1,801,781	43,407
Yates	6,919	6,828	642,324	30,084	10,551
Total	1,195,481	1,147,251	84,584,458	72,195,337	29,631,530½

As a basis for estimating the probable production, the following table will be useful:

This table shows the total produce of Milk in thirteen States, for the year ending June 30, 1860, and also the quantity used for food, and the amount manufactured into Butter and Cheese for each State:

STATES.	MILCH COWS. NUMBER.	TOTAL PRODUCE. QUARTS.	USED AS FOOD. QUARTS.	MAN'FACTUR'D BUTTER. QUARTS.	MANUFACTURED CHEESE. QUARTS.
Maine	147,314	265,165,200	112,013,085	146,097,262	7,054,853
New Hampshire	94,880	170,784,000	75,052,328	86,959,550	8,772,122
Vermont	174,667	309,056,400	81,288,157	196,022,925	31,745,318
Massachusetts	144,492	260,085,600	135,555,626	103,724,200	20,805,774
Rhode Island	19,700	35,460,000	21,570,272	13,193,128	696,600
Connecticut	98,877	177,978,600	63,585,989	99,071,856	15,320,755
New York	1,123,634	2,022,521,400	543,030,641	1,288,695,987	190,794,772
Pennsylvania	673,547	1,212,384,600	553,828,525	648,697,450	9,858,625
New Jersey	138,818	249,872,400	109,868,653	139,287,811	715,936
Delaware	22,595	40,671,000	22,763,870	17,881,275	25,855
Maryland	99,463	170,033,400	96,286,486	73,714,130	32,784
Wisconsin	203,001	349,192,800	174,214,114	170,638,162	4,340,524
Virginia	330,713	595,128,600	405,561,119	188,463,968	1,103,513
Total	3,281,701	5,858,334,000	2,394,618,865	3,172,447,704	291,267,431

According to these statistics fifty-four per cent. of the entire produce was made into butter. Now, on this basis, if we take one thousand eight hundred quarts of milk as the annual product on an average for each cow, and eighteen (18) quarts as the average quantity of milk required for a pound of butter, then the eleven millions and nine thousand cows of 1870 would yield, if their milk was all made into butter, one billion one hundred million pounds; and if fifty-four per cent. of this is the actual product of the country, as is represented in the table for 1860, then we have the butter product of 1870 represented by nearly six hundred million pounds. But we think it may be safely estimated at more than this. The report of the American Dairymen's Association for 1870, gives a list of nearly one thousand one hundred cheese factories. The list is very incomplete, as it is well known that there are a much larger number; but this list alone, at an average of four hundred cows to the factory, would embrace nearly a half million of cows. There are a large number of farms scattered over the country, where cheese manufacture is carried on at the farm, and if the number of cows so employed be added to the number belonging to factories not reported, there can be but little doubt but that the whole number employed for cheese dairying would be swelled to eight hundred thousand cows. At three hundred pounds of cheese to the cow, we should have the product of 1870, amounting to two hundred and forty million pounds.

Now, according to the table for 1860, forty-one per cent. of the milk product is consumed directly as food, fifty-four per cent. is made into butter, and five per cent. is made into cheese. Therefore we find that, allowing five quarts of milk to the pound of cheese, and taking five per cent. of the gross amount of milk, the cheese product of 1870 would amount to nearly two hundred million pounds, and this too on the basis that ratios are the same in 1870 as 1860. We may remark here that

THE ANNUAL AVERAGE PRODUCT OF COWS

in our estimate, (viz.,—three hundred and sixty pounds of cheese per head; or, if the milk is made into butter, one hundred pounds of butter per head,) is considered only a fair average annual product. These estimates of the present annual cheese product correspond very nearly with the quantity estimated by those who have kept statistics in regard to this branch of industry. They put the whole product of cheese made in 1869 at two hundred and forty million pounds. If anything more was needed to show

THE INACURACY OF THE CENSUS RETURNS

of 1869 as here reported, we might refer to the cheese product of New York for that year in the table which is put at forty-eight million five hundred and forty-eight thousand two hundred and eighty-nine pounds, when according to the New York census returns of 1864 the quantity of cheese made in the State that year for sale and exclusive of what was consumed in families of farmers amounted to seventy-two million one hundred and ninety-five thousand three hundred and thirty-seven pounds. Cheese dairying in New York since 1864 has been largely increased.

From the incomplete returns published in the report of the American Dairymen's Association for 1870, we find eight hundred and twenty-five factories given, and if each averaged three hundred cows they would make a total of two hundred and forty-seven thousand cows. If we estimate four hundred pounds of cheese to the cow as the average product, the gross make of cheese at these factories would amount to ninety-eight million eight hundred thousand pounds. In view of all the facts in my possession, I feel warranted in placing the butter product of the United States and Territories during 1870 at more than six hundred million pounds, and the cheese product at two hundred and forty million pounds. The table, on next page, given by Dr. Loomis in the Patent Office report of 1861, will be of interest, as showing

THE PER CENTAGE OF MILK CONSUMPTION, PREVIOUS TO 1861, IN THIRTEEN STATES.

"It is worthy of notice," he says, "that but five States, viz., New Hampshire, Vermont, Massachusetts, Connecticut, and New York, use over three per cent. of their milk for cheese, and that all south of Pennsylvania use less than one per cent. Rhode Island, Massachusetts and Maryland produce the least in proportion to their population; Vermont, New Hampshire, New York and Wisconsin produce the most in proportion to their population. Massachusetts, Rhode Island, Connecticut, New York and Maryland, consume the least in proportion to their population. Virginia consumes as food nearly seventy per cent. of the entire milk product of that State; Rhode Island over sixty per cent., and Maryland, Delaware, Massachusetts and Wisconsin over fifty per cent. of the product of the States severally. New York and Vermont manufacture into butter nearly two-thirds of their entire milk product. But one State, Virginia, uses less than one-third of its milk in the manufacture of butter. Rhode Island uses the largest per centage in the manufacture of cheese; New York the largest per centage in butter; and Virginia the largest per centage as food. Virginia uses the smallest per centage in butter and cheese, and Vermont the least per centage as food.

This table shows the per centage of Milk consumed as food, and manufactured into Butter and Cheese. Also, the average produce in quarts to each person, and the average amount each consumed:

STATES.	CONSUMED. PER CENT.	BUTTER. PER CENT.	MANUFACTURED CHEESE. PER CENT.	AVERAGE PRODUCE TO EACH PERSON. QUARTS.	AVERAGE CONSUMED BY EACH PERSON. QUARTS.
Maine	.42	.55	.03	422	177
New Hampshire	.44	.50	.06	524	230
Vermont	.26	.63	.11	980	255
Massachusetts	.52	.40	.08	211	110
Rhode Island	.61	.37	.02	203	124
Connecticut	.35	.56	.09	287	135
New York	.27	.64	.09	520	140
Pennsylvania	.46	.53	.01	417	192
New Jersey	.44	.55+	.01—	372	163
Delaware	.56—	.44—	.01—	362	203
Maryland	.57—	.43—	.01—	247	141
Wisconsin	.50	.48	.02	463	232
Virginia	.68+	.31+	.01—	373	254

"The average amount consumed daily by each individual, taking the whole thirteen States, is one pint. The greatest average daily consumed by each person is 1.6 pint in Vermont and Virginia. The least average daily consumed by each person is 0.6 of a pint in Massachusetts.

Dr. LOOMIS gives the following table, showing the quantity of Milk received in the city of New York, at the depots of the Erie, Harlem and Long Island Railroad companies, for the year ending June 30, 1861:

MONTHS.	HARLEM R. R. QUARTS.	ERIE R. R. QUARTS.	LONG ISLAND R. R. QUARTS.	TOTAL. QUARTS.
July	2,816,720	2,743,750	282,530	5,843,000
August	2,657,150	2,636,880	286,250	5,580,280
September	2,399,410	2,225,800	265,190	4,890,400
October	2,320,610	1,959,740	269,890	4,550,240
November	2,057,570	1,715,128	267,890	4,040,588
December	2,068,320	1,564,670	262,660	3,895,650
January	2,061,730	1,547,630	260,010	3,869,370
February	1,853,080	1,474,150	266,740	3,593,970
March	2,169,590	1,788,910	275,840	4,234,340
April	2,203,010	1,944,770	286,180	4,433,960
May	2,436,800	2,320,670	301,900	5,059,370
June	2,463,090	2,492,510	301,650	5,257,250
Total	27,507,080	24,414.608	3,326,730	55,248,418

In 1861 thirty thousand six hundred and ninety-four cows were required to supply the milk transported to New York city on the Harlem, Erie and Long Island Railroads. The average annual cost of transport was five hundred and fifty-two thousand four hundred and eighty-four dollars, and the cost of milk as received for transportation was one million one hundred and four thousand nine hundred and sixty-eight dollars annually. We have no statistics at hand to show the quantity of milk used in New York city for the year 1870, but the quantity and its cost must be very much greater than in 1861.

VALUE OF THE MILK CROP IN 1860.

Dr. LOOMIS says:—"The value of the milk crop may be very fairly estimated from the value of milk used in the manufacture of butter. Fifty-four per cent. of the entire crop in the thirteen States before named is made into butter; hence, the value of butter forms a very correct basis for ascertaining the true value of milk. In the following table the prices of milk given for each State has been derived by taking the average prices given for the cost value of butter at the places where it is made, and extended over a period of twelve years.

The localities were selected from various sections of each State. This method was pursued with all the States except Wisconsin, which extended over a period of only three years.

He adds:—"I am aware that these values, with the exception of Delaware, fall below the generally estimated value of milk, yet I am confident that if there is any variation from the true value, it is that I have over-estimated them."

The value of milk in the United States in 1860, or before the war, he thought would average less than one cent and five mills per quart.

He says:—"The following table is a correct statement of the value of milk per quart; the total value of the crop; together with the value of the amount consumed in each of the named States:

STATES.	PRICE PER QUART CENTS.	VALUE CONSUMED.	TOTAL VALUE.
Maine	1.36	$1,523,377 96	$3,606,246 72
New Hampshire	1.44	1,080,753 52	2,459,289 60
Vermont	1.28	1,040,488 41	3,955,921 92
Massachusetts	1.68	2,277,334 52	4,369,438 08
Rhode Island	1.64	353,752 46	518,544 00
Connecticut	1.60	1,017,375 82	2,847,657 60
New York	1.36	7,385,216 72	27,506,291 04
Pennsylvania	1.28	7,089,005 12	15,518,522 88
New Jersey	1.76	1,933,688 29	4,396,754 24
Delaware	2.00	455,277 40	813,420 00
Maryland	1.20	1,155,437 83	2,040,400 80
Wisconsin	1.48	2,578,368 89	5,160,053 44
Virginia	1.12	4,542,284 53	6,665,440 32
Total		$32,432,361 47	$79,857,980 64

With the above tables as a basis, it was estimated that the entire milk crop of the United States for the year 1860, exceeded $160,000,000, or as follows:

Amount consumed as food,	$90,000,000
Amount manufactured into butter,	65,000,000
Amount manufactured into cheese,	5,000,000
TOTAL,	$160,000,000

The additional value produced by the manufacture and transportation of butter and cheese he estimates will make the value of the crop for the year 1860, exceed $200,000,000. The estimate is made on the value of milk at 1.48 cent per quart. At two cents per quart the value of the dairy would be upwards of 260,000,000.

MILK PRODUCT OF 1870.

Now if we proceed upon the above basis in estimating the entire milk crop of 1870, taking its increase of quantity and advanced prices, we shall have the following.

Milk consumed as food, say 40 per cent. of whole product, at 2 cents per quart	$170,400,000
600,000,000 pounds of butter, at 30 cents,	180,000,000
240,000,000 pounds of cheese, at 12 cents,	28,800,000
TOTAL,	$379,200,000

This is below the estimate made by Commissioner WELLS in his Report upon the "Industry, Trade and Commerce of the United States," for the year 1869. He puts the value of dairy products of the United States at $400,000,000 per annum. It will be seen, then, that the diary has become an important branch of National Industry.

DAIRY FARMS AND FIXTURES.

In Dairy Farming the first thing, naturally, to be considered is the farm. Reference has been made to the importance of a suitable climate as one of the requisites to success. Experience and experiment must of course determine what our several localities are best adapted to; but it is certain that much of the land in this Northern belt is well adapted for making butter and cheese. Its climate is comparatively cool, and that is a matter of great moment in securing dairy products of fine flavor and quality. With its showers and dews, pure water and fresh sweet feed, it answers the description of a good dairy country, which the warmer and drier Southern and Western latitudes do not. I am satisfied there is no branch of farming in this Northern belt that will suffer less from outside competition than dairying, and hence, where locality favors it nothing in the long run will pay better.

PERMANENT PASTURES.

But climate may be favorable and locality unfavorable for the dairy. We must consider whether the lands are naturally adapted to grass, or that pastures at least may be made enduring, and that the farm is well provided with an abundance of pure water.

These two points are very essential to success. I refer to pastures, in distinction from meadows, because a rotation of crops may be adopted on arable land, so that sufficient hay may be produced, where the natural condition of the soil would not continue to be productive of grass from year to year, during long periods. But pastures should be of a character to be made enduring, for a variety of reasons which I shall presently notice.

SIZE OF HERDS.

The question is often asked, how large a number of cows can be kept profitably in one herd? or, rather, what is the limit to the number that will yield the best average returns as a dairy? I have taken some pains to get the opinion of practical dairymen, both in this country and in Europe, on this question; and it seems to be the universal expression of those who have given the matter attention, that, in their experience, sixty cows are about the limit, or maximum number. If we take pains to look up the largest average yield of dairies in the country, we shall find, almost invariably, that they are among the small herds numbering from twenty to forty cows.

Very large herds become unwieldy. They are more subject to disease, and a larger number of accidents in proportion, than smaller herds. In driving to and fro in the pasture, there is more excitement or worry, which operates to lessen the average quantity of milk. There is also a greater proportion of farrow, or abortive stock in such herds, hence in New York, dairymen who have large farms, prefer to divide them up, making their dairies number from thirty to fifty cows each.

DIVIDING HERDS.

I found this condition of things prevailing in the dairy districts of England and Scotland, and I therefore conclude that herds having a larger number than sixty cows are not to be generally recommended. If it is desired, however, to keep a larger number, I should advise that the cows be pastured in separate herds of say thirty each, and that they be milked and wintered in separate stables, allowing no communication among the several branches.

In some instances, I have seen dairies of a hundred cows, divided up into two herds of fifty each, and good results were obtained. The herds were milked and wintered in one barn, but in stables opposite or adjoining each other, and so arranged that the cows of the different herds could have no communication with each other whatever.

This fact in relation to the size of herds it is important to understand; since large losses have been made by persons who have tried the herding of a large number of animals together for dairy purposes.

FENCING.

There is another point of considerable economy in the management of dairy farms, often overlooked even by old and experienced dairymen, and this is in regard to fences. In New York it is daily becoming a problem of increasing interest where we are to obtain our fences. All sorts of hedges are recommended, but who has ever seen a good one in New England or New York!—one that will stand the test of every day practical utility in turning stock? In England they are easily enough produced, and so are pastures. A humid atmosphere, frequent showers, frosts so light as not to injure grass in winter or even render it unfit for the sustenance of sheep ordinarily, even in mid-winter. Absence of our fervid heats of summer, and during summer many more hours of daylight render any comparison between that country and our own in the way of growing hedges, of doubtful character. But few persons, I imagine, have even sat down to fairly estimate

THE EXPENSE OF FENCING THE FARMS OF A STATE.

It has been vaguely estimated that $40,000,000 would not fence the farms of New York. But to fence one hundred acres of land with only four lots require nearly eight hundred rods of fence, which, at $1.50 per rod, would cost $1,200. Now deduct one-third of this for the fencing of the contiguous farms, and we have $800 per hundred acres for the cost of board fences. A town—after rejecting poor land—of say one hundred such farms, would cost

$30,000, and a county of twenty such towns the enormous sum of at least $1,500,000. Multiply that by the number of counties in a State and see what an immense sum we arrive at. The corollory is a safe one that the fences of New York cost more than the Erie Canal or the Central Railroad. At least one-third of these fences are of no earthly use, but on the contrary, it can be proved, are a serious damage.

Upon dairy farms, therefore where it is practicable, the farm should have but one line of interior fence. Immense sums are thrown away by the farmers of the country in

USELESS SMALL ENCLOSURES.

It is not necessary to go into the exact details of cost in erecting a substantial fence, dividing a farm into ten acre lots. This in the outset is a heavy outlay of capital and labor, but the burthen of repairing must be carried from year to year. Division lines between farms should always be marked with good substantial barriers. Where stone are plenty upon the farm, they are perhaps well employed in division or line fences, but it is hardly advisable to use them for interior barriers, especially such as may require to be removed from time to time.

In early times when timber was plenty, and forests to be cleared, the expense of fencing a farm was of not so much account as now. Then a selection of timber could be made and a thousand rails split, with but a trifle more labor than a quarter that number from the cullings of the present wood lot of the farm. Timber among the early settlers was considered of very little value. Now it is costly, and the farmer who has much fence to build must study economy in material as well as in labor, and even under the best management he finds the expense burthensome. The division of a dairy farm into numerous small enclosures, I regard as poor economy, and in many ways objectionable.

The generality of fences upon American farms, to say the least, are unsightly. Besides the first expense and labor of keeping them in repair, they occupy too much land, and are a harbor for weeds and bushes, and briars; all of which must be put down as serious objections.

I know there are men who claim great advantages for small enclosures, and who regard five, eight, or ten acre lots as almost indispensable in their farming operations. I do not propose to argue points with them, but simply suggest that the cost of fencing such enclosures for ten years be figured, and compared with the advantages claimed. In most instances, I think, the balance sheet will be a strong argument against the fences. Of course some small enclosures may be necessary, such as that for the vegetable garden, the orchard, &c. I do not object to these, but to the extending of them over the whole farm. Upon half the farms in the old States, it would pay the occupants to

EMPLOY AN EXPERIENCED ENGINEER,

to make a careful survey of the farm and establish the location of fences. Let the farmer make a plain statement of the character of farming he is about to follow, his actual necessities upon the farm, requiring of the fence engineer a reduction of the fences to the lowest possible point. I am very certain that the fences on most farms may be so arranged as to afford ample convenience, and yet be largely reduced as to length. The necessity of building strong and high fences along the road-side is not so imperative now as formerly. There is a law in many of the States against cattle running at large in the highways, which ought to be enacted in all the States and put in force in every neighborhood.

THE LOG AND RAIL FENCES

of the early settlers, have both had their day. Neither is to be recommended, except perhaps in heavily wooded regions, where timber is of little value. In old districts they must soon pass away, since timber is becoming scarce and land is too valuable to be wasted by this character of barrier. They are very objectionable in plowing, and even upon dairy farms when such a fence divides pasture and meadow, considerable more expense is required to do the mowing, as the machine cannot run into the corners, which must be trimmed by hand. Besides, as was remarked at the outset, they are a harbor for weeds and bushes, since they are more liable to be left uncut, than when the fences are straight, and there are no corners to prevent obstructions, as the work goes on. It should be remembered that we do not fence against the strength of cattle; for if our animals were so inclined, they would break down nearly all the wooden fences which we build. What we seek in the construction of interior farm fences, is to build a barrier that will appear formidable to cattle, of sufficient strength to resist ordinary storms of wind, and the occasional contact from cattle rubbing against it. It should be so high that cattle cannot reach over it, so compact that they cannot get their heads through it, and so near the ground that they cannot get under it.

MOVEABLE PANELS.

For surrounding patches of land that require breaking up and cultivating, and to be returned again to grass an effectual barrier can be erected at much less expense for labor and material than the heavy post and board fence commonly recommended. There are various forms of moveable panels, easily erected and taken down and removed from place to place, which are of great practical utility and economy upon dairy farms. Some of our New York dairy farmers find the picket fence the most formidable barrier to cattle, of all the kinds of wooden fence in use.

A LIGHT FENCE

of this description, and which has been found to be an ample protection against stock, for patches of grain, vegetables, &c., recommended by Mr. S. S. WHITEMAN of Herkimer, is constructed as follows:—The pickets are four feet long, two inches wide and five-eights of an inch thick. They are nailed three inches apart on the rails, or seventeen pickets to the rod. The rails are ten feet long, two inches wide and one and a half inches thick, three rails to a panel; that is — a rail at top and bottom, and the third rail running diagonally between the other two in the form of a brace. In making these panels a frame or skeleton form is constructed arranged with wooden pins, so as to separate the various pieces the desired distance apart.

The top and bottom rails are then dropped into their appropriate places, the pickets arranged between the pins, where they are rapidly nailed with five-penny nails. After the skeleton frame is once constructed, these panels may be speedily made. The pickets do not cover the ends of the rails, a space being left for lapping the panels together, when they are to be set up in the fence. The method of putting the fence up is to let the rails of one section overlap the rails of the other at the point where they are joined together; the sections being supported at the right height from the ground by a stone or block. Then a stake about the size of a common hand spike, is driven down on each side of the lapping sections, and supporting block, and the top of the stakes fastened together with wire. These panels can be easily loaded on a wagon rack and removed from place to place as needed.

DIGGING POST HOLES.

Line fences and that separating the pasture and madow may be of a more permanent character. When posts are to be set, the holes can be dug expeditiously after the following method:—First, strike a line and mark off the distances between the posts, sticking small stakes about four inches from the line. Then make the center of the hole opposite the stakes. The digger stands faceing the line of fence, making the hole the width of the spade at the line, and slanting towards him as he digs, while all the other sides are perpendicular. This slant enables the digger to lower the handle of his spade and bring up a full spadeful, enabling him to do the work easily and expeditiously.

BOARD FENCE.

There are various ways of making board fence. When boards sixteen feet long are used, they may be six inches wide and one inch thick. The posts then should be set seven and a-half feet apart. Fasten the boards at each end with a seven inch spike and a two and a half inch slat, resting the boards on the spikes. The lap on each end of the boards should be six inches.

At the middle post, as there is no lap, a six inch spike may be used. If the boards used are but thirteen feet long, they should be one and a-fourth inches thick, and the middle post may be omitted. By using slats, and allowing the boards to rest on spikes, rather than driving them through the boards, they are less liable to decay, while the panels may be easily removed as occasion may require. The question of

ECONOMY IN FENCING

does not receive the attention which it deserves among farmers. The cost of fencing farms, and their repair year after year is enormous. It would be well if we could look forward to something more tasteful than the rail structures, which disfigure the country at every hand. We must get in the way of doing work in a more economical way. As we grow older as a nation, structures, whether they be in buildings or fences, must inevitably be improved. It would be better that we begin at once since much money would in the end be saved.

CHANGE OF PASTURES.

I have endeavored to show the importence of economy in the matter of fencing, and it may be well perhaps in this connection to name some of the practicle results of the plan recommended. The practice which obtains with some of dividing the pasturage into separate fields, and changing the herd every week or two from field to field is now generally disapproved of by our best dairymen.

Cows confined to one field are more quiet and contented. They will usually go over in the course of the day every portion of the field, selecting their food, and when filled they lie down to rest, and manufacture grass into milk. All extra labor, excitement and gluttinous feeding from an over stimulated appetite lessens the quantity of milk. Everything about the "every day pasture" is familiar, and if food is abundant, they have no thought beyond leisurely taking their meals, and reclining at ease on some favorite spot, ruminating or dozing over their "knitting work" as it has been aptly termed—no shadow of discontent clouding their peaceful and seemingly happy existance.

But let a bite of grass in new fields be had and all this is changed. They over-feed, and in consequence their health is more or less deranged; they tramp around in every nook and corner of the field in search of dainties—become restless and discontented, and not unfrequently some of the more active and enterprising members of the herd, try fences and make excursions into fields of grain and prohibited crops. I have seen herds with one or two unruly disposed members, though perfectly quiet and orderly while confined to one pasture, become so restless and discontented from a change to new fields, as to be exceedingly troublesome and cause serious losses.

There are other reasons. The pastures will not be so uniformly cropped; large portions will get a rank growth, be rejected by stock, and therefore afford less nutritious food through the season, than when used as one pasture.

FRESH PASTURES PRODUCE SCOURS.

Fresh pastures are more apt to produce scours, as is well known, deranging the appetite and health to a greater extent than when confined to one field. The argument generally used in favor of two pastures, is that the daily tramping of the cattle on the one pasture renders the food less fresh and palatable, and that the alternate pastures obviate this, giving time for grass to grow, thus producing more food and better results. The conclusion arrived at, is not true in fact. Stock when turned into a new pasture do not rest till they have roamed over and examined every part of it, and will tramp down, soil, and destroy more food than if the same land was in one pasture, thereby really affording or rendering available to the herd, a less amount of nutritious food during the season. Cattle, it is true, like

A CHANGE OF FOOD,

but this change should exist in the varieties of grass in the same pasture, and not in different fields. Of course the aftermath and gleanings from grain fields are to be consumed by stock in fall, as deemed expedient, but the summer pasture should be one field, as productive of more milk with less trouble, expense and loss.

PASTURES SHOULD NOT BE OVERSTOCKED.

Pastures, it is proper to say, should not be overstocked—the supply of food must be abundant, otherwise serious losses will be incurred. There is nothing gained by stocking clear up to, or a little beyond, the full capacity of the land, and trusting to an extraordinary good growing season to bring the animals through.

Much milk will require a proportionate amount of food, and I have yet to see the cow miserly kept on scanty fare, that can turn that fare into a large dairy product. The rule should be, the largest quantity and best quality of dairy products per cow, and not the largest number of cows without thought or care as to the respective quantity or quality of milk from each.

DAIRY BARNS.

An important requisite in Dairy farming is to have a convenient barn. Indeed, of so much practical importance is this, that I must treat the subject at considerable length. A handy barn for a grain farm is a very different structure from what is needed on a dairy farm. Dairymen of experience affirm that a convenient dairy barn on a farm carrying fifty cows, will save an annual expense in labor of at least $200 over the structures in use twenty years ago, and, indeed, over those which are largely in use at the present day.

THE MODERN DAIRY BARN

began to be erected in the old dairy districts of New York about ten years ago, and it is a matter of surprise that a people who have been sixty years engaged in dairying as a specialty, should have neglected this branch of their art so long.

The modern dairy barn is roomy, and arranged, if possible, so that one building or a structure under one roof, will meet all the wants of the farm. This is easily done, when a side hill and running water are convenient to the farm house. In such cases the stables for milking are those in which the cows are kept in winter. This arrangement saves the cost of a special building, or "milk barn" as it is termed.

The stables should not only be well lighted, but arranged with wide drop doors at the sides, so that for summer use you can expose a skeleton or section of the frame, admitting into the stable a flood of light and pure air.

MANURE CELLARS.

There has been great difference of opinion whether manure cellars under the stable are injurious or otherwise.

Many barns in Central New York are constructed with the cellars under the stables, and in no instance where they have been properly ventilated, and absorbents used for taking up the liquid manure, have I heard of any bad effect on account of the manures, &c. The stock is quite as healthy, and appears as thrifty at all seasons, as in barns without manure cellars. I have examined manure cellars under stables, at different seasons of the year. Some of them were badly ventilated, and were foul with gases emanating from the decomposing mass of excrement which had been dumped without absorbents. Such a condition of things must be a source of disease to stock and cannot be recommended. In others, where ventilation has been secured, and absorbents, such as muck, dry earth or sawdust freely used, the atmosphere was comparatively pure, and free from any disagreeable odor. Generally those who have manure cellars under their stables are pleased with them. They save a great deal of labor in the course of a year, and, with the precautions I have named as regards ventilation and absorbents, have not been found to be objectionable.

A CONVENIENT DAIRY BARN.

I shall describe somewhat minutely what has been found to be a convenient dairy barn having capacity for fifty cows. It has a basement or manure cellar under the stables. The barn stands on the edge of a knoll or side hill, and is one hundred feet long by forty feet wide, and has a stone basement nine feet high. The bottom of this basement, which is used for manures, is paved with cobble stones, pounded down in the earth, and then cemented with water lime and sand, in the proportion of one part lime to nine parts sand. This forms a perfectly tight bottom and is the receptacle for all liquid and solid excrement from stock in the stables above.

The basement is well lighted and ventilated, and teams can be driven through the central alley for removing manures. Muck and dry earth are hauled into the central alley, during odd spells in summer, to be used from time to time as absorbents, and when thus mingled with the liquid and solid excrement a large quantity of fertilizing material is made.

THE STABLES

are on the sides of the building, immediately above the basement, and are eleven feet wide back of the feed box, and the cows are fed from the central alley, which is fourteen feet wide. The cows stand four feet apart, or rather they occupy that space, and are fastened with double chains two feet long, attached to a ring sliding on a post. Between each cow there is a plank partition extending into the central alley, the width of the feed box, and back into the stable some two feet. This plan gives the cow more liberty and ease of position than stanchions, and some prefer these fastenings to stanchions on this account. Back of the cows and along the outside of the stables, the floor is raised some five inches higher than the drop where the cows stand, and there is an open space between the two floors where the manures are pushed into the cellar below. This it will be seen can be done very rapidly. (Some use a trap.) The stables are well lighted and ventilated. Above the cows are

THE DRIVE FLOORS AND BAYS

where the teams deposit the hay and fodder. The loads come in at one end and go out at the side on the other end, so that several teams can be in the barn and the work of loading and unloading go on at the same time, and not interfere with each other. On one side of the barn are the

HORSE STABLES AND CARRIAGE HOUSE,

communicating with the upper or drive floor, and all arranged in the most perfect manner as to granary and the means of dropping hay for feeding horses and cattle.

In the upper loft over the drive way, a flooring is arranged with open spaces, where a considerable quantity of corn in the stalk may be stored until such time as there is leisure for husking. The leading feature of the barns now being built in the dairy region is to have the drive floors and bays above the stables. When the site is suitable some prefer to have the drive way near the peak or top of the barn. The hay may then be rolled from the load on either side into the bays.

In feeding,—the stables being below,—the fodder is thrown downwards, either through openings arranged in the bays, or in the central alley, according to the manner in which the cows are placed in the stables.

A portion of the basement is partitioned off for roots, which at the time of harvesting are dumped through a trap on the feed floor.

Not far from the southern shores of Oneida Lake, and at the geographical center of the State of New York, a peculiar religious sect, numbering about two hundred votaries, has established itself upon a few hundred acres of choice land. They do almost everything among themselves, and conduct a system of mechanical operations and high farming. They have men of science and education among them, and their workshops and farming operations are, in many respects, models of excellence.

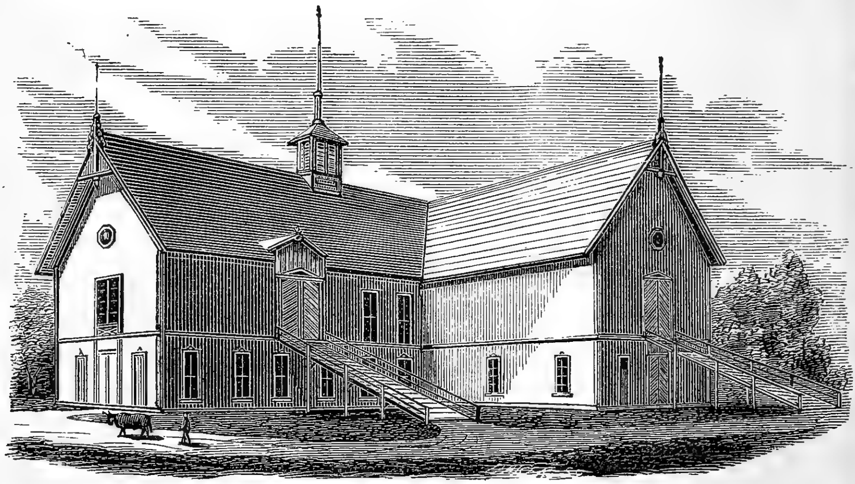
AN EXCELLENT DAIRY BARN.

A few years since, they sent their architects through the country to examine all the best barns that could be found, and from a large number of plans they modeled and erected a dairy barn of the following description:—It is one hundred and thirty-five feet long by seventy feet broad, and has a hip roof. The structure is of wood, resting on a stone basement nine feet high. The basement is divided by walls into spaces for the manures, the root cellar, and bottom of the bays. There are three drive ways or barn floors running across the building, with bays thirty feet square on either side of the central drive way, so that the teams can deliver their loads from the three floors. The stables run all around the outside, except in the spaces taken up by the drive way. The stables on the ends hold twenty cows each, and the four stables on the sides, between the floors, have nine stalls each, so that seventy-six animals can be housed at one time.

Under the middle drive way is the root cellar, where roots are dumped by opening a trap door; on the other floor are traps for dropping muck, or other absorbents into the manure cellar. The drive ways are fourteen feet wide, and the width of the stables sixteen feet, including the mangers, which are three feet. Back of the cows there is a manure sink two feet wide, and from this to the outside of the building is a space of five feet. There are four

VENTILATORS

that run from top to bottom so as to give good ventilation. Saw-dust and



MEADOW BROOK FARM DAIRY BARN—ELEVATION.

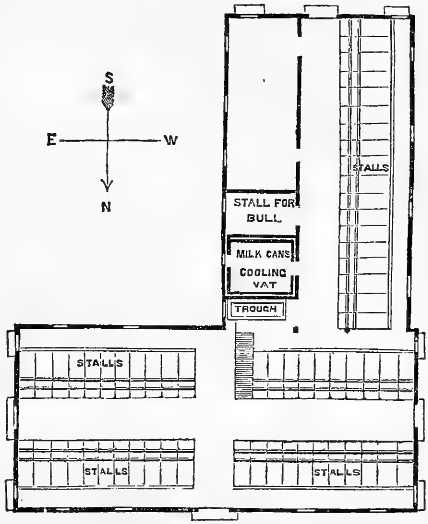
cut straw are used for bedding stock. Of the straw, about four hundred loads are used for the purpose during winter. The hay is cut into chaff, and at certain seasons, when cows are in milk, it is mingled with meal or bran before being fed. When bran is used the cows get each about four quarts per day. The root cellar holds about four thousand bushels, and the roots are fed during winter. It is the only barn I have seen arranged on this plan. The bays for hay extending into the basement seems to me to be objectionable. The arrangement for storing both hay and grain, and the feeding of stock, appear to be convenient.

MEADOW BROOK FARM DAIRY BARN.

By the politeness of Mr. Geo. S. Bowen, of Chicago, Ill., I am in receipt of the accompanying cuts showing elevation and plan of Dairy Barn erected in 1870 upon his Meadow Brook Farm, near Elgin Ill., the following description being taken from the Western Rural:

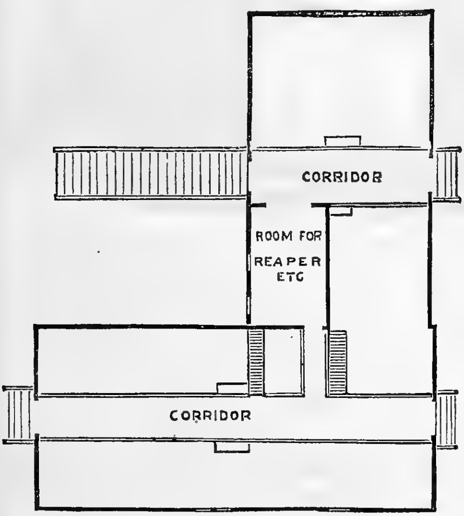
"The barn is L-shaped, the main being 96x36, the wing 40x36; its hight from the ground to the ridge-pole is forty-two feet. The lower floor, as will be seen by the accompanying diagram, is devoted to stalls, milk-room, water-trough, root-cellar, etc.

"Mr. B. has contrived to secure ample and ready ventilation — a point which is very often considered too lightly in the construction of buildings of this character. The stalls occupy portions of both the main part and the wing, and will accommodate sixty-three cattle, with single feed boxes for each, and long, hinged supply lines immediately in front. There is a space of seven feet from the drop (or receptacle for the droppings) to the windows, which are large—their size admitting of increased ventilation during hot weather, and facilitating the removal of excremental matter.



LOWER FLOOR.

"A wind-mill pump is to be supplied to raise water into a reservoir so constructed as to fill the cooling vats in the milk-room, and to provide water for the stock during stormy weather.



UPPER FLOOR.

"A protected flight of stairs leads from the lower to the upper floor, where there is a large room for storing farming utensils; a grain-bin, 36x20; two bays for hay, one 76x12 and the other 36x12. The entrance floors are seventy-six and thirty-six feet, respectively, and reached by bridges or causeways leading from the ground. There are eight large sliding double doors, all moving on rollers, and four hay slides to get whatever is needed to the lower floor. Successive flights of stairs communicate with a large cupola. The cost of this barn was three thousand six hundred dollars. There were used in its construction one hundred and ten thousand feet of lumber, fifty-five thousand shingles, and two thousand eight hundred pounds of nails."

ANOTHER STYLE OF BARN

is used by those who have a prejudice against manure cellars. It is built with or without a basement. The cows stand in two rows opposite each other, with their heads facing the outside of the building, and the space in the center between the cows and the drop is wide enough for a drive way for hauling out the manures. The cows enter at the central door, and take their places on either side. Absorbents may be used for taking up the liquid manures, and every day, when the stables are to be cleaned, it is piled upon a sled or wagon and taken directly to a field where it is to be used.

HOW MANURES ARE MANAGED.

HARRIS LEWIS, Herkimer Co., N. Y., has been quite successful in managing the manures from his stock, from a barn of this description. He uses saw-dust for absorbing the liquid manures in his stables, at the rate of about sixty bushels per week for a stock of fifty cows. The liquid manure thus absorbed is hauled from day to day to a meadow lot containing twenty-five acres. It is spread as evenly as possible with a shovel or fork, and in the spring it is brushed, so as to be completely broken up and distributed in fine particles. By underdraining, and the use of this top dressing, he has been able to bring a piece of ground containing twenty-five acres, originally of only ordinary fertility, to a condition in which the annual yield of hay is sufficient for the winter keep of fifty cows.

THE CONVENIENCE OF MANURE CELLARS.

Buildings of this kind, however, are much less convenient than those provided with manure cellars, as there are many days in winter when it is stormy, and inconvenient and difficult to haul manure from the stables. Besides, if they are to be applied upon grounds that are somewhat descending, a considerable portion of the manure is liable to be washed away as the snow goes off in the spring. With the cellar, on the contrary, advantage can be taken of the time in applying manures, and practically they are found to be productive of the best results.

BARNS FOR CUTTING AND STEAMING FODDER.

I have yet another barn to describe, adapted to a level surface, and where the straw from considerable quantities of grain is to be cut and steamed for cattle food. This barn was erected for Mr. TRUESDALE, an extensive dairy farmer in Wisconsin, who spared no expense in obtaining the best models and architects, and who is said to have the most perfect dairy barn in that State. I visited this establishment in 1869, and give a sketch of it from my notes:

The barn is an immense structure, being in outline the form of a T. The top of the T is one hundred and twelve feet long by forty feet wide, with twenty-two feet posts. The whole stands upon a heavy wall, which forms a cellar under the building for manures. The part representing the top of the T is used for threshing, shelling corn, grinding the grain and cutting the fodder. Immediately to the right, but separated only by a short platform, is another building in which all the fodder is cooked by steam. The cattle stand in the body of the T, in two long stables at the sides, with their heads facing each other, the central alley being sixteen feet wide. The stables are nine feet wide, and the platform on which the cows stand is four feet nine inches to the stanchions, leaving a ditch one foot wide and a space of three feet back of the ditch to the sides of the building. The stanchions are three feet three inches apart from center to center, and the platform on which the cows stand is raised so as to give a drop of nine inches. Of this drop a space of five inches is left open, through which the manure is pushed to the cellar below. The stables will accommodate one hundred and forty cows—seventy animals on a side. The second story (above the cows) is used for oats, grain unthreshed, and hay, the hay being stored in the lower end, in a section by itself, for spring use.

THE THRESHING

is done as the straw and grain are needed for the stock. The threshing machine and straw cutter are in the second story of the top of the T. The grain in bundles or loose, is thrown on a car, which runs on rails through the different sections over the cows, and a load is drawn up to the machine by a simple arrangement operated by power from the engine. The various machines are then set in motion, and as the straw is threshed it passes to the straw cutter, and falls chopped in pieces, to a large bin below. The chaff is blown out of the grain and falls into the same bin, while the grain passes on and falls into a fan mill below, where it is cleaned, and goes into a bin. Everything is arranged so conveniently, that but little labor or time is employed to do this part of the work, from time to time as needed.

PREPARING THE FEED.

The corn sheller and mill for grinding the grain are below with the grain bins opposite. Oats and corn are mingled together in the proportion of two-thirds of the former to one-third of the latter, when it is carried by machinery above, falls into the hopper, and is ground and passed to its appropriate bin. There are two steam boxes sixteen feet long, five feet wide and five feet deep. They stand upon cars, with a track leading through the central alley of the stable to the steaming room. These cars are run up to the straw and meal bins, and the boxes filled. First the straw is filled into the steam box a foot deep, then one bushel of the mixture of oats and corn meal is sprinkled on, and so alternately with straw and meal until the box is filled, which gives four bushels of meal to the box. Then the boxes are run into the steam room and the contents wet down by pumping water through a hose.

At the bottom of the boxes are perforated iron pipes running three times lengthwise across the bottom, and arranged at one end so as to be locked on to the steam pipes connected with the engine. The cover is then fitted to the box, and the steam let on. In about half an hour the contents of the box are broken down and cooked.

FEEDING THE COWS.

The food steamed in the morning is thrown out into the car and left to cool till evening, when it is just pleasantly warm to the hand, and is ready for feeding. The night's steaming is treated in the same way for the morning feed. The cars are run along the central alley, between the heads of the cows, and each animal receives her share in the manger before her. The two boxes of steamed food are sufficient for one feed of one hundred and forty head of cattle. It will be seen, therefore, that in addition to the straw, the one hundred and forty head get sixteen bushels of meal, or about three and one-half quarts of meal each per day. The cows are very fond of their rations, and under this treatment were looking sleek and in good condition.

GAIN BY STEAMING FOOD.

Mr. Truesdale's estimate shows about twenty-five per cent gain in cost of feed over the ordinary method where hay is used, to say nothing of the important saving made in converting his straw into available manures. The stock is wintered in this manner, and when the cows begin to come in milk, he commences feeding hay. The stables, I should have remarked, are well lighted, and ample provision is made for ventilation, so that the cows have really a luxurious abode in their winter quarters.

THE MANURE CELLAR

is immediately under the cow stables, and is well lighted and ventilated. In the fall of the year, or during summer when work is not pressing, muck, which has been thrown out of the ditches and dried, is carted into the cellar and piled in the central alley as an absorbent. From five hundred to eight hundred loads of muck are thus stored annually. The liquid and solid excrement from the cows goes down into the cellar through the opening in the stable floor as I have described, and every day or two the muck from the central alley is thrown upon the dung until all moisture is absorbed.

HOW THE MANURE IS USED.

Mr. Truesdale's system here is, without doubt, a good one, and the large quantities of manure annually made, must in a few years give ample returns upon the farm. A portion of this manure is used for top-dressing meadows and newly seeded lands, in the fall, at the rate of about twenty loads to the acre, evenly spread and brushed down fine, and about fifty acres are annually treated in this way.

Under this arrangement of barns and machinery, two men will take care of one hundred and forty head of cattle, steaming the food, cleaning the stables, and doing all the work necessary for the care and comfort of the animals. There are two open yards, one on each side of the barn, where the cows from each stable are provided with water, which is pumped from a never-failing well. These yards are partly planked, and are to be wholly planked the coming year.

BARN WITH FOUR ROWS OF STABLES.

An Ohio correspondent of the Rural New-Yorker sends the following description of a Dairy Barn:

Its distinguishing characteristics are a free use of tram-ways, and a separate building for the factory operations incident to feeding a large drove of cattle, and for the storage of grain and feed.

The size of the main barn is 96 by 56 feet; of factory, 24 by 20. The barn will hold one hundred and twenty cattle, and hogs *ad libitum.* The basement story, or hog and manure cellar, is not shown in the elevation. It is divided into pens for hogs, on either side of a central alley. The basement story of factory contains the steam engine and a continuation of the tram-way which passes through the hog cellar.

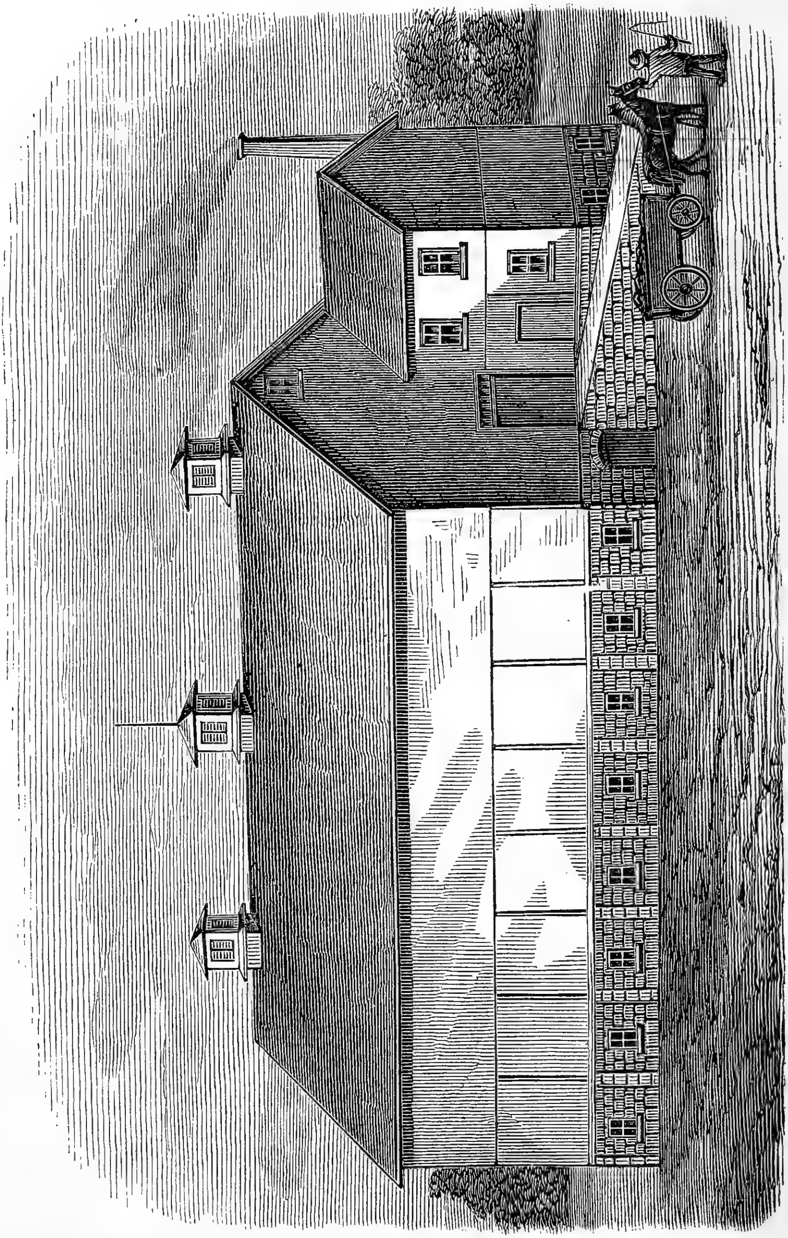
The second floor of the barn contains the cattle stables, arranged for four rows of cattle, each double row facing a feeding alley in which there is a tram-way for the easy conveyance of the cooked food. The second story of the factory is for the grist mill, cider mill, saw frame, or any other machinery it is desired to use. A belt also runs to a separate shaft in the main barn, for turning the hay cutter, threshing machine and corn sheller.

The third story of the barn contains the barn floor, with large bays on either side. Also a room for cutting hay and a bin for the cut feed. A tram-way and hay car are provided for the easy handling of the hay and fodder used. The corresponding story of the factory is for the reception of grain, and of meal from the grist mill below. The necessary spouts and elevators are provided, as common in grist mills. In the fourth story of factory is stored the bran or mill feed.

On a level with the purline plates is laid another floor for corn in the ear. This floor is also provided with tram-way and car. The stables are provided with manure traps, one foot by twelve, running the whole length of the stalls, and hung upon hinges. These render the cleaning of the stalls an easy task. If more accommodations are required, the length of the barn might be increased. One correspondent says:—I believe in this barn, three men might take care of one hundred and twenty cattle and five hundred hogs, including the running of the engine and the machinery. As to cost, no estimate can be made, since lumber and stone or brick vary so much in price in different localities. Where both are abundant, the cost would not exceed four thousand dollars.

The accompanying plans will, perhaps, the better enable the reader to comprehend the arrangement of the barn.

In Fig. 1 is shown the plan of the stables on the second floor, S, S, S, S, stalls for cattle; M, M, M, M, mangers; A, A, alleys in front of cattle; Mt, Mt, Mt, manure traps; *t*, *t*, tramways; St, switch track between alleys;



LARGE STOCK BARN—ELEVATION.

machinery room is shown at end of elevation. Fig. 2, S, steam engine; *t*, tramway; B, steam box.

Fig. 3 shows a sectional view of barn and factory. A, first story; B, second story; C, third story of barn; D, D, hay bays; E, corn loft; *e*, *e*, (dotted line) ground level; *a*, first, *b*, second, *c*, third, and *d*, fourth stories of factory.

PRACTICAL BEARING OF MANURE CELLARS.

I have given some of the leading features esteemed requisite in the con-

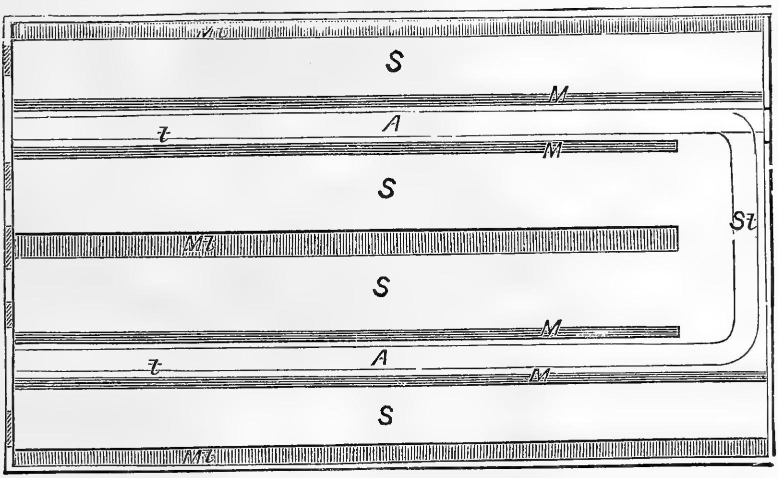


Fig. 1.—Second Floor of Stock Barn.

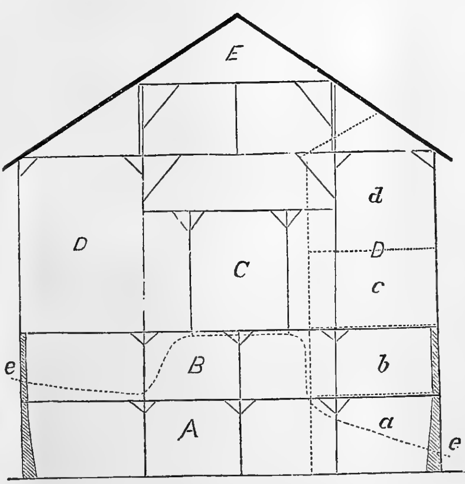


Fig. 3.—Sectional View of Barn and Factory.

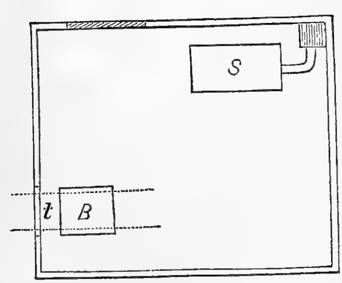


Fig. 2.—Engine Room.

struction of a convenient dairy barn. Of course the size of building and internal arrangements may be modified to suit the wants of particular cases; but I regard the manure cellars underneath the stable of great practical utility, I have seen such rapid and large improvement in dairy lands from its adoption, that it has commended itself strongly to favor. I know of farms that were quite ordinary a few years ago that are now made to carry an extraordinarily large stock, and I have repeatedly asked the occupants in what manner they have been enabled to produce crops sufficient to supply food for an extra number of cows upon the farm (sometimes double the number that are kept on adjoining farms of the same size,) and the reply has been that the result was accomplished through the manure cellar. Before the manure cellar was inaugurated they say:—"Do the best we could, much of the manure went to waste. The quantity at most was small compared with what is at present turned off, and yet the labor expended under the old system was vastly greater than now. I do not say but there are other methods for producing the same results, but they cost more, are less convenient, and from the liability of neglect are not so likely to prove successful.

THE DAIRY HOUSE.

THE question is often asked whether under our factory system a dairy house is required on the farm. I should advise such a structure, though it need not be so expensive and elaborate as is sometimes seen under the old system of family dairying. The building should be arranged and fitted up for both butter and cheese manufacture. The reason for the erection of such a structure even in cases where the milk is to be carried to a factory will, from a moment's reflection, be obvious.

In the first place, the factories open and close operations at stated periods, and during the time they are not working considerable quantities of milk must be cared for and utilized at the farm. With no provision for the care and manufacture of such milk, the annual loss from waste will soon amount to more than the cost of building and fixtures, to say nothing of the worry and trouble in trying to utilize the milk without any conveniences.

Again, occasions occur when it is desirable to make up the milk on the farm to secure the butter or cheese for family use. Possibly, from time to time some accident may happen which would exclude a batch of milk from the factory, and in such cases it may often be worked up on the farm without material loss. Cases not unfrequently occur where a factory is badly managed, where the cheese or butter maker is incompetent, and while such a condition of things remains, or during the time it may take to make a change of manufacturers, it will be desirable to hold the milk at the farm. There are a variety of circumstances constantly occurring in neighborhoods where factories exist which make the necessity for a dairy house imperative, if the dairymen would avoid losses, and I therefore think it economy to provide such structures, and I hold that they belong to good dairy management.

WHAT IS A PROPER DAIRY HOUSE,

and how should it be located? For convenience it should be situated near the milking stables, but out of the way of odors and gases arising from the decomposition of manures, since milk absorbs these with great facility, resulting in injury to the product. Where side-hills are convenient to the other buildings they afford advantageous situations for placing the dairy house. In such cases the lower story of the house, if built of stone, will help to secure a low and even temperature for the milk room. A building twenty-five feet by thirty feet, a story and a half high, would be ample for a dairy of forty cows. The lower part should be divided into two departments, one for butter manufacture and the other for cheese. The two departments should be arranged so as to afford easy communication, the one with the other. If

COLD SPRING WATER

can be conducted into the house the butter department should be arranged with water tanks sunk into the earth to hold water twenty inches deep. The tanks may be made of wood, but are better if of stone, well cemented. Pipes leading from the tank or tanks through the wall on the lower side of the building will conduct off surplus water. These tanks are for holding the cans of milk for obtaining cream and will be more fully described hereafter under the head of butter manufacture. There should also be

A SMALL BUTTER CELLAR

connected with this department by partitioning off a part of the room next the bank or hillside. The milk room should have windows at the upper part or near the ceiling protected with gauze wire, so as to be used for ventilation. The floor of

THE CHEESE MAKING ROOM

may be a step higher than the butter room, and should be provided with self-heating vat for cheese making, press, hoops, and curd knife. The story above should be in one room, and is to be employed for curing cheese. There should be a large ventilator in the center, rising above the roof of the building and extending through the ceiling of the curing room provided with a wicket by which the draught may be regulated or shut off as desired. About the sides of the room, and even with the floor there should be openings nine inches by twelve, arranged with wickets, so that air may be admitted in large or small quantities, or closed off, as needed. With the small ventilators at the sides and the large ventilator in the center

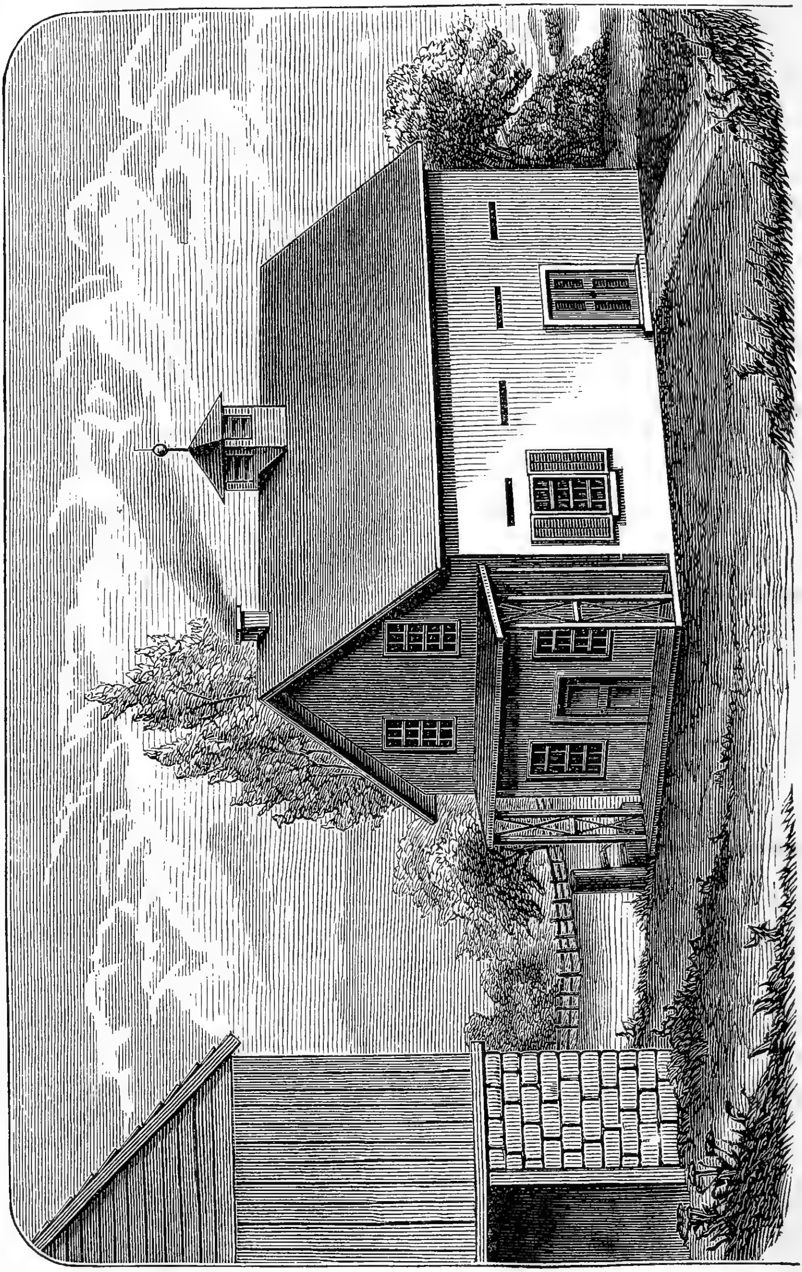
THE CURING ROOM

may be kept free from impurities and noxious gases, while the temperature to some extent may be controlled in warm weather. The curing room should be well lighted, as light operates beneficially in securing a fine flavor to the cheese.

When the dairy house is to be located on a level surface, and stone is expensive or not convenient, the building may be wholly of wood, the bottom room having double walls, and if possible should be shaded by trees. Instead of tanks set in the ground the room may be provided with the

JENNING'S PANS.

The pans consist of large shallow tin vats, set in wooden vats, with spaces between for water. The pans are of various sizes and one pan is designed to hold

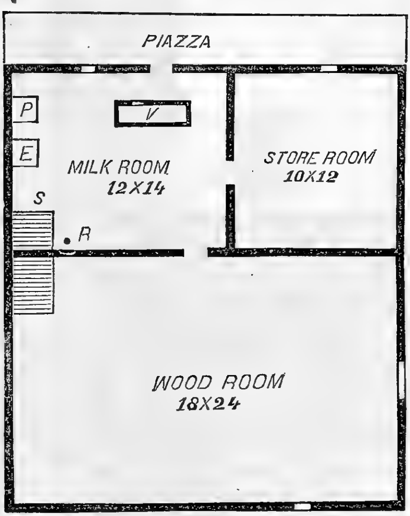


CHEESE DAIRY HOUSE—ELEVATION.

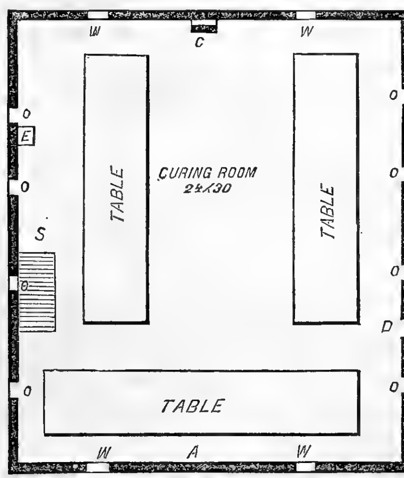
the entire mess of milk of the dairy at one milking. The water may be conveyed to the pans either by pipes leading from the penstock, or it may be drawn from the well. I have not proposed here to enter into minute descriptions of dairy house and apparatus, as these more properly belong to the topics in which butter and cheese manufacture are considered. But I have given some of the leading features required in the construction of these establishments, from which a general idea may be had.

DESCRIPTION AND PLAN OF A FARM DAIRY HOUSE.

In the plan of farm dairy house here presented, economy, simplicity and convenience have been studied, together with the means of regulating temperature in the cheese-curing room to some extent by the use of wickets and ventilators. The design is for farms where cheese dairying is conducted as a specialty and where from twenty-five to thirty-five cows are kept.



BASEMENT, OR FIRST FLOOR.



SECOND FLOOR.

A building twenty-four feet by thirty feet, story and a-half high, will be large enough for an ordinary sized dairy—say of the number of cows abovenamed. Light is to be admitted only on the north and south sides, as less liable to let rays of the sun fall on the cheese. The lower part is divided into rooms for making cheese, twelve by fourteen feet; store-room, ten by twelve feet; the balance, wood house, eighteen by twenty-four feet. If desired, a portion of this latter room may be partitioned off, or nearly the whole of it converted into a place for setting milk for butter during spring and fall. A piazza runs along the sides of the store room and room for making cheese, rendering these parts cooler in summer, and affording a convenient place for drying aud sunning utensils. The upper part of building, the cheese-curing room, twenty-four by thirty feet, eight feet high, studded, and lathed and plastered.

A ventilator runs from ceiling in center of room above the roof, terminating in usual form with arrangements at ceiling for closing draft entirely, or conducting larger or smaller quantities of air as desired. Air is admitted under the roof (where it joins the sides of the building) into the garret, so that by opening slides inside the ventilator above the ceiling, a current of air may be maintained in the garret part. Openings, with wickets, are placed at the bottom of the room, and along and through the sides of the building, to the open air—three or more on a side. These openings are ten inches by twenty inches; the wickets close tight or admit more or less air as desired at pleasure.

An ice reservoir or refrigerator on rollers can be set in the room in which ice may be exposed if neccessary, in extremely hot weather. A good coal stove, tables with *hemlock* bed-piece, for holding the cheese, thermometer and platform scales. These are the general features of the dairy house suggested. The whole will be readily understood by the cuts:—O, O, openings with wickets; C, chimney; E, elevator; D, door for delivering cheese; A, alleys; W, windows; V, vat and heater for making cheese; P, cheese press; E, elevator for elevating cheese; S, stairs; P, cistern pump.

AN ABUNDANCE OF GOOD WATER.

In regard to water I start with the broad proposition universally recognized by dairymen of long experience, both in this country and in Europe that dairying cannot be successfully conducted without an abundance of good water to meet the daily wants of stock. Stagnant water, the water from sloughs, mingled as it often is with a considerable per centage of vegetable matter, even though it be abundant and easy of access, has an unfavorable influence on the flavor of "dairy goods," and of itself precludes the dairyman from reaching the highest standard in his product. I have no space now to discuss the physiological side of this question, but I state a fact abundantly proved in practical experience. There is great difference of opinion among people who are not experts as to

WHAT CONSTITUTES GOOD BUTTER AND GOOD CHEESE.

Persons whose tastes have been educated by long use of an inferior product do not readily appreciate the imperfections existing in second class goods. The great markets of the world are demanding better grades of food than they did twenty or even ten years ago, and in no class of food is this more observable than in dairy products. It is only the best article that really pays or is made remunerative to the producer for a series of years. We must look then to some of

THE LEADING REQUISITES TO SUCCESS.

To the dairyman an abundance of pure water, of easy access to stock, will be found important. Many suppose that if there be water located on one part of the farm, the other parts being dry, that will suffice for all practical purposes in supplying the needs of dairy stock. This is a mistake, especially where large herds are to be kept. Cows should at no time be compelled to travel long distances to slake their thirst, since the greater exertion and labor imposed must in proportion affect the quantity as well as the quality of their milk. Instances have repeatedly come under my observation where springs have failed and cows, in consequence, subjected to travel over a considerable distance to get water. The milk not only fell off rapidly in quantity, but in several ways depreciated in quality, especially in hot weather, showing a tendency to quick decomposition, and giving an inferior product when worked into cheese. Water should be so conveniently situated in pastures that stock will require no extra or special travel to obtain it, and it should be situated at such points in the field that stock feeding over the ground naturally go toward it, so that when a supply of food has been taken, the animals may slake their thirst, lie down and quietly convert their food into milk.

MILCH STOCK AVERSE TO EXERCISE.

For it must be observed that milch stock are averse to any large amount of exercise, and do not ordinarily care to take more than is necessary in supplying themselves with food. Give them plenty of food and an easy access to water and they quickly fill themselves and spend most of their time at rest. When water is situated in out of the way places on the farm, cows will often go thirsty for a considerable portion of the day rather than make a special journey to obtain it. This has been observed by all practical farmers, and yet it is curious that many who are conversant with the fact neglect to take proper advantage of this peculiarity in the habits of the animal. It is an important object with the dairyman who desires the highest success, to promote as far as may be (without resorting to artificial means,) the taking of an abundant quantity of water by his herd. Milk cannot be made without water, and when it is secreted largely, a large amount of water is absolutely required.

WATER IN MILK.

Milk of an average good quality contains in one hundred parts from eighty-five to eighty-seven parts of water. Is it not surprising that any one would suppose that a material like this could be of excellent quality when the dilution is made up from pools of stagnant or putrid water, which would be shunned by every intelligent mind as the very hot-beds of disease? And yet we often compel our animals to drink this character of water and expect them to manufacture from it a pure, healthy milk. The subject demands attention everywhere. Where there are an abundance of streams and springs of living water they only require to be properly utilized, but where they fail the difficulty can be obviated in the application of wind-power for raising water from wells.

WIND-POWER FOR PUMPING WATER.

The modern windmill is a very different affair from the old cumbersome and expensive power, which needed constant attention to make it serviceable.

The modern windmill regulates its own sails according to the force of the wind. It is started or stopped with the greatest ease; it is easily erected and is not expensive, and therefore comes within the reach of any ordinary farmer. Where pure water then may be had from wells, there can be no excuse for subjecting the herd to the bad influences I have enumerated, and I am convinced that one of the troubles complained of in the flavor of cheese is caused by bad water, and the sooner dairy farmers look this thing fairly in the face and set about correcting the evil, the sooner will they be on the right road to success. It should be understood that bad water must always be an inseparable objection to the production of the nicer grades of butter and cheese. Where good clean running water cannot be had, I should advise the digging of wells and the use of wind-power for pumping water, at convenient points over the pasture lands. Then large tanks or troughs should be provided and arranged so that the surplus water may flow back into the well, as this course keeps the water in motion and obviates, in a measure, the necessity of extreme care and attention.

SHADES IN PASTURES.

There are those who advocate that shades in pastures are detrimental to milch cows; or rather, that shade trees, by affording a comfortable place for cows to rest during hot weather, cause a decrease in their milk, and therefore they are objectionable, by holding out inducements to and fostering habits of laziness on the part of the cows. They reason that cows, to yield a large quantity of milk, will require a proportionate amount of food; that the longer you can keep the cow feeding, the more grass she will store away to be manufactured into milk. In hot weather, they say, cows are not disposed to be industrious, but lounge lazily under shade trees in the middle of the day, wasting valuable time and, what is of more consequence, neglecting to keep the milk-producing machinery in vigorous operation. If the pastures are deprived of shade, they say the cows will find it uncomfortable resting in the hot sun, will prefer to keep more upon their feet, and are therefore induced to spend most of their time in feeding. Some dairymen therefore cut down and destroy every vestige of shade in pastures, and are earnestly recommending this system to the dairy public. I hear of some so eager in carrying out this principle that pains are taken to go out among the herd from time to time during the day, starting the animals up from their resting places, and thus urging them to the consumption of more food.

I do not approve of this system, nor do I believe that it has any advantages on the score of economy. It certainly cannot commend itself for its humanity, since the system is a species of cruelty and a disregard for the comfort of creatures which, though dumb and devoid of reason, have the more claim to our kind care and protection.

THE FORCING SYSTEM.

It is undoubtedly true that the quantity of milk can be increased under a forcing system of feeding if certain circumstances and conditions are observed. And, first among these conditions is quietness and freedom from anything like labor or extra exertion on the part of the cow. A certain amount of exercise may be needed for health, but all exercise produces a waste of the animal structure which must be repaired by food. The first office of food is to support respiration and repair the natural waste of the body, and if the waste is excessive, by reason of excessive labor, the food will go first to supply this waste and after that for the production of milk. Hence, those who study to get large results from milch cows are careful to

KEEP THE ANIMALS AS QUIET AS POSSIBLE,

avoiding excessive travel or labor, taking care that there be no disturbing causes for excitement, such as fear, anxiety, or solicitude, for these waste food, and check the secretion of milk to a much larger extent than most people imagine. The principle is true, whether acknowledged or not, that the more comfortable we make our milk stock the better will be the results. If during the heat of the day cattle seek shade and lie down to rest, their quietness, comfort and enjoyment will add more to the milk-pail than food taken in discomfort and excessive exercise. We are presuming, of course, that the animals are placed in pastures that afford an abundance of food, and pastures should never be overstocked. In good pastures

IT IS NOT NECESSARY THAT COWS SHOULD BE CONSTANTLY FEEDING,

for we can see from the peculiar structure of their stomachs, that nature intended a considerable portion of time to be spent at rest, that the process of rumination and digestion be perfected. The first stomach seems to be simply a receptacle for storing up a quantity of food to be used and enjoyed at leisure. The food as it goes into the first stomach is very imperfectly masticated. After having filled this receptacle the animal rests from her labors and is now prepared to enjoy her food, which is thrown back in small quantities into the mouth, where it is chewed, and then goes into the third and fourth stomachs to be properly assimilated and digested. Hence rest is required; and to deprive the animal of a comfortable resting-place or to drive her out in the hot sun while in the act of rumination or masticating her food is not only cruel but a piece of intolerable stupidity.

THE ONLY REAL ARGUMENT AGAINST SHADE TREES

in pastures is, that the animals collect there and deposit manure where it is not needed. The proper way to avoid this is to erect temporary shades, and they can be removed from time to time to different parts of the field and thus be made of double service—affording comfort to cattle and manuring the land. I have seen this plan adopted with the best results; the temporary shades being placed on barren knolls and the poorest parts of the pastures, and these places were thus brought into a high state of fertility. I believe in shade trees and shades in pastures, and am convinced from observation and experience that the herds do better with them than without them. It is an inhuman practice to compel cattle to bear the intense rays of the sun during our hot summers. They need protection at such seasons, and if man finds shade at times not only grateful but necessary, I cannot see why the same rule may not apply in some degree to our domestic animals. It is true they may not die from exposure to the sun's rays, but if the hot, panting beasts could speak we should learn that their health was not promoted by this exposure.

MANAGEMENT OF GRASS LANDS.

THE GRASS CROP IS,

without doubt, one of the most, if not the most important of any known to agriculture. It is the basis for all successful farming. It is the natural food of our most useful animals, and without grass we should soon have no stock, no manures, and scarcely any cultivated crop. The money value of the grass crop in the United States is immense. LEWIS F. ALLEN, in his work on American cattle, estimates the number of neat cattle in the States and Territories in 1867 at 28,145,240 head, and he puts their value at a thousand millions of dollars.

That is only one item which may be credited to grass; for if we add the annual product of the ten millions of milch cows, together with the horses and the sheep and wool of the country, we shall begin to appreciate how much the nation owes to grass for its prosperity and wealth. Indeed, the enormous value of this crop is comparatively overlooked by political economists in their calculations.

Before going into an examination of its pecuniary value let us look for a moment at its value in the higher and more extensive relations it bears to the comforts not only, but existence of the human race.

"All flesh is grass," say the Scriptures, but in a different and more extensive sense than is there conveyed is, truly, all flesh grass. Strike out of existence the two great families of the bovine and wool-bearing animals, and where would the human race be left? To say nothing of the innumerable comforts that spring from these two races of animals, such as wool, leather, &c., for which various substitutes could be doubtless discovered, the very existence of a large part of mankind is directly dependent upon them.

Despising all vegetarian theories, we only call upon the common sense of mankind to prove that without meat, which is itself fed, nourished, and sustained upon grass and grass alone, one-half the human race would perish at once. Such is the value of grass æsthetically considered. But look at the

PECUNIARY VALUE OF GRASS,

and for this purpose we may refer to official statistics. In the report of the Agricultural Department for 1864 the value of the hay crop that year in the United States is put at $365,707,074. Commissioner WELLS gives the hay crop of 1860 at 25,000,000 tons. He estimates its value at $10 per ton, which amounts to $250,000,000.

But the value of pasturage must be equally as great, or greater. For probably, taking the country together, the hay represents the maintenance of the live stock for one-third only of the year, while pasturage embraces two-thirds. Then there is the labor of gathering the hay, which goes into its value to offset a part of that. We cannot estimate the value of the grass crop for 1869, therefore, at less than $700,000,000. Remember we speak here of grass in its popular sense, as embracing the clovers, which, strictly speaking, belong to the leguminous family of plants.

Now the cotton crop of 1869 was valued at $303,000,000, corn at $450,000,000, wheat, $375,000,000, oats, $137,000,000, potatoes, $90,000,000. Who will say in view of these facts that cotton, or corn, or wheat is king? Among all the productions of the earth grass, unpretentious though it be, is truly king. It is the only truly indispensable product of the earth that nature herself takes care shall not fail. But for dairy farmers — who owe so much to this crop, and which if it failed but for a single season wide-spread ruin would stalk abroad — its importance need not further be discussed.

The great question with dairy farmers to-day and at all times must be in what way can grass be made to thrive and produce abundantly? The question is a broad one and I shall first touch upon the matter of pastures.

PASTURES, OVERSTOCKING, ETC.

In the first place many pastures are habitually overstocked. By this practice the roots of grasses and the whole plants are kept so small that their growth is feeble, and not one-half the feed is afforded that the land would produce if stocked lightly a year or two and the grass allowed to get a good thrifty start. But this is not the only disadvantage from overstocking. The feebly growth of the grasses allows other plants to creep in, and the ground soon becomes overrun with weeds, which on account of their not being cropped by stock, grow in great luxuriance, maturing their seed and thus impoverishing the soil.

THE CURSE OF AMERICAN DAIRYING

to-day is weeds. When once they get full possession they become so formidable that the farmer is often disheartened and gives up their eradication. Many farmers, too, have an erroneous notion in regard to the destruction of weeds on grass lands. The impression often prevails that the only way of getting rid of weeds is to break up and thoroughly cultivate the ground in hoed crops. This is not always convenient or even desirable, for in many cases it cannot be done without breaking up the herd or dairy, while some uneven surfaces cannot be plowed. There is another way of killing weeds such as the daisy and that class of plants, by the liberal use of manures and grass seeds. I have eradicated white daisy in several instances by simply applying farm yard dung and gypsum, and strewing the ground with a heavy seeding of clover. Establish your clover upon the soil and feed it until it is luxuriant and it destroys the daisy and other weeds, by a system of plant-garroting, strangling and choking the life out of them. Then some weeds may be killed by frequent cutting and not allowing them to seed. It is always advisable to pull up or exterminate bad weeds on their first appearance in pastures, and not allow them to spread.

The subject of pastures is of great importance to the dairy interest. To know how to produce milk cheaply and of the best quality, is the underlying stone of the dairyman's success. The points to be determined, it seems to me, are these:

WHAT KIND OF PASTURES ARE BEST FOR THE DAIRY?

Are they those which have been long in grass, or are they those which have been recently plowed and re-seeded? Can pastures be kept productive when remaining long in grass; or in beginning to fail, is it necessary to renew by plowing and re-seeding; and, finally, what are the cheapest as well as the best modes of obtaining quality and productiveness of pasturage?

In considering these questions it should be borne in mind that the subject has reference to pastures for the production of milk, or those adapted to the dairy. Soils vary in character, and when under the modifying influence of climate and location, exhibit a peculiar fitness for certain plants; thus we have those best adapted to the production of grain, grass, fruit, or for those abounding in textile fiber.

I have said you cannot profitably carry the dairy upon the extensive plains of the West and South-west. They lack water. Pastures become brown and dried up long before midsummer; nor will they hold grasses of any approved kind for any long time. We are not, therefore, to consider the treatment of all pasture lands alike, but of those that are particularly well adapted to grass, and which cover a considerable portion of the lands known as the dairy region.

Now, what are we to do with pasture lands that begin to fail from over-cropping, or from other causes? Shall we plow them up, re-seed, or shall we adopt some other mode of renovation? I know of pastures that have been in grass for sixty years and upwards, and to-day show no signs of failure, Wherever I have been through the dairy region I find these pastures, and it is the universal testimony of those who have them that they are yielding better returns in milk than any recently re-seeded grounds.

I have seen old pastures plowed, re-seeded, and put in meadow, where the annual crop for a few years was large, but when put back again in pastures gave poor returns, and took years to obtain a nice, thick sod. This may not always be the case, but it is frequent and, I am inclined to think, general.

It may be said that the fault lay in re-seeding; that a greater variety of seeds should have been sown, timothy, the clovers, orchard-grass, blue grass, red top, &c. Our farmers generally, I believe, seed mostly with timothy, clover and red top, using the ground at first for meadows, and afterwards for pastures. What we want (and it is usually that which obtains in old pastures) is a variety of grasses springing up in succession, and those that will bear cropping, so that they will afford a good fresh bite from May till November.

OLD PASTURES

are generally filled with a variety of plants that are adapted to the soil, and in plowing and taking off grain crops and then re-seeding, the conditions or elements of fertility are somewhat changed, so that anticipated results are not always obtained.

In 1855 I plowed up an old meadow, about two acres of which was yielding large crops of timothy and clover, but so situated in the field that the hay crop could not be got off in time. I took from these two acres the first year one hundred and eighty bushels of corn and the second year one hundred bushels of barley, when the land was seeded down to timothy and clover. For two or three years it did not produce satisfactorily, though receiving the usual dressing of plaster. I also top-dressed it with stable manure—perhaps twenty loads to the acre—but without getting the large crops of grass that I did before re-seeding. Some mineral elements, therefore, I supposed to be wanting—perhaps potash, and so I top-dressed with ashes and had no further trouble. I have seen quite a number of old pastures that were yielding tolerably well, plowed with somewhat similar results. The land would bear abundant crops of grain, but grass failed to be enduring, or was less nutritious, and hence frequent plowings and re-seedings were resorted to.

OLD PASTURES FOR FATTENING STOCK.

I have visited many stock farms where men make a business of buying cattle and fattening them for the market, and they say to me that they have never been able to fatten stock with that facility from grass raised on newly seeded grounds as on that of those put down many years ago, or from pastures that have never been broken up at all. Others make similar statements. I shall not dispute the point that we may doctor up our lands to produce any desired crop, but to do so is expensive, and will often require more science and skill than are common in the country.

When nature furnishes the conditions for producing grasses that give the best results in milk, and when these grasses become firmly established in the soil, are we not pursuing a suicidal policy in destroying them, by over-cropping, or by allowing weeds to smother and crowd them from the soil, under the impression that our pastures can be renewed at any time by plowing and re-seeding?

Would it not be better and cheaper to exterminate weeds and give our pastures some rest during the hot, dry weather of July and August, by feeding sowed corn instead of cropping down to the roots and allowing the sun to roast them out and destroy the plants? It is the weeds, and over-cropping, and unprotected covering of pasture lands in hot weather that are the fruitful sources of failure of grass in pastures.

Generally on rich soils, like those of Herkimer, N. Y., the old dairy pastures need but little, if any, organic matter; the decay of roots and the droppings of stock supply this matter in abundance, and hence the application of cheap mineral manures is that which is most needed. These, of course, can be readily supplied , but if we are to plow up and take off grain crops, barn-yard manures must be used, which are more expensive.

It is very unprofitable for the dairyman to break up lands that are yielding, or can be made to yield readily, good crops of grass. Our most successful dairymen in the Eastern and Middle States believe that grain can be purchased from abroad cheaper than they can raise it. Grain raising, therefore, with many is considered a matter of necessity rather than choice, but grass fails and the lands are plowed and re-seeded. This may be well enough for meadows, but is not so conveniently managed in pastures.

If a part of the pasture land begins to fail and it is designed to plow and re-seed, the land must be fenced, which is expensive and often inconvenient. But after getting it down to grass cattle cannot be turned in until the plants become somewhat established, as they tread up the ground, pull up the grass by the roots, and by midsummer there is a barren field. Again, to plow pasture lands the herd must be reduced to meet the necessities of the case. This is also an objectionable feature, and one that is always distasteful to the dairyman.

TOP-DRESSING GRASS LANDS.

When grass utterly fails, plowing and re-seeding doubtless should be resorted to; but generally pasture lands may be kept permanently in grass by giving them a little extra care and attention. If they begin to fail from overcropping or neglect, a judicious course of top-dressing and sowing seed will be found preferable to the plow. Usually on the black, slate lands of Herkimer, plaster at the rate of one hundred to two hundred pounds to the acre every alternate year will keep pasture lands in good condition. I have found great benefit from the use of ashes in connection with plaster, at the rate of two or three barrels per acre; well decomposed horse manure hauled out in the fall, broken up fine and applied when the cows are in the afterfeed, has produced good results. I have no doubt but that all pasture lands in the dairy region would be greatly benefited by the use of bones, as this material is largely taken from the soil.

The quantity of phosphates that have been removed from soils long employed in dairying must be very large. When in Europe in 1866 I had an interview with Professor Voelcker, who has made so many analyses of milk. In his laboratory the different constituents in a gallon of milk are separated in bottles. One bottle contains the oil, another the casein, another the phosphates, another the milk-sugar, &c., &c.

THE QUANTITY OF PHOSPHATES IN A GALLON OF MILK

is by no means infinitesimal, but if placed in the hand would surprise most dairy farmers on account of its bulk. If we consider for a moment the large number of such handsful that are taken from dairy pastures in milk every year and never returned, and in addition the bone material required in the young calf it must be evident that some soils at least are deteriorating in this element.

The Doctor remarked, while showing the bottle containing the phosphates, that they were really the manure, upon which the finer and more nutritious grasses feed, and that the best results nearly always follow from their application upon old dairy farms. There is an immense waste of bones in America. In England they are husbanded and imported from America and other countries, and largely used.

The views of Dr. VOELCKER correspond with my own observation and experience in regard to old pastures, if properly kept up in fertility, being superior for milk to newly cultivated grounds.

THE QUALITY OF MILK,

he says, is greatly influenced by the finer grasses native to the soil, and these are only found upon the old swards. When we commence cultivating by breaking up, we get a coarser herbage that produces an inferior quality of milk.

TOP-DRESSING WITH ARTIFICIAL MANURE.

The remarks of Dr. VOELCKER in a recent lecture before the Derbyshire Agricultural Society may be of interest in this connection. He said that some years ago he made a series of experiments with a variety of artificial manures as applied to grass lands; and the result of those experiments, carried out on a tolerably large scale in several counties in England, was to lead him to the conclusion that the most economical and most efficient manure that could be applied to grass lands was good farm yard manure. No manure produced so good a result, if they could get plenty of it, as good stable dung on grass land; but as they could not always get enough they must get the next best, or the land, instead of becoming richer would become poorer and poorer. In determining which was the best substitute, they had to consider what was the character of the land. If, as was the case with most of the Derby pastures, the land required lime; they should lime it well, and having done so, leave it for a couple of years without putting any manure at all upon it. His experience showed that in most counties of England it was desirable to apply bones to grass land, but bones never did well on newly limed lands, and in many cases where they had been so applied, he had not been able to see where the bones went to. It was very important to settle the point whether the land needed lime. If the herbage looked unhealthy or "deathlike," as people said, they might take a little of the soil and pour upon it weak spirits of salt, and if there was an effervescence that would be an indication that there was enough lime. If they tested the land in that locality they would find that by far the larger part of the pasture land required lime. The effects of liming might be regarded as permanent, and after its application they should adopt other means. Supposing the lime to be thoroughly incorporated with the land, the next thing to be decided was whether bones would answer as a manure. There were no general rules which would hold good under all circumstances. On some descriptions of land bones had little effect; on others the effect was perfectly marvelous. Speaking generally, on heavy soils fresh bone dust, at any rate, did not show so well as on light and more porous soils; and as some bone manure was rather expensive at the present time it was well to make an experiment on a small scale before applying it extensively. The result of his inquiries went to show that all good artificial manures for grass lands should contain a certain proportion of phosphatic materials, if possible, in the shape of bone dust; and light land should also be supplied with salts of potash. Pasture lands to yield a good crop must be also supplied with a considerable proportion of nitrogenous matter in the shape of ammoniacal salts, and he would recommend for light pasture lands mixtures of manures which should include potash—a good deal of which was now got from Germany, where it had been discovered in a state called Kaihit. They ought to pay for that something like £3 to £3 10s. per ton retail. It was imported into England for something like £2 10s. It was retailed at £4, which was rather too much profit, and the farmers should insist upon getting it for less, and the dealers could well afford to reduce the price. He would recommend for light marly grass land one hundred weight of superphosphate, which would cost six shillings; two hundred weight of bone dust, which at seven shillings and sixpence, would be fifteen shillings; two hundred weight of potash salt, at four shillings, which would be eight shillings; and one and a-half hundredweight of Peruvian guano, which would be £1 or twenty-one shillings, making a total of £2 10s. per acre. He would not advise them to lay out less than that if they wished to apply artificial manure to grass land at all, as he thought it would be like wasting away powder by dribbling it into the breech-lock of a gun, where it would produce no effect. Two hundred weight of bone dust and the same quantity of Peruvian guano, and three-fourths hundred weight of nitrate of soda made a very good dressing for light grass lands. On heavy soils they might leave out the potash salts, more especially if they contained a fair proportion of the better description of the more unctuous kinds of red clay.

FIELD EXPERIMENTS ON CLOVER SEEDS AND PERMANENT PASTURE.

In the Journal of the Royal Agricultural Society of England, issued in 1869, Dr. Voelcker gives a report of experiments on clover seeds and permanent pasture. Subjoined are the experiments:

Field Experiments on Clover Seeds, made in 1867 *at Escrick Park Home Farm, by Messrs. Coleman and Hull.*

The field upon which the following experiments were tried grew barley in the preceding year. The usual mixture of clovers and Italian rye-grass was sown with the barley. The seeds came up well, and the plant was tolerably good and uniform on the piece selected for the experiments. Apparently the selected piece of land was uniform in depth and in its general character. It was divided into eleven equal and adjoining plots of one-twentieth of an acre each. The eleven plots were treated as follows, as regards manure:

PLOTS.	NAME OF MANURE.	QUANTITY OF MANURE PER PLOT.	RATE PER ACRE.		
			ts.	ct.	lb.
1	Nitrate of soda	22½ lbs.	0	4	0
2	Sulphate of ammonia	22½ lbs.	0	4	0
3	Mineral superphosphate	22½ lbs.	0	4	0
4	Common salt	22½ lbs.	0	4	0
5	No manure	...	...	...	...
6	Muriate of potash	22½ lbs.	0	4	0
7	Sulphate of potash	22½ lbs.	0	4	0
8	Sulphate of lime	1 lb.	1	0	0
9	Mineral superphosphate and nitrate of soda	22½ lbs.	0	4	0
10	Mineral superphosphate and muriate of potash,	22½ lbs.	0	4	0
11	No manure	...	...	...	...

The artificial manures were sown by hand on the 11th of April; the clover was cut on the 12th of June for the first time, and a second cutting was obtained August 24th, 1867. The produce of each plot was carefully weighed on the same day, and as soon as cut, when the results incorporated in the following table were obtained:

Table showing the Produce of Artificial Grasses (mixed Clover and Rye-grass) on Experimental plots of one-twentieth of an acre each, made at Escrick Park Home Farm, York, in 1867:

PLOTS.	MANURE USED.	WEIGHT OF CLOVER.								
		FIRST CUTTING.			SECOND CUTTING.			TOTAL.		
		ct.	qr.	lb.	ct.	qr.	lb.	ct.	qr.	lb.
1	Nitrate of soda	8	2	7	2	0	7	10	2	14
2	Sulphate of ammonia	10	2	0	2	1	17	12	3	17
3	Mineral superphosphate	5	2	14	2	2	9	8	0	23
4	Common salt	5	2	16	2	2	7	8	0	16
5	No manure	5	1	26	2	3	4	8	1	0
6	Muriate of potash	6	1	21	3	1	14	9	3	7
7	Sulphate of potash	5	1	12	2	2	7	7	3	19
8	Sulphate of lime	4	1	23	2	2	3	6	3	26
9	Mineral superphosphate and nitrate of soda	10	3	16	2	0	0	12	3	16
10	Mineral superphosphate and muriate of potash	9	0	0	4	3	2	13	3	2
11	No manure	6	0	17	2	3	2	8	3	19

Mr. HULL kindly furnished me with the following notes, which he took on the field during the progress of the experiments.

The manures were sown on the 11th of April, and no perceptible change was produced by any one of them until the 23d of April, when the clover seeds on plot 1 and plot 9 could readily be distinguished from those on all the other plots by their darker green color and more vigorous growth.

First Cutting.

Plot 1 was dressed with nitrate of soda alone, and plot 9 with a mixture of nitrate of soda and superphosphate. Both plots had a darker green color than the rest throughout the experiment.

The nitrate of soda on plot 1 encouraged the growth of the rye-grass to such an extent that it quite smothered the growth of the clover plant.

Plot 2. *Sulphate of Ammonia.*—The rye-grass grew vigorously, but was not so long and coarse as the rye-grass on the plot dressed with nitrate of soda, while it was superior in quality in comparison with the latter. The clover on the plot grew fairly, but was weak.

Plot 3. *Mineral Superphosphate.*—Rye-grass good, but clover thin; very weak, and much blighted.

Plot 4. *Common Salt.*—Rye-grass and clover fair, but short.

Plot 5. *No Manure.*—Appearance of plant much like that on preceding plot.

Plot 6. *Muriate of Potash.*—The clover on this plot was very good, both as regards color and vigor of growth, and the rye-grass also was strong and of good quality;

Plot 7. *Sulphate of Potash.*—Clover good, but rye-grass weak.

Plot 8. *Sulphate of Lime.*—Rye-grass very thin and unhealthy in appearance; the worst piece of the eleven experimental plots.

Plot 9. *Nitrate of Soda and Superphosphate.*—Clover plant quite smothered by rye-grass, which grew very long and coarse, and of quality little better than good oat straw.

Plot 10. *Superphosphate and Muriate of Potash.*—Decidedly the best plot; clover remarkably strong, with a good broad leaf of a dark green color. Rye-grass also very vigorous and of excellent quality.

Plot 11. *No Manure.*—About the same as plots 3, 4 and 5.

Second Cutting.

Plot 1. There was scarcely any clover in the second cutting, and rye-grass also was very thin and weak.

Plot 2. Clover very weak; rye-grass much better than on the preceding plot, though short.

Plot 3. Much the same as plot 2; rye-grass not quite so strong.

Plot 4. Rye-grass and clover short and weak.

Plot 5. Clover fair; rye-grass short.

Plot 6. Rye-grass good; clover leaves broad and of a good color.

Plot 7. Clover good, but rye-grass weak and thin.

Plot 8. The produce on plot 8 small and weak.

Plot 9. Merely a few plants of clover were left on plot 9 after the first cutting, and the rye-grass was very thin and weak; the soil appearing to have been quite exhausted by the first cutting.

Plot 10. Clover very good, with a good broad and dark-colored leaf; the rye-grass also strong and healthy. By far the best plot.

Plot 11. Much the same as 4 and 5.

We owe to Messrs. LAWES and GILBERT a series of most valuable and instructive field experiments on the influence of different fertilizing matters on the quantity and quality of the produce of permanent pastures. The changes which several of the fertilizers employed by Messrs. LAWES and GILBERT produced in the character of the herbage of several of their experimental plots are so instructive that for some years past I have made it a point to pay a visit to Rothamsted Park at the time when the grass crop is in the hight of perfection. Having frequently seen with my own eyes in what a remarkable degree the growth of true grasses, especially the coarser kinds, is encouraged by nitrogenous fertilizers, and having also noticed the changes which a mixture of salts of potash and superphosphate produces on permanent pasture in the relative proportions of leguminous plants and true grasses, I was quite prepared for similar changes in the produce of the Escrick experiments. But the difference in the quality of the produce of some of the experimental plots at Escrick Park was more striking than that which I had previously witnessed at Rothamsted Park, or anywhere else.

The Italian rye-grass on plot 9 I found at harvest time, as Mr. HULL truly observes, so exceedingly coarse, that it appeared scarcely better than good oat straw, and very few clover plants could be seen. Again, the effect which muriate of potash, and in a still higher degree a mixture of muriate of potash and superphosphate produced on the clover plant was truly magical.

I never before witnessed anything so striking and instructive as these experiments on artificial grasses. There must, of course, be a good reason why in this instance the quality as well as the quantity of the grass crop were so much more powerfully affected by the different manures than I found to be the case in other experimental trials. We know that the character of the soil materially affects the quality and the weight of the crops we raise upon different classes of soil. It is, therefore, natural to connect the remarkable results obtained in the Escrick Park experiments with the peculiar character of the soil on the experimental field. I have, therefore, taken care to obtain a fair average sample from the field on which the grass experiments were tried, and after drying the sample at 212 Fahr., I submitted it to a careful analysis, according to which the composition of the soil is represented in the table on the following page.

Composition of the Soil of the Field at Escrick Park Home Farm, on which the Experiments upon Clover seeds were tried:

Organic matter and loss on heating	4.28
Oxide of iron	.61
Alumina	2.16
Carbonate of lime	.39
Sulphate of lime	.25
Carbonate of magnesia	.23
Potash	.14
Soda	.05
Phosphoric acid	.08
Insoluble silicious matter (sand)	91.81
	100.00

Even a superficial inspection will show at once that this is an extremely poor and very light, sandy soil. Mr. COLEMAN, moreover, informs me that the field from which this soil had been taken, had been badly farmed, and that it was in consequence in a poor agricultural condition.

It will be noticed that this soil is remarkably poor in available potash, and I may add, in almost all the more valuable fertilizing constituents found in good soils. The total amount of oxide of iron and alumina was not quite three per cent., and of lime there was not a-half per cent. On the other hand it abounds in silica, for on examination I found the ninety-two per cent. of silicious matter which enters into the composition of this soil to consist almost entirely of pure fine grained quartz sand.

I need hardly say that a soil containing ninety-two per cent. of sand and very little clay, and a still smaller proportion of the more valuable soil-constituents has to be regarded as extremely poor. Such soils are readily exhausted by cropping, and though they will yield fair crops when literally supplied with manure, they are naturally very unproductive.

The extreme poverty of this soil in available potash at once intelligibly explains the benefits which both the clover seeds and the Italian rye-grass derived from the application of muriate of potash; and presents us with a good illustration of the utility of chemical analyses and the aid of the chemist, of which the practical farmer may occasionally avail himself with advantage. The analysis clearly points out a deficiency of potash and also of phosphoric acid; and hence the employment of potash manures on land of that description may be recommended with confidence. The composition of land like that of the soil of the experimental field, moreover, shows that lime or clay-marl may be applied to it with advantage, and that it is impossible to grow any good roots, or barley, or wheat, or clover on land of that character without giving it a liberal dressing of phosphoric manures. Moreover, the loose and porous nature of the soil, and the want of a fair proportion of clay in it, clearly indicates the necessity of manuring it but very moderately with ammoniacal or nitrogenous manures; for as the proportion of available mineral constituents which enters into the composition of the ashes of our usual farm crops is but small, and the solubility of these matters in water is greatly facilitated by ammoniacal salts, such poor soils are all the more rapidly exhausted when the crops grown upon them are too liberally manured with fertilizers rich in nitrogenous matters, or in salts of ammonia.

For the sake of better comparison 1 have calculated the yield of each experimental plot for an acre, and placed the results in the subjoined table:

Table showing the Green produce per Acre of 11 Plots of Artificial Grass (Clover seed and Rye-grass) grown at Escrick Park Home Farm, 1867:

Plots.	Manures Used.	Produce per Acre. First Cutting.			Second Cutting.			Total.		
		ts.	ct.	lb.	ts.	ct.	lb.	ts.	ct.	lb.
1	Nitrate of soda	8	10	28	2	1	28	10	12	56
2	Sulphate of ammonia	10	10	0	2	8	4	12	18	4
3	Mineral superphosphate	5	12	56	2	11	68	8	4	12
4	Common salt	5	12	96	2	11	28	8	4	12
5	No manure	5	9	72	2	15	80	8	5	40
6	Muriate of potash	6	8	84	3	7	56	9	16	28
7	Sulphate of potash	5	7	16	2	11	28	7	18	44
8	Sulphate of lime	4	9	12	2	10	60	6	19	72
9	Mineral superphosphate and nitrate of soda	10	17	96	2	0	0	12	17	96
10	Mineral superphosphate and muriate of potash	9	0	0	4	15	40	13	15	40
11	No manure	6	3	4	2	15	40	8	18	44

An attentive perusal of the preceding figures will bring to light several particulars on which a few observations may not be out of place.

1. In the first place it will be noticed that two plots were left unmanured. In all experimental trials, at least two, or, if possible, three plots, should be left unmanured. Although the crop in a field may appear quite even and the soil uniform as regards depth, texture and general character, the weight of the produce of such a field invariably differs to some extent in different parts. Natural variation in the productive powers of different portions of the same experimental field must be expected to occur in all cases; but these variations must not surpass a certain limit, or else no fair and legitimate deduction with respect to the efficacy of the manuring matters employed can be made from the results of the experiments. Many of the anomalies which so much perplex the experimenting farmer, I am inclined to think, are often solely due to inequalities in the soil, or to differences in the agricultural condition of the several experimental plots. For this reason it is absolutely necessary in field trials to determine whether the natural variations in the productive powers of different parts of the experimental field are not so great as to spoil the experiments altogether. In the case before us it will be seen that one of the unmanured plots yielded, when calculated per acre, eight tons five hundred weight and forty pounds, and the second plot eight tons eighteen hundred weight and forty-four pounds; the variation in the production of the two

plots thus amounted to thirteen hundred weight and four pounds, showing no greater difference than can be expected under favorable circumstances.

2. Neither common salt nor sulphate of potash appears to have had any effect upon the produce, for it will be seen that the weight of the clover seeds on plots 4 and 7, dressed respectively with salt and sulphate of potash, was somewhat less than that of the unmanured plots. I attach no value to the apparent diminution of the produce on plots 4 and 7, for the increase is not sufficiently large to entitle us to infer from the result that the saline matters used on these two plots had an injurious effect upon the crop.

3. On plot 8 sulphate of lime was used at the rate of one ton per acre. This is a very large dose. Although sulphate of lime and gypsum is but sparingly soluble in water, and for that reason may be used with perfect safety in much larger quantities than in this experiment, provided it is well mixed with the soil, a large dose of finely-powdered gypsum, when applied as a top-dressing to young clover seeds, appears to injure the plants and to retard their growth.

4. It is worthy of notice that while common salt had no effect upon the produce, muriate of potash materially increased it. We have here another direct proof that soda is incapable of taking the place of potash in the nutrition of plants.

5. On plot 3 mineral superphosphate alone had no effect whatever on the crop. This is an interesting result, for it seems to indicate that the great deficiency of potash, which is characteristic of the soil of the experimental field, entirely prevented the display of the useful functions which we know perfectly well that superphosphate of lime does discharge on land of a better character. On poor, light, sandy soils we may learn from this that a purely mineral superphosphate cannot be used with advantage for clover seeds. I may observe in passing that on such soils mineral superphosphate has even little effect upon root crops, for which phosphatic manures are so largely used with the best effect.

6. It is remarkable that while plot 3, manured with mineral superphosphate, gave no increase whatever; and plot 6, manured with muriate of potash, gave an increase of one ton four hundred weight and forty-two pounds over the average produce of the two unmanured plots, (average produce eight tons eleven hundred weight and ninety-eight pounds,) the mixture of both manures on plot 10 gave the largest weight of clover seed and rye-grass per acre of any of the eleven experimental plots.

In the first cutting plot 10 produced nine tons, and in second nearly five tons of green clover seeds, or both cuttings yielded in exact weight thirteen tons fifteen hundred weight and forty pounds, which is an increase of five tons three hundred weight and sixty-four pounds per acre over the average yield of the two unmanured plots.

Plot 10 gave not only the largest increase per acre, but the quality of both the clover and rye-grass was much superior to that of the produce of any other of the various experimental plots.

7. There is another circumstance connected with the result obtained on plot 10, which deserves the best attention of the practical agriculturist. It will be seen that, although the first cutting produced a heavy crop of clover seeds of by far the best quality of any of the experimental plots, the land was left in a better agricultural condition after the first cutting than where no manure at all was applied, and a much smaller weight of green clover seeds was reaped at first; for on plot 10 the second cutting yielded nearly five tons of green produce, in addition to the first, whereas the two unmanured plots, 5 and 7, yielded only two tons fifteen hundred weight of additional produce in the second cutting. The liberal supply of available potash and soluble phosphates thus had the effect of greatly increasing the weight of the crop, improving its quality, and leaving the soil in a better agricultural condition for the next crop.

8. Again, it will be noticed that on plot 6, on which muriate of potash alone was employed, the second cutting weighed more than the second cuttings of the other plots, except that of plot 10, where superphosphate was added to the potash-salt. It therefore appears that the beneficial effects of potash on soils so poor in this element as the land on which these experiments were tried, has a more permanently beneficial effect than some of the fertilizing matters which were used on other plots.

9. On the other hand, nitrate of soda unmistakably had a tendency to exhaust the land; for it will be noticed that on both the plots 1 and 9, on which nitrate of soda was used, the second cuttings weighed less than those of the unmanured plots.

As already mentioned, the nitrate of soda on plots 1 and 9 encouraged the growth of very coarse and inferior rye-grass, which completely smothered the clover plant.

When I saw the experimental field late in the autumn of 1867, after harvest, the contrast in the appearance of the various experimental plots was most striking. While the land on plots 1 and 9 appeared quite burned up and exhausted, and scarcely any clover was visible, the potash plots could be readily distinguished by a dark green color and healthy look of the remaining herbage, in which clover predominated.

We may thus learn from these experiments that nitrate of soda alone, or even in conjunction with superphosphate, should not be used as a top-dressing for artificial grasses on very poor sandy soils, like the soil of the experimental field, inasmuch as nitrates hasten the exhaustion of the potash naturally present in such soils in very small proportions. Indeed, nitrate of soda, and in a minor degree, ammoniacal salts, are the worst artificial manures that can be used under such circumstances. It may be further observed, that no just estimate can be formed of the real value of a special manure if no account be taken of the condition in which the land is left after the crop has been removed from it. This is not the first time that I have noticed this tendency of nitrate of soda to produce rapid exhaustion of naturally poor soils, and I would therefore strongly recommend farmers to abstain from the employment of it as top-dressing for grass or corn crops which are intended to be grown on naturally poor, sandy soils.

The following simple method for breaking down bones has been recommended:

DISSOLVING BONES.

Bones may be dissolved or broken down by taking a box or hogshead, and covering the bottom about two inches deep with ashes and lime mixed —one part of lime to two of ashes. The lime should be newly slaked and mixed with the ashes, both dry; then put in a layer of bones, then two or three inches of lime and ashes again. Fill up in this way to about eight inches of the top, and then fill out with clean ashes on the compound and wet it gradually until the whole mass is thoroughly saturated, but not so as to drain. Let it stand at least six months, and when wanted for use take it out, fork it over, pick out all the bones that are not soft, and save them for the next batch, and then pulverize and mix the ingredients well together. It makes one of the strongest and best fertilizers in use, and when composted with fine manures is admirable for top-dressing grass lands.

The more ready way of dissolving bones is by the use of sulphuric acid. To every hundred pounds of bones about fifty or sixty of acid is taken. If bone dust is used, from twenty-five to forty-five pounds of acid. The acid must be mixed with two or three times its bulk of water, because if applied strong it would burn and blacken the bones without dissolving them.

The bones are placed in a tub, and a portion of the previously diluted acid poured upon them. After standing a day another portion may be poured on and finally the remaining portion on the third day, if they are not already dissolved. The mass should be often stirred.

Dr. J. F. HODGES of Belfast, at a meeting of the Chemico Agricultural Society of Ulster, recommended the farmers to adopt the following plan: Place in a wooden trough or tub, the bones, broken into as small pieces as possible, and pour upon them one-third of their weight of boiling water, and, having steamed the mass so as to render the bones completely moist, add one-third of the weight of the bones of sulphuric acid and common vitriol of the bleacher, and mix the materials completely, by stirring them, by means of a wooden shovel or old spade. The mixture may be conveniently made in an old sugar hogshead, and should be allowed to remain some weeks previous to being used. It may be mixed, if necessary, with dry peat, mold, or refuse charcoal, or with sawdust; but lime should not be added to it. By carefully following these directions, the farmer may obtain a compound of high fertilizing value, and much superior to many of the specimens of dissolved bones offered for sale. The addition of slacked lime and soap-boilers refuse, which some persons occasionally use, should be avoided. By employing the bones as described, the manure will be found to contain a large amount of soluble phosphate, which very few of the advertised manures afford.

ASHES

are valuable in eradicating mosses, and furnishing food for grasses, and are worth at least twenty-five cents a bushel for most of our grass lands.

LIME

is of great service to some soils. Six years ago I limed an old side hill meadow, mossed over and not producing. It was applied at the rate of forty bushels per acre, and the annual crop of grass has ever since been good.

I am inclined to think that good old pastures produce a better quality of milk than those recently re-seeded, and that it would be cheaper and better to renovate by top-dressing than to plow and seed.

THE TROUBLE WITH RECENTLY RE-SEEDED PASTURES

is, the grass early in the season is apt to be rank, watery and more fleshy than the thick, fine herbage of old pastures. Considerable portions of it often get the start and soon become woody, and are rejected by stock. A recently re-seeded pasture will not bear cropping like one that is old. The coarser varieties of grasses are so rank as to crowd out the smaller and finer grasses, which are the most valuable for the production of milk. The feed in old pastures springs up earlier and lasts longer than on grounds recently re-seeded.

MILK-PRODUCING GRASSES.

White clover, wire-grass, (*poa compressa*,) and June or Kentucky blue-grass are valuable for producing milk; they are indigenous to most dairy soils, and are generally abundant in old pastures, where they seem to thrive best. The character of food a cow eats has a greater influence on the quality of milk she yields than many imagine.

During the season of drouths, when the cows begin to eat the tufts and portions of pasture that have been rejected or left to grow up high and rank, I have found the quality of milk so depreciated that it took from twelve to thirteen pounds of milk, and in some instances more, to make one of cheese. We may perhaps get more bulk of grass by plowing and re-seeding, and yet obtain poorer results in milk than from the old, thick sward that has been broken up. One great source of failure and decline of grass in old pastures, is over-stocking, as I have already remarked. The lands are crowded to their utmost capacity year after year and receiving scarcely any attention, must succumb at last.

Again, weeds are allowed to go to seed and get possession of the soil, and where they thus overrun the ground and destroy the grasses, doubtless the best course to adopt is to plow and re-seed; but the true course is to pay attention to pasture lands in season, giving them an occasional top-dressing, scarifying the surface in spring, and sowing seeds here and there upon patches that begin to fail. As a top-dressing

SAWDUST,

in which the liquid manures have been absorbed, applied in fall or spring, gives great vigor and growth to grasses. It can be spread over the surface in a finely divided state, and is in condition to be available to plants.

Road-scrapings and composts of muck, earth, and manures applied in the fall, and pulverized over the surface with a brush harrow, together with the use of ashes, plaster and lime, all of which are available to farmers, will be found of service in keeping up a permanent pasture. And it is believed, by taking a few acres annually and treating them with manure, better results will be obtained at a less cost than by plowing and re-seeding.

I may remark that, in the use of barn-yard manures, fresh cow-dung ought not to be used on pastures for the dairy, as it produces grass distasteful to dairy stock, and some claim it to be the cause of abortions.

The more common method of improving pastures and meadows in the dairy district of Central New York is by

THE USE OF GYPSUM (SULPHATE OF LIME).

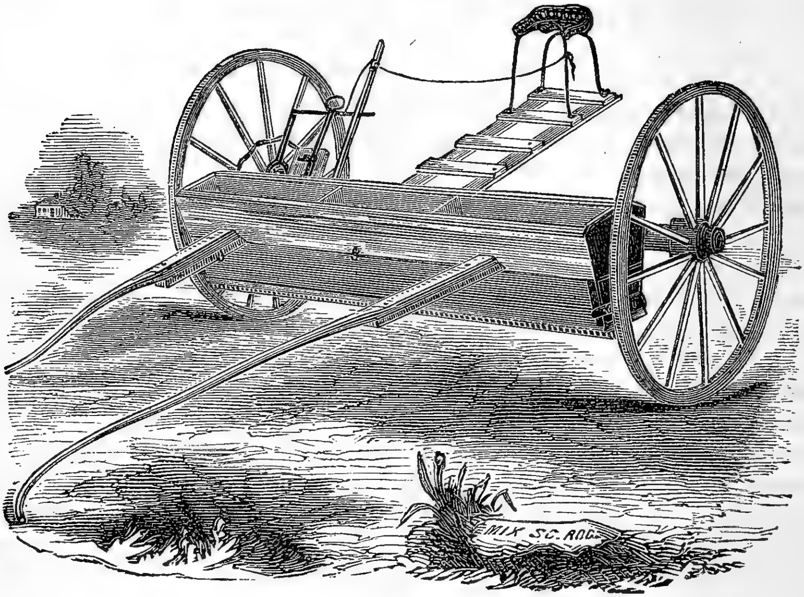
It is very extensively employed by the farmers of Herkimer and the adjoining counties, and with the most marked results. In the Valley of the Mohawk there are mills for grinding the stone into powder. The stone is taken from the quarries in Western New York, and is transported in boats on the Erie Canal in large quantities during the summer, and in this way the mills are supplied. The grinding is mostly done in winter, in spring and early summer.

It is applied to lands usually in early spring and up to the middle of June, and sometimes as late as July, though for meadows an earlier application must be made to be of much benefit to the crop of standing grass.

Many farmers commence hauling their gypsum in winter, depositing it in small box-like houses, located in different parts of the farm, where it is convenient for an early application in spring, when the roads are bad, and thus advantage can be taken of sowing or scattering it upon the land at the earliest moment after the snow is off the ground. Others living within a few miles of the mills haul and spread directly upon the land during the spring or early part of June.

It is sown either by machine or hand. Machine sowing is best, as it scatters it more evenly over the surface, a matter of considerable importance in the application of mineral fertilizers of this description. One of the best machines for the purpose with which we are acquainted is SEYMOUR'S Improved Plaster Sower.

It can be used not only for sowing plaster, but many other fertilizers besides, such as guano, bone dust, ashes, salt, lime, &c., at the rate of any quantity per acre as desired. It will sow them as well when *damp* as when dry, and as the machine is light, simple, not liable to get out of repair, not expensive and sows rapidly, dairy farmers will find its use economical. The machine is represented in the accompanying cut.



THE QUANTITY OF GYPSUM USED PER ACRE

differs considerably with different farmers—from one hundred to two hundred or more pounds to the acre. Some sow upon the land only every second year, taking half the pastures or meadows every year alternately. It has been estimated that in Herkimer county, a third more feed is obtained from the land, one year with another, by the judicious use of gypsum. However this may be, the increase in grass from its use, both in meadows and pastures, is very considerable, and dairymen regard "plaster," as it is termed, as one of the important adjuncts in dairying. It is certain that our pastures are kept fresher and greener by the use of gypsum, and a neglect in its application for any considerable time is made apparent in the milk pail, and decrease of the cheese product.

Gypsum in its natural state is a compound of sulphuric acid, with lime and two equivalents of water, and has the following composition in one hundred parts:

Lime	32.56
Sulphuric acid	46.51
Water	20.93

It is sometimes artificially made by pouring sulphuric acid upon quicklime. The fertilizing power of gypsum, when used in conjunction with animal manures, is very apparent in the growth and richness of the vegetation produced, and experiments have placed its value beyond a doubt, in the cultivation of the artificial grasses, and especially such plants as sainfoin, lucerne and clover. It is found to answer best when spread in moist, damp weather.

THE VALUE OF GYPSUM

in agriculture has been the subject of great diversity of opinion ; due in part, no doubt, to a want of proper observation of the circumstances in which its application has or has not been successful. Upon some soils it is said to be of no appreciable benefit, while there is considerable difference observable in its effects upon the dairy soils of New York in different seasons.

There are various theories put forth in explanation of its action, and the question is not altogether a settled one. Liebig thus speaks of it:—"The evident influence of gypsum upon the growth of grasses, the striking fertility and luxuriance of a meadow upon which it is strewed, depend in some measure upon its fixing in the soil the ammonia of the atmosphere, which would otherwise be volatilized with the water which evaporates.

"The carbonate of ammonia contained in rain water is decomposed by gypsum, in precisely the same manner as in the manufacture of sal-ammoniac, soluble sulphate of ammonia, and carbonate of lime ; and this salt of ammonia possessing no volatility, is conseqnently retained in the soil." One hundred pounds of gypsum, Liebig calculates, would be equal in ammoniacal fertilizing energy, to what would result from six thousand five hundred and twenty pounds of horses' urine.

Sir Humphrey Davy held the opinion that the influence of gypsum on clover and other plants of this description is due to their containing naturally a large proportion of sulphate of lime, and consequently required it in greater abundance than all soils are capable of furnishing. He examined the ashes of these plants, and found that they afforded considerable quantities of gypsum, which substance, he thought, might probably be intimately combined as a necessary part of their woody fiber; and he believed that when gypsum failed to produce a good result, it would be found that the soil naturally contained so much of the salt that its artificial supply was unnecessary.

LOCATION OF PASTURES.

Pastures, it may be remarked, should be located upon uplands, or well-drained soils. This is of great practical importance. The grass upon swampy or wet lands not only yields an inferior quality of milk, but milk often highly charged with the elements of putrefaction. When pastures are wholly or mostly composed of low or wet lands, the herds are liable to become more or less diseased. Foot-rot, bloody murrain, and febrile diseases are not unfrequent. I have known bloody murrain to be so virulent on such lands that they had to be abandoned; but by under-draining the land and returning to pasture the stock was rendered healthy.

The excessive drain on the animal system in the production of milk, has an important influence on this class of animals, rendering them less able to withstand disease than those that are not yielding milk; hence they require more favorable conditions in their management than other stock.

DEFICIENT DRAINAGE OF PASTURES.

In some remarks on this subject the London *Field* has the following:

"There can be no doubt, for experience has proved it, that one of the chief causes of periodical disease is a want of drainage. In this respect our tillage lands are generally better managed than grass lands, for many imagine that pastures do not require under-drainage; but this is essentially a mistake. On some lands scouring takes place periodically; others are liable to produce splenic apoplexy, black leg, and red water. Now, however different these may be in their characteristics, Dr. Voelcker, in his investigations, has thrown much light on the subject. It would appear that 'Scour is partly caused by a too rapid growth of grass, and its consumption, either green or converted into hay, while in an unripe state—that is, while containing an excess of saline and nitrogenous ingredients, and a lack of sugar.' And this is especially the case on imperfectly drained lands. Again, splenic apoplexy, which was very frequent during last autumn, was owing, in a great measure, to the rapid growth of grass from some warm showers in the autumn after the very dry summer. 'The plant found in the soil an excess of mineral matter; the animal eating such rapidly-formed and raw food was affected, the blood rendered viscid, and inflammation of the spleen ensued.' Even the liver-rot in sheep is caused hy a rank state of grass upon undrained or partially-drained lands, and Professor Simonds, in his investigations, shows that the conditions causing this terrible disorder only occur during two months of the year, and generally from rank vegetation. Professor Coleman, in a paper lately read at the Central Farmers' Club, states:—'As two instances of very fatal diseases which arise from unhealthy grass, I may mention black leg and red water. Black leg invariably attacked animals grazing on some peaty, swampy pastures, and disappeared when the same were thoroughly drained.' It may be objected to this, that these diseases may also be found on land that has been drained. But though this may be so in many cases, the fact still remains that in almost all cases where grass land is unhealthy for stock, it is because an excess of moisture impoverishes the herbage, and during the summer causes a too luxuriant and rapid growth."

The importance of draining wet lands is so well understood, that I need only briefly allude to it here. A few years since I paid a visit to John Johnston, the great farmer of Geneva, the pioneer of draining in this country, and who, it is said, has had more practical experience in draining than any man in America. He said to me that in his first efforts he had made great mis takes; that all drains should be laid directly up the incline, instead of trying to cut off springs by running the ditches horizontally or diagonally across the inclines; that it was not necessary to drain land when stagnant water stood more than four feet below the surface, but that when water stood within two feet of the surface, land is benefited by drainage. A soil filled with water cannot be heated downward, as experiments have shown that ice will remain unmelted in the bottom of a vessel filled with water, which has been made to boil by the application of heat to the surface.

Under-drained soils are heated by the warm rains sinking into them. Mr. JOHNSTON said that he would not build drains of stone, even if a supply were found on the farm, if he could get tiles at reasonable cost, because the excavations for stone drains would require greater labor, and such drains were liable to fill with mud or dirt, especially in soft lands. He would lay drains at least four feet deep, in order to secure their full benefit in heavy rains, and to place them beyond the reach of subsoil plows, moles and roots.

In order to prevent obstructions, drains should have a continuous fall, and this could be easily ascertained by stretching a line and measuring the depth of each tile from it. There was no danger of uniting the tiles too closely; the joints should not have over a quarter of an inch space, and ground tan-bark or shavings are a suitable covering to the joints.

LAYING DOWN PASTURES.

In seeding for permanent pastures, a greater variety of seeds should be sown than is commonly employed. The grasses are evidently social in their character, and delight to congregate together. From a single sod in a rich, natural pasture as many as thirty varieties have been counted. If we mix the varieties of early and late blooming, we get not only a succession for feed, but also a heavier growth upon the land. The mixture of varieties recommended by Mr. FLINT is excellent, and may be advantageously adopted. He recommends for seeding the following proportions:

Sweet-scented vernal, flowering in April and May	1 pound
Meadow fescue, May and June	2 "
Meadow Foxtail " "	2 "
Orchard-grass " "	6 "
June-grass " "	4 "
Italian rye-grass, June	4 "
Perennial rye-grass "	6 "
Perennial clover "	3 "
Timothy, June and July	3 "
Red-top, " "	2 "
Rough-stalked meadow, June and July	2 "
White clover, May to September	5 "
Total	40 pounds

To this we should add, blue-grass (*Poa compressa,*) three pounds, and Alsike clover, three pounds.

ALSIKE CLOVER

has only been recently introduced into this country, but from all the accounts we get of it, it would seem to be extremely valuable as a pasture grass; more productive than white clover, and quite as hardy, highly relished by stock, and, like white clover, is adapted to the production of milk of good quality.

Mr. RICHARD GIBSON, of New York Mills, N. Y., who has for some years past managed with great success the noted thoroughbred herd of WALCOTT & CAMPBELL, gives the following communication to the New York Central Farmers' Club as the result of his observation and experience, both in this country and England, in relation to

PASTURE GRASSES.

He says the objects sought are, to get our pastures as thickly covered with as good a quality of herbage as our soil is capable of growing, and to have them bear stocking early in the spring to withstand drought, and to continue to yield a "good bite" all through the season.

To accomplish this, it will therefore be necessary for us to ascertain which of the cultivated grasses are best adapted to our particular soils, and in what proportion they should be sown.

I shall not attempt to recommend a particular mixture of seeds, but will merely give a general description of some of our best pasture grasses, and the quantity of seed per acre generally sown in mixture with other grasses, and leave each one to select such as may seem best suited for his soil and purpose. If we take them in alphabetical order, we shall find first, *agrostis vulgaris*, a very common grass in some districts.

* *Agrostis Vulgaris*, or red-top, is well suited for permanent pastures, but it should be fed close, otherwise it becomes wiry—grows in any soil, moist or dry—and stands our hot seasons well. I think it is over-estimated by most farmers, and worth more for lawns than for pastures—2 to 3 pounds.

Anthoxanthum odoratum, or sweet vernal grass (6 pounds,) should be introduced into all mixtures for permanent pastures, on account of its early spring growth, as it is also one of the latest in the autumn—luxuriates most in rich and cool soils—$\frac{3}{4}$ pound.

Alopecurus pratensis, or meadow fox-tail ($5\frac{1}{4}$ pounds). This is one of our very best pasture grasses, being quite early, much liked by cattle, and withstands our hot summers without burning. It flourishes best in a rich, moist, and rather strong soil ($1\frac{1}{2}$ to $2\frac{1}{2}$ pounds).

Dactylis glomerata, or orchard grass, (11 pounds), is in my opinion the most valuable grass we have, and should enter largely into all mixtures intended for permanent pasture. It is one of our earliest, as well as most nutritious and productive grasses, and is exceedingly palatable to stock of all

* The numbers immediately after the name of grass indicate the average weight of the seed per bushel. The numbers after the description the number of pounds generally sown per acre in mixture with other grasses.

kinds. As a pasture grass it should be cropped close (four to five pounds).

Festuca duriuscula or hard fescue (9½ pounds). This is not so productive as some of our pasture grasses, being one of the fine and dwarf-growing varieties, still it is desirable as thriving well in dry situations, and withstanding drought better than many other kinds (2 pounds). Of the numerous varieties of the fescues.

Festuca Pratensis, or meadow fescue (13 pounds), is the most desirable, and it is one of our best grasses, producing a large bulk of very nutritious grass, highly relished by cattle, does not attain its full growth until three years from the time of sowing; prefers soils of good quality (3½ pounds).

Lolium Italicum, Italian rye-grass (15 pounds). Occupies the same position among grasses in England as timothy does here. Is remarkable for its early maturity and rapid reproduction. I have not succeeded in growing it satisfactorily here, but I think it can be done, as it succeeds well in the dry Australian climate. If it can be grown here it will become one of our standard grasses (6 to 8 pounds).

Phleum Pratense, or timothy (44 pounds). Is so well known that it needs no description. More valuable for meadows than pastures, as it will not bear close grazing (3 pounds).

Poa pratensis, or blue grass (13½ pounds). Is common in most sections of the country, but prefers limestone lands. Starts early in the spring and remains green until checked by frosts (1½ pounds).

Poa trivialis, or rough-stalked meadow grass (15 pounds). Much like the blue grass in appearance, except that the one has a smooth and the other a rough sheath. It is one of our most valuable grasses, highly nutritive, and both cattle, horses and sheep are very fond of it (2 to 4 pounds).

The above are some of the most valuable of the grasses; the list might be extended, and I should always recommend sowing in a mixture with above grasses, red clover and *trifolium repens*, or white clover, say 3 or 4 pounds of each per acre.

Mr. George Sinclair wrote a very instructive essay on "Grasses," in which he says, after advancing some reasons why a variety of grasses should be sown, "There is another important law in the natural economy of the grasses which governs all those species of most value to the farmer. It is this, that individual plants of the same species will not grow close to each other for any length of time, for however thickly planted from seed in one or two seasons, intermediate plants decay and leave vacant spaces, which are soon filled up with spurious grasses, weeds or moss; but when a variety of different species adapted to the soil are mixed together, they grow close, form a dense bottom and continue permanent."

That is just what we want in this climate, "a dense bottom," to withstand our scorching sun and dry summers, and to obtain which we must have a variety of grasses.

Just one instance, quoted from the same authority, to illustrate how closely plants will grow. "A rich natural pasture at Endsleigh, Devonshire, Eng., contained twenty-two different species of grasses on something less than the space of a square foot of the best fattening pastures;" and in a turf one foot square of a very old pasture in Lincolnshire, on having the soil carefully washed from the roots of the herbage, and the individual plants of which it consisted separated, their number amounted to one thousand and ninety, while in a pasture formed of rye-grass and clover, only seventy-five plants were found per square foot."

In seeding, whether it be for pastures or meadows, too great pains cannot be taken to have a good seed bed. In this latitude (43°), and on most of our dairy soils, I prefer

SEEDING IN SPRING,

as the young plants then have longer time to establish themselves before cold weather. However, location, the character of the soils, and circumstances, will always have controlling influence on this point. For spring seeding the land should be plowed in the fall, and unless mellow and in good tilth, it should be plowed again in the spring. Then, unless the land is very rich from previous manuring, well rotted manure should be spread upon the surface and worked in with the cultivator until the surface is finely pulverised, and for covering the seed, a light harrow or brush should be used that they may not be covered too deeply. The great point in successful seeding is to have the land in good heart and fine tilth.

SOILING.

There is another system of management adopted by some with great success. When lands are expensive and a considerable portion of the land is arable, the rougher or broken lands, and such as are not easily cultivated, are put into permanent pasture, and a system of half soiling is adopted.

The plan of whole soiling, or keeping the cows in the stable and yard, has been strongly advocated by some, and there are many points about it that commend it to favor. But while it seems to have been successfully practised by a few persons, whose lands are located near cities and are of limited extent, and are in consequence valuable, still the system is not generally adopted among the dairymen of this country or Great Britain.

The profits of feeding cows wholly by soiling instead of pasturing, must depend of course upon the market value of land in different localities. Where land is cheap and a given quantity of food can be furnished cheaper by pasturage than for the labor involved in soiling, it is evident pasturage will be preferred.

But the system of part soiling, as now adopted by our best dairymen, is for the purpose of keeping up a flow of milk during the hot, dry weather, when grass in pasture depreciates in quantity and value. European writers have stated that there are

SIX DISTINCT ADVANTAGES

to be obtained from the practice of soiling:

I. It saves land.

II. It saves fencing.

III. It economizes food.

IV. It keeps the cattle in better condition and greater comfort.

V. It produces more milk.

VI. It increases immensely the quantity and quality of the manures.

The second and third of these propositions are so self-evident that I need not discuss them here; but of the other four I may allude briefly to the arguments urged by the advocates of this system. And first, how does it save land?

Cattle that are turned to pastures, they say, waste as much and often more food than they consume. This is done in various ways—by treading it down; by dunging; by staling; by blowing upon it; by lying down upon it; and again, when there is a flush of feed, by a portion of the grass not being touched by stock, thereby becoming rank, old and woody, and thus going to waste.

The late Mr. QUINCY of Massachusetts, who was an earnest advocate of the system, and who practiced it with great success upon his farm, says he was enabled by soiling to keep twenty cows on the product of seventeen acres of his land, but which under the old system required fifty acres.

European writers make the difference between the two systems (soiling and pasturing,) as one acre to seven. But, taking Mr. QUINCY's maximum quantity, which he says was never at any time required to be increased for the full supply of food for the number of cows named, it will be seen that the number of acres needed through the soiling season for fifty cows would be forty-two and a-half acres. This, it will be seen, is quite a saving, as it would have taken, according to his statement, one hundred and twenty-five acres of this land for the same stock at pasture.

The objection that the constant plowing of land under the soiling system would soon exhaust it, is answered by the argument that crops that are not permitted to go to seed make no heavy drafts on the soil; besides, by the practice of soiling an abundance of manure is at all times at command, and hence it is concluded that by no system of farming can land be enriched at so little cost.

Under the fourth proposition, that it keeps the cattle in better condition, it is contended that animals kept under this system are healthier and not so liable to accident.

HEALTH OF SOILED STOCK.

The experiences of the English, as well as that of Mr. QUINCY, seem to show that stock provided regularly with an abundance of food, with a plentiful supply of pure water, and otherwise properly cared for, are seldom essentially ill; seldom miscarry or meet with those accidents incident to herds that are roaming over pastures, often subjected to hunger and thirst, drinking muddy and impure water, driven and worried by dogs, breaking down and jumping over fences in quest of food, or otherwise gratifying their propensity for mischief. They are also more protected against noxious weeds that often injure the milk as well as the animal.

The soiling system does not necessarily confine the animals wholly to the stable. A yard is provided in which rubbing posts are set, and where shade is insured. Into this inclosure they are turned for several hours during the day, and where they can take all the exercise necessary for health.

Those who have practiced soiling milch cows, seem to be unanimous in their statements that more milk is thus produced than by pasturage. The arguments proceed upon the principle that by soiling an abundance of nutritrious, palatable food is always at command, whereby the flow of milk may be kept up to the highest point throughout the season. Experience teaches us what high feeding is capable of doing in the production of milk, and other things being equal, the argument cannot be charged as wholly theoretical.

IN THE SAVING OF MANURES

there can be no doubt but an immense advantage is gained. Mr. QUINCY estimates the value of manures made from soiling to be equal to the whole cost of labor employed to take charge of his stock.

KINDS OF FOOD TO BE USED IN SOILING.

I have now gone over the chief points in favor of this system. I can only briefly touch upon the kinds of food to be used and the order of their succession. The English speak of lucerne, clover, peas, cabbage, &c., as used for soiling. Mr. QUINCY relied chiefly upon but four kinds of green crops for carrying on the system. 1st. grass; 2d. oats; 3d. Indian corn; and 4th. cabbages. He used grass for the first month of the soiling season. This was cut from his earliest pieces, patches here and there about his buildings, and the sides of a private road leading through the farm.

He gives as the result of his experience, that one acre of good clover is sufficient for six head of grown cattle from the twentieth of May to the twentieth of June. Oats are made to be the food for July, one acre being sufficient for every four head of cattle soiled. The oats are sown at the earliest moment possible, and generally afford a good cut by the first of July. But when oats alone are depended upon without the aid of any other crop, he advises that one-half the destined quantity of land should be sown as early as the seed can go into the ground, and the other half a week or more later, that the crop may have some succession.

Indian corn is relied upon for the month of August; and during the month of September reliance is placed upon the grass from the second crop, from those acres in which soiling was effected in the month of June. The grass of the second crop, he says, will generally enable the farmer to soil to the fifteenth of October if his grass land be in good heart.

From the fifteenth of October till the time cattle are housed, reliance is placed upon the tops of winter vegetables, such as carrots and turnips, together with cabbages. This food is distributed in racks under cover, or in the barn, about six times each day in due proportion.

I do not propose in this place to discuss the minutiæ—the time of sowing and best manner of raising crops—as my object has been merely to give a general outline of the system. It undoubtedly has great advantages under certain circumstances, and the plans of barns which I have given, are arranged so that it could be in whole or in part adopted.

HALF-SOILING.

Now the half-soiling to which I have alluded is managed in this way (and I give simply an outline of practice adopted by some of our leading dairymen in Central New York. My description is the management of Dr. Wight, whose location is near Utica, N. Y.):

Dr. Wight has had some experience in "part-soiling," during several years past, and he says he is satisfied that when the soil is well adapted to the system, as it is on the Mohawk flats, it is far more profitable than the old method of grazing. His practice has been to set apart about twenty-five acres of pasture for fifty cows. Commencing about the middle of May he lets the cows to pasture a few hours each day, still giving them what they will eat of the early cut fine hay, of the previous year's crop, and which has been cured and stored especially for this purpose. Then he soon begins to cut some rye, sown early and thickly the previous autumn on rich soil. The advantage of rye is, that it is fit for feeding earlier than any other soiling food. But he feeds it no longer when he can get early clover, as it is too light a crop to be profitable. Early clover is then fed twice a day, as long as it remains green and succulent. Next late, and large clover, followed sometimes by oats, sown thickly on rich soil, and cut just before they begin to head. Oats are succeeded by sowed corn, the seed having been drilled in at different times, and this he continues to feed till frost comes, exchanging awhile with the second crop of small clover, which furnishes as much feed as the first crop.

He generally turns the cows upon such after-feed as he does not wish to cut for a second crop of hay, both for the purpose of saving the feed and to benefit the next year's crop of hay; as a large growth of after-math left on the ground of the Mohawk intervales, injures the succeeding crop very much. By pursuing this course, he says he finds three acres will carry as many cows through the year as four acres treated in the usual way.

The expense in labor is considerably more, but that is counterbalanced by the increase in manure. Cows fed thus, he affirms, will at least equal if not surpass those kept in the usual way, in both quantity and quality of milk, and the dairyman, by adopting this method, finds his profits enhanced nearly one-fourth.

Full soiling he has never practiced, as he cannot overcome the prejudice of feeling it to be better for the health and comfort of stock to roam freely in the open air a considerable portion of the time.

MR. BIRNIE'S PLAN OF SOILING.

In 1869 I was at the residence of Mr. WILLIAM BIRNIE, of Springfield, Mass. Mr. BIRNIE has a reputation as a breeder of Ayrshire stock, and he gave me the outlines of his management for a dairy of twenty cows, which are kept upon fifty acres of land in the immediate vicinity of Springfield, the milk going to milk dealers for consumption in the city.

Upon this farm the practice of soiling has been adopted for the last ten years, and the results have been eminently satisfactory. Out of the fifty acres there are ten acres which make up a rough, broken pasture, upon which the cows are allowed to feed daily and take their necessary exercise. In addition to the ten acres of rough pasture land, seven and one-half acres are employed for crops, in soiling, as follows:—Rye, one and one-half acres; clover, two acres; and sowed corn, four acres.

He commences cutting and feeding the rye about the 1st of June, and by the time that is fed off the clover is ready. The clover is cut over three times during the season. For ten days, while the hay is being harvested, the cows are fed from the meadows. Then comes the sowed corn which, with the after-feed from the meadows, finishes the remainder of the season.

As soon as the rye is cut and fed, the ground is immediately plowed and prepared for cabbage; and from this crop a considerable profit is realized, the sound, hard heads being sold, while the loose leaves and soft cabbage are fed to the cows on mornings during frosty weather in the fall, when grass begins to depreciate.

Usually the plowed land has a four years' rotation, being then seeded in connection with an oat crop, and with the following proportion of seeds to the acre: Clover and herd's grass, one peck each, and red top, one bushel.

Now, here are seventeen and a-half acres, five and a-half only of which are under the plow, that give an abundance of food during the pasturing season for twenty cows. Under the system of pasturage alone it would take at least forty acres to carry the cows through the same period; and on many farms fifty acres would not suffice.

It may be remarked that the rough, broken land of ten acres is of a poor character of soil, and does not afford a large amount of food, so that proper allowances should be made on this account.

The labor of feeding, he said, would amount to something; but this is partly and perhaps wholly paid back in the greater quantity of milk yielded, the better health of stock and the saving of manures—this last being an important item.

Where lands are cheap we cannot expect the system of green soiling to pay, but where they are valuable and scarce the plan adopted by Mr. BIRNIE is suggestive, and will be found remunerative if properly conducted.

RAISING AND FEEDING ROOTS.

Mr. BIRNIE feeds largely of roots during the winter, of turnips and mangolds, each animal getting about one-half bushel per day. The turnips are fed during the early part of the winter, and the mangolds later. He gave me a statement of a crop of mangolds grown on two and one-half acres. The land had been prepared with the design of raising tobacco, but it was thought best to put it to mangolds. Thirteen cords of well rotted stable manure were hauled on, and the land plowed the 26th of April, and again the 7th of May. The ridges were made two feet apart, and fifteen hundred pounds of bones dissolved or broken down in sulphuric acid, together with sixteen bushels of coarse salt, were used as special fertilizers. Then about the 10th of May, seed of the long red variety was drilled in at the rate of six pounds per acre. On the 3d of June the plants were hoed the first time, and seven days after they were cultivated with the horse-hoe, followed by hand hoeing, thinned by drawing a hoe through, and the blank spaces filled by transplanting. In the first week of July the horse-hoe was again run through the rows, and the plants thinned out from eight to twelve inches apart—one plant in a place. On the 16th of July the horse-hoe was again used, which was the last cultivation employed, as the plants now generally covered the ground; but wherever vacancies occurred they were filled with cabbages.

On the 15th of September the leaves were stripped to feed the cows, and eighteen two-horse wagon loads were taken from the piece before harvesting. At the time of harvesting twelve loads more of leaves were gathered and fed to the cows. He commenced to gather the crop on the 9th of October, finished on the 23d, and harvested seventy-six loads of roots, each load weighing twenty-five hundred pounds, the whole crop amounting to three thousand one hundred and sixty-five bushels, besides four hundred heads of sound cabbages. The expense of this crop was estimated as follows:

13 cords stable manure, at $6 per cord	$78 00
1,500 pounds vitriolized bones	18 75
16 bushels salt	3 20
Total for manures	$99 95

The labor employed was as follows: Men and teams five days in plowing; men's labor twelve days planting; twenty-five day's work cultivating in June; eleven days' work cultivating in August; twenty-seven and a-half days' work in October, harvesting; ten days, man and team, hauling and storing roots in the cellar, &c.

As the price of labor varies at different seasons and in different places, I have not thought it worth while to set any special value upon it, but let each one figure the cost of labor to suit himself.

The manures, it is evident, should not be wholly charged against the crop, as their influence extends over and benefits the land for other crops. The yield was a remarkably good one and shows what can be done by thorough cultivation.

THE COMMON PLAN.

Now, the usual system adopted by our dairy farmers is to rely mainly upon pasturage, and in giving a little extra food from green corn fodder, so as to meet the necessities of drought, or to help carry the stock along for about five weeks, say from the 20th of July to the 1st of September, when the animals are turned into the after-feed. Grass is usually most abundant during the early part of the season, and if pastures are not over-stocked up to the middle or latter part of July the herd may be carried through the balance of the season at little trouble and expense, by having a provision of forage from sowed corn.

THE TIME FOR SOWING CORN

for the summer soiling of milch cows is, for the latitude of Central New York, from the 1st to the 15th of June. The land should be heavily manured and the seed scattered thickly in drills, the rows say about two feet and a half apart and not to exceed three feet. I have experimented with this crop by sowing the seed broad-cast, planting in hills, and drilling in rows at various distances apart, and have uniformly found the best result when used in the way recommended. What we want to obtain is a heavy growth of tender, brittle stalks which will be readily consumed by stock with no waste. Thin seeding or drilling the rows too far apart will be apt to give the stalks considerable size, with a large amount of woody fiber, which the cows will not eat.

The breadth of land to be sown must vary, of course, according to the quantity of food desired, but should not fall below an acre for every ten cows. It is true the season may be such that the whole may not be needed, but this will not result in loss, for if the stalks are cut, bound and shocked before frost, they may be cured, and will afford a large amount of valuable fodder for the cows in fall and early winter, when something better than hay is required for the animals in milk.

On rich land, well manured and in good tilth for the seed, it is surprising what a large amount of nutritious food can be grown to the acre of this crop. It is admirably adapted as a milk food, not only giving quantity but quality, and if we take into account its adaptation to a variety of soils, and wide range of climate, its productiveness and the ease with which it may be cultivated, there is not in the whole catalogue of forage plants one so valuable for the summer soiling of milch cows as Indian corn.

In sowing some use the Western or Dent variety. It gives a larger yield than any other, but the stalks are apt to grow coarse and woody, and it is less nutritious than other kinds. In our own experience, sweet corn of the Evergreen variety has given the best results in milk. From the following

ANALYSES OF DIFFERENT VARIETIES OF CORN

it will be seen that sweet corn is comparatively rich in caseine, albumen, and sugar, while the per centage of fiber is much less than that of other varieties:

	Ohio Dent.	White Flint.	Eight Rowed Yellow.	Sweet Corn.	Tuscarora.	Pop Corn.	Buel's Dutton
Starch	41.85	40.34	30.29	11.60	48.90	46.90	36.06
Gluten	4.62	7.69	5.60	4.62		9.24	5.00
Oil	3.88	4.68	3.90	3.60	8.72	6.96	3.44
Albumen	2.64	3.40	6.00	14.30	2.32	5.02	4.42
Caseine	1.32	0.50	2.30	5.84	2.00	2.50	1.92
Dextrine	5.40	2.90	4.61	24.82	14.00	2.25	1.30
Fiber	21.36	18.01	26.80	11.24	10.00	8.50	18.50
Sugar and Ext. Matter	10.00	8.30	5.20	14.62	13.68	7.02	7.25
Water	10.00	14.00	13.40	10.32		12.12	15.02
	101.07	99.82	98.10	100.96	99.62	100.51	92.91

No dairyman, looking for a profitable return from his herd should neglect to provide a patch of sowed corn for soiling in connection with pasturage during the hot, dry weather of August and September. If the seed is put in early a portion of the crop will be fit to cut in the latter part of July, when pastures begin to fail. Cows should not be allowed to shrink in their milk for want of nutritious food at this season of the year, for when once the flow of milk is checked from this cause it will be difficult to get them back again into a "milky habit."

An abundance of food for soiling, in the way referred to, will make a larger difference in the receipts than most men imagine who are accustomed to depend solely on pasturage for summering the herd. And in case of drought the satisfaction of knowing that your stock is amply provided for, more than compensates for growing this special crop, to say nothing of the money receipts coming from its use.

MEADOWS—ENGLISH SYSTEM.

As to the management of meadow lands and the establishment of permanent meadows there is great diversity of opinion among dairy farmers. The English, who have studied these questions and who have had long experience upon a soil and in a climate particularly well adapted to permanent meadows, do not believe in setting apart much land for this purpose. In my tour through the dairy districts of England, I was often surprised at the small quantity of land put down in permanent meadows upon dairy farms. They believe that grass is most profitable when it is to be cropped by cattle; hence the area of pastures is extended while that which we understand by meadow lands is reduced to the narrowest limits.

THE ENGLISH DAIRY FARM

may be said to be divided up into pastures and arable lands. Upon their cultivated fields much of the hay comes from a regular rotation after grain crops; the field is mowed once or twice and is then broken up for a crop of wheat. Various mixtures are sown, and large yields often the result. I have seen meadows on what is termed the four or five course shift, where the first crop of hay would be at least three tons per acre. I was upon a splendid meadow of this kind in Devonshire, where the seeding of the previous year had been as follows: Eight pounds red clover, two pounds white clover, four pounds trefoil, and three pecks of Italian rye-grass. This is not given as an illustration of the best mixture, but rather as a specimen of what some of our American farmers would call heavy seeding. Lands often get more and a greater variety of seeds. The English say they can get more profit by cultivating their arable lands, raising grain, and feeding cows when not in milk, with cut straw, turnips and oil meal, instead of keeping them wholly on hay. And the profits of English dairy farms, I may remark, are very much larger than with us. Their permanent meadows are kept up by a system of mowing and cropping alternately. Ground bones and phosphatic manures are used to some extent as a top-dressing, but barn-yard manures are for the most part employed for the grain and root crops. I am inclined to think that

A SYSTEM OF ROTATION IN CROPS,

in which the land should lie in meadow from four to eight years, according to the character of the soil, would be much more satisfactory in results than the attempt to make permanent meadows over a large area which, from its extent, cannot be properly top-dressed with manures furnished from the farm except at long intervals. And, although grain farming alone as a specialty cannot hold out a promise of any considerable gains on many of our Eastern soils, still in connection with the dairy, by which the straw and coarse fodder can be utilized and the land, by rotation, be made to produce better crops of hay, we may, on the whole, be able to get better profits than by a system of permanent meadows.

PERMANENT MEADOWS.

Much, of course, must depend upon the soil and its situation. When lands are rough, or not easily tilled—lands that are filled with stone, which at every seeding would require much labor in removing—it may be desirable, if possible, to put down in meadows that are to remain long in grass. How, then, can these be made productive from year to year, in the least expensive way? Perhaps the most economical method in treating such lands would be in

TOP-DRESSING WITH LIQUID MANURES,

as the liquid excrements from animals produce the most remarkable results upon grass lands. In 1866 I was upon Alderman MECHI's farm near London, where the system of liquid manuring is most elaborate, and where the results obtained are truly astonishing. His stables are constructed over cellars laid in stone and cement, so as to be water tight. The cattle stand upon sparred floors, where the liquid and solid excrements drop through the openings between the narrow joists to the manure pit below. A large tank is sunk in the ground outside the building, and pipes laid from this to the manure cellar. Pipes lead also from the tank into the fields where there are hydrants, to which gutta percha hose are attached for distributing the liquid manures. The solid and liquid manures in the cellar are every few days flushed with water, so that they can be pumped into the tank by the aid of a steam engine, and from the tank they are forced through the pipes to the fields and distributed over the crops from time to time, by simply manipulating the flexible hose. By this system his crop of Italian rye-grass yielded thirteen and a half tons green, or if made into hay about four tons seventeen hundred weight at the first cutting, and as much more at the second cutting. From

THE MEADOWS NEAR EDINBURGH,

on which the town sewage flows, the rye-grass has been made to yield, it is stated, at the enormous rate of eighty tons green grass, or twenty-five tons of hay, to the acre. This system is not applicable, of course, to American dairy farms, but I mention it to show the value of irrigating grass lands with liquid manures. But I have another method more practical, one that has been adopted in Herkimer with success, and which may be carried out on the majority of dairy farms.

ABSORBING LIQUIDS WITH SAW DUST.

It consists in absorbing the liquid manures of the stables by the use of saw-dust or muck, and applying as a top-dressing.

Mr. LEWIS of Herkimer, N. Y., has practiced this system with great success. He commenced some years ago by taking twenty-five acres of land which were then of only ordinary fertility. These he underdrained and seeded to timothy, clover and orchard grass, and began to top-dress with liquid manures. He uses saw-dust for the absorption of the liquid manures, and for this purpose it is spread in the stable behind the cows. As fast as the liquids are absorbed by the saw-dust, during the winter, they are hauled immediately to the field and placed in piles. In Spring these piles are spread as evenly as possible over the surface with a fork or shovel. Then he goes over it with a brush harrow, which completely breaks up and distributes the manure in fine particles. He uses basswood dust from seasoned wood, and which is obtained at a neighboring match factory.

By this practice he has for some years past been enabled to get from this meadow a quantity of hay sufficient for the winter keep of fifty cows.

LIQUID MANURES.

Dr. VOELCKER, the celebrated agricultural chemist of England, in a recent lecture on the subject of manures, made the following remarks:—"He need not speak of the superior value of the liquid over the solid excrementitious matters of dung, for that was well known to intelligent farmers; but there was a chemical point to which he must be permitted to direct attention, and it was this: The liquid portion of rotten dung had a most active power of dissolving the more valuable fertilizing matters of the solid excrements of animals. They know, for instance, that phosphate of lime—the material on which principally the value of bone dust depended—was soluble to a great extent in liquid manure. As the liquid in rotten dung dissolved a large proportion of the more valuable constituents of the solid excrements they would now see an additional reason for preserving their liquid manure, for in so doing they would not only retain the fertilizing matters in urine, but they would also prevent the waste of the most valuable constituents of the solid excrements. He had dwelt on that chemical point, because it had come under his notice especially, in consequence of an examination of the liquid portion of dung, sent to him by Mr. CAMPBELL of Buscott Park. In that liquid he found a very large proportion of phosphate of lime, which was otherwise insoluble."

Wherever I have seen liquid manures used in this way, whether absorbed by sawdust, or muck or loam, previously dried, the very best results have been obtained. A point of great importance in

TOP-DRESSING MEADOWS

is, to use fine manures, or such as can be readily broken up and distributed, so that the particles may reach the roots of all the plants. Coarse manures improperly prepared, ought not to be used, as they cannot well be broken down, remaining in lumps upon the surface, obstructing the growth of grass and clogging the machines while mowing.

TOP-DRESSING AFTER MOWING.

In top-dressing meadows with the solid excrements from cattle, or farm yard dung, very excellent results are obtained by making the application immediately after mowing. The manure then acts as a mulch, protecting the grass roots from the scorching rays of the sun, while the fall rains carry the particles to the plants, giving them vigor, and thus enabling them to withstand the severity of winter frosts. Gypsum should always be used immediately after the application of manure for top-dressing, in order to avert the escape of ammonia.

THE STANDARD VARIETIES OF GRASSES FOR MEADOWS

are red-top, timothy, the clovers, and orchard grass, to which may be added perennial rye-grass, tall oat-grass, rough-stalked meadow-hard fescue, or such varieties as seem best adapted to the soil and situation.

The following are the analyses of timothy and red-top at the time of flowering:

	WATER	STARCH	WOODY FIBER	SUGAR.	ALBUMEN, &C.	GUM.	MINERAL MATTER.
Timothy,............................	70.0	5.5	12.5	4.2	4.0	1.8	2.0
Red-top,............................	71.0	3.8	13.0	4.9	3.3	1.5	2.5

ORCHARD GRASS.

Complaint is sometimes made against orchard grass, that it grows too much in tufts or tussocks. This may be obviated by heavy seeding. I have seen meadows of great productiveness from this variety alone, where the turf was solid, and the yield of hay at the rate of four tons per acre. It was cut twice during the season, and even after the second cutting a large yield of after-math was produced. In these cases the land had been seeded at the rate of one and one-half to two bushels per acre. The following table shows

THE NUTRITIVE VALUE OF GRASSES,

as made from analyses. They do not always represent their experimental values, but still the table is useful in comparing approximate values of different varieties. It is taken from C. L. FLINT's valuable work on "Grasses and Forage Plants."

NAME OF GRASS.	ALBUMINOUS, OR FLESH-FORMING PRINCIPLES.	FATTY MATTER.	HEAT-PRODUCING PRINCIPLES—STARCH, GUM, SUGAR, &C.	WOODY FIBER.	MINERAL MATTER OR ASH.
Sweet-scented vernal grass,..................	10.43	3.41	43.48	36.36	6.32
Meadow fox-tail,..........................	12.32	2.92	43.12	33.83	7.81
Tall oat-grass,.......................	12.95	3.19	38.03	34.24	11.59
Orchard-grass,..............................	13.53	3.14	44.32	33.70	5.31
Orchard-grass, seeds ripe,..................	23.08	1.56	26.53	43.32	5.51
Meadow soft-grass,.........................	11.52	3.56	39.25	39.30	6.37
Meadow barley-grass,......................	11.17	2.30	46.68	31.67	6.18
Perennial rye-grass,.......................	11.85	3.17	42.24	35.20	7.54
Italian rye-grass,..........................	10.10	3.27	57.82	19.76	9.05
Timothy,...................................	11.36	3.55	53.35	26.46	5.28
Annual spear-grass,........................	11.83	3.42	51.70	30.22	2.83
June-grass,................................	10.35	2.63	43.06	38.02	5.94
Rough-stalked meadow-grass,...............	9.80	3.67	40.17	38.03	8.33
Grass from irrigated meadow,................	25.91	6.53	32.05	25.14	10.37
Grass from irrigated meadow (second crop),...	10.92	2.06	43.90	34.30	8.82

The following table, from analyses of BOUSSINGAULT and others, gives the appropriate composition of the green stems and leaves of some of the leguminous and other plants not usually cultivated for hay:

	GREEN PEA STALKS.	SPURRY.	GREEN STALKS OF BUCKWHEAT.	COMM'N VETCH.	FRENCH VETCH.	WHITE LUPINE.	COMMON WHITE FIELD BEAN.	GREEN OATS FODDER
Water,................	80.00	77.00	82.5	77.5	79.5	86.0	85.0	82.0
Starch,................	3.40	2.3	4.7	2.6	3.8	1.3	1.5	5.0
Woody fiber,...........	10.31	12.0	10.0	10.4	11.5	7.0	9.0	7.5
Sugar,.................	4.55	......	....	......	......	......	0.2	3.5
Albumen,..............	0.90	2.7	0.2	1.9	0.7	1.8	1.05	1.0
Gums, &c.,............	0.65	5.2	2.6	7.6	3.6	2.9	2.25	0.5
Fatty matter,..........	....	......	....	......	0.9	1.0	1.0	......
Phosphate of Lime,......	0.19	0.8	....	......	......	......	....	0.5

IMPROVING LANDS BY IRRIGATION.

There is another method of keeping up permanent meadows which I am surprised is not more frequently taken advantage of by the dairy farmers of America, and this is irrigation. Where meadows are located at the foot of hills and slopes, and where the water of small streams coming from the uplands can be taken advantage of, valuable results can often be obtained at trifling expense, simply by leading the water in channels so that it may be made to overflow the meadows. In Great Britian opportunities of this kind are generally taken advantage of by farmers.

UTILILIZING WATER FROM SPRINGS.

I was recently upon a farm in Lewis County, N. Y., where a meadow of forty acres had been made to yield annually, a crop of three tons of hay per acre, by utilizing the water from springs oozing out of the slope above it. This meadow was slightly undulating, and the surface soil largely made up from the wash of the hills. It had been underdrained, but the large and continuous yield of the grass crop was due mainly to irrigation. Along near the foot of the hill above the meadow, there is a small stream, made up from numerous springs coming out of the hills, and this stream having been made to take a diagonal course across the slope, is employed to irrigate the entire meadow lot whenever desired.

The water is first let upon the meadow in the spring when the snow is going off, and is left upon the ground a week or more, when it is turned off. Then about the middle of May, if the weather is dry, the ground is flooded again and so from time to time till the grass gets a good, thrifty vigorous growth. Sometimes only portions of the field are flooded when the grass is not heavy, and the whole is effected with but little trouble, by means of sluices from the creek, and a hoe to turn the water on different parts of the meadow as desired. This meadow had been sown about ten years, and had received but little attention in manures.

Mr. Allen, of the same county, has a meadow of a hundred acres lying at the foot of a range of hills; but there are no permanent streams or springs which can be made to overflow it. Still in the spring of the year a large quantity of water from the melting of the snows, comes down, and by cutting channels this is utilized in flooding the land, and producing the most marked result in the yield from his meadow, which has been down in grass more than twenty years.

I was recently upon a meadow of six hundred acres, in the state of Wisconsin, which had never been plowed. About twenty years ago, advantage was taken of a considerable stream of water flowing on one side of the field, and by erecting a dam and gates at a point in the stream just above the field, and cutting sluices from it to the meadow, and then again a ditch at the lower end of the field to let the water off into its main channel, the land could at any time be flooded. This meadow had never received a particle of manure, and for the last fifteen years the annual crops have been large.

Mr. Kiersted of Ulster Co., N. Y., states, in a communication published in the Transactions of the New York State Agricultural Society, that he had a piece of land—a coarse gravel, nothing but Johnswort grew upon it. There was a large spring directly above the lot, though the water running as is mostly the case from springs, in a channel directly across the lot. He went to work cutting channels with a plow, and drew the water upon the land; the result was, red top and herds grass came in and grew so stout that it lodged. The water, he says, should be attended to at least twice a week, and not allowed to become stationary or stagnant.

I have not proposed to discuss the different methods adopted to effect the objects of irrigation, but have merely alluded to some of the simple modes which have been employed with success. Numerous and well authenticated statements might be given of the valuable results obtained in fertilizing fields by artificial irrigation, and thus increasing their productiveness.

Sir John Sinclair, in speaking of this operation, calls it one of the easiest, cheapest and most certain modes of improving poor land, in particular if it is of a dry and gravelly nature. "Land," he says, "whenever improved by irrigation, is put into a perpetual state of fertility, without any occasion for manures or trouble of weeding, or any other material expense;" and in explaining the philosophy of its effects, its valuable results, it is supposed, are not due altogether to the artificial moisture furnished the plant, but to the mechanical action of the irrigating current of water in exercising the plants; strengthening their organisms, keeping their stems and root crowns clear of obstructions, and promoting the equable distribution of the soluble materials of their food. These probably play a considerable part in irrigating fertilization.

"The difference of effect, from the mere circumstance of flowing or stagnation of the water, is prodigious; for while flowing water coaxes up the finest indigenous grasses of the climate and renders them sweet and wholesome, nutritious and luxuriant, stagnant water starves, deteriorates, or kills all the good grasses."

GROWING ROOTS FOR DAIRY STOCK.

Every one who keeps stock should make some provision for their winter keep by raising a patch of roots. We have heretofore alluded to the benefit resulting from this kind of food for cattle during winter and spring. The foddering season in latitude 43° falls but little short of six months. Continued feeding of dry food for so long a period has a tendency more or less to derange health. This is particularly so with milch cows, many of the diseases which occur from time to time being induced by badly regulated diet. There is nothing that improves the health of stock like an occasional feed of carrots, beets, or turnips through the foddering season.

There may be difference of opinion in reference to the kinds of roots most profitable to grow; but there can be none with regard to the improved condition of stock that have a daily or even semi-weekly allowance of this character of food. For the spring feeding of milch cows roots of some kind should be regarded as indispensable. After years of experience in the management of dairy stock and ample experiment in feeding, in order to get the best results for the season, I have come to the conclusion that the value of roots as a spring feed for milch cows can hardly be over-estimated. Dairy stock that had a daily allowance during the spring months, come upon grass in vigorous health, and are enabled to yield heavy returns of milk throughout the season. If a cow on turning to grass is thin and in feeble health, nearly half the summer is consumed in regaining health and condition; and until this point is attained a maximum yield of milk cannot be expected. Many dairymen complain in the early part of the season that their stock is doing poorly, though an abundance of pasture is provided, and they cannot see the reason. But if the cause be traced out it will often be found to be in impaired health or some derangement of the system, resulting from the character of the food consumed during winter and spring. Cattle like a change of food, and it is as necessary for their health as for that of the human species.

When we make use of milk from animals it is of the utmost importance that it be kept free from every objectionable taint. A sickly cow not only yields a diminished profit, but she yields unhealthy milk, and unhealthy in a higher degree than her flesh. If for no other reason than improving the health of dairy stock, root culture should enter into the operations of every dairy farmer. Beets, carrots and mangolds should be sown early, but turnips may be delayed till the latter half of June. The mangold has this advantage over other roots, it keeps late, and is therefore valuable for feeding during the latter part of spring. Sugar beets—the white and yellow—are nutritious, and make a good feed for cattle. Beets require a deep and well pulverized soil. In field culture they grow best where the land has been sub-soiled. In root culture, whether for beets, carrots, or turnips, it pays well to manure heavily with well rotted manure. Fresh manures are objectionable in this respect; they induce a sprawling, imperfect growth of roots, and more especially is this so with carrots. In field culture we should always prefer that the drills be so far apart as to admit of cultivation between the rows with horse power. It takes more land it is true, but then this is amply compensated by the less amount of labor necessary to raise the crop. When labor is high it pays to use the various improved devices for tilling the soil and cultivating crops which are to be worked by horse power. If the rows are from two to two and one-half feet apart they can be readily worked by the horse-hoe, and the weeds kept down at much less expense than by hand labor. All roots demand thorough culture and freedom from weeds. Clean culture is the main secret in growing a root crop. Large returns cannot be had where the ground is allowed to be overrun with weeds, and it is always better to plant no more than can be well cultivated. Some persons make a mistake in laying out more work than can be accomplished with the usual force on the farm, and so in their effort to get through the whole, they no more than half cultivate the ground, allowing weeds to get the start; and thus root culture is abandoned because it is managed so that it does not pay. This is all wrong; it is always the safest course to start moderately, and as it were, "feel one's way" into a business until all its parts are perfectly understood. No one need expect to grow carrots, or beets or turnips, without labor. They may require more attention than the inexperienced at first expected, but they are a good investment, and will pay back for all work well directed and judiciously applied.

Some prefer the culture of carrots because they make a good feed for horses as well as cows. The crop requires more labor, because the plants are of slow growth at first, and cannot be so readily freed from weeds on this account. It is a good plan to sow radish seed at the time of putting in the crop, as the radish springs up earlier and serves to mark the rows.

Where turnips are to be planted the ground should be well manured and repeatedly plowed up to the time of sowing. This will keep down weeds and give a good seed bed. Where the ground is prepared by ridging and the seed sown on the ridges it can be cultivated earlier and with more ease than by flat culture. The quantity per acre and the profits of a root crop will depend on the manner in which it is cultivated, and cared for. By special cultivation immense yields have been made. In ordinary or fair culture from six hundred to one thousand bushels per acre on good soil may be obtained. Roots should be more extensively grown. By this means more stock can be kept on the farm, an increased quantity of manures made, and of course better profits realized than where no such culture enters into a part of dairy farm management.

TURNIP CULTURE.

In 1865 I visited Mr. Brodie of Jefferson Co., N. Y., who is well known as a breeder and importer of thoroughbred Ayrshires. He believes that turnips are the best root crop for cattle feeding, and he raises annually large quantities of them for this purpose. He practices a system of rotation in which turnips enter as a regular crop. The system is as follows: The first crop after breaking up grass land is Indian corn; this is followed by roots, generally turnips or potatoes, and the third crop is barley or oats, when the land is put down to grass by seeding with about a peck of timothy and seven pounds of clover seed per acre. From five to eight acres of turnips (Swedes) are usually sown, and as many as seventeen hundred bushels to the acre have been raised, single specimens sometimes weighing from twenty to twenty-three pounds. Mr. Brodie thinks turnips are worth 10c. per bushel when hay is $10 per ton, and the cost of raising and storing them is 2½c. per bushel, calling the use of the land $5. The tops also are worth something for feeding.

A neighbor, who made the experiment to test the value of turnip tops for milch cows, found that the increase of milk, from feeding to twenty cows, was worth $1 per day for cheese making.

For turnips the land is plowed in the fall, and cross plowed in the spring, sometimes twice, and then the drills are opened and well rotted manure applied at the rate of thirty-five loads per acre. When long manure is to be used it is forked over two or three times and applied last. The drills are made with a Scotch plow, having long handles and a long share, thus facilitating the opening of a perfectly straight row. This is important in order that the machine for weeding may cut the weeds away close up to the plants.

BONE MANURE

had been tried by Mr. BRODIE for turnips, but without giving satisfactory results. The rows are made twenty-eight inches apart, and seed sown about the 1st of June, at the rate of three pounds per acre. After the plants are well up they are thinned out to twelve inches apart and the weeds kept down between the rows by the use of a Scotch horse-hoe. This implement consists simply of a common cultivator frame, with a thin, sharp shovel-tooth in front, and two rear cultivators or knives running down perhaps six inches and then bent at right angles inward, so that this machine may be set to run close up to the plants without injuring them. It does the work effectually, leaving but little labor to be done in hand-hoeing.

HARVESTING, STORING AND FEEDING TURNIPS.

When the turnips are ready for harvesting, the men go along the rows with a sharp hoe and strike off the leaves of a plant at a blow. The tops are gathered up and given to stock, and when all are removed a team and harrow are brought into the field and the roots hauled out with the harrow. This, it will be seen, is a very expeditious mode of pulling the roots, and one that should be generally known to those who are engaged in growing turnips for stock.

In storing turnips they should not be kept too warm, and a little frost does not injure them. They generate considerable heat, and when stored in a large heap provision should be made for ventilation.

For fattening animals two bushels are fed per day; but for cows a peck at a feed and twice a day is all that is used. When "calves begin to come" and when cows are giving milk in the spring, a quart of beans per day is added to the feed of each cow. Cattle that are fed a bushel of turnips per day will not take much water.

In estimating the value of turnips as compared with hay at $10 per ton, Mr. BRODIE put them at 10c. per bushel, though he remarked that he would not sell at that because if he had a surplus it would be more profitable to purchase stock and feed for the butcher. It will be seen that under this system where from eight to ten thousand bushels of turnips are annually grown a large amount of stock can be wintered, and of course an increased quantity of manure made upon the farm.

PLAN OF ROOT-GROWING AT YORK MILLS, N. Y.

Mr. Richard Gibson, who had the management of the stock farm of Walcott & Campbell at New York Mills, and who has been very successful in managing root crops, has recently given the following details in regard to his system of growing this crop. He states that in 1869 he raised about fifteen acres of roots, which yielded at the rate of one thousand bushels per acre; and the cost, including rent of land and manures, was 6½c. per bushel. Two rods of the red mangolds yielded at the rate of two thousand and thirty bushels, by weight, to the acre. He believes there are great advantages in ridging the land for root crops, because in that way more surface soil which contains most of the properties of plant food, is next the roots. Again, one man can cultivate the ridges with the horse-hoe as easy as a man and boy can where there are no ridges. A better seed-bed also is made in this way. The ridges are about one foot wide on top where the seed is drilled. He says:

"I will commence at once with what I consider the great secret of the successful cultivation of roots, viz.: Autumnal or fall cultivation. And in endeavoring to be as concise as possible will not here give my reasons for preferring this season of the year, except to observe that we have a better opportunity of destroying foul weeds, &c., than in the hurry of spring work. The first great object to be attained is to get a fine seed bed, as soon after harvest as convenient, either by plowing, or as I prefer, with the two-horse cultivator, followed by the harrow and roller. If this has been properly done you will have a fine seed bed, when the first shower will cause all seeds of annuals, &c., lying in the soil near the surface to germinate.

"When you judge all seeds have started growing, the land should be plowed up deep, which will kill one crop of weeds—and at this time I prefer to apply the barn-yard manure. If it is coarse, would plow it under; but if well rotted and on light soils, would apply to the surface, and well incorporate with the surface by harrowing, again producing a fine seed bed, thereby causing all other seeds left in to germinate and be killed by the frosts.

"As I have before remarked, a fine mold is one of the principal objects aimed at by the root grower. We gain this the best on heavy soils by ridging in the fall; they lie thus until the latter part of April when they are harrowed down, the artificial manure sown and the ridges again made up, not reversed. The fine winter mold is thus kept at the surface, where required.

"Sowing does not immediately follow, but time is allowed for the moisture from beneath to find its way upward again, which it is sure to do. Another reason why the soil is better to be plowed up deep and made fine is, that in time of drought moisture ascends from below by capillary attraction, just as a piece of thread placed with one end in the water would become all wet from the moisture below. So do the minute particles of earth carry moisture from below upward—provided the subsoil be porous. Again, a very great source of moisture in dry seasons is the night dew, which permeates well-tilled porous soils, conveying all its rich treasures of nitrogen for the supply of the plant, but which dews could not penetrate to the rootlets of the growing plants on lands which are simply skimmed on the surface.

VARIETIES.

"There are three varieties of turnips, viz.: Swedish, or ruta-bagas, yellow and white. The white or common turnips are sown last, but used first, followed by the yellow, and lastly the Swede, which is the kind generally grown to store for winter use.

"There are also several varieties of mangolds, viz.: long, red, and yellow, the yellow and red globes, also the white or sugar beet. I prefer the globes on all soils except such as are very deep and rich, where you can get a greater weight of the long varieties; but I consider for a general crop, the yellow globe the best, being the hardiest and also most nutritious. The sugar beet I have discarded, not being able to grow such large crops, and it is apt to grow fangy, which makes it harder to pull up, and liable to break in the ground.

SOWING.

"There are two ways of sowing, either on the flat in rows from eighteen to twenty-six inches apart, or on ridges twenty-six inches apart. Each plan has its advocates. For my part I prefer the ridge on all soils except very light, as being so much easier to hoe and keep clean.

MANURES.

"Of the various kinds of manures I have used, I have found good barn-yard dung answers best, taking all soils and seasons into consideration. When I say dung, I don't mean straw and water, but manure made from animals eating oil-cake or grain, and made in sheds or good yards, with buildings well spouted—applied at the rate of fifteen to twenty-five loads per acre. But occasionally you are so situated as not to have sufficient manure to spare, therefore must use artificial, and indeed, though not absolutely necessary, it is what I would always advise, to give the young plant a good start and force it along, so as to get it out of the way of the fly as fast as possible. Nothing that I have tried answers the purpose so well as superphosphate of lime applied at the rate of two to three hundred weight per acre.

"Others may be so situated that they have no barn-yard manure to spare; in that case would sow bone dust at the rate of ten to fifteen bushels per acre, with a little quick, active manure, such as guano or superphosphate, applied at the time of sowing to give the young plant a start. What manure is applicable to one soil might not be to another; we must ascertain what suits our soil the best, there are so many circumstances to be taken into consideration—character of soil, previous course of cropping, climate, &c. It would be foolish to say bones would suit all lands, or that because guano failed on a certain soil it was good for nothing. It is like a physician prescribing for a patient when he doesn't know his disease. I have never known bones to fail, and of this you may be sure, good barn-yard manure always tells.

"The yield per acre will depend in a great measure upon the means employed; the increase being for the most part dependent upon the state of the soil, and the quantity of manure applied. It must, however be obvious, that after the land has been brought into the necessary state of tillage the next question is, to what extent manure may be applied best to facilitate the object. It becomes merely a calculation whether an extra ton of manure will or will not produce a corresponding return in weight of roots. So far as my experience has gone I have found that by an extra application of one hundred weight of suitable artificial manure at the cost of two to three dollars, from four to five tons increase of roots may be produced. The mangold being a plant of marine origin, salt is necessary to its full development. I have generally applied this in the fall at the rate of from two to four hundred weight per acre.

TIME AND METHOD OF SOWING.

"I have already noticed how important it is for the soil to be reduced to a very fine condition before the sowing of the seed; but there is another point to which it is advisable to draw attention, for the moisture of soil has a very powerful influence on the early growth of the plant, as well as upon its continual development. In ordinary seasons the usual method of sowing the seed as soon as the tillage operations are completed, appears to answer satisfactorily; but when the seasons are unusually dry, there is a great advantage gained by modifying this system. The land having been ridged and rolled, instead of sowing the seed immediately it is better to delay the operation for twelve or fourteen days. There are one or two reasons for this practice which are worthy of notice. The chief inducement is, to give time so as to enable the natural moisture of the land to rise into the recently worked soil. If you examine land shortly after it has been worked in dry weather, you will find a moist layer of earth on the surface of the ridge, which covers up a dry layer beneath. When the seed is sown upon such a ridge the moisture of the upper soil causes the seed to sprout, and as its roots pierce into the ground beneath, they enter a drier soil from which they can procure no moisture, and therefore no nourishment. This causes a check in the growth just when the turnip-fly is busy at its work; and unless there should happen to be a fall of rain, the crop is sacrificed, or at any rate seriously injured. But when the ridges have been ready for sowing twelve or fourteen days, generally the moisture of the soil will have risen into the ridge, and no such check can arise; but if the land should be too dry for the seed to sprout, then it waits for rain, and when the supply comes it grows as if it were in a hot bed. Under such circumstances it is a matter of no importance how dry the surface may be at the time of sowing.

"Mangolds should be sown in this climate early, in fact as early in the spring as the land is warm enough and in a proper condition. I generally sow before corn-planting—Swedes from the 10th to the last of June. Quantity of seed per acre, Swedes, about two pounds. For the sake of an extra half a pound of seed a crop has often been lost. Sow thick enough, so that if the fly or beetle does attack them there will be plenty left for the crop. Mangolds, if drilled, will require about five pounds, if dibbled, not so much after cultivation.

"The young plants will make their appearance in about six or seven days. As soon as they can be distinctly seen, the horse hoe should be run through them, and when the plants are about three inches high they will be ready for flat hoeing, and this is a very particular operation. If the horse hoe has been properly used, it will have left a ridge from three to four inches wide and two to three above the general level, with a row of plants in center; these are singled out with hand hoes, being careful to leave but one plant at intervals of twelve inches, and if the land is very rich, they may be left still farther apart. If your land has been properly cleaned before sowing, it will now require very little attention—running the horse hoe through a couple or three times, and it may require going over again with hand hoes. But if the weeds make their appearance, keep up the battle—you can't grow both. Whenever they show themselves keep the horse hoe moving; let them once get well ahead and you are beaten.

PULLING.

"I commence about the beginning of November. They should be safely pitted before sharp weather sets in. Mangolds are very sensitive of frost, therefore should be got up first. Turnips will stand considerable frost without injury, provided they are not bruised or handled much while frozen. We generally pull up the mangolds, give them a shake and wrench off the tops; a knife should not be used; it is better to leave a little soil on them than cut into the root, as they bleed considerably wherever the skin is broken, and are apt to decay.

"I will endeavor to describe a very expeditious way of gathering turnips; where your crop is large and soil dry it answers well, and is very cheap: Take a sharp hoe and cut off the tops of two rows, gathering them with your foot as you go along. When you have gathered a good sized heap, pull up with your hoe a few turnips where the heap is to be placed. Another man brings along two more rows and piles his tops on the same heap, so that the tops from four rows are piled in one row of heaps. Care must be taken to pile the tops in rows each way, and make good large heaps. When all the tops are cut off, run a chain harrow between the heaps of tops, and in an hour or two cross harrow them, which will shake off all the soil and take them up clean. A common drag will answer, but a chain harrow is better, not bruising the turnips in the least. For three years I have taken eight to ten acres up each year, and they keep until June; and no rotten ones.

STORING.

"If you have not cellar room sufficient to store all your roots, they may be kept equally well, in fact, I believe, better, for late feeding, by properly pitting. They may either be stored in heaps in the field where grown, or carted home, near barns, and pitted in long heaps, about four or five feet wide at the bottom, and arranged as high as will stand, gradually sloping toward the top; the piles to be covered with a few inches of straw and then about ten inches of soil, well beaten down, so that there are no cracks or open places where the frost can enter. Care should be taken that the piles are made on top of the ground, in dry situations; and at intervals of six or eight feet drain tiles or wisps of straw should be placed in the ridge to allow the heat and steam to escape, for after being placed in large heaps they always heat more or less, and if there is no vent for the steam, &c., to escape it rots the roots. More roots are rotted every year by being covered too close than by frost.

"I have not said much about carrots, as I have discarded them for cattle, because I believe we have in the turnip and mangold nearly everything desirable in the root crop. For horses, probably they are better, also for butter making in winter. But they have always cost me twice as much per bushel as mangolds have done, and for causing a flow of milk I am perfectly satisfied that the mangold is altogether superior. On finishing our carrots one year ago, and commencing to feed mangolds, our cows increased their milk very perceptibly.

"If I were asked to name the best root for all purposes, I should have no hesitation in naming the globe mangold. 1st. It can be grown on land unkind for the growth of tnrnips. 2d. Such lands will bear a much heavier crop. 3d. It may be kept much later in the season, and if fed judiciously with other food it is equal, if not superior, in its fattening qualities, to the best kind of turnips. 4th. It has fewer enemies, the cut worm being the only insect that I have found to prey upon it here. 5th. Let it once get fairly established in the ground before hot weather sets in, and drought has very little effect on it—standing dry weather better than any crop with which I am acquainted. You may lose a little in quantity but gain in quality.

"The turnip, though it has its enemies, has also its good qualities, indeed for pregnant animals I prefer it to the mangolds; also for fattening stock up to April, when the mangold is better and increases in nutrive value. For butter making in winter I have no doubt that the parsnip is one of the best roots, ranking fully as high as the carrot, but from my own experience, I cannot recommend them for field culture, as they require so much hand weeding, and being so long before they come up, give the weeds such a chance. I have always been able to grow mangolds at one-half the price per bushel, and for causing a flow of milk, I consider them superior.

ROTATION OF CROPS.

"A root crop here can never bear the same relation to other crops in the rotation as it does in England; there it is the great crop for cleaning and manuring the land for another course; here it must be grown in a great measure for the value of the root alone; there, half the crop is generally eaten on the field where grown, by sheep, the other half being fed to cattle in sheds; here, it must be regarded more as a crop which may be profitably used to keep our cattle and sheep in a growing and healthy condition through long winters. As a crop in the rotation, I would take a field that wants cleaning, as you have a better chance to get your lands clean with roots than any other crop, though they may cost you more a ton to produce. After roots, if your climate is suitable to the growth of barley, I would sow that, and seed down, as it is well known that grass seeds 'catch' better with barley than anything else, and the soil after turnips, with the constant hoeing, is generally in such a friable state as barley delights in. After turnips last year, I sowed oats on a small piece of one acre, two roods and three perches; have just finished them; there were ninety-one bushels—and one man was threshing part of a day, which were not measured—in all there would not be less than ninety-six to ninety-eight bushels. The grass seed also grew well."

BEETS.

Hon. HENRY LANE of Cornwall, Vermont, who has been very successful in raising large crops of the American Improved Imperial Sugar Beet, thus details his manner of cultivation in an essay before the Vermont Dairyman's Association. He says:

"A light sandy soil is least suitable to the growth of the sugar beet, while the various loamy soils, and especially those containing a large proportion of clay, are best adapted to its growth.

PREPARATION OF THE SOIL.

"In the first place, all stagnant water, either on the surface or within reach of the roots of the beet, should be removed by thorough drainage. Although the beet requires a large amount of moisture to carry on a vigorous and healthy growth, yet I know of no plant that will show the presence of stagnant water quicker than the beet by its assuming a yellowish hue and sickly aspect. It will not extend downward its usual length, but on reaching water will divide into numerous small furzy roots, which spread in all directions, to the great injury of the crop; hence, in the preparation of most soils, and especially clay soils, thorough drainage is necessary. Land intended for beets should be kept in high condition by a liberal application of fine manure, at least twenty-five loads per acre. If your soil contains quite a per cent. of clay, it should be plowed in the fall, as the action of the frost will mellow it. Avoid sowing on turf land, for the turf will obstruct the tap-root and thus induce a development of furzy lateral roots, much to the injury of the crop. After the manuring and plowing have been done, harrow the ground until mellow, ridge with the double moldboard plow, making the ridges thirty inches apart, flat down the ridges with a garden rake. I sow with HARRINGTON'S or HOLBROOK'S seed sower, at the rate of four pounds of seed per acre.

TIME OF SOWING.

"With beets the success of the crop depends very much upon early sowing. The very first suitable weather after the frost is out and the soil sufficiently dry to be worked, should be improved even if this is as early as the middle of April. Beets, after growing to one half-inch in thickness, form a concentric ring or layer about every fifteen days; these vary in number from six to ten, depending upon the length of the season after planting. The oldest leaves are those at the bottom of the crown, and are in direct communication with the older and central layer. As new leaves are formed, the central leaves on the top of the crown communicating with the last and external layer, each succeeding layer being external to the one preceding it, its diameter and bulk increases in an increased ratio, the last two being at least equal to the four internal ones, consequently doubling the crop, and this generally after the first of September.

DISTANCE BETWEEN ROWS AND PLANTS IN THE ROW.

"I would not have the distance between the rows less than two feet or more than two and one-half feet. This latter distance I consider the best, as it gives more space to run the cultivator. It is always better that the crop should be made up of large, sound roots, than that it should consist of a great number of smaller ones, even though the weight be the same per acre. The large roots require less labor from the singling out to the final harvesting of the crop, and indeed, till they are fed out. I leave the plants eighteen inches apart in the row. If the plants stand eighteen by thirty, there will be eleven thousand six hundred and sixteen per acre. At this distance, each beet weighing eight pounds, would give to the acre forty-six and a-half tons.

SINGLING AND HOEING THE CROP.

"After the plants have put forth their second pair of leaves, the cultivator should be run between the rows, and the "bunching" should follow. This is done with a hoe, cutting out twelve or fifteen inches, leaving about three inches in the drill untouched all along its length. Soon after bunching, the singling and weeding should be performed. After singling out the plants and the first weeding is performed, the after labor is accomplished by the hoe and cultivator, requiring but little more labor than an ordinary hoed crop. Beets require a large amount of moisture, and by frequent tillage, keeping the surface light and porous, the soil will retain this necessary moisture.

HARVESTING.

"In ordinary seasons, the middle of October is the best time for harvesting this crop. This variety of beets can be lifted by hand without the use of a fork. The roots when pulled are left lying in the rows until dry. The tops are removed by wrenching them off by hand or cutting with a knife. If the knife is used care should be taken not to injure the crown of the beet. As the tops are removed, place the roots in heaps to dry, and go through the

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sweating process previous to their removal to the cellar. Protect them at night and from storms with their own leaves. After two or three days, they can be stored in the cellar for winter use, and if stored dry, will keep sound, even if hundreds of bushels are placed in one pile.

COST OF RAISING.

"If we would make a field crop of the beet, we must avoid the old practice of doing all the labor with the hoe, thumb and finger, and give them clean culture by the frequent use of the horse cultivator. They can be raised for five cents per bushel (of sixty pounds). At this low cost, and considering their great value as food for cattle, sheep and swine, how can a farmer think of wintering his stock without his cellar of roots. This subject is well deserving the attention of all farmers."

ANALYSIS OF MANGOLDS AND TURNIPS.

The following table, the result of analyses by Sir HUMPHREY DAVY and Mr. HEREPATH, shows the comparative value of the sugar beet with mangolds and turnips.

QUANTITY OF NUTRITIOUS AND FAT-PRODUCING ELEMENTS IN 1000 PARTS.

	Mucilage or Starch.	Sugar.	Gluten or Albumen.	Total.
Swedish turnips,	9	51	2	62
White turnips,	7	34	1	52
Mangold wurzel,	13	119	4	136
Orange globle wurzel,	15¾	106¾	1½	134
Sugar beet,	17¾	126¾	1¼	145¾

COTTON SEED MEAL.

Cotton seed meal has not been used to any great extent by American dairymen as a feed for milch cows. Among those who have used it for this purpose there is some difference of opinion as to its value. In 1866, while going through the dairy districts of England, I found farmers often speaking of cotton seed meal, and commending it as a highly nutritious and valuable food for milch stock. With some it was preferred to linseed cake, and much surprise was manifested that its use had not become general in the dairies of America. The question of what is the cheapest and best food for milch cows is one of considerable importance to the dairy farmer, and is by no means settled. Some insist that good pasturage and early cut, well cured hay are sufficient for the summer and winter keep of cows; while others regard it profitable to give in addition to the above a daily allowance of grain or meal of some kind. With the constant variation in the price of different grains, it often becomes quite difficult to determine which is relatively the cheapest for feeding purposes. A scale of prices based upon the experimental or nutritive value of different kinds of foods for animals, would be extremely useful to farmers, since I am convinced that many feed in a hap-hazard way and without knowing whether the cheapest or the dearest food is employed.

To the general lack of knowledge in respect to the comparative nutritive value of different kinds of food for stock may be attributed, at least to some extent, the limited use of linseed cake and cotton seed meal among the stock-keepers of the country.

In regard to the value of cotton seed meal for milch cows, I find an interesting statement from Mr. A. W. Cheever, in the Massachusetts Ploughman. He gives the experience of farmers in Cumberland and Franklin, where cows are made to yield a large quantity of milk by a daily allowance of the meal. Mr. Morey, he says, showed him cows that would yield, at their best, twenty-four quarts, and were, at the time of his visit, giving from twelve to sixteen quarts. In summer, each cow gets, in addition to pasture, two quarts of cotton seed meal. Mr. Belcher also feeds in the same manner. They both think very highly of cotton seed meal for feed.

Mr. B. was formerly cautious in the use of it. Now he buys a cow and immediately puts her on a full feed of cotton seed meal. "He bought a cow last spring for seventy dollars that was claimed by the owner to give twelve quarts. He now milks eighteen quarts from her daily.

"Mr. Morey says if he is out of cotton seed one day his cows will shrink a quart each, and neither Indian meal or wheat shorts will keep them up to their quantity; but after feeding cotton seed again one day they will come up again to their full rate. Neither of the gentlemen named have ever had a case of garget or swelled udder on their premises," &c.

Mr. Cheever says he knows of other herds in the town of Franklin that are fed on cotton seeds very freely, that are healthy and free from anything like garget. In his own experience he has been quite cautious in the use of cotton seed, having rarely fed more than two quarts per day to a cow, but with such examples is inclined to feed more boldly in the future, "as it is one of the cheapest grains he can buy, and, according to the chemists, one of the richest."

Dr. Voelcker, who some years since made a number of analyses of cotton cake and cotton seed meal for the purpose of determining its nutritive value, speaks of it as a most valuable feeding substance. He says the best decorticated cotton cake has a light yellow color and is free from any strong smell; neither has it any well-defined taste.

Mixed with water in a roughly powdered state it does not become gelatinous like linseed cake; nor does it develop any pungent smell under this treatment like rape seed.

Cotton cake does not contain any large amount of mucilage nor anything that produces, on mixing with water, a volatile, pungent and injurious essential oil.

Cattle often take at once to it, and even when fed upon linseed cake they soon get accustomed to the taste of cotton cake and apparently eat it as readily as linseed cake. It contains very high and much larger percentage of flesh-forming matters than linseed cake. This circumstance suggests that cotton cake may probably be given with great advantage to *young stock and to dairy cows.* As by far the largest proportion of the nitrogen of food is nct assimilated in the system, but passes away with the excrement of animals, the dung produced by stock fed upon cotton cake will be found particularly valuable.

In comparison with linseed cake, there is much less mucilage and other respiratory matter in cotton cake. This deficiency is compensated, to a certain degree, by the larger amount of oil in cotton cake. The proportion of indigestible woody fiber in decorticated cotton cake is small, and not larger than in the best linseed cake. Lastly, it may be observed that the ash of cotton cake is rich in bone material, and amounts to about the same quantity as that contained in other oil cakes.

Two specimens of cotton seed meal, on analysis, gave the following results:

	No. 1	No. 2
Moisture	9.40	10.21
Oil	17.39	19.71
Albuminous compounds (flesh forming matters)	43.81	40.25
Gum, mucilage, sugar and digestible fiber (heat producing substances)	11.21	16.38
Indigestible woody fiber	10.44	5.84
Inorganic matter (ash)	7.75	7.61
	100.00	100.00

On analyzing the ash of the cake it gave the following average composition:

Potash	39.045
Soda	None.
Chloride of sodium	None.
Lime	3.750
Magnesia	13.500
Oxide of iron	1.530
Phosphoric acid	39.649
Sulphuric acid	.930
Carbonic acid	.363
Soluble silica	3.252
Insoluble silicious matter (sand)	17.706
	99.724

From this analysis it will be seen that, for the purpose of supplying animals with bone material, cotton seed is a very valuable kind of food.

The conclusion which Dr. Voelcker draws from his numerous analyses is as follows:—"The best cotton cake is richer in oil and albuminous (flesh-forming) compounds than linseed cake, but contains less mucilage and other respiratory constituents. The mineral portion of cotton cake resembles closely, in composition, that of linseed and other oil-cakes. Like the ash of all cakes it is rich in earthy and alkaline phosphates, and well adapted to supply animals with bone materials. Genuine oil meal is simply thick, decorticated cake reduced to a coarse powder, and of course has the same composition as the cake from which it is made. Decorticated cotton cake and oil meal, in comparison with other kinds of artificial food, are decidedly cheap feeding materials."

In the early manufacture of cotton seed meal, injurious effects were sometimes attributed to its use as a cattle food, on account of the large percentage of indigestible woody matter, or husk of the seed which it contained. This hard shell in which the kernel of cotton seed is encased being removed or taken out by the manufacturers of the cotton seed meal, makes it unobjectionable in this respect.

LINSEED.

This is the seed of the flax plant, the *Linum usitatissimum* of botanists, and the type of the linaceous group of vegetation. The seed contains on the average about twenty-two per cent. of oil, ten of sugar, forty-five of starch, and eighteen of albuminous matters. When the oil is expressed the residuum is linseed cake, a highly nutritious cattle food; as are also the seeds themselves in a crushed or half-boiled state. There can be no doubt of the nutritive advantages of the plan of crushing and boiling the flax seed, and steeping in the liquid the usual allowance of dry food, over that of giving animals the seed whole and alone, or in conjunction with dry food in its ordinary state. The plan which has been found to answer best is to mix the crushed or ground linseed in the proportion of one of linseed meal to one gallon of water, adding three pounds of beans, peas or oatmeal, to neutralize its oleaginous properties, and to give it when cool. It is stated that a cow supplied with the usual feed of hay and turnips, which gave four quarts of milk per day, yielded eight quarts, besides improving in condition "on getting two additional feeds from one bushel of flax seed chaff pressed in a tub of boiling water, allowed to stand for twelve hours, and mixed with two pounds of oatmeal and four ounces of salt." These feeds were thus given: The first feed of steamed mixture at 7 A.M.; then some hay; at 10 A.M. thirty pounds of sliced turnips; the cows were then let out for two hours, until the house was cleaned out and fresh littered; the next feed was thirty pounds each of mangold wurzel, and at 7 P.M. another steamed feed and hay for the night.

LINSEED CAKE

is well known as a fattening food for cattle, and for milch cows it is useful in moderate quantities as a means of keeping up their condition, and thus securing richness in their produce.

RAPE CAKE

is of very similar properties and value. From four to six pounds given daily to each cow, at the same time that it greatly diminishes the requisite supply of other food, will very much enrich the milk. In nutritive value 22-3 parts of these oil cakes are equal to 100 parts of good hay. From experiments made by Mr. Thompson on the comparative effect of linseed and beans during equal periods in producing milk and butter, it was found that the amount of milk produced by beans was equal to the mean of that produced by linseed during ten days; the amount of butter under the bean diet was greater than under that of any other kind of food whatever. This is an important fact in reference to the soures of butter in the food, since the linseed meal employed in the experiments contained twice as much oil as the bean meal.

LUCERNE.

The *Medicago sativa* of botanists and a member of the leguminous family. It is a deep-rooting perennial, with clover-like stems, and is, in a mild climate or on a good deep calcareous soil, one of the most productive sources of green food, yielding more than clover and being considered by some to be even superior in quality. Good grass, however, such as the Italian rye-grass, must be considered a better food. The seed is sown early in April, and during the season four cuttings at least may be taken. A fourth part of an acre will yield an ample supply for one cow during the soiling season. This and similar green crops, which if taken in excess are liable to render the animals "hoven," may be safely given when slighty air-dried. Lucerne contains in 1000 parts, 750 of water, 143 of woody fiber, 44 of gum, 22 of starch, 19 of albumen, 8 of sugar, &c. Its inorganic constituents contain a large preponderance of lime, with considerable quantities of potash, soda, phosphoric and sulphuric acid. Compared with meadow hay its nutritive value is represented by 83, the latter being 100.

THE DIFFERENT CLOVERS CONSTITUTE

probably, as valuable food for cattle generally as the true grasses, and for milch cows they excel in the principles essential to an increased flow of rich milk. The analysis of the three important species used for both fodder and hay, substantially, as given by EINHOF and CROME, are as follows:

	RED CLOVER.	WHITE CLOVER.	LUCERNE.
Water	76.0	80.0	75.0
Starch	1.4	1.0	2.2
Woody fiber	13.9	11.5	14.3
Sugar	2.1	1.5	0.8
Albumen	2.0	1.5	1.9
Extractive matter and gum	3.5	3.4	4.4
Fatty matter	0.1	0.2	0.6
Phosphate of lime	1.0	0.9	0.8

STRAW.

Straw, besides its value as litter has, when of good quality, considerable value as fodder. Cut up and soaked in emulsions of linseed or similar preparations, it serves the important part of giving bulk to the richer kind of food, while it is not itself innutritious. The best straw for this purpose is that of the oat. The nutritive equivalent and percentage of nitrogen in the different kinds of straw is shown in the table given below, as compared with meadow and clover hay:

NITROGEN IN DIFFERENT STRAWS.

	Nutritious equivalents.	Percentage of Nitrogen.		Composition per cent.					
		Dried.	Undried	Water.	Woody fiber.	Starch, gum and sugar	Gluten, albumen &c.	Fatty matter	Saline matter.
1. Meadow hay,	100	1.34	1.15	14	30	40	7.1	2 to 5	5 to 10
2. Red clover hay.........	75	1.70	1.54	14	25	40	9.3	3 to 5	9
3. Rye straw....	479	0.30	0.24	12 to 15	45	38	1.3	2	4
4. Oat straw....	383	0.36	0.30	12	45	35	1.3	0.8	6
5. Wheat straw,	426	0.36	0.27	12 to 15	50	30	1.3	2 to 3	5
6. Barley straw,	460	0.30	0.25	12 to 15	50	30	1.3	2	5
7. Pea straw....	64	1.45	1.79	10 to 15	25	45	12.3	1.5	4 to 6

CONSTITUENTS OF FOOD OF ANIMALS.

The importance of attention to the proper constituents of the food of animals is very properly insisted on by Dr. Thomson in his little work entitled "Experimental Researches on the Food of Animals," and is clearly pointed out in the table given in the next page, which I have extracted from it. From this it is evident that food containing the greatest amount of starch or sugar does not produce the greatest quantity of butter, although these substances are supposed to supply the butter; but the best product of milk and butter is yielded by those species of food, which seem to restore the equilibrium of the animals most efficiently. The first column in the table represents the food used by two cows; the second column gives the mean milk of the two animals for five days; while the fourth contains the amount of nitrogen in the food taken by both animals during the same period.

	Milk in five days.	Butter in five days.	Nitrogen in food in five days.
	lbs.	lbs.	lbs.
1. Grass....................................	114	3.50	2.32
2. Barley and hay...........................	107	3.43	3.89
3. Malt and hay.............................	102	3.20	3.34
4. Barley, molasses and hay.................	106	3.44	3.82
5. Barley, linseed and hay..................	108	3.48	4.14
6. Beans and hay............................	108	3.72	5.27

"From this table," continues Dr. Thomson, "We may infer that grass affords the best products, because the nutritive and calorifiant constituents are combined in this form of food in the most advantageous relations. The other kinds of food have been subjected to certain artificial conditions, by which their equilibrium may have been disturbed. In the process of haymaking, for example, the coloring matter of the grass is either removed or destroyed by fermentation, while certain of the soluble salts are removed by every shower of rain which falls during the curing of the hay."

OATS.

Oats are of the least value for fattening purposes of all the cereals, and, unlike the others, the meal is most nutritious when made from the kernel alone. When made into bread, it possesses very great nutrition and excellence. It is rich in flesh-formers, and consequently valuable for food for the laboring classes, in furnishing elements contained in a meat diet, which is not always attainable to them. This is particularly the case in portions of Europe, where it furnishes one of the principal articles of food. The composition of oats, after most of the husk has been removed, is as follows:

Water	14.0	Or economically:	
Gluten and albumen	18.0	Water	14.0
Starch	39.9	Flesh-formers	18.0
Sugar	5.3	Fat-formers	51.1
Gum	2.8	Accessories	14.7
Fat	5.9	Mineral matter	2.2
Fiber	11.9		
Mineral matter	2.2		

It is a fact worthy of remark, that of one hundred pounds of oats, two-ninths, or about twenty-three pounds, consist of husks, which are of no value as food. Oats are most valuable as food for horses, and in this country are used almost entirely for this stock.

BARLEY.

The composition of barley is as follows:

Water	13.9	Or, economically,	
Gluten	13.0	Water	13.9
Starch	47.5	Flesh-formers	13.0
Sugar	4.1	Fat-formers	52.0
Gum	3.5	Accessories	16.9
Fat	0.4	Mineral matter	4.2
Fiber	13.4		
Mineral matter	4.2		

BUCKWHEAT.

Buckwheat, although valuable for fattening purpose, is grown but little in this country, comparatively with other grains. The composition of the grain when ripened is:

Water	14.0	Or, economically:	
Gluten	9.0	Water	14.0
Starch	48.0	Flesh-formers	9.0
Gum	2.5	Fat-formers	52.1
Sugar	2.5	Accessories	23.3
Fat	1.6	Mineral matter	1.6
Woody fiber	20.8		
Mineral matter	1.6		

The good returns, easy cultivation on poor soils, and ability to stand extremes of temperature, render this a desirable grain on the farm, and there is no reason why it should not occupy as high a position as some of the other cereals.

Table of comparative equivalents of different Cattle Foods.

Foods.	Percentage of flesh formers in one hundred pounds.	Percentage of fat formers in one hundred pounds.	Total nutritive percentage in one hundred pounds.	Nutritive equivalents of one hundred lbs. of superior English hay.
Irish potatoes,	1.4	18.9	20.3	245.3
Carrot,	0.6	6.6	7.2	691.6
Parsnip,	1.2	7.0	8.2	607.3
Jerusalem artichoke,	1.0	18.8	19.8	251.5
Sugar beet,	0.9	13.6	14.5	336.5
Swedish turnip,	1.0	5.2	6.2	803.2
Common white turnip,	0.9	3.3	4.2	1185.7
Mangold wurzel,	1.0	12.6	13.6	367.6
Green pea stalks,	0.9	7.9	8.8	565.9
Spurry (green),	2.7	2.3	5.0	960.0
Green stalks of Buckwheat,	0.2	4.7	4.9	1016.3
Common vetch (green),	1.9	2.6	4.5	1106.6
French vetch (green),	0.7	4.7	5.4	922.2
Green stalks of white lupine,	1.8	2.3	4.1	1212.1
Green stalks of white bean,	1.0	2.7	3.7	1345.9
Green oats (fodder),	1.0	8.5	9.5	524.2
Green timothy grass,	4.0	9.7	13.7	363.4
Green red-top grass,	3.3	8.7	12.0	415.0
Superior English hay,	13.5	36.3	49.8	100.0
Red clover (green)	2.0	3.6	5.6	907.1
White clover (green),	1.5	2.7	4.2	1185.7
Lucerne (green),	1.9	3.6	5.5	905.4
Red clover (hay)	22.5	18.7	41.2	120.8
White clover (hay)	18.7	40.0	58.7	84.6
Lucerne (hay),	12.7	38.0	50.7	98.2
Wheat flour,	14.7	66.4	81.1	61.4
Indian corn,	11.0	66.7	77.7	64.2
Rye meal,	14.3	55.8	70.1	71.0
Barley meal,	13.0	52.0	65.0	76.0
Oat meal,	18.0	51.1	69.1	72.0
Buckwheat meal,	9.0	52.1	61.1	81.5
Peas,	23.1	41.9	65.0	76.0
Kidney Beans,	23.9	39.3	63.2	78.7
White field beans,	24.0	39.7	63.7	78.2
Lentils,	25.7	38.9	64.6	77.0
English linseed cake,	22.1	51.0	73.1	68.0
American Linseed cake,	22.2	48.6	70.8	70.3

A careful examination of this table, prepared from the best English, American and German authorities, and the comparison of the money value of these articles of food, modified as experience may suggest, with their feeding value as here given, would be of immense benefit to farmers, and save them much money, often injudiciously expended.—*U. S. Ag. Rep.*, 1865.

STOCK—SELECTION, CARE AND MANAGEMENT OF FOR THE DAIRY.

Which is the best breed of cows for the Dairy and how is it to be obtained? This question has been before the dairy public for the last quarter of a century, and to-day is by no means settled among practical dairymen. If you go among the breeders of thorough-bred stock, you will get no end of argument, backed by a formidable pile of statistics, to show that this or that breed is best. It is now Short-horns, then Ayrshires, or Alderneys, or Devons, or Dutch cattle; just as you happen to meet those interested in one or the other of these breeds.

Now it may be presumed that none of these men intend to mislead; for they may have strong convictions of the truth of what they advocate, and, under certain conditions, I think it might be proved that either would be right. But that any one of these breeds is best adapted to all soils, all climates, and for all purposes, is quite another matter, and which is not true in fact. The practical questions for dairymen to decide are, *first*, what breed of cattle is best adapted to the climate, the soil and the surface of the country, or farm where the stock is to be kept, and *second*, what breed is best adapted to the particular purpose for which it is wanted. It would, it seems to me, be exceedingly poor economy for the butter maker, located on a rough, hilly surface, affording scanty herbage, to select short-horns; because they are not an active race, and demand a plentiful supply of nutritious food, food easy to be obtained. And to the cheese dairyman, located on a level or slightly undulating surface, yielding an abundance of rich food, who desired to get the greatest profit from making cheese and *beef*, it would be equally bad economy to select the Alderney. And yet if one was to engage in butter dairying alone, where extra quality and high prices were looked after sharply, the Alderney might serve his purpose altogether best.

It is from overlooking certain conditions, and hoping to realize every excellence, such as quality and quantity of milk, of butter, of cheese, of beef with activity and endurance all centered in some one breed, that has caused so much dissatisfaction and difference of opinion among dairymen, in regard to particular breeds.

I have not proposed to discuss the breeding of stock at length, and in its various relations. The subject is a broad one, and a better knowledge of it can be had by taking up some special treatise like the admirable little work, for instance, of Mr. Goodale, Secretary Maine State Board of Agriculture, or that on American Cattle, by Hon. Lewis F. Allen. But what I have proposed is to to touch briefly upon some leading points of most practical utility to dairymen. Without entering upon the history of the different races of horned cattle, it will be sufficient to state that cattle have been domesticated from the earliest ages, and have been so varied by breeding that it would be impossible to say from what species of wild animals they have been derived—whether they had a common ancestry in one wild species, or in several. It is contended by some that the origin of the more marked breeds is due to several wild species, and that these have contributed to make our cows what they are. But however that may be, we know that different breeds have existed from very remote times.

BREEDING INSTEAD OF PURCHASING COWS.

No one will deny that one essential requisite to success in dairying is to have good cows for the business, and in considering how this is to be obtained, it is evident the surest method would be to rely upon breeding animals upon the farm where they are to be used, rather than to purchase at random from droves, providing a kind, or race of animals can be obtained that will transmit desirable qualities or excellencies from geueration to generation with reasonable certainty. Experience teaches us that we cannot rely upon the common stock of the country, to transmit any desirable quality with that certainty we can obtain from cultivated breeds which have been long bred in reference to special qualities, and have, in consequence, established a fixed type in this regard. I think our dairymen need not look beyond four or five breeds of thorough-bred cattle for obtaining desirable results; namely, the Short-Horns, the Ayrshires, Devons, Alderneys, and the Dutch or Holstein cattle. There are other breeds more or less famous in the districts where they originated; such as the Galloways, the Kerrys, the Herefords, the Bretons, the Swiss and other European varieties. Some of them, at least, when transported from their native districts, have not given such satisfaction on the whole as the breeds I have named.

ACCLIMATED CATTLE.

Again it is of some importance to have cattle acclimated. How long it may take a race of cattle reared in a climate different from ours, to become perfectly adapted to the change from one country to another I cannot say, but it evidently requires some time. Hardiness and good constitution are of the utmost importance in milch stock. The drain on vitality from the yield of milk for long periods together, with the annual production of the calf is excessive, and hence the greatest attention should be given to this point. For what would it avail to have cows capable of yielding an enormous product, that were wasting away with consumption, or of so little vitality as not to be able to resist disease or the ordinary inclemencies of our climate? I have seen such herds and the cost of nursing and keeping them up, with the annual loss of stock, left no profit in their product.

BREEDING FROM HEALTHY ANIMALS.

From ascertained physiological laws, says Prof. VERRILL, "it appears that the ova of the female which are to become the germs of the future young, begin to develop at a very early period and continue to increase up to the time of impregnation. It is obvious then that constitutional diseases or imperfections, will be most likely to affect the ova. Hence only healthy or vigorous females should be used for breeding purposes, and they should be in the prime of life—not too young nor too old. It is equally important that the male should be perfectly healthy and sound, and free from all constitutional and hereditary diseases or imperfections.

THE EXCESSIVE USE OF THE MALE

for breeding purposes, either by placing him with too many females, or employing him too often, is to be carefully avoided. The production of spermatozoa is one of the most exhaustive operations of the animal system, and if carried to excess, not only weakens the organs and destroys more or less the vitality of the spermatozoa, but seriously impairs the general health, and especially the nervous system." I feel it the more incumbent to allude to this point because over a considerable area in New York, and in other dairying districts,

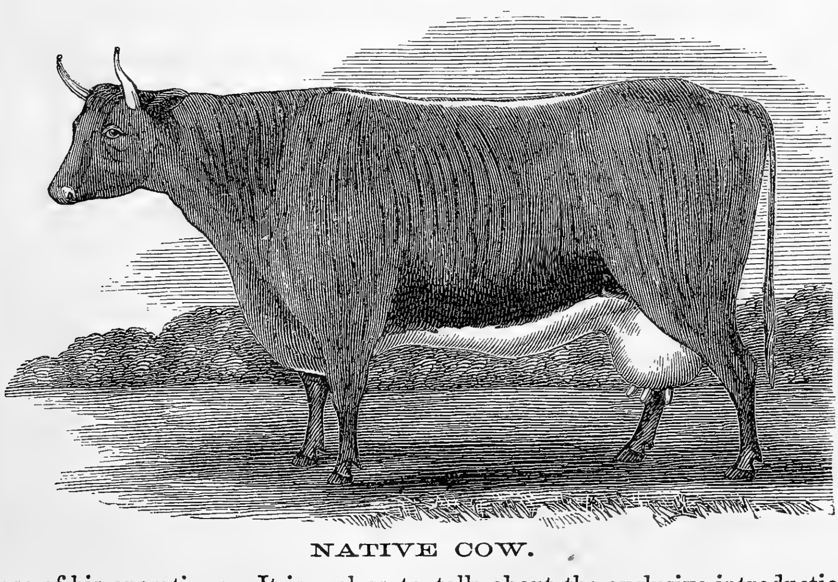
ABORTION

is excessively common among cows, and has become epidemic, causing immense loss. In New York commissioners have been appointed by the State, and have carried their investigations over the infected districts during a period of three years, but without arriving at any positive conclusion as to the cause of the disease. It doubtless has its origin in several causes, and it is strongly suspected that one of the principal causes of the disease is the employment of inferior males, or those that have been so over-taxed by excess as to weaken the reproductive organs and impair the quality and quantity of spermatozoa. A low vitality too, of the cow from excessive milking and perhaps constitutional imperfections, operating with the other, have doubtless had an influence in developing this disease. "From the manner in which the young becomes united with the mother, so that the liquid portion of the blood may pass freely from one to the other, we may readily understand how the health or food of the mother may affect the embryo, or also how the mother's blood may be affected by the constitutional peculiarities of the embryo; and therefore, since the embryo partakes also of the qualities of the father, how the mother may be so affected indirectly by the peculiarities of the male, that she may transmit those qualities to subsequent young by other males. The tainting of the mother's blood is produced in this manner.

Examples of this are common where a mare has first brought forth a mule. Subsequent colts for several years will present more or less the mulish features. One of the earliest and most striking cases recorded, occurred in 1815, when a pure Arabian mare was served by a quagga, a species of wild ass, striped somewhat like a zebra. The resulting hybrid had the quagga characters well marked. Afterwards, in 1817, 1818, and 1821, she had colts by a pure blooded black Arabian horse, but each of them bore more or less of the peculiar features and markings of the quagga, although she had not seen him after 1816. Cases have been noticed in breeding between horned and hornless breeds of sheep and cattle, where the first calf of a cow of a hornless breed has been by a bull having horns, subsequent calves, although by bulls without horns, and of the same pure blood as the cow, have had long horns. Similar facts have often been noted in regard to dogs. A bitch of pure blood having once had pups by an inferior dog, will not afterward produce pure-blooded pups by a dog of her own breed. From these facts all breeders of choice animals should learn the necessity of allowing females to breed only with pure-blooded or desirable males, even if all the young are not to be reared."

CROSSING COMMON STOCK WITH THOROUGH-BREDS.

As a general rule however, the dairyman must rely upon the common stock of the country on the one hand and the thorough-bred bull on the other, for the



NATIVE COW.

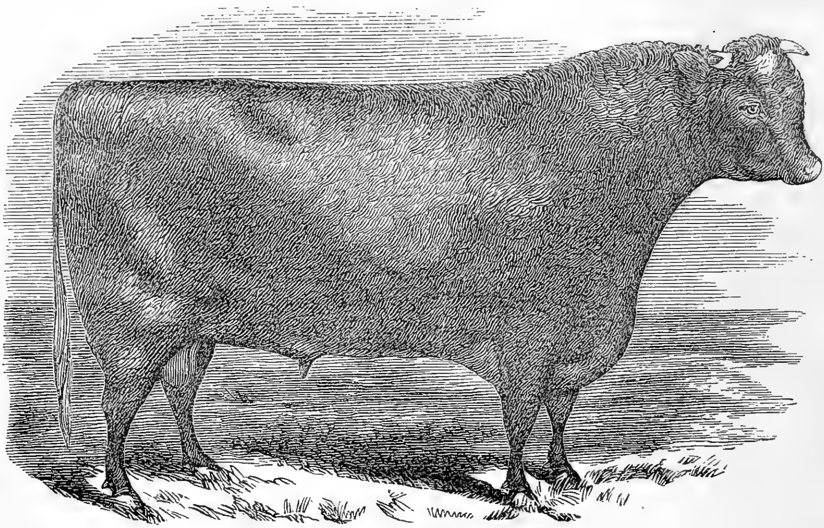
base of his operations. It is useless to talk about the exclusive introduction of pure thorough-breds to meet the present wants of dairymen. The animals would be altogether too expensive even if it were possible to find them. Again, it may be doubted whether any advantage would be gained in the mere production of milk, over a judicious crossing of common stock with thorough-breds. The grade animal, as a milker, may prove equal to or even superior to the thorough-bred. It may be better acclimated and, as a rule, is more hardy. Losses are constantly occurring from time to time in every herd, from accident and disease. A portion of the herd must be turned off for this reason and on account of age. The only practical course, therefore, it would seem for the majority of dairymen is, to start with a good herd of native stock, using a thorough-bred bull, and breed up to the qualities desired. In saying this I do not object to the breeding of thorough-bred stock on dairy farms; that may be done, and may be found advisable; but I would commence at first in a small way, extending the business by degrees, as found profitable.

WHAT IS TO BE CONSIDERED IN BREEDING.

I have said, the first thing for the dairyman to decide, is the use which he intends to make of his stock, and to what breed his lands are best adapted. To this end he must have some knowledge of the leading characteristics of the several breeds from which his choice is to be made. We may, therefore briefly glance at some of the chief features of the five breeds which have been named.

SHORT-HORNS.

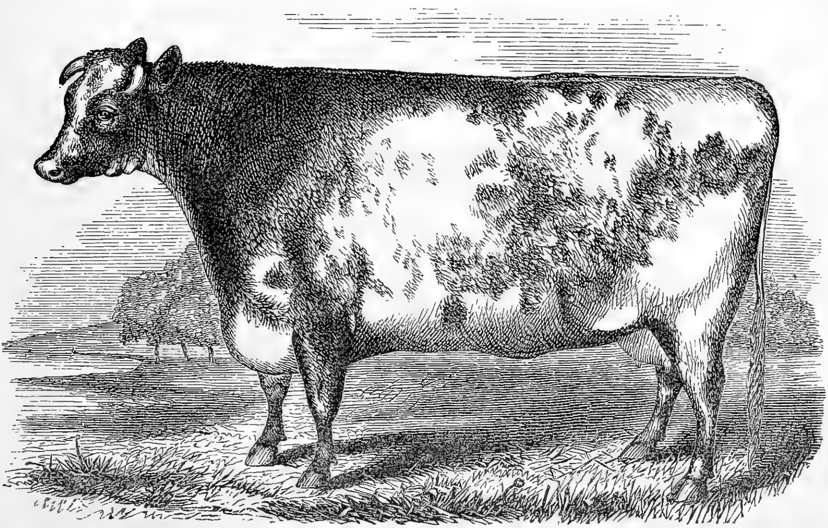
First, of the short horn or Durham, which has done more, perhaps, to improve our cattle than any other breed, and which is really the most won-



SHORT-HORN BULL.

derful exhibition of the skill of the breeder. This large, docile, and rather inactive breed originated on the richest pastures of England. It has been bred especially for beef, and from its breeding was never intended to roam over rough, hilly surfaces, and gain thrift upon the lean feed of thinnish soils.

That breeders have accomplished eminent success in this animal is unquestioned, and in nearly all countries where it has been introduced it has improved the size of cattle, and the quality as well as the quantity of beef. Some strains of this blood have been remarkable for their milking qualities, as we have abundant proof in England, and from early and late importations into this and other countries. Indeed, Mr. Allen, in his work on American Cattle, affirms that they are the greatest milkers in quantity of any breed whatever, with the exception of the Dutch, or that they may be comparatively inferior, as education, keeping, or purpose may govern. We have numerous well authenticated instances, he says, of their giving six, seven,



SHORT-HORN COW.

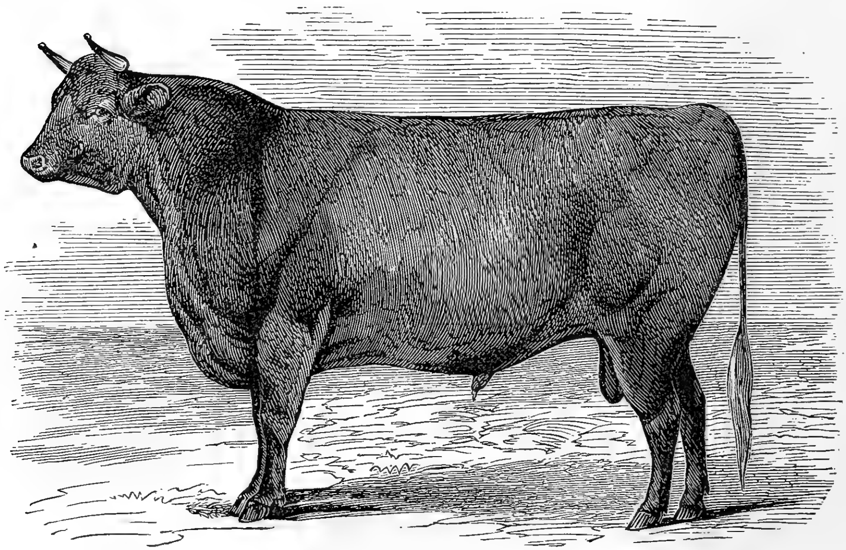
eight, or even nine gallons a day, on grass alone, in the hight of the season, and yielding fourteen to eighteen pounds of butter per week, and of holding out in their milk as well as other breeds of cows through the year. And he remarks further, that if the breeder's attention be turned solely to the dairy quality, he succeeds in obtaining, with few exceptions, good milkers. But if he turns his attention, regardless of milk, to the grazing qualities of his stock, he can gradually breed out the tendency to milk.

THE SHORT-HORN GRADES.

When Short-Horns are crossed on the common stock of the country, where good milking strains have been selected, the grades have often proved of great excellence as milkers. Upon fertile lands, rather level, or slightly undulating, and that furnish a large yield of nutritious grasses, this breed, from its peculiar aptitude to fatten readily, will naturally commend itself to those dairymen who desire to get a profit from their animals in beef, as well as in milk.

DEVONS.

The Devons originated in the south-western part of England on other and different pastures. They have another kind of beauty, and have been bred for another kind of use; not so large as the Short-Horn, thriving better on thinner soils and poorer forage, making good working oxen, and tolerably good milkers; in fact, more of an animal for all uses than the Short-Horn, but inferior to it for certain special purposes in certain localities. The Devon yields a milk of rich quality, that will yield more butter in proportion to quantity than that of any other breed, except the Alderney. She is in some respects well fitted for a dairy cow, being docile in temper, easy of keep and readily managed. Her udder is of good shape with good teats, the milk



DEVON BULL.

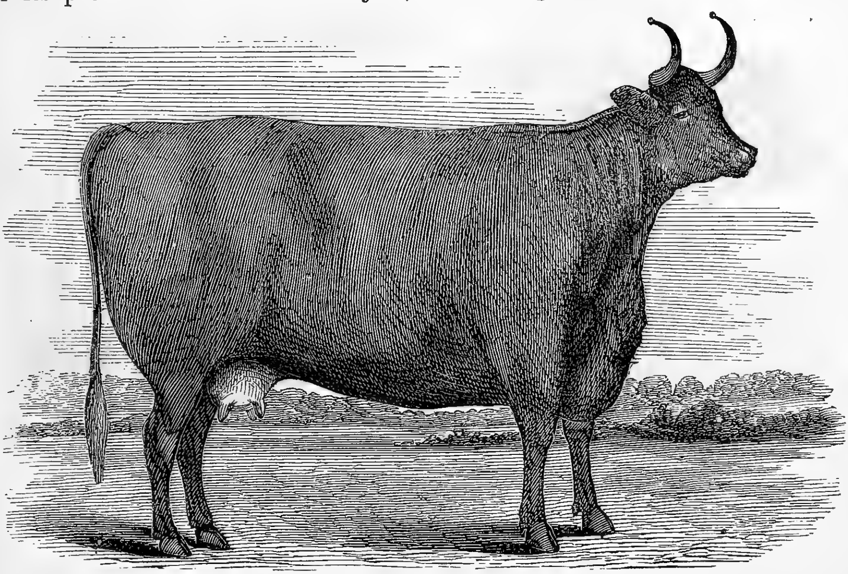
easily drawn, and not unfrequently remarkably good milkers have been found in this breed. We have good authority, says Mr. Allen, that some of them have yielded ten to twelve pounds of butter per week, and they have given eighteen, twenty, and twenty-two quarts of milk per day, for months after calving, under steady milking. As a beef animal the Devon has always ranked first class. The flesh is fine, juicy and of delicate flavor. The Devon matures early, and develops rapidly under good feeding. Devon oxen have always been regarded as among the best.

DEVONS FOR BUTTER.

The butter dairyman on rather thinnish soils, or on rough, hilly pastures, and especially if he looks to the production of beef in connection with butter-dairying, will scarcely pass over the Devon as wholly unworthy his consideration. I cannot agree with some authors in their deprecating estimate of this breed. In the southern dairy districts of England, I found them largely used for the dairy, and highly esteemed; and my own experience with Devon grades satisfies me they are much higher in the scale of good milkers than the Herefords, with which they are sometimes classed, for dairy purposes; of course it is important to select stock from good milking families.

THE AYRSHIRES,

originating on the western side of Scotland, in a moist climate, have been bred specially for milk; and for this use no one questions their value. They are medium in size, hardy, healthy, pretty well fitted to our climate and pastures; and for the milk farmer and cheese dairyman, where milk or its products alone are the object, considering the size of the animal, the



DEVON COW.

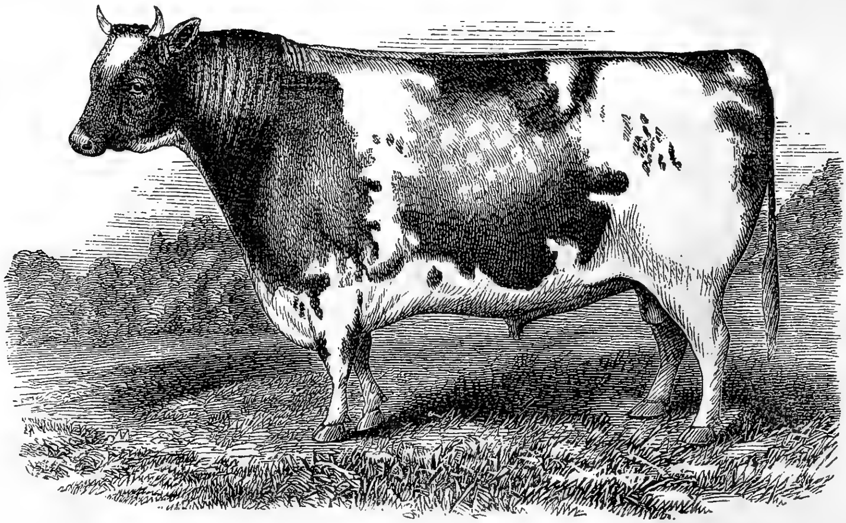
food required for its keep, the great variety of soil and surface of the country to which it is adapted, perhaps no breed can show a better record.

YIELDS OF MILK FROM AYRSHIRES.

We have European accounts of some most remarkable yields of milk from Ayrshire cows. According to some writers, from six hundred to eight hundred gallons of milk per year is not unusual, while in some instances a thousand and more gallons have been produced. We may remark that these high yields have not been generally made by Ayrshires in this country, though the testimony of our dairymen in regard to their superior excellence as milkers is universal. Their only fault is in their short teats, which often renders them difficult to be milked, and in their highly excitable or nervous organization, which requires gentleness and extreme care in their management. They are not esteemed as a beef-making breed, though breeders claim that they readily fatten. I have fattened and used the meat of Ayrshire grades, and find them inferior, as beef-makers, to the Short-Horn and Devon.

SHORT TEATS.

It may be remarked in this connection, that a short teat is a serious defect in a cow. The milk is not only drawn slowly from such cows, but milkers often neglect to milk clean, and in consequence the cow is made to decrease in her yield, and not unfrequently loses the use of one or more teats from obstructions resulting from neglect in drawing the milk. Hundreds of valuable cows in the dairy districts are injured and ruined from this cause.



AYRSHIRE BULL.

When Ayrshires are crossed on the common stock of the country, or with cows having more or less of Short-Horn blood, the grades are generally good milkers, and the teats are greatly improved. Some of our dairymen insist that a high grade Short-Horn covered with a thorough-bred Ayrshire, gives the best result, and is to be preferred to the thorough-bred Ayrshire for the dairy.

THE ALDERNEY OR JERSEY.

The Alderney or Jersey, comes from the group of rough, rocky islands in the channel between England and France. The pastures here are not luxuriant, the feed is generally rather short, but very nutritious, and in that damp, mild climate, the feed extends through most of the year. The Alderneys are small in size, with deer-like head, thin neck, high shoulders, hollow back, large belly, and a clean, good sized udder. Though by no means a handsome animal, I do not think they are so homely and mean looking as many writers charge against them.

RICHNESS OF ALDERNEY MILK.

It is perhaps needless to say that the Jersey cow is famous for the richness of her milk. It has a deep yellow, creamy color, and in England the Somersetshire cheese dairymen nearly always have two or three Alderneys in their herds, to give quality and color to their milk. At Versailles it was shown that milk of this breed yielded six and a-half per cent. of butter, and Sir William Collings of the Isle of Jersey, carefully observed the quantity of butter from one of his cows; it amounted to three hundred and ninety-four pounds per year. In another case, five cows for five years yielded three hundred and fifty-three pounds per year each. Many similar statements might be given.

ALDERNEYS AS BUTTER COWS.

As a butter cow, the Alderney undoubtedly has great merits; and where rich milk and a fine quality of butter is sought after, for fancy prices, the

AYRSHIRE COW.

Alderney, or a dash of Alderney blood in the herd, is of advantage. They do not yield a large quantity of milk, nor are the animals so hardy as the other breeds named, still they are more and more coming into use, and when crossed on deep milkers of our native stock, give good satisfaction among the butter dairymen.

CROSSING ALDERNEYS AND AYRSHIRES.

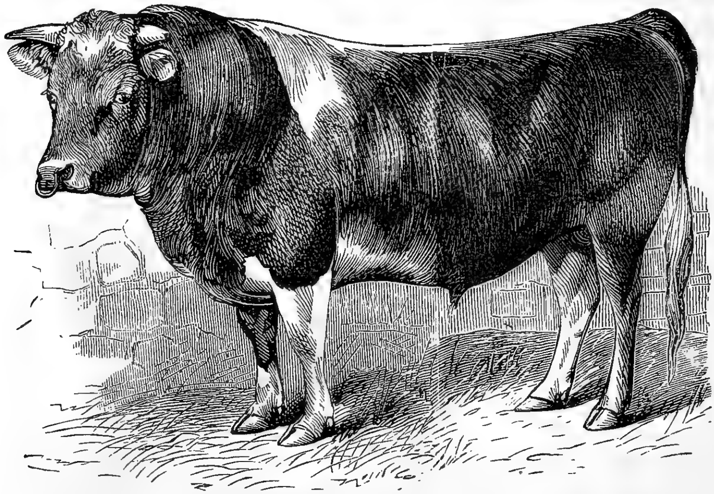
I should not consider the crossing of a pure bred Alderney with a pure bred Ayrshire as judicious. The cross has not been successful in Scotland, the result in both ways having been to produce a progeny having the inferior points of both breeds.

THE ALDERNEY BULL,

as has been remarked by Mr. STEPHENS, "has not so good a frame as the Ayrshire cow, nor has the Alderney cow so good a constitution as the Ayrshire bull. There would be no economy in such crosses, since both breeds ought, from their high character, and world-wide reputation as dairy breeds, to be kept distinct and pure." But in the crossing of one or the other of these breeds on a common grade cow, the case is different, and good results may be expected.

THE DUTCH BREED.

The Holstein or Dutch Cattle of North Holland, are perhaps the most noted for the dairy of any originating on the Continent of Europe. Holland has long been a dairy country, and the farmers there have given more care

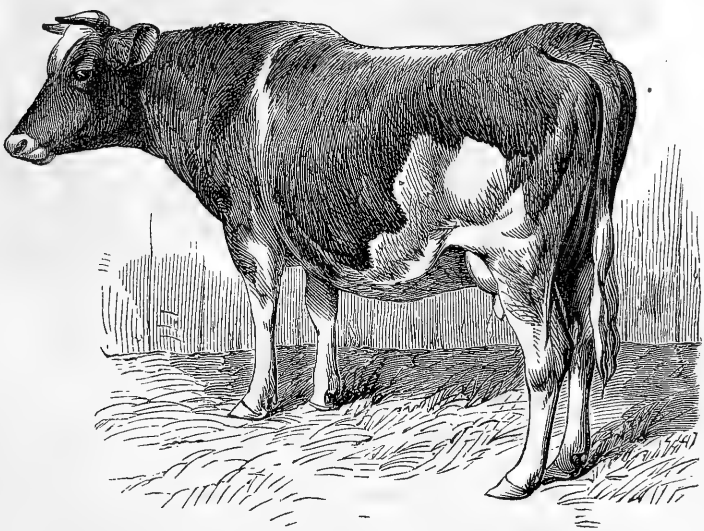


ALDERNEY BULL.

and attention to their cows than to any other domestic animal. The breed is of large size, and of a compact, massive frame, capable of making good beef. Their color is black and white, spotted or mottled in picturesque inequalities of proportion on the body. The horn is short, and the hair short, fine and silky. The Holsteins have been long bred and cultivated with a view to develop their lacteal production, and their milking qualities are truly wonderful. Some have expressed doubt, whether cows of so large a size, weighing from thirteen to fifteen hundred pounds, could be made profitable on much of our dairy lands. Doubtless on poor, thin soils their introduction might not prove advisable; but when there is an abundance of food, the case would be different. Holland cattle have as yet received but little attention from American dairymen, but if the European accounts given of them are to be credited, there is reason to believe they would prove a success, on our deep, rich soils or most productive pasture lands.

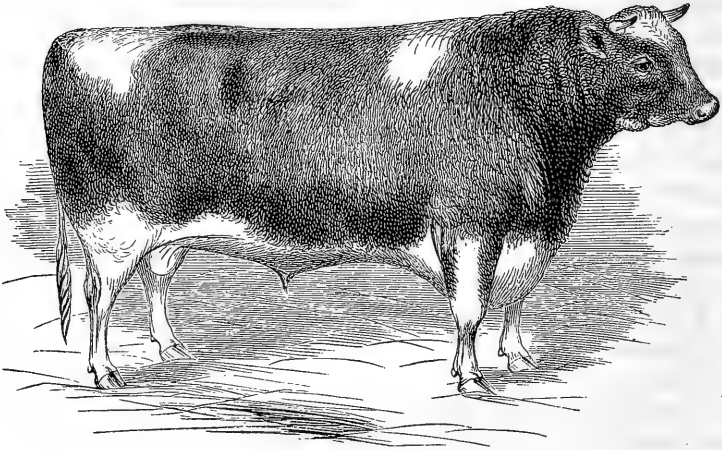
NORTH HOLLAND CATTLE AS MILK PRODUCERS.

In June, 1869, I received a letter from Mr. MILLER, then at the Royal Farming Academy at Eldena, Prussia, in which he gives an account of the North Holland cattle, and especially of the herd belonging to Professor RHODE of the Royal Academy. One of these cows, he states, had yielded in one year six thousand one hundred and forty-two Berlin quarts of milk, equal to one thousand five hundred and forty-eight English gallons. If we assume that a gallon of milk will make a pound of cheese, it will be seen that the annual product of this cow would be about three times as much as that yielded by what is considered our best dairy cows. Mr. MILLER states that a herd of twenty-two Holland cows owned by Professor RHODE made an average yield of three thousand five hundred and ninety-five and five-tenths Berlin quarts of milk each per year, while three Ayrshires in the same herd yielded only about half the quantity, or one thousand seven hundred and ninety-five and one-half quarts each. At the rate of milk given, this herd of North Holland cattle would have made an average in cheese of about eight hundred pounds each for the season. But whether as good yields can be



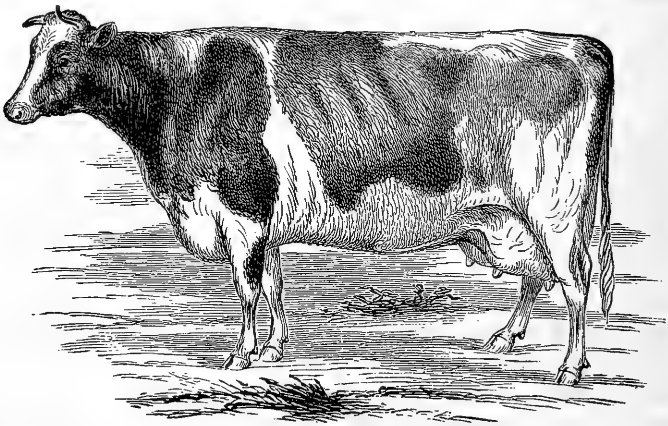
ALDERNEY COW.

made here by this breed, of course, must be decided by trial. Of recent importations of Holland cattle, it is said that one of the cows, six years of age, dropped a calf on the 15th of May, weighing one hundred and one pounds, and from the 26th of May to the 27th of July, by careful and exact record, gave four thousand and eighteen pounds fourteen ounces of milk. The largest yield in any one day was seventy-six pounds five ounces, or thirty-five and one-eighth quarts. Her average for ten days was seventy-four and forty-seven hundredths pounds per day, and the amount of cream produced from this milk was twenty-two seventy-one-hundredths per cent. Six days' milk of this cow being set for cream, produced seventeen pounds fourteen ounces of good butter. The Holstein cows have a reputation of being specially adapted to cheese dairying, and it is for this purpose, doubtless, they should be employed.



HOLSTEIN BULL.

Enough has been said, perhaps, to indicate the practical side of this question. The dairyman must have a clear understanding of his situation and the use to which his animals are to be put. Then remembering that "like begets like," he will select his materials, and breed to the desired point. The most



HOLSTEIN COW.

practical course to be recommended, it would seem, is by raising our native stock by a judicious admixture with the blood of milking breeds; and then by improving on these grades.

BAD HABITS INHERITED.

In breeding stock for the dairy a point quite generally overlooked, but which is of great importance in securing good results, is to breed from animals that are even-tempered and not disposed to be vicious. Peculiarities of bad temper, irritability and a disposition to be troublesome, seem to be transmitted from either parent to the offspring with considerable certainty. With the grazier these qualities may, in a measure, be tolerated. To him the chief points of consideration must be an aptitude in the animal for taking on fat at as little expense as possible, the finenees of the grain of the meat, mode of laying on fat, smallness of bone, soundness of constitution, and a certain congeniality of the animal for the climate and soil on which it is to be grown or made ready for the shambles, being important. The grazier is not brought into that close familiarity with, or daily handling of the animal that is a necessity on the part of the dairyman, and hence, what might be considered intolerable vices in the dairy, would not be developed or noticed in the mere grazing animal. An animal may be descended from a good milking family, and under certain conditions of extreme care, prove to be a superior milker, though of a nervous and excitable temperament; but if she be naturally vicious and bad tempered, she will cause more vexation and annoyance in the long run than her milk is worth, while she is always liable to become worthless as a milker from freaks of nervousness and ill temper, which the herdsman, with all his care, is unable to prevent. I have seen and owned animals of great milking capacity, which it was a most disagreeable task to milk, and which, if the milk wasted by them during milking through the season were counted out, would make their yield poor indeed, so far as profit was concerned.

I believe that a great many good cows are annually spoiled by cruel treatment and the bad temper of the milkers. Still there are vicious cows, and those of an extremely nervous organization, from which no profit can be realized under any course of treatment. I know men who have bred from a vicious and nervous thoroughbred bull, who are very much dissatisfied with this peculiarity of the parent infused in their herds. I have bred from animals disposed to be unruly and mischievous, cows that had acquired the habit of sucking their own milk, and have found these peculiarities strongly marked in their offspring; not invariably, it is true, but generally when any viciousness was strongly marked in the parent, it was pretty sure to be developed in the offspring. My experience is, that such animals, even though they may be good milkers, do not on the whole pay in the dairy. I do not believe in pounding and beating milch cows, and have never seen any good come of it; but a vicious beast is such a sore trial to the patience that most dairymeu are better off to be at once rid of it. Such cows cannot well be trusted to hired help without being pretty sure a mishap of some kind will befall them during the season; besides, the time spent in tampering with a bad-tempered cow, will make her milk cost a high price, even though she yield a large quantity.

VALUE OF A GOOD-TEMPERED COW.

One of the most valuable qualities in milch stock is quietness and good temper; and in selecting animals to breed from, these qualities should be sought after, and considered of prime importance. Experience and close observation have taught that "like produces like," in other words, that the qualities of the parent, such as beauty or nitidity of form, disposition to fatness, goodness of flesh, abundance of milk, and temper are inherited by their offspring. And yet dairymen often overlook serious defects of temper, and raise stock for the dairy that prove very unprofitable on this account.

When thorough-bred bulls are to be purchased to improve dairy stock, they should not only be descended from good milking families, but from families that are known to be of good temper and free from any strongly-marked viciousness; and by always selecting bulls of this character from which to breed, the defects in dairy stock referred to may be corrected, rather than increased.

INFLUENCE OF KINDNESS.

It may be remarked, also, that gentleness and quietness in milk-stock result in a measure from education. I have seen so many heifers ruined, which might have been fashioned into valuable stock for the dairy, that I desire to call attention to the importance of early handling and educating stock that is intended for milk. An animal cannot be taught quietness and familiarity with persons in a day, or in a month. Habits are slowly formed; and if we would secure the highest results, the animal should be petted while young, and should have a constant familiarity with persons, and the feeling thoroughly impressed that man is its best friend, from whom it has nothing to fear and to whom it may naturally look for kindness and protection. The treatment should be commenced with the calf and continued until it shall have become a full grown animal. Then it will have formed those feelings of affection for, and sympathy with persons, similar to those implanted in the brute for its young. I have seen heifers and cows reared in this way, taking to a kind milker, exhibiting strongly marked affection, and showing a degree of patience and consideration that plainly indicated the feeling to which I have referred. Calves and heifers should be freely handled but never irritated or plagued, as this will teach them bad habits, which they will not forget as they grow older. I like to see stock that can be approached at any time in the pasture, and that has no fears of being handled or petted. For a milker, most dairymen prefer a heifer to come in when two years old, and if she has been well kept, so as to have attained good size, she will then be old enough to become a cow. The habit of giving milk is in part a matter of education, and I prefer to form that habit young.

The impression prevails with many, that good blood is the only important requisite in rearing dairy stock. To reach the highest success, something more is necessary. The stock must have good keep and kind care. Good blood is a requisite; but the best milking strain may be rendered inferior by poor keep and a bad education. To those who propose raising calves, with a view of having them take their place in due time in the dairy, I say commence at once to educate for milkers. Good feed, good care, with the habit of fondling your animals, will have an important influence in molding them to your wishes, and in securing desirable results.

SELECTING COWS FOR THE DAIRY.

In the enumeration of points for the selection of good milch cows, we find some valuable hints in a work by Prof. J. H. MAGNE, from which we briefly quote. A more extended description of points will be found in Mr. ALLEN's excellent work on American Cattle—a work that should be in the library of every American dairyman. Among the points to which attention should be given, the digestive organs are important. He says:—" Where these are defective, good milch cows are rarely met with, since these organs have a powerful influence on the exercise of all the functions, and particularly on the secretion of the milky glands. A good state of the digestive organs is evinced by a belly of moderate size, with yielding sides; a large mouth; thick and strong lips; a good appetite; easy and quick digestion; glossy hair; supple skin, with a kind of unctuous feel. The constitution should be sound, and this is implied by large lungs; a broad and prominent chest; a somewhat slow respiration; and a great inclination to drink—an inclination stimulated by the abundant secretion of milk. Preference should be given to cows with small bones, fine and slender limbs, and tail fine at its base; the head small but longish, narrowing toward the horns; the horns themselves of a bright color, tapering finely and glistening; small neck and shoulders, apparently long because slender, especially near the head; small eyelids well divided, but not much wrinkled; prominent eye, and a gentle, feminine look.

" Good milkers allow themselves to be easily milked—often while ruminating they look with pleased eye (easily recognized) at the person who milks them; they like to be caressed, and caress in return. The udder is formed principally by the glands which secrete the milk, and called the milky glands. These, four in number, two on each side, are designated by the name of 'quarters,' each constituting nearly a fourth part of the udder. The udder is composed, moreover, of skin, cellular tissue, fat, lymphatic ganglions, vessels, &c. In almost all cows, the abundance of the milk is in proportion to the size of the mamelles. The marks indicating that these glands are constituted so as to produce much milk are, a very large developement of the hind quarters; a wide and strong lumbar region; a long rump; haunches and hind legs wide apart; a large space for lodging the udder; milky glands well developed, and causing the udder to be of considerable size. In good cows the gland constitutes a large part of the udder, and accordingly after milking, it shrinks much and becomes soft, flabby and very wrinkled. The teats should be set apart from each other, as indicating that the milk vessels are spacious. Of all the marks for ascertaining good cows the best are afforded by the blood vessels; if the veins which surround the udder are large, winding and varicose, they show that the glands receive much blood, and consequently that their functions are active and that milk is abundant. The veins on the lateral parts of the belly are easily observed. These veins issue from the udder in front, and at the outer angle, where they form, in good cows, a considerable varicose swelling. They proceed toward the front part of the body, forming angles more or less distinct, often divide toward their anterior extremity, and sink into the body by several openings."

GUENON'S DISCOVERIES.

Some years ago Mons. GUENON, a Frenchman, made the discovery that cows known as "good milkers," had certain characteristic marks, shown in the hair growing upon the udder, and upon and between the thighs above the udder. Following out this peculiarity on different animals, and noting the variations in the marks on a great number of cows, from the best to the most inferior milkers, he was enabled to establish his theory of the "milk mirror" or "escutcheon," as it is termed. The basis of the theory may be stated in general terms, as follows:—The hair on the buttocks of cattle grows in two different directions, one portion pointing upward, and another part downward, and thus producing a sort of fringe at the point of juncture. The hair which has an upward tendency, has been termed the "escutcheon," the larger the extent of the "escutcheon," according to M. GUENON, the greater the promise of milk, and also of the continuance even after the cow is in calf. A cow may have a small escutcheon, and yet be a good milker; but observation leads to the conclusion, that if she possessed a more fully developed escutcheon, she would have been a better milker. In estimating the extent of the escutcheon, allowance should be made for the folds in the skin, otherwise a large escutcheon may be taken for a small one. Besides the escutcheon there are tufts of hair which, when seen on the cow's udder, have a certain degree of value. It may be observed here, that M. GUENON's theory is very elaborate, and cannot be relied upon in all its details, though its general outlines or leading features, when taken in connection with the shape and size of the cow, the texture of her skin, development of the udder and milk vein, her disposition, endurance of constitution and other points, give valuable aid in selecting good milkers. The principles laid down by M. GUENON, are of considerable value as additional aids to other well known points of a good cow, but *they should not be relied upon singly and alone*, as indicating what is, and what is not, a good milker in every case. I have known "experts" in the theory to be deceived, or make bad selections in cows; and I have been misled, relying too much upon the marks, or escutcheon, overlooking perhaps other essential considerations.

MAGNE'S CLASSIFICATION OF COWS.

M. MAGNE, in his summary of M. GUENON's system, divides the cows according to the quantity of milk which they give into four classes.

FIRST-RATE COWS

are in that class, where both divisions of the lower escutcheon, the mammary and the perineum, are large, continuous and uniform, and cover at least a large portion of the perineum, the inside of the thighs and udder, and extend moreover, with little or no break, more or less over the limbs, eliptical in shape, and situated in the posterior face of the udder (Fig.1,2). But the cows may be

Fig. 1.

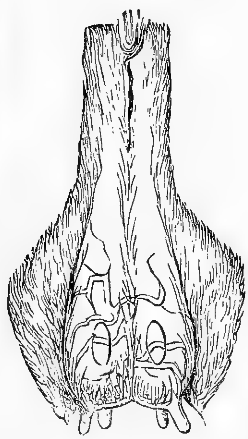


Fig. 2.

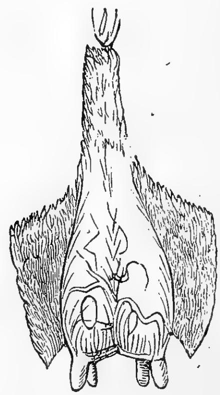


Fig. 3.

considered first-rate as milkers, if in the absence of a well developed escutcheon, they possess the following marks:—Veins of the perineum, varicose and visible externally, or at least easily made so by compression at the base of the perineum; veins of the udder large and knotty; milk veins frequently double, and equal on both sides of the animal, and forming zigzag or wavy lines within the belly. In addition to the marks shown by the veins and by the escutcheon, the udder should be large and yielding, of homogeneous texture, having a thin skin covered with fine hair, and yielding or shrinking much under the process of milking. The chest should be ample, and a good constitution displayed by regular appetite, and a disposition to drink much; the skin soft and supple; hair short and soft; head small; horns fine and smooth; eye quick, but gentle; fine neck and feminine air.

GOOD COWS

are those that present the mammary portions of the escutcheon well developed; but the perineum portion is either wanting or but partially developed. (Figs. 3, 4). If the escutcheon is ever so well developed, the cows are middling or bad, and do not belong to the first or second class, if the veins of the udder are not in considerable numbers, and the milk veins under the belly are not large.

MEDIOCRE COWS

possess the lower tuft of the escutcheon of the mammary part, little developed or indented, and the perineum portion irregular, narrow and contracted.

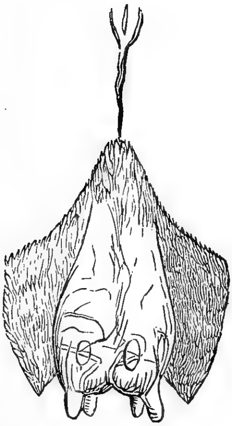


Fig. 4.

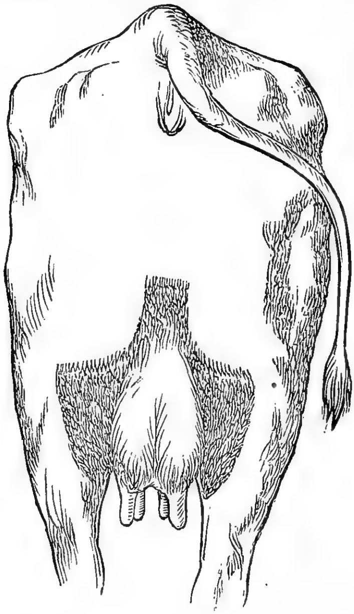


Fig. 5.

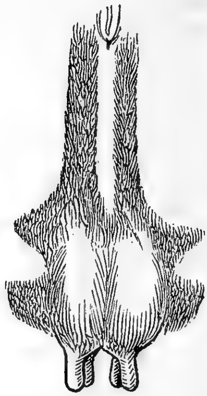


Fig. 6.

(Figs. 5, 6). The perineum veins are not visible, and the veins of the belly are small and straight. The head is large, skin stiff and thick, and the animal is often peevish and restless.

BAD COWS

possess escutcheons of very small extent (as shown in Figs. 7, 8); no veins are visible in the udder or the perineum, and the milk veins are feebly developed. The cows of this class are generally in good condition, and showy, taking animals, the thighs are fleshy, the skin hard and thick, neck thick, head and horns large, and the latter of large dimensions at the base."

I have perhaps quoted sufficient to show the general outlines of M. GUENON's theory, without going into an elaborate essay on the subject, which would need a large number of cuts to be clearly explained. But desirable as it may be for the dairyman to have a good strain of milking stock, his success will not depend altogether upon blood and skill in breeding.

THE FEEDING AND MANAGEMENT

of his herd is an art which he will find is not to be learned in all its details in a day. Some dairymen never can, or at least never do, learn it. During the past ten years my business has called me very much among dairymen, where almost every variety of management is adopted. I have seen men with "scrub-herds," picked up here and there from the common stock of the country, obtaining an enormous product. I know men who get from common stock an annual yield of between six hundred and seven hundred pounds of cheese to the cow, while perhaps a neighbor with much superior blooded stock is unable to obtain anything like that product. How is this effected? In the first place these men have a natural talent for selecting good cows, and in the second place, they seem to be in perfect sympathy with the animals under their control, attending to every detail for their comfort, providing wholesome, nutritious food, pure water and pure air—everything of this kind in abundance—keeping the animals properly sheltered from storms; feeding always with great regularity; paying the most marked attention to the time and manner of milking, and withal preserving a uniform kindness and gentle-

Fig. 7.

Fig. 8.

ness of treatment throughout every operation, a gentleness extending even to the tone of the voice. It is really astonishing what a large difference in the yield of milk it makes by attending properly to a number of small things, which would seem to many quite too insignificant to be worth observing. Indeed, had I not seen these effects in numerous instances and in my own experience, I could never have believed that their influence was so potent.

DRYING COWS OF THEIR MILK.

It would be impossible, in the scope of the present volume, to discuss all the essential points of management for dairy stock. I can allude only to some of the leading requisites for success. I commence first with drying cows of their milk at the end of the milking season. There is great difference in opinion among farmers as to the time that a cow should go dry. Some contend that no injury follows from milking cows so long as they will yield milk, or up to within a week or two of the time at which they are to calve; while others insist that at least from two to three months should be given a cow to go dry. The latter is doubtless the more sensible and judicious course to be adopted. A cow that is to "come in" during the early part of March, should be allowed to go dry in December. She will then have time to recuperate and repair that waste which has been going on in the production of milk, and in building up the structure of the young which she carries.

It is a great drain on the system to continue the milking of a cow in winter, and up to near the time of giving birth to her calf; and it is to be doubted whether an animal treated in this way will yield any more, if as much profit, as she would were the other course adopted. For it is not altogether the quantity of milk that is to be looked after, but its quality must also be taken into account. Cows that are overtaxed and weak, yield milk of poorer quality than when in vigorous health. And as to the question of health, endurance and long life, all experience must show that the animals wear out sooner, are more liable to disease and mishaps, under the "excessive milking system," than when allowed a reasonable time for rest.

FALL AND WINTER FOOD FOR COWS.

But what makes the matter worse is, that many dairymen provide no feed beyond hay to animals yielding milk during the winter. They are often exposed to biting storms of rain, and sleet and piercing winds, all of which operate in reducing the tone of health, and in undermining the constitution. Hence we not unfrequently see cows wasting away with consumption, and meeting with little accidents that prove fatal, because the cows have not the vigor to resist them. Some cows, it is true, are inclined to give milk the year round, and are difficult to be dried off. Such animals require something more than hay; and an additional feed of ground grain (oat and corn-meal mixed), should be commenced to be given in the fall, or at least as soon as grass begins to depreciate in its nutritive quality. "Frozen grass and moonshine," even though furnished in great abundance, are not the kind of food on which deep milkers thrive and are invigorated. Cows, whether in milk or dry, ought not to be allowed to fall off in flesh late in fall, or at the commencement of winter. Thin cows are sensitive to cold, and require more food for their winter keep than they do when commencing the season with a good coat of flesh. It is always less expensive to get stock in condition during warm weather, or before winter sets in; and it is therefore very poor economy to allow deep milkers to run down thin late in fall, as it often entails a good deal of careful nursing all the winter through, in order to bring the animals safely over to grass.

DRAWING ALL THE MILK FROM THE UDDER.

In drying cows of their milk, attention should be given that all the milk be drawn from the udder at any one milking. Some are in the habit of only partially drawing the milk from time to time, when drying off cows. It is not a good practice, as the milk left in the udder becomes thick and putrid, causing irritation and inflammation, and not unfrequently results in the loss of a teat, or a portion of the bag, the next season. When cows are being dried off, they should be examined every few days, and their udders completely emptied of all accumulated milk; and with cows supposed to be dry, their teats should be tried at least once a week, all winter, to see if there be any accumulation of milk. I have had serious losses from trusting to hired help in this matter, and taking for granted that it had been properly attended to. There is no safety unless the work is done under your own eye, or an examination made with your own hand. And it may be remarked that in the management of dairy stock, nothing pays better than a frequent oversight of the creatures by the master's eye. Hands, however trusty, sometimes get careless and indifferent in their care of stock, which can only be corrected by constant oversight on the part of the proprietor.

SHELTER.

The importance of keeping stock well housed from storms during inclement weather is often under-estimated by dairy farmers. Much more food is required for stock exposed to cold, bleak winds and storms of sleet and snow, than when properly sheltered. A certain amount of food is needed to keep up animal heat, and it is much cheaper to supply this warmth in properly constructed stables than to use extra fuel in the shape of hay and grain, to keep up heat in the open yard. It has been estimated that an animal wintered in the open yard, without any other shelter than that afforded by fences and the sides of buildings, will consume a third more food than if properly housed. And even with the additional food, the animal does not come out so well in spring as the sheltered animal on less food. The principle is abundantly established, and ought to be recognized by every one who has had the care of stock; and yet, strange as it may seem, a large proportion of the herds are left shivering in the cold from morning till night, under the impression, it would seem, that the stable can only be used economically during night, or as a place in which to give food. Some insist that this exposure is promotive of health, that it imparts vigor and tone to the system, and that attention in housing from cold and storms during the day is a species of pampering, highly injurious to the constitution and well-being of the animal. Unfortunately for those who hold these opinions, the record of losses, of accidents, of diseases incident to milch stock, are against the theory, and in favor of those who are careful to shelter their stock from undue exposure.

A CERTAIN AMOUNT OF EXERCISE,

of sun and air, together with freedom from restraint, is without doubt conducive to health, but the conditions must be favorable or such as the stock enjoy.

An animal may be trained to endure cold, exposure and fatigue, and under certain conditions, health may be maintained. But you cannot impose, at the same time, the duties of maternity and the yielding of large quantities of milk, because the waste of the system from these sources is so great as to leave only a small amount of vitality to be employed in another direction. This is particularly the case with milch cows, which, under a system of domestication and breeding, have been educated into a "milky habit." Left to themselves under the most favorable circumstances, in warm weather, they like but little exercise compared with other classes of animals; and when required to exercise much, always fall off in milk. Warmth, comfort and quietness are particularly essential to these animals, and any system of management opposed to these conditions, must in a measure, fail to be profitable to the dairyman.

DISEASES FOLLOW EXPOSURE.

Cows that are in milk, or that have been milked late, are peculiarly sensitive to cold, and they are frequently injured by being exposed to storms. By getting wet, and becoming chilled, pulmonary complaints and other diseases are induced, and thus the farmer has a sick animal on his hands which is a source of trouble and anxiety, and not unfrequently a total loss. Many of the troubles that come upon cows at the period of calving, may be traced directly to exposure during the winter; and therefore on this account alone will it pay the farmer to shelter his stock on the approach of storms, either of wind, or snow, or rain. During those days in winter that are sunny and warm, there may be no objection to allowing stock to run at large in the yard a greater portion of the day; but in extreme cold weather three-quarters of an hour in the morning and the same length of time in the afternoon, to slake their thirst at the trough, will give them all the exercise needed. The remaining portion of the time they will be better in a warm, well-ventilated stable, where they can quietly ruminate, without fear of being hooked and driven about by master cows.

Any one who may have closely observed the habits of milch cows kept out in the yard during extreme cold weather, it would seem, could not well come to a different conclusion. The animals often stand about the buildings, pinched up and shivering, the cold exciting to bad temper which they vent upon the underlings, severely punishing them without cause, and many times to the serious loss of the owner. At such times open the door of your stable, and give them choice of entrance, or to remain without; and if they do not seek warm quarters they differ from any of the herds with which I am acquainted.

THE LOSSES FROM NEGLECT

of, and inattention to stock during winter, are so large, that the subject cannot be too urgently pressed upon the attention of dairymen. If farmers will only take a common-sense view of the question, and seriously count the cost of the neglect to which I have referred, I am convinced they will agree with me, that an important saving may be made by the proper sheltering of stock during the rigors of winter.

CARDING COWS.—SCRATCHING POLES.

The practice of carding cows is of great importance in promoting health, and increasing the profits of the dairy. It not only improves the health of stock, but leads to habits of neatness and cleanliness about the stables, that have an important influence in securing good, clean milk, during the spring months. I would furnish cattle with scratching posts in the yard, and place a pole firmly on posts with one end higher than the other, to accommodate animals of different sizes, that they may pass under and scratch themselves as desired. When these are erected, they will soon be found polished from frequent use.

THE STOMACHS OF RUMINANTS—PREPARING FOOD FOR ASSIMILATION.

Before discussing questions in regard to feeding stock, it will be well, perhaps, to allude briefly to the manner in which ruminants prepare their food for assimilation. We quote from Dr. J. V. Smith:—"The cow requires large quantities of food; it remains in her stomach a long time, but the relative amount of nutrition needed is small. A carnivorous animal has only one stomach, and requires food more condensed and nutritious. Generally animals that chew the cud have four stomachs, to fill which requires a great bulk of food, and they must be filled or they will collapse, and the opposite walls will meet and destroy each other by their involuntary action. Hence, when the food of such animals is too concentrated, health rapidly declines. The slops of distillers do not sufficiently distend the stomach, and the milk secreted from such diluted food, lacking the elements of nutrition, is doubtless the cause in cities of many diseases of children that partake of it. The first stomach or paunch, may be called the receiving organ; it is very capacious, and is divided into four compartments. The animal takes its food at first with very imperfect mastication, storing it away in the rumen or paunch, and at its leisure, converts the food into nutriment. It makes balls of its food, by chewing it, then, one after another, lets them down into the paunch till this organ may be compared to a basket filled with eggs. The food becomes moistened, and is perpetually revolving through the different compartments of the rumen, and undergoing important preparation for future digestion. The muscular coats of the rumen consist of two layers, running in different directions, and these muscles are the mechanical agents by which the food is kept in motion, and by running in these different directions they are enabled to act upon all the differently-formed cells of this enormous viscus. The animal when at rest, or on lying down, commences the process of using the food. These animals like company, for they are social. A cow generally will not give as much milk when solitary, as when associated with her kind. Digestion now commences with a reversed action. One of the balls comes back into the mouth, where it is chewed over and made into a smaller ball, when it is discharged into a second stomach by another passage, the entrance to which is under the animal's control. There a fluid is secreted, and mixed with the food so received, and becomes of a yellow color. Here the animal has no further control of the food. Thence the food drops into the third stomach, which is smaller, and here the food, if not completely broken down, is ground into pulp and mixed with a white fluid, when it drops into the fourth stomach in a yellow, creamy stream. In this stomach it becomes arranged in layers, and by the secretion of another and peculiar fluid, is changed into chyme. This form it must of necessity assume before its nutritive matter can be separated. The solution being complete, or so much so as it can be rendered, the food passes through the lower orifice of the stomach into the duodenum or first intestine, where its separation into the nutritive or innutritive portions is effected, and the former begins to be taken up by the lacteals, and carried into the system."

IN SUCKING CALVES

this fourth stomach is the one that is active, and it is the one which is used for rennet in coagulating milk for cheese making. In the earlier ages of the world, when habits were simple and wants were few, the only cheese used was obtained from this stomach of the animal. But afterward it was found that the material of the stomach itself would curdle milk, and hence came the manufacture of cheese. Thus we see the food of these animals must go through the various wonderful processes described before it is fitted to furnish nutriment.

BALLS OF HAIR

are sometimes found in the first stomach, from one inch to four inches in diameter. In the spring cattle curry each other, to allay itching, by licking, and in so doing they cannot get the hairs off their tongues, and are forced to swallow them, when they naturally take the shape of a ball. The animal tries to expel it, but the structure of the tongue prevents, when it is swallowed again, and is kept going to and fro up and down many times. Of course such a foreign substance will often produce disease, which is likely to have many names and for which medicines totally inefficacious are prescribed. It is obvious that, at the season named, it is very important in the treatment of cattle to curry them with the curry comb, to prevent the formation of these hair-balls.

COWS IN CLOSE CONFINEMENT.

In the winter management of dairy stock it has been urged by some that the animals winter best when kept confined to the stable most of the time. Some dairymen scarcely allow the cows to leave the stable during the whole winter. Each cow has a water box before her which is supplied with fresh running water as desired. I have examined herds and taken the testimony of the advocates of this system, and although cows kept in a well-lighted, well-ventilated and cleanly stable, daily curried and bedded with straw appear healthy, still I cannot approve of the system. Such cows may for the time give more milk and lay on more flesh, but at the expense of health and vitality. Health and physical development are indispensable. Locomotion is not only natural but necessary. There is not a respectable medical authority in the country that dare recommend the dispensing with daily exercise in the air for man and beast where health and physical development are sought after. Weakness and incapacity are induced by confinement. We must not sacrifice indispensable ends to temporary profit and convenience. Temporary profit is often the wanton violation of physiological law. Provide warm sheds, and well ventilated stables, with bedding; feed well and groom well, but allow stock an opportunity for free exercise, at least an hour or two each day, whenever the weather permits.

HOW COWS SHOULD GO INTO WINTER QUARTERS.

Now we have said that one essential point in the wintering of dairy stock is to have the animals in good, thrifty condition, when they go into the stable at the commencement of winter. Deep milkers are apt to milk down thin in fall, and when there is a disposition to lose flesh in this way, it is always well to commence feeding ground grain, oat-meal, bran and ship-stuffs; since it is much easier and less expensive to put on flesh in the fall, when the weather is comparatively warm, than in winter. If the animals go into the stables in good condition, and are properly dried of their milk, they will continue to gain through the winter, on good hay alone. But if they get a daily ration of roots—either carrots, turnips, or mangolds—with a little straw to pick at from time to time as a change, they will come out in spring in good, healthy, serviceable condition. They must be fed and watered with regularity, and I prefer that the feeding be three times a day—morning, noon and night.

In Herkimer Co., where we have been engaged in dairying for seventy years, a great many experiments or different methods of management have been tried, but our best dairymen say that when cows are wintered on early cut hay, with an allowance of roots of some kind, and treated in the way I have indicated, the cows almost invariably do well after calving, with no trouble from retention of after-birth or from garget.

EARLY AND LATE CUT GRASS — RELATIVE VALUE FOR MILCH COWS.

The opinions of dairymen in regard to the nutritive value of grass cut for hay at different stages of maturity have changed materially during the last few years. Grass now, in the best dairy districts of New York, is cut much earlier than it used to be; and it is found by experience that cattle thrive in winter upon early cut grass properly cured, and come out in spring in a much better condition as to flesh and health, than when fed upon grass cut when over-ripe. When grass is left to stand till over-ripe there is a large amount of woody fiber, which the animal cannot assimilate. Hence, in order to get sufficient nutriment, a large bulk has to be consumed. It has been proved by experiments made by our best Herkimer county farmers, with a view to determine the relative value of early cut grass, that the early cut grass in feeding will give as good results when given without any additional food as the late cut grass with a moderate daily ration of meal.

Some farmers, therefore, prefer to cut a portion of their grass early in June, before it comes fairly into flower, curing it without allowing it to get wet, and storing it where it can be used specially for spring feeding. In this way some avoid feeding grain in spring, when cows begin to come in milk.

I have made frequent examinations of herds carried through to grass without a particle of grain, or indeed any other food except the early cut grass, nicely cured, and the animals on turning to grass were in good, fair condition. I do not approve, however, of wintering milch cows on one kind of food, believing they should have variety, such as roots, straw and coarse fodder, in addition to a full supply of the best hay; and then, when cows begin to come in milk, before turning to grass, a little ground meal, bran or ship-stuffs should be given daily. I mention these facts in reference to early cut grass in order to show that it is much more nutritious than many farmers suppose.

STOCK SHOULD BE WINTERED WELL.

To have stock make a good yield of milk during the season, it is important that the animals be wintered well, and not allowed at any time to get poor in flesh, or weak. The cow that comes through the winter weak and debilitated, and reduced in flesh, will require the larger part of the summer to recuperate. She will yield not only a small quantity of milk during the time she is recuperating, but it will be poor in quality, and hence such an animal can render but meager profits even on the cheapest kind of land; for her care, and the labor of milking, &c., will nearly if not quite eat up in cost the value of her product.

THE VARIATION IN THE QUALITY OF MILK,

on account of poor keep, thinness of flesh, and a debilitated condition of the animal, has been very abundantly set forth by the chemists, in their analyses of milk from such animals. In such cases the butter has been found to fall off from five per cent. to less than two per cent., with a considerable reduction also in the casein. The influence of poor keep on the *quality* of milk, is a question not very well understood or appreciated by the majority of farmers. The man who keeps his herd poorly, and delivers his milk at the factory with those whose herds are well fed and cared for, ought in justice to make a proper allowance for an inferior quality of milk. To come in on an equality with his neighbor's good milk, is in fact to take from his neighbor a certain amount of property without accounting for it. There is no practical method as yet, at the factories, for regulating this abuse, except by excluding such milk from the factory. But there is another question of considerable importance in connection with cutting grass early. The meadows are more enduring and yield better returns year after year. In New York we find

ONE GREAT CAUSE OF MEADOWS RUNNING OUT,

is allowing the grass to stand until ripe or over-ripe, before cutting. When meadows are thinly seeded, and it is not desirable to break them up, the turf will be greatly improved by cutting the grass early, just as it comes in flower. It is very poor economy to let the grass stand until over-ripe to shed seed, hoping to re-seed in this manner and get a good turf. A much better way will be to cut the grass early, and then as the fall rains approach go over the ground, scattering seed wherever it is needed; but when the earth freezes deeply, and the roots of the grass are liable to be destroyed by frost, this operation of seeding can be done early in spring. One great trouble in

GETTING A GOOD TURF UPON MEADOWS,

results from using too little seed and too few varieties. When timothy alone is to be raised, a half bushel of seed to the acre is none too small a quantity to be used. A very successful farmer in Herkimer, who grows large crops of timothy, adopts the following system:—If old land (or land upon which a hoed crop has been grown), it is plowed in the fall. Then in the spring a coat of manure is spread on the surface and worked in with the cultivator, and the grass seed sown with some spring grain.

VALUE OF EARLY CUT GRASS.

In regard to the value of early cut grass for dairy stock, the experiments, not only in my own dairy but numerous well authenticated statements from others, leave not the slightest doubt. The most remarkable result, however, on record, was that obtained in the feeding of the Vermont cow. Taking into consideration that the animal received no grain, and was fed nothing but grass and hay, her record is worthy of a place beside the celebrated Oakes cow. The Oakes cow, it will be remembered, produced four hundred and eighty pounds of butter besides suckling her calf for five weeks, and all between the fifth of April and the twenty-fifth of September. She received, however, in addition to her full allowance of grass, a bushel of corn-meal per week, and all her own milk skimmed. The Vermont cow, upon grass and hay alone, produced during the year 1865, five hundred and four pounds of butter, and the following is her record, given by her owner, Mr. A. Scott of Craftsbury, Vermont:

Dec. 20th, 1864, to Apr. 20th, 1865,	200 lbs. @ 60 cents per lb.	....	$120.00
Apr. " " " Aug. " "	180 lbs. @ 30 " "	....	54.00
Aug. " " " Sept. " "	40 lbs. @ 40 " "	....	16.00
Sept. " " " Oct. " "	34 lbs. @ 50 " "	....	17.00
Oct. " " " Nov. " "	30 lbs. @ 55 " "	....	16.50
Nov. " " " Dec. " "	20 lbs. @ 55 " "	....	11.00
Total for the year, -	504 lbs.		$234.50

This cow is described by her owner as of good size, and of native breed, and when purchased, four years before, was considered a very ordinary cow.

The Oakes cow was also of native breed. In the Transactions of the New York State Agricultural Society, we find a notice of several cows remarkable for their large yield of butter during a short period, but it is not stated upon what feed the animals were kept. Thus we have the Nourse cow of Danvers, that produced fourteen pounds of butter per week for sixteen weeks; the Sanderson cow of Waltham, fourteen pounds weekly for the same length of time; the Hazelton cow of Haverhill, the Bosset cow of Northampton, and Buxton of Danvers, the first two yielding fourteen pounds, and the last sixteen pounds weekly for twelve weeks. Geo. Kerr, of Ontario Co., N. Y., reports nineteen pounds of butter from a native cow in one week, and sixteen pounds weekly for the two succeeding weeks. T. Comstock of Oneida Co., from a three-fourths native and one-fourth Durham cow, seventeen pounds five ounces in one week, and C. D. Miller of Madison Co., twenty and one-half pounds in one week; and from the same source we learn that G. A. Mann of Onondaga Co., made sixty-seven and a-half pounds of butter from the milk of one cow, in thirty days.

The Vermont Cow came in milk on the 15th of December, and on the 25th Mr. Scott commenced setting the milk. The first nine days she made twenty-three pounds of butter, and in twenty-six days she had filled a tub of fifty-two pounds. In the detailed statement which Mr. S. gives in reference to the feed and management of this cow, we find considerable difference from the usual practice, and indeed from the commonly received opinion of farmers on this question. He believes as much butter can be made in the barn by having the cow come in in winter and fed upon hay, as in the summer upon grass, and the remarkable results obtained seem to prove it. He does not believe in feeding meal to cows, and has not fed any for the last five years. He remarks:—"If I had a cow as good as one I spoiled with meal a few years ago, I think, with my present treatment, she would make three pounds of butter a day, instead of two and a-half as the cow alluded to above has done."

MR. SCOTT'S MANAGEMENT OF COWS.

The management of his stock is as follows: The cows are fed on hay three times a day, no more or less; are watered morning and evening, and then put back into the stall, and kept there night and day during the winter. The amount of hay fed to this cow did not vary a pound from twenty-five pounds a day; smaller cows take about twenty pounds. The hay that cattle eat, he says, does them little good until they raise it up and chew it over in the cud; then it goes to form milk or flesh, as the case may be. If the animals have a comfortable place to lie down in they commence chewing it over as soon as they get their meals eaten, and when twelve o'clock comes they are ready for their meal again, and so on until evening. There should always be regularity in feeding and watering.

He describes his barn as double-boarded, outside and in, with double windows, and so ventilated that the temperature may be controlled at pleasure, even in the coldest weather. It is thrown open all round or shut up, just as the weather happens to be, and is kept above freezing point. But another important point, from which the highest results named have been reached, is in securing the hay in such a manner that a large percentage of the nutritive matter is retained. Haying is begun about the 8th of June, and finished, if possible, by the 25th. Another crop is cut the last of August, and in some places a third crop in September; and he well remarks that instead of commencing haying about the 4th of July and finishing in August and September, as has been the practice from time immemorial, all the grass ought to be cut and in the barn by July. Here then, after all, is a part of the secret of Mr. Scott's success. It is in making the hay so that it shall be equal in nutritive value, or nearly so, to the fresh grass of pastures. There can scarcely be a doubt but that immense losses are sustained by our best farmers in this matter of harvesting the hay crop. We do not commence harvesting early enough, but wait until much of the nutritive value of the grass has been wasted and used to form woody fiber, under the impression that we are getting more bulk and therefore more available food. Some years ago Mr. Lewis of Herkimer, abandoned the use of meal and grain in spring, believing better results were obtained from early cut grass properly cured. I went out to Mr. Lewis's farm in spring, and made a personal examination of his herd, for the purpose of seeing how far flesh and condition could be maintained in the way suggested, and I found the animals as thrifty as had been represented. The experiment of Mr. Scott is valuable in this: it demonstrates the relative value of early cut and late cut grasses, for no one can doubt the fact that his hay must have contained a more than ordinary amount of nutrition to produce the result—a result, we venture to say, which could not be realized from late cutting. Most farmers are aware that hay as usually cut and stored is insufficient to keep milch cows in a full flow of milk for any considerable length of time. When no additional food is given they fall off rapidly in flesh, and the milk depreciates in quantity and quality, even if the cow has all the hay she can consume.

INJURY FROM FEEDING CONCENTRATED FOOD.

There is another question raised by the experiment of Mr. Scott, and that is, to what extent milch cows are injured by feeding concentrated food? He asserts that he spoiled a cow by feeding meal. Of course cows are liable to be injured by over-feeding; but we are not prepared to admit that a judicious use of meal will injure a cow for milk. The feeding of meal may be, and doubtless is, more expensive than grass cut and prepared as he suggests; and admitting that such hay makes the most milk, it does not prove that meal fed judiciously will spoil the animal, without it be from over-feeding. Cows doubtless are injured and their lives shortened by excessive feeding of meal and grains, but if hay is poor or cut after half of its nutritive elements have passed away, the waste must be made up in some way in feeding, or the animal runs down, and when turned to pasture, is a long while recuperating.

CUTTING AND COOKING THE FOOD.

But where considerable quantities of straw and coarse fodder are raised on the farm, it may be of advantage to utilize it by cutting and cooking. In the English dairies, as I have observed, stock is mostly wintered upon cut straw, pulped turnips, and oil cake. The food is not generally cooked. In using cooked straw, a certain proportion of meal, bran, or ship stuffs is added to make up a nutritive equivalent equal to good meadow hay, and the experimenters pretty generally agree that the gain by cutting and cooking is about one-third; that is, that the expense of food is one-third less than when hay alone is used in the usual way. I have referred to this system in the account I gave of the Truesdale barn. A few years ago Hon. Wm. I. Skinner of Little Falls, N. Y., set up machinery and experimented during one winter, to satisfy himself in regard to the system. He divided his stock, feeding forty-four head upon straw and shippings, and twenty-six head upon hay. The forty-four head were consuming four hundred and forty pounds of oat straw and three hundred and fifty-two pounds of shippings per day, and two men were employed to cut and steam the food and take care of the stock. The whole expense was as follows:

440 lbs. straw, @ $10 per ton	$2 20
352 lbs. shippings, @ 2¼c., market price	7 92
2 men, at 9 shillings per day each	2 25
Wood, used for cooking per day	39
	$12 76

or twenty-nine cents for each head per day. Each cow received ten pounds straw and eight pounds shipping per day. The twenty-six cows consumed six hundred and fifty pounds of hay per day, and the expense for this lot was as follows:

650 lbs. hay, @ $25 per ton	$8 12½
Labor, 1 man, 9 shillings per day	1 12½
	$9 25

or thirty-five cents per day for each cow, showing a balance in favor of straw and shippings of six cents per day for each head. Cut straw averages about five pounds to the bushel, and cut hay eight pounds. The eight pounds of shippings make a little over ten quarts. I examined this stock several times during the winter, and to all appearance those fed on the cooked food were plump and doing better than the lot on hay. The several descriptions of feed used are put at the market price that winter.

MR. E. W. STEWART'S EXPERIMENTS.

Mr. E. W. Stewart of Erie Co., N. Y., who has experimented largely in cooking food for cattle, says:—"Steaming renders moldy hay, straw and corn-stalks sweet and palatable, thus restoring their value; renders peas and beans agreeable food for horses as well as other stock, and thus enables the feeder to combine more nitrogenous food in the diet of his animals. Half hay and half straw, mixed and steamed, more than equals hay unsteamed. When cows are kept in milk through the winter, cooking their food will greatly increase the yield of milk." He estimates the saving in food for each cow in milk at $8.00 for the season. Again he says, that a mixture of oil and pea meal and bran makes an excellent food to produce milk, and keep up the condition of the cow; one and a-half pounds of oil and pea meal and three pounds of bran mixed with ten pounds of hay steamed per day for each cow weighing eight hundred pounds, will generally be sufficient. This, he says, has been determined by his experiments, long and faithfully tried. And, he adds, this may be thought a small quantity from which a cow of that size, at her best season, could produce four gallons of milk and keep up her condition; but it must be remembered that four gallons of milk contain only about four pounds dry matter, which will leave a supply for the thrift of the cow. And when this sixteen pounds of hay, oil, and pea meal and bran, are thoroughly cooked together the nutriment is all extracted by the animal. In experimenting to determine what amount of bran or meal upon straw would make it equal to hay, he found two quarts bran and one quart corn meal on one bushel of oat, wheat or barley straw rendered it equal to the best of hay. When considerable quantities of coarse fodder are raised on the farm, doubtless cutting and steaming could be practiced with considerable advantage, but it is a question whether it will pay to introduce machinery for cooking early cut hay, and the general impression of our dairymen is, that for this kind of food, considering the extra labor and expense in cooking, there would be no advantage.

COWS CALVING.

The practice is now quite common in New York to allow cows to drop their calves while confined in the stanchion. The practice is not to be recommended. It is better as this critical time approaches, to separate the cow from the herd, placing her in a roomy stable, where she may have perfect freedom, and where she may be at liberty to perform the necessary office of cleansing the young calf and giving it suck. In most cases parturition will be natural and easy, and, as Mr. Flint remarks, "the less a cow is disturbed or meddled with the better." Soon after calving a bran mash, made with tepid water, should be given to the cow, which operates favorably on the expulsion of the afterbirth.

SPRING AND SUMMER FEED FOR MILCH COWS.

There is a great difference of opinion among dairymen in reference to the kinds of grain best adapted to milch cows in spring. Dairymen generally suit their own convenience in this matter, without much regard to the opinion of others. If they have raised and have on hand a surplus of corn, or barley, or oats, they are very apt to feed one or the other as best suits their convenience at the time; and if grain is to be purchased, the matter of prices has more of a controlling influence than what is best adapted to the animal economy. So widely do people differ on this question that many prefer to feed in spring nothing but hay, if of good quality, claiming that the cows will be healthier when turned to grass, and that the net profits from the dairy will be greater than where grain is used in spring feeding. In other words, that the value of the grain fed in spring more than balances receipts from the extra quantity of cream and butter produced; and hence grain feeding in spring must be very poor economy. Another class of dairymen, who claim to have looked pretty closely to the profits to be realized from milch cows, and to have compared results one year with another, say that nothing is gained by having cows "come in milk" as early as February or March. They prefer the months of April and May, as not only more agreeable, but actually resulting in greater profits. They argue that cows "coming in milk" early in the season, are more exposed to cold and storms which must injure the health and weaken the constitution of the animal; that it sooner wears out the cow, and yields no more net profit than when a later date is had for commencing the business of dairying. Why, they say, should one do extra work in milking and nursing stock through the bad weather of February and March, when the result from stock calving thus early, not only is no pecuniary gain, but brings positive injury to the herd?

Others insist that greater profits are realized when cheese and butter making is commenced early in the season. But if we assume that cows are to come in milk as early as March, then some kind of food other than hay —at least hay as usually harvested—seems to be imperatively demanded, in order to keep stock in decent condition as to health and strength, until it comes to grass.

THE SECRETION OF MILK A HABIT.

Now, the secretion of milk is in some respects a matter of habit or education, and should be promoted and kept up from its first flow. This cannot be accomplished on late cut hay alone, since the cow cannot be induced to consume the quantity necessary for her maintenance and a full yield of milk of good quality. This will be made evident by comparing the constituents of milk and those of ordinary meadow hay. Suppose the cow is yielding but eight quarts or twenty pounds of milk per day. This will contain a little over two and a-half pounds of dry material, as follows:

	lbs.
Of casein	1.000
Of butter	0.625
Of sugar	0.875
Of phosphate of lime	0.045
Other mineral ingredients	0.055
Total	2.600

Twenty pounds of ordinary hay contain of albuminous matter, fibrine and casein, &c., say about 1.85; oil, butter, &c., say 5.36. So it will be seen that this quantity of hay (considering that a part of the nutritive matter is not assimilated, and passes off in the excrement), will be mostly needed for the manufacture of the milk alone, while a like quantity and more must be used for her maintenance. Experience as well as science amply demonstrates the fact that late cut hay when used as an exclusive food for milch cows is insufficient to produce milk rich in quality and large in quantity. Mr. J. B. Lawes of Rothamsted, England, in a recent paper on the

EXPENDITURE OF FOOD BY RESPIRATION,

says:—"If there is one thing which is more firmly established by scientific inquiry than another, it is that actual waste or expenditure of substance is going on during the whole period of our existence, and that unless this waste be compensated by food, death must quickly ensue.

"The nearest approach to the continuance of life without food is in the case of those animals which pass through a period of hybernation. A dormouse for instance, sleeps through a great part of the winter; the little animal becomes cold to the touch, shows no sign of respiration, and is to all appearance dead. Nevertheless, careful experiments have proved that slow respiration is going on all the time, accompanied with gradual loss of substance; and if the cold weather be sufficiently prolonged, or the animal be subjected by artificial means to a continuance of low temperature, death will take place; if not from other causes, at any rate as soon as there ceases to be a supply of accumulated fat, or other material within the body, available for the purposes of respiration.

"Indeed, the resources of the body itself, unreplenished by food, can supply the necessary material for waste for only a limited period. The minimum amount of food required to maintain existence will vary for a given live weight according to the description of the animal, the description of the food, the conditions of life and individual peculiarities. But, to say nothing of other losses, as part of the substance of the body passes off into the atmosphere with every respiration, it is absolutely certain that death cannot be far off whenever the supply of food is stopped.

"The fact of a constant expenditure of food by respiration has a very important bearing on the economy of the farm. Every animal that is kept, whether for labor or for the production of meat, requires a given amount of food for the mere maintenance of life. If it receive more than this, the remainder may serve to enable the working animal to perform his labor or the meat-making animal to increase in substance and in weight, and consequently in value.

"It may be mentioned, in passing, that direct experiments have proved that the expenditure by respiration is very much greater within a given time while an animal is awake than while it is asleep; and again, very much greater in exercise than when at rest.

"Confining attention to the case of the animals fed for the butcher, it will be obvious that the economy of the feeding process will be the greater the less the amount of food expended by respiration in the production of a given amount of increase; and it is equally obvious that one ready and efficient means of lessening the proportion of the waste or expenditure to the increase produced, is to lessen, as far possible, the time taken to produce it; in other words, to fatten as quickly as possible.

"An example taken from the ordinary practice of the farm clearly illustrates the point, and shows the great importance of bearing the facts in mind. From the results of numerous experiments made at Rothamsted, it may be assumed that on the average a pig weighing one hundred pounds will, if supplied with as much barley meal as he will eat, consume five hundred pounds of it, and double his weight—that is, increase from one hundred pounds to two hundred pounds live weight, in sixteen or seventeen weeks. The following table shows the amount of dry or solid constituents in the five hundred pounds of barley meal, and how they will be disposed of in the case supposed:

500 POUNDS OF BARLEY MEAL PRODUCE 100 POUNDS INCREASE AND SUPPLY.

	IN FOOD.	IN 100 INCREASE.	IN MANURE.	IN RESPIRATION, &C.
	Lbs.	Lbs.	Lbs.	Lbs.
Nitrogenous substance,	52	7.0	59.8	276.2
Non-nitrogenous substance,	357	66.0		
Mineral matter,	11	0.8	10.2	....
Total dry substance,	420	73.8	70.0	276.2

"From the figures in the table we learn that the four hundred and twenty pounds of dry or solid substance which the five hundred pounds of barley meal contain, about seventy-four are stored up in the one hundred pounds of increase in live weight, about seventy are recovered in the manure, and two hundred and seventy-six, or nearly two-thirds of the whole, are given off into the atmosphere by respiration and perspiration—that is to say, are expended in the mere sustenance of the living meat and manure-making machine, during the sixteen or seventeen weeks required to produce the one hundred pounds of increase.

"But now let us suppose that instead of allowing the pig to have so much barley meal as he will eat, we make the five hundred pounds of barley meal last many more weeks. The result would be that the animal would appropriate a correspondingly larger proportion of the food for the purposes of respiration and perspiration, and a correspondingly less proportion in the production of increase. In other words, if the five hundred pounds of barley meal be distributed over a longer period of time, it will give less increase in live weight, and a larger proportion of it will be employed in the mere maintenance of the life of the animal. Indeed, if the period of consumption of five hundred pounds of meal be sufficiently extended, the result will be that no increase whatever will be produced, and that the whole of the food, excepting the portion obtained as manure, will be expended in the mere maintenance of the life of the animal. The conclusion is obvious, that provided the fattening animal can assimilate the food, a given amount of increase will be obtained with a smaller expenditure of constituents by respiration, the shorter the time taken to produce it. In fact, by early maturity and the rapid fattening of stock, a vast saving of food is effected. It is true that the flavor and quality of the meat of the one-year old sheep or the two or three-year old bullock, are not as good as that of the three or four-year old sheep, or the four or five-year old ox. But it is obvious that the mutton and beef of the older animals can only be produced with a much greater expenditure of food, and generally at an increased money cost, which must put them beyond the reach of a great majority of consumers."

HORSFALL'S EXPERIMENTS.

Some of the most valuable experiments for feeding milch cows are those made by Mr. HORSFALL of England. By affording a full supply of the elements of food adapted to the maintenance and produce of the animal, he was enabled to obtain as much milk, and that which was as rich in butter during winter as in summer. He used, to some extent, cabbages, mangolds, shorts, and other substances rich in the constituents of cheese and butter. "My food for milch cows," he says, "after having undergone various modifications, has for two seasons consisted of rape cake, five pounds, and bran, two pounds for each cow, mixed into a sufficient quantity of bean straw, oat straw, and shells of oats, in equal proportions, to supply them three times a day with as much as they will eat. The whole of the materials are moistened and blended together, and after being well steamed, are given to the animal in a warm state. The attendant is allowed one pound to one and a-half pounds per cow, according to circumstances, of bean meal, which he is charged to give to each cow in proportion to the yield of milk, those in full milk getting two pounds each per day, others but little. It is dry and mixed with the steamed food, on its being dealt out separately. When this is eaten up, green food is given, consisting of cabbages from October to December, kohl-rabi till February, and mangolds till grass time." His cows under this treatment usually yield from twelve to sixteen quarts of milk (wine measure) per day, for about eight months after calving, when they fall off in milk, but gain flesh up to the time of calving. From these experiments, conducted in a careful manner, it would seem that food rich in albuminous matter produced the best results. Bean meal contains twenty-eight per cent. of this substance. Beans are not used in this country as food for stock, but if we select other grains, rich in cheesy matter, the principle may be carried out, and satisfactory results obtained.

The three grains containing albuminous or flesh-forming matter in largest proportion next to beans (if peas are excepted), are rye, oats and barley, each containing from ten to fourteen and a-half per cent.; these, when ground into meal and mixed in equal quantities, taking their usual market value into consideration, are perhaps the best that can be selected. My own experience in the use of these grains as a spring food for milch cows corresponds with that of others as giving most satisfactory results. I have used oats and peas ground into meal together, and could wish for no better feed, but the cost was more, which was not met by increased production of milk. Barley and oats ground and mixed together have also been used with good results. Corn-meal I deem objectionable, on account of its heating nature. Its influence at times is very deleterious, having been known to lessen the quantity and injure the quality of milk, and in some instances dry up the cows. Bran is a very valuable feed for milch cows; it is rich in phosphates and nitrogenous or flesh-forming material, and when mingled with oat meal, gives the very best results.

FEEDING GRAIN IN SUMMER.

On the question of feeding cows grain through the summer, the general opinion among dairymen is, that it does not pay so long as the herds have an abundance of good grass. When shorts and bran can be obtained at cheap rates, and feed is beginning to fail, they may doubtless be employed with profit. Mingled with the hay and fed to cows, the milk gives a larger percentage of cream, while the quantity of milk also is increased.

The most natural, and of course the healthiest food for milch cows in summer is the green grass of our pastures. When cows are giving an extra quantity of milk, and in consequence are milking down thin and poor, it will be advisable to use concentrated food. The principle to be understood is that milk of good quality and large quantity depends upon food, and that the condition and strength of the animal must at all times be kept up. If allowed to run down and become poor and weak, we are undermining the constitution of the cow, and by inattention and neglect defeating the ends by which our best interests are to be promoted.

TURNING TO GRASS.

When cows are first turned to grass in spring, if feed is abundant, they should not be allowed in the pasture but a few hours each day, for several days—the change of food should be gradual. Serious troubles have sometimes resulted from inattention to this point, especially when turning cows into luxuriant afterfeed in autumn.

SALTING COWS.

Another important matter in the management of dairy stock is to have it properly provided with salt. The best way to salt dairy cows is to have the salt in some place conveniently located for stock, where daily access may be had to it, and the animals allowed to take whatever their appetites crave. It may be placed in boxes arranged in the feed alley of the stables, or in troughs in the shed, or open yard. Where cows have free access to salt, they soon regulate their appetite to the daily use of small quantities of it, taking no more than is required to promote health. Animals require more or less salt, according to the character of their food, and the practice of salting at certain intervals is often injurious, since they are liable to overfeed of it, causing excessive scouring and derangement of health. This is particularly the case when salt is thrown out to stock indiscriminately in the fields at intervals of a week or more. In such cases the master cows not unfrequently gorge themselves, preventing the weaker animals from getting a due supply, and thus one part of the herd is injured by overfeeding, and the other part by not obtaining what is needed. When the animals have access to salt, nature dictates as to its use, and hence the best results, both as to health and yield of milk, follow. Salt is very necessary for milch cows. Without it the milk becomes scanty and imperfect. It is an important element in the blood, and furnishes the soda necessary to hold the cheesy part of the milk in solution. Haidlin found in one thousand pounds of milk, analyzed by him, nearly half a pound of free soda, and over a third of a pound of chloride of sodium. There was also one and three-quarter pounds of chloride of potassium. There are various purposes in the animal economy that require salt, and cows in milk should at all times have free access to it. Perhaps the greatest necessity for its use is in spring, when cows are first turned to pasture. The food then is rather deficient in saline matter, and does not furnish sufficient for a large quantity of milk. As grass becomes more mature the mineral elements are more abundant, and there is less desire on the part of animals for salt. It is on this account and because cows have been dried of their milk, that in winter much less salt is required in the dairy than in summer. From experiments that have been made it has been found that in May and June, when milch cows have been deprived of salt for several days, the milk shrunk from one to two per cent. in quantity, and from two to four per cent. in quality. Later in the season the experiments showed less difference. Thus it will be seen that dairy stock, to produce the best results, should have a daily supply of salt, and that the quantity is much better regulated by the animal than it can be by the stock-keeper who doles it out at intervals.

WATER FOR COWS.

I have alluded to the importance of providing milch cows with good water, and something more may be said on this point, because it is one of the secrets of success, which the great majority of dairymen to-day do not fully comprehend. The importance of providing an abundance of water for cows in milk cannot be over-estimated. Every practical dairyman must have observed how rapidly cows shrink of their milk in hot, dry weather, when water is scarce and the animals do not get their usual supply. But although in such cases the cause of milk falling off is traced to its true source, many forget to take a hint from such observation in their management of milch stock during the summer and fall. Cows of course will live where the daily supply of water is limited, and by yielding a less quantity of milk, they adapt themselves to the circumstances under which they are placed. And if water is not abundant or is situated in out of the way places, where it is not easy of access, the animals soon educate themselves to get along with a much less quantity than they would were it placed before them in abundance. Up to a certain point, the animal will accommodate herself without complaint to the conditions, and it often happens that because cows show no very marked uneasiness nor falling off in flesh, it is supposed they get all the water which they require, when in point of fact they are taking only a limited supply. Herds thus situated do not yield large returns. The fault is not in the cows, but in their management. Now, milch cows should rather be induced to take all the water they will, and at no time should they be allowed to suffer from thirst. A cow that gives a large quantity of milk, must of necessity require more water, other things being equal, than the cow that gives only a small quantity of milk, for we must remember that of the constituents of milk eighty-seven parts or thereabout are water. To what extent the quantity of milk can be increased and at the same time a good quality be secured, by inducing the animal to take an abundant quantity of liquid, is still a question undetermined, but that milk of good quality can in this manner be increased and without injury to the animal, there is not the slightest doubt. Upon this point we have some interesting experiments by M. DANCEL, as communicated to the French Academy of Sciences. He found that by inciting cows to drink large quantities of water, the quantity of milk yielded by them can be increased several quarts per day without materially injuring its quality. The amount of milk obtained, he says, is approximately proportional to the quantity of water drank. Cows which, when stall fed with dry fodder, gave only from nine to twelve quarts of milk per day, at once produced from twelve to fourteen quarts daily, when their food was moistened by mixing with it from eighteen to twenty-three quarts of water per day. Besides this water taken with the food, the animals were allowed to drink at the same intervals as before, and their thirst was excited by adding to their fodder a small quantity of salt. The milk produced under the water regimen, after having been carefully analyzed and examined as to its chemical and physical properties, was adjudged to be of good quality, and excellent butter was obtained from it.

The precise proportion of water which can thus be given to cows with advantage, he says, is a point not readily determinable, since the appetite for drink differs very considerably in different animals. But by observing the degree of the appetite for drink in a number of cows, by taking note of the quantity of water habitually consumed by each of the animals in the course of twenty-four hours, and contrasting this quantity with that of the milk produced, M. DANCEL asserts that any one can see that the yield of milk is directly proportionate to the quantity of water absorbed. He asserts, moreover, that a cow that does not habitually drink so much as twenty-seven quarts of water per day—and he has met with such—is actually and necessarily a poor milker. She will give only from five and a-half to seven quarts per day. But all the cows he has seen which drank as much as fifty quarts of water daily, were excellent milkers, yielding from nineteen to twenty-three quarts of milk. In his opinion the quantity of drink consumed by a cow is a valuable test of her worth as a milk producer.

Now, whether the inferences drawn by Dancel from his experiments be strictly true in any particular or applicable in all cases, need not be discussed for the present, but they illustrate in some degree at least, facts familiar to practical men. The most common observer must have taken note that in the human family the mother suckling her infant requires and consumes more liquids than she did before or after her period of nursing. And the practical dairyman must have been dull indeed if he has not observed the difference in the appetite of cows for water before and after they have begun to give milk. The lesson which practical dairymen should learn from these facts is, that cows to yield the best returns must be provided with an abundance of pure water, so located that it is easy of access at all times. In fine, that inducements held out in this way for cows to drink, are a paying investment to dairymen. But while milch cows can be made to yield larger returns by a judicious use of liquids, we cannot recommend pushing the point to that excess which may affect the health of stock or reduce the quality of milk to a low standard.

FALL FEEDING.

As pastures begin to fail the latter part of July, soiling in part either with green corn fodder, lucerne, millet, oats, or clover must be resorted to, for keeping up a flow of milk, until cows go to the aftermath. It is essential that the flow of milk be kept up, for if cows are allowed to fall off in milk at this season of the year, it will be impossible to bring them back again by fall feeding. I need not discuss this point further, and I have only a word more in relation to the fall treatment of stock, since it is here that many dairymen make very grave mistakes. As the season advances occasional frosts begin to appear, and although grass may be abundant it is flashy and the frosts injure materially its nutritive value.

At this season more than any other cows are apt to milk down poor, and often before the dairyman is fully aware of the fact. If it is desirable to keep up a flow of milk, a little bran or ground grain can be used with profit; even a few nubbins of corn fed daily will prove serviceable in keeping up the strength and condition of the animal. But this is not all; the cold storms and frosty nights are injurious unless the animals are sheltered. Cows in milk, as I have remarked, are susceptible to cold, and if not protected from the inclement weather fall off rapidly in flesh and milk; even in summer a cold rain storm lessens the quantity of milk, as every dairyman must have observed; but towards the approach of winter, after yielding milk for several months, the general tone of the system is reduced, and the animal is unable

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to withstand sudden changes without being injuriously affected. Stock that is reduced in flesh at the commencement of winter, will require at least a quarter more food to bring it through to grass than it would did it start in high condition. This fact is lost sight of by many who suffer their cattle to run down in the fall, milking them late, and allowing them to be exposed to all kinds of weather. In cold, stormy nights during the fall cows will do better in the stable, even with no feed, than to be left out exposed to the inclemencies of the weather. What little food they pick up at such times is not of much account; they will seek out some spot that affords a partial protection from the storm and cold, huddle together, and stand there shivering and discontented till morning. It is at such times that more or less injury is done to the underlings of the herd from being hooked and driven about by master cows. Perhaps at no season of the year does stock require more care and attention than late in the fall, and at no season is it so generally neglected. Many never think of housing an animal at this season so long as the ground remains uncovered with snow, and many fancy they are saving fodder by withholding food so long as there are patches here and there of frozen aftermath, that are not eaten down. Such persons are often found complaining that their hay rapidly wastes away after feeding has commenced, and is wanting in nutrition; that their stock comes out thin in spring, and the yield of milk during the summer is less than it should be. They have no definite idea where the trouble lies; it is either in the hay or in the season, or in the cows, and they mourn over their bad luck, when in fact the real cause of all the trouble arose from neglect and want of care and attention in the fall treatment of stock.

Cows that are expected to yield largely must have careful treatment and liberal feed—they must be protected from the inclement weather in roomy, well-ventilated stables. The importance of comfortable, well-lighted and well-ventilated stables for milch cows is imperfectly understood, although much has been written on the subject. It should be remembered that a large share of the food eaten is used in furnishing warmth to the animal, and if we can supply warmth by artificial means, it will be equivalent to a certain percentage of food. Good shelter, therefore, serves in part for food. It has been well remarked that "beside the actual loss of food from the increased amount required under exposure to cold, there is a further loss in milk from the *feeling of discomfort.* The secretions are always disturbed by influences that cause pain or uneasiness, and every shiver of a half-frozen cow will make itself visible in the milk pail." It will often therefore, be a matter of economy for dairymen to commence feeding cabbages, the tops of roots, or small quantities of grain, just as soon as the grasses of the pasture have been touched with frosts. A daily allowance of bran, shorts, or ground feed of barley and oats, or oats and corn, in the proportion of two parts oats to one of corn, will be of the greatest service in keeping up a flow of milk and at the same time keeping the animal in health and condition.

There are many more topics in regard to the management of stock which I could have wished to discuss, but enough perhaps has been said to give an outline of the more important requisites in this branch of dairy management.

RAISING CALVES.

In raising calves they should always have a good start, and for this purpose I know of nothing equal to milk as it is drawn from the cow. Some people recommend separating the calf from the cow a day or two after it is dropped. I think it should be allowed to run with the cow and have all the milk it can take for at least four or five days. Ordinarily the cows milk will not be in a proper condition for human food under four or five days from the time of dropping her calf, though many dairymen who are anxious to make the most out of the milk insist that it is good enough for cheese-making at the fourth milking.

After the calf is taken from the cow it should be generously fed with new milk until it is two weeks old at least. This should be the earliest period at which the commencement of any substitute for new milk ought to be given. I should prefer to feed new milk for some time longer, but still very good calves may be raised by compounding a food for them a little less expensive than new milk.

If skim milk can now be afforded, the calves will thrive on liberal feeding, but the cheese dairymen often feel that even skim milk is too expensive to be long continued, and are not satisfied till the diet of the calf is reduced to whey. Now, if whey and oil meal be properly prepared, it can be made to serve as a very good substitute for milk. The whey should be dipped off when sweet from the vat, then bring it to the boiling point and turn it upon the oil meal. Let the mixture stand till night, and then feed. In the morning, whey sweet from the vat may be fed. At the commencement a little less than a pint of oil meal per day will be sufficient for four calves. This may be gradually increased till each calf has a daily ration of half a pint. At first it is better not to feed calves all the whey they will drink at a time. A large feed of whey cloys the appetite and deranges the health. A half pail of whey at first is enough for a feed, which may be increased to three-fourths of a pail and a pail, as the calf increases in age. Two meals a day, if the calf runs in a good pasture, is sufficient. Calves fed in this way ought not to be weaned until they can get a good bite of afterfeed from the early cut meadows. It is important to keep them in a growing, thrifty condition, with no check. When weaned earlier, their growth is often checked by reason of short, dry or innutritious feed in pastures. When whey cannot be had, the following substitute for milk in feeding calves is recommended by the Irish Farmers' Gazette:—"Take three quarts of linseed meal and four quarts of bean meal, and mix with thirty quarts of boiling water, when it is left to digest for twenty-four hours, and it is then poured into a boiler on the fire, having thirty-one quarts of boiling water. It is here boiled for half an hour, being stirred with a perforated paddle to prevent lumps and produce perfect incorporation. It is then set aside to cool, and is given blood warm. When first used it is mixed with milk in small quantity. The milk is gradually decreased till they get the mucilage only. Indian meal may be given in place of bean meal, and perhaps pea meal would serve the same purpose as bean meal, the latter not being common in this country. I have used buckwheat meal cooked into a porridge and added to whey, for calves, with good results, and I have no doubt that buckwheat meal could be substituted for bean meal in the mixture, and make a good feed. It is desirable and important to feed the calf well and hasten the maturity of the young animal so that it will come in milk at two years old. Many complain that they are unable to have their heifers in milk until three years of age. Heifers coming in milk at two years of age invariably make better milkers than those coming in milk a year later, to say nothing of the profit of one season's milk. It will be seen, then, that a little extra care and feed pays well, in order to an early maturity of the animal."

Mr. Brown of Herkimer Co. prefers March calves in selecting stock to raise. The calves are fed new milk for two weeks, at the rate of eight quarts per day each. After this, commence adding whey to the milk, and feed in this way up to the twentieth of April. By this time, if there is a sufficient quantity of whey made daily, no milk is given, but oil meal is made to take the place of milk, the quantity for each calf being at the rate of one-half pint of dry meal per day. Boiling water is turned upon the meal, which increases its bulk, in a few minutes, to three times the quantity of dry meal. It is then mixed with the scalding whey, and when sufficiently cool given to the calves. About three-fourths of a pail of whey to each at a mess, and two feeds per day are deemed sufficient. The calves are turned out to grass as soon as a good bite can be had, but the whey and oil meal are allowed daily until the time for turning into good fresh after feed, when its use is discontinued and the calves weaned. In this way good thrifty calves are raised, which winter well, and to all appearance are as healthy and in as good growing condition as though they had been raised on milk. The calves are always provided with a good shelter where they can go at will, out of storms. When oil meal cannot be had, oat meal is substituted, at the rate of two-thirds of a pint for each per day. The whey should be scalded, as in this condition it is better adapted to the animal, and has a tendency to prevent scouring.

RAISING CALVES ON THE SOILING PRINCIPLE.

Mr. G. D. Curtis of Wisconsin, contributes the following to the Boston Cultivator:—"About the first of April last, I began raising ten heifer calves for the dairy—taught them to drink at three or four days old, and fed them the milk of five cows, two hundred weight corn meal, and what hay they would eat, till May 15th. Milk and meal were then discontinued, and for the next two months they had about ten quarts sweet whey per head a day, and what clover and orchard grass they would eat, fed three times a day, of which they consumed half an acre. The next sixty-three days they were fed the sowed corn that grew on one-half an acre, and the same allowance of whey as at first. About the twentieth of September they were turned into wheat-stubble ground, seeded to grass last spring. When six months old the heaviest one weighed four hundred and thirty pounds, live weight, and the lot averaged four hundred pounds per head. The expense of cutting and feeding the grass and cornstalks was about the same as harvesting and threshing an acre of wheat.

The milk fed, if made into cheese,	$55.00
Two hundred weight corn meal at 16s,	4.00
Hay, estimated,	1.00
One acre land to wheat would have brought,	30.00
Value of whey, say	10.00
Eight tons of hay to winter them,	40.00
Total one year,	$140.00

Equal to about fourteen dollars per head for yearlings,—about double the cost of 'peace prices.'

"I have been engaged in dairying and stock-raising for the past twenty years, and have tried nearly all the different ways of feeding calves, and consider the experiment of the past season much the best. It produces very superior animals, and is no more expensive than the other plans."

CALF SKINS.

When calves are to be slaughtered for veal, or killed at a very early age, as is common in some dairy sections (in the latter case the hide and rennet only being saved), some attention should be given to stripping off the hide properly, and preparing it for market.

Calves that are to be "deaconed" should be allowed to live at least four or five days, and when killed the throat should not be cut crossways, for it can be bled just as well without. The skin should then be removed by slitting the hide from the middle of the under jaw to the root of the tail, and down the inside of the forelegs from between the dew-claws to the slit already made, and down the outside of the hind legs over the gambrel joint, and then direct to a point in the slit first named, midway between the teats and the roots of the tail. It is the safest way to draw the skin off with a windlass or a horse, but when this is inconvenient great care should be taken not to cut or hack the skin, as a cut part way through the skin is quite as bad as a hole. Instead of a knife for removing the skin, a bone or hard wood instrument shaped like a knife should be used, as it can be done almost if not quite as rapidly and with no danger to the skins. If the skin be a veal it should now be weighed and the weight marked down, as veal skins are purchased by the pound. But whether a "deacon" or a "veal" it should be stretched out on the floor or some level place, and about two pounds of salt applied, taking care that every spot is touched. The better way is, after sprinkling the skin as evenly as possible, to take an old brush or the hand and rub the salt thoroughly in. After lying for a day or two, if in the way, it should be hung up and allowed to dry under cover, but not exposed to the sun. If the skins are on hand after the first of June, they should be frequently whipped, to prevent the working of moths. The taking off and care of skins should not be left to young and careless boys, but should receive the personal attention of the farmer, or some trusty person. For skins taken off in the above manner and free from cuts, the tanner can afford to pay a price considerably above the market for ordinary skins as they run. Damaged, "slunk and dead skins," have a value, but should be sold as such for what they are worth.

HOVEN IN CATTLE.

Among the many diseases of dairy stock, *hoven*, or hove, as it is usually termed, is of frequent occurrence. It is induced by a sudden change of diet, as when animals in spring are turned from hay upon luxuriant pasturage, or later in the season, by changing from the pasture to a full growth of after-feed in meadows. Cows, when thus turned into fresh herbage, devour it greedily, which produces over-distension of the rumen, followed quickly by hove. A similar derangement of the digestive functions sometimes happens, it is said, from feeding turnips, though the more frequent occurrence of this disease coming under our observation, has been from a change of diet, and where the animals have been allowed to gorge themselves upon luxuriant grass. The food in such cases is imperfectly matured, the stomach becomes loaded, the process of rumination is prevented, decomposition takes place, gas is generated, and the animal becomes swollen with confined air that distends the paunch and intestines.

Great care should be exercised in the management of stock at the particular seasons referred to, since with proper precautions, the malady may often be avoided. It is always best that the change of food should be brought about by degrees, allowing the cows at first to take only a part of a meal, and continuing in this course for a few days until they have become somewhat accustomed to the fresh grass. In spring, after having been restricted during our long winters to dry food, a sudden change to a full supply of succulent food will be apt to derange health, even if the animals by chance escape an attack of hove. It will be well, too, on first turning to grass, that it be done at such times as when the weather is dry and the herbage is not covered with dew; and this rule should be particularly observed on first turning stock into luxuriant aftermath.

There is scarcely a dairyman of any considerable experience but has had cases of hove more or less severe among his cows—and the loss of valuable animals on account of the malady is of frequent occurrence. Indeed hove is so sudden in its attack and the disease progresses so rapidly, that unless speedy relief is given the animal dies. The fermentation which the food undergoes is facilitated by the heat and moisture to which it is exposed while in the rumen. The gaseous compounds produced by the fermenting process vary according to its duration; at first carbonic acid gas is evolved, but in a short time this product gives place to carbureted hydrogen gas.

Various medicines have from time to time been recommended, but scarcely any, with the exception of chloride of lime, is of much avail. When the attack is not severe the animal often recovers without any assistance. Chloride of lime is frequently found effectual in bad cases, administered in a small quantity of water, the dose of chlorinated lime being from three to four drachms. Used in time it effectually neutralizes the carbureted hydrogen gas. In its action the chlorine quits the lime and unites with the hydrogen and forms a substance—muriatic acid—with which the new uncombined lime unites, and the result is a harmless substance—muriate of lime.

In severe cases there should be no delay in adopting the necessary treatment, or the animal may be lost, for death in this disease is caused by suffocation. Immediate relief is given by puncturing the rumen, a quite simple operation when it is understood, and one which should always be resorted to in bad cases. As the disease is of such a character that no time is to be lost (for if the animal is to be saved, prompt action is required), every farmer should understaud the nature of the operation and be able to perform it. By observing the following diagrams but little difficulty need be had in operating successfully.

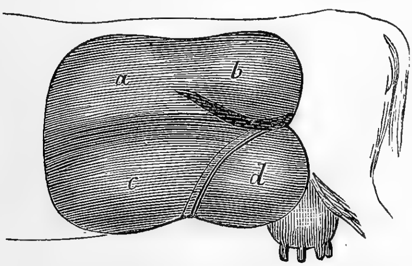


FIG. 1.

It is important to bear in mind that the operation should always be performed on the *left side* of the animal, in consequence of the inclination of the rumen to that part of the abdominal cavity. Figure 1 is a sketch intended to represent the first stomach in its natural situation; *a*, the anterior pouch; *b*, the anterior-posterior, *the one which is opened in these cases; c*, the middle, and *d*, the posterior-inferior.

The place of puncture is in the flank about three inches below the spinal column, and mid-way between the last rib and the hip.

The instrument recommended by veterinary sugeons is called a trocar; it consists of a stilet, having a lancet-shaped point and a sheath. We give Professor SIMONDS' directions, as follows:

"The stilet should be about six inches in length, and when placed within the sheath it should protrude about three-fourths of an inch; its diameter may vary from three-eighths of an inch to half an inch. In performing the operation it is best to first puncture the skin with a lancet; which having been done, insert the point of the instrument in the wound and thrust the stilet covered by the metal sheath inwards and slightly downwards, using sufficient force to penetrate the coats of the rumen; afterwards withdraw the stilet leaving the sheath in the situation. The sheath is to remain until the gas has escaped, when it is to be removed and the edges of the wound in the skin brought together by a stitch of strong silk."

As farmers are not usually provided with the proper instruments for performing the operation, a dirk-bladed knife may be used, and a quill or any small tube introduced into the puncture for the escape of the offending gas. There is no danger attending the operation when the proper instrument is used.

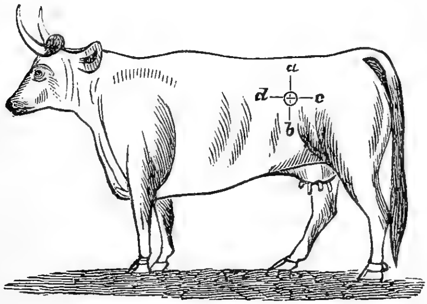
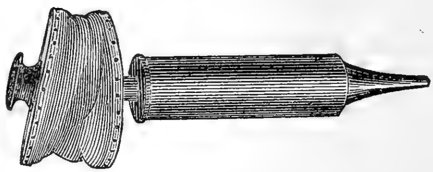


FIG. 2.

Figure 2 represents the point where puncture should be made—at the point where the lines *a*, *b* and *c*, *d* intersect each other.

HUTCHINS' FUMIGATOR FOR DESTROYING LICE ON CATTLE.

The fumigator consists of an iron cylinder with a circular bellows attached to one end, and the opposite end is contracted into a nozzle, so as to be easily inserted into the wool when using it for sheep ticks. It also has sieves at each end of the cylinder to prevent the fire passing into the bellows or out through the nozzle; by this means the smoke is never hot enough to do the least injury to animal or plant.



The cylinder being filled with cut tobacco and pressed down a little, same as you would fill a tobacco pipe, is ignited on top, and the smoke is forced out through the nozzle by the action of the bellows.

For ticks on sheep, introduce the nozzle into the wool, and give one or two good puffs; then move it from two to four inches, and puff again, and so on till you fill the fleece with smoke. It will take from two to four hours to smoke one hundred sheep, and one pound of tobacco will be sufficient for that number.

To kill lice on cattle, colts, &c., fill the hair with the smoke, then blanket them. In all cases go over them again after the nits hatch. It is better to take sheep into the open air to smoke them to prevent it making the operator sick.

For lice on plants and bushes of all kinds, also for the currant worm, squash bug, &c., cover the bushes or plants with some old clothes box, or anything to hold the smoke, then give them a good smoking; it will not injure the plant, but will kill the vermin.

MILK.

Of all the various foods used for the support of human life milk is one of the most perfect. It is almost the only food that will, when used alone, support life, and maintain health and vigor for an indefinite length of time. The earliest records of our race tell us of flocks and herds, and it may be assumed that not only the milk of animals but that the products of milk, in some form, have been employed in the diet of man from the most remote times. But while milk has been the natural food of the young of all mammalia, and while it has been, for ages, both in its natural and manufactured state, a blessing to the poor and a luxury to the rich, little was known comparatively of its composition, and of its behavior under certain peculiar conditions, until within the last half century.

Milk is described by the chemists as a secretion produced from the elements of blood and chyle, by the mammary gland of the female animal of the order, *mammalia*, after giving birth to young. It is a whitish, opaque liquid, of an agreeable, sweetish taste, and a faint but peculiar odor. It is slightly denser than water. Cows' milk of good quality has a specific gravity of about 1,030; woman's milk, 1,020; goat's and ewe's milk, 1,035 to 1,042; and asses' milk 1,019; that of water being 1,000. Whatever food has the effect of inducing the secretion of a very large amount of water, must necessarily give milk poor in quality. Such is the effect when food is supplied of distillers' grains, grass from irrigated meadows, acid slops, obtained by allowing barley meal, cabbage leaves, and other vegetable matter mixed with a great deal of water, to pass through the lactic acid fermentation. There cannot be much question but that whey may be added to this class of food, though there seems to be great difference of opinion among those who feed whey to milch cows, as to its materially affecting the proportion of solid constituents of the milk. We need a series of carefully conducted experiments to satisfactorily determine this matter and put the question at rest. Dr. Voelcker is led to conclude from his experiments that milk is rich when it contains twelve per cent. of solid matter and about three per cent of pure fat. Anything above this is of extra rich quality.

SPECIFIC GRAVITY A TEST OF QUALITY.

The specific gravity of milk is an important test of its quality. From experiments made in the Doctor's laboratory, for the purpose of ascertaining the influence of dilution upon the specific gravity of milk, and the quantity of cream thrown up, some useful hints are obtained. Water being the standard at 1.000, cream 1.012 to 1.019, and good milk 1.0320, the temperature always being 62° Farenheit, the following results were obtained:

	SPECIFIC GRAVITY	PER CENT. CREAM IN BULK.
Pure Milk at 62° Fahrenheit,	1.0320	11½
" " and 10 per cent. of water,	1.0315	10
" " " 20 " "	1.0305	9
" " " 30 " "	1.0290	8
" " " 40 " "	1.0190	6
" " " 50 " "	1.0160	5

Experiments with the hydrometer and direct weighing give the following:

	SPECIFIC GRAVITY AT 62° BEFORE SKIMMING.		SPECIFIC GRAVITY AT 62° F. AFTER SKIMMING.
	BY HYDROMETER.	BY DIRECT WEIGHING.	BY DIRECT WEIGHING.
Pure Milk,	1.0320	1.03141	1.0337
" " -|- 10 per cent. of water,	1.0285	1.0295	1.0308
" " -|- 20 " "	1.0250	1.0257	1.0265
" " -|- 30 " "	1.0235	1.0233	1.0248
" " -|- 40 " "	1.0200	1.0190	1.0208
" " -|- 50 " "	1.0170	1.0163	1.0175

Another experiment made upon skimmed milk with hydrometer gave the following:

	SPECIFIC GRAVITY.
Skim Milk,	1.0350
" " with 10 per cent. of water,	1.0320
" " " 20 " "	1.0265
" " " 30 " "	1.0248
" " " 40 " "	1.0210
" " " 50 " "	1.0180

From these investigations the following conclusions are drawn:

1. That good new milk has a specific gravity of about 1.030.

2. That skim milk is a little more dense, being about 1.034.

3. That milk which has a specific gravity of 1.025 or less, is either mixed with water or is naturally very poor.

4. That when milk is deprived of about ten per cent. of cream and the

original volume is made up by ten per cent. of water, the specific gravity of such skimmed and watered milk is about the same as that of good new milk; this circumstance however, does not constitute any serious objection to the hydrometer or lactometer, as milk skimmed to that extent cannot be mixed with water without becoming so blue and transparent that no instrument would be required to detect the adulteration.

5. That when unskimmed milk is mixed with only twenty per cent. of water, the admixture is indicated at once by the specific gravity of about 1.025.

Mr. FLINT gives the result of a test of different specimens of milk, the hydrometer and lactometer being used on the morning's milk, at a temperature of of sixty degrees. The scale was graduated for pure milk at one hundred degrees.

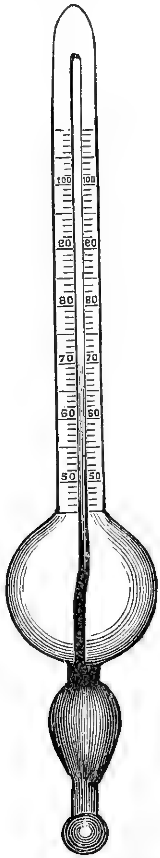
The first pint drawn from a native cow stood at	101	Degrees.
Strippings of same cow,	86	"
Milk of pure bred Jersey,	95	"
" " " Ayrshire,	100	"
" " " Hereford,	106	"
" " " Devon,	111	"
While their cream stood,	66	"

All these specimens of milk were pure, and milked at the same time in the morning, carefully labeled, put in separate vessels, and set upon the same shelf to cool off; and yet the variations of specific gravity amounted to twenty-five degrees; or, taking the average quality of the native cow's milk at ninety-three and one-half degrees, the variations amounted to seventeen and one-half degrees. But knowing the specific gravity at the outset, of any specimen of milk, the hydrometer would show the amount of water added. This cheap and simple instrument is therefore of frequent service. At the cheese and butter factories the lactometer and cream gauges are the only instruments employed to determine whether milk is delivered pure or has been watered. It is found that notwithstanding the milk of different cows in the same herd will vary considerably in specific gravity, still when it is all massed together, the specific gravity of such milk, if compared with the milk of different herds of a neighborhood, will be very nearly the same. It is from this fact that the attempt has been made in New York to establish the lactometer test as competent evidence in the courts, and some of the lower courts have so ruled.

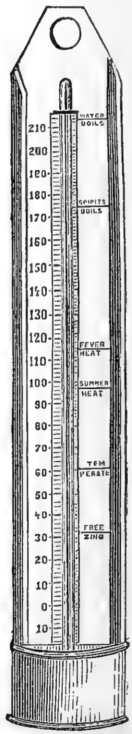
LACTOMETER IN COURT.

An interesting and important case was tried in 1868 at the Circuit Court held at Herkimer, Judge FOSTER presiding, as to whether the hydrometer or lactometer, as it is commonly called, be or be not a reliable milk test, and alone competent to convict where the instrument indicates watered milk. The suit was brought by the Treasurer of the Frankfort cheese factory against one of its patrons, to recover a penalty for alleged violations of the law to prevent adulteration or watering of milk. The plaintiff claimed that the defendant at certain times during the year 1865 brought to the factory milk which, when tested there by the hydrometer and cream gauges, indicated from twelve to seventeen per cent. less specific gravity than pure milk, and hence that it had been diluted with water. No other proof was in evidence except the tests of the instruments at the factory as above named. The defendant denied the allegation, and he and his three sons testified that the milking and

LACTOMETER.



FLOATING THERMOMETER.



THERMOMETER—NICKEL PLATED.

carrying the milk to the factory had been done by them, and that no water, to their knowledge, had ever been added to the milk.

The witnesses on the part of the plaintiff were the manager of the factory and some of its patrons, together with several managers of factories from different parts of the country and Canada, of large experience and of high reputation. The plaintiff proved the testing of defendant's milk at the factory by the hydrometer and cream gauges—that it was deficient in cream and indicated by the hydrometer from twelve to fifteen per cent. of water. Several managers of factories stated that where the tests were applied to the milk known to be pure, from different dairies, the variations were generally no more than from two to three per cent. from the standard of pure milk. Several of them testified also, that they regarded the lactometer to be perfectly reliable as a milk test, and that this conclusion had been arrived at from hundreds and even thousands of tests of milk from dairies as it came to the factory. The plaintiff's counsel attempted to show from reported analyses of milk, and from other sources, that the variable constituents of milk, for the most part, were the cream and the water, both of which were lighter than pure milk, that consequently, where there was a deficiency of cream and the specific gravity was less than pure milk, as had been shown in the milk furnished by the defendant, it could be accounted for in no other way than from adulteration or watering the milk.

The defense took the ground that the hydrometer was a mere float, well adapted to determine the specific gravity of fluids and of milk, but that the latter being made up of several constituents, all of which were liable to vary from time to time, the specific gravity of the compound at the factory gave no positive evidence of its quality as it came from the cow, unless such quality had been clearly ascertained as a standard from which to make comparisons. It was proved by several witnesses that in testing milk known to be pure, from different cows, with the hydrometer, there was considerable variation, sometimes as much as ten per cent.; and this variation had occured where the cows were of the same breed, fed on the same kind of food, and general treatment alike. It was proved from the books and from witnesses that the quality of milk is affected by various circumstances, such as difference of breed of the cows, quantity and quality of food, distance from time of calving, withholding salt for a time, and then salting, health of stock, general treatment, &c. From Voelcker's analysis of four samples of new milk, it was shown that the water varied from 83.90 in one hundred parts, the butter from 7.62 to 1.99, the caseine from 3.66 to 2.94, the milk sugar from 4.46 to 5.12, and the mineral matter from .64 to 1.13, making percentage of dry matters vary from 16.10 to 10.05.

Another analysis of several specimens of milk was referred to in the Report of the Department of Agriculture, where the difference in constituents was considerable, one specimen showing 93.0 of water, 1.8 of butter, 3.4 of casein, .8 milk sugar, and .1 of salts—thus making a variation of water between that and the specimen analyzed by Voelcker of over nine per cent. The milk sugar varied nearly five per cent., and the ash over one per cent. It was proved also that in making tests of milk with the hydrometer, great care was necessary in having the temperature exact, and in having the milk thoroughly mingled or stirred together, since the upper portion of the milk was of less specific gravity than that at the bottom.

One of the witnesses testified to the following experiments made with the milk of different cows in his own dairy. I was present at the tests, and helped to conduct the experiments:

First. A heifer's milk at 80°, when tried with the hydrometer marked the instrument $\frac{1}{2}$° below zero, showing five per cent. variation from pure milk.

Second. Milk of cow eight years old at 80°, hydrometer stood $\frac{1}{4}$° below zero, a variation of two and a-half per cent. from pure milk.

Third. Milk of all the cows mingled together in the vat at 80°; hydrometer $\frac{3}{8}$° above zero, showing a variation of 3.75 per cent.

Fourth. Thin cream at 80°, taken from night's milk in the vat; hydrometer sunk below 10°, or the point graduated as pure water.

Fifth. Milk at 60°, taken from near the bottom of the vat, and where the whole depth of milk in the vat was only four inches; hydrometer stood 1° below zero, showing ten per cent. variation from pure milk line.

Sixth. A portion of the above milk in the vat, taken from the top at 60°; hydrometer stood $\frac{3}{8}$° below zero, or 3.75 per cent. variation.

Seventh. The above milk thoroughly stirred and mingled together in the vat, and at 60°; hydrometer $\frac{3}{4}$° below zero, or $7\frac{1}{2}$ per cent. variation.

Eighth. The same milk above, stirred together and raised to 80°; hydrometer $\frac{1}{8}$° above zero, or one and a quarter per cent. lighter than pure milk.

Ninth. Milk from twelve years old cow at 80°; hydrometer $\frac{1}{2}$° above zero, showing five per cent. water.

Tenth. Milk from eight years old cow at 80°; hydrometer stood at zero, or pure milk mark.

Eleventh. Milk from a two years old heifer at 80° temperature; hydrometer $\frac{1}{2}$° above zero, or five per cent. variation.

Twelfth. Milk from a two years old heifer, 80° temperature; hydrometer $\frac{1}{4}$° above zero, or two and a-half per cent. variation.

Greatest variation in milk of different cows as above tested at 80° temperature, one degree or ten per cent.

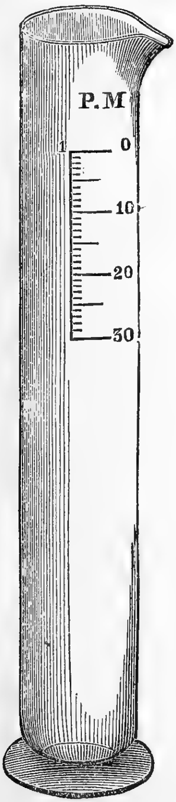
For every 2.28° of temperature the hydrometer marked one per cent. variation.

I have thus given some of the leading points as brought out in this case in regard to the hydrometer or lactometer. The arguments of counsel on both sides were able, as was also the Judge's charge to the jury, which, after a mature deliberation, brought in a verdict for the defendant, thus settling the question that the hydrometer alone, in cases of this kind, is not sufficient to convict.

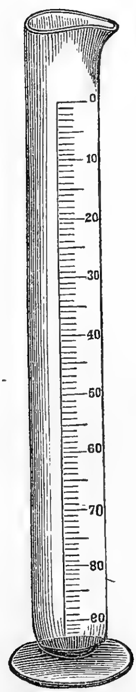
The Court House was densely crowded and great interest manifested by dairymen and others during the whole time this case was being tried, which lasted two days. Counsel for plaintiff, Hon. R. Earl and Brother, of Herkimer; for defendant, Hon. Roscoe Conkling and Hon. F. Kernan. I may remark here, in closing, that the result of this suit does not lessen the value of the hydrometer and cream gauges in the hands of intelligent persons. They act as *sentinels*, warning the operator of any unusual condition of the milk, and when such occurs he should not hastily jump at conclusions, but look carefully at all the causes likely to have influence in the case, and then make up his judgment upon them.

TEST OF WATERED MILK.

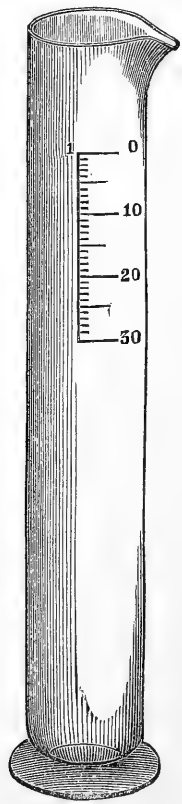
In making a test for watered milk, two equal glass jars or cream gauges are taken, and a small jar which is graduated and used for a one per cent. glass. Now one of the cream gauges is filled to gauge mark, ten, with milk which is known to be pure and drawn from several cows. This will be the standard for pure milk for that day. Fill the other glass, to the same number,



CREAM GAUGE.



PER CENT. GLASS.



CREAM GAUGE.

with milk from the can you wish to test. To avoid any mistake, mark the first jar pure milk, by putting the letters P. M. on the side or bottom. Set the jars away, side by side, a sufficient length of time for the cream to rise. Now note the quantity of cream on each. If a less quantity is found on the milk you are testing than on the other, it indicates dilution or skimmed milk. Now remove the cream from each with a spoon; introduce the hydrometer or lactometer into the jar marked P. M. and note on the scale mark where it floats. Now place the hydrometer into the other. If it sinks lower than in the first, it is very strong evidence of dilution with water. Replace the lactometer in jar marked P. M. and from per cent. glass filled with water exactly to 0 or zero, pour into P. M. jar until the lactometer sinks exactly to the same point as in the other jar. Now count or number on per cent. glass from zero down (each mark represents half of one per cent.), and you will have precisely the percentage of water with which the milk you are testing has been diluted. Care must be taken to have the temperature of the samples the same.

RECENT MILK TESTS.

The subjoined results of milk examinations made during the present year, 1871, by Mr. J. A. Wauklyn, member of the Royal Bavarian Academy of Sciences, and published in the London Milk Journal, will be of interest in this connection:—" In making examinations of milk for sanitary or commercial purposes, it is customary to use determinations of specific gravity as indices of the *strength* of milk. It is, however, recognized that owing to the circumstance of cream being lighter than water, while skimmed milk is heavier, the indication of strength afforded by a determination of specific gravity is not very precise. Obviously, if in addition to the specific gravity, the percentage of cream were taken, a connection could be applied so as to rectify the indication of strength derived from specific gravity. In the course of an examination of milk, undertaken for this Journal, the observation was made that there is another source of inaccuracy hitherto quite unsuspected. Skimmed milk consists mainly of water, caseine, milk-sugar, and a small quantity of mineral salts. Now, the exact molecular condition of the caseine influences the specific gravity of milk. In other words, samples of milk of the same strength will vary in specific gravity according to the exact molecular condition of the caseine. Especially are these changes in condition brought out if milk be kept for a while. This is illustrated by the following examples.

"In attempting to analyse articles of general consumption, with a view to determine the extent of adulteration, it is necessary to operate on a large number of samples obtained from *bona fide* purchasers, and to adopt means calculated to ensure comparable results. We do not intend on this occasion to enter fully into the subject of milk analysis, but we may state that plans commonly adopted are of little worth. We have had to notice the untrustworthiness of specific gravity determinations of milk—that is to say, the danger of judging of the strength of milk by its specific gravity. To be of any value at all, the specific gravity determination must be made while the sample of milk is very fresh. After milk has been kept for two or three days, even in a closed vessel, its specific gravity falls in a very remarkable manner. The following examples exhibit this in an extreme form. The specimens of milk had been kept in corked bottles for four days:

	SP. GR. AT 60° F.	PERCENTAGE OF SOLIDS DRY, AT 212° F.	PERCENTAGE OF ASH.
Sample *a*,	1.0004	11.34	0.94
" *b*,	0.9960	10.48	0.75
" *c*,	1.0184	8.92	0.66

Showing that the highest specific gravity sometimes accompanies the lowest percentage of solids. The reason of this want of correspondence between specific gravity and solid contents we have already explained. Meanwhile, in judging of the strength of milk, we propose to adhere to the method of evaporating to dryness in the water-bath, and weighing the residue.

"We have examined seven samples of milk sent to us by different persons, with a request that they should be examined. We have found in one hundred parts by weight of each, as follows:

	TOTAL SOLIDS, DRY AT 212° FAHR.	ASH.
No. 1,	11.34	0.94
2,	11.33	0.85
3,	11.04	0.72
4,	10.48	0.75
5,	9.39	0.62
6,	5.98	0.57
7,	8.92	0.66

"The sample No. 6 is a gross case of dilution. It is milk supplied to a workman's family in Bethnal-green, and contains no less than four parts of water to six of milk. Samples Nos. 5 and 7 are not so bad, but unless dilution had been practiced, the milks were exceedingly and abnormally poor.

"We recently obtained a specimen of country milk from the Dairy Reform Company. We procured it in the perfect confidence that, if pure unadulterated milk can be obtained from any source, it can be obtained from this admirably-managed association. The specific gravity was 1024.8, taken with great care with an accurate balance, at a temperature of 60° Fahr. As a crucial test we sent a special messenger to the Victoria Dairy, in Union Street, Hackney, to obtain four samples of milk from one cow. We wished to test the milk as drawn straight into the sample bottles from each quarter of the udder. The results were:

	Sp. gr., at 60° Fahr.
Right side, front quarter	1020.4
Left side, " "	1021.3
Right side, hind quarter	1023.0
Left side, " "	1023.5

"The cows in this dairy are well cared for, and fed on meal, clover, and other foods calculated to give a good quality of milk; but we thought the drawing of the first portions of milk from each quarter would scarcely give fair samples, since the strippings are always richer. We have also obtained, as the result of the strippings from all the quarters, milk with a specific gravity of 1025.1. When, therefore, a great deal is made of very high specific gravities, we can only say, from a milk consumer's point of view, that the results must be accepted with due caution.

"We rely more for practical purposes on careful weighings of the solids obtained directly from milk at the boiling point of water, and of the ash, after carefully burning the same solids. The results are most satisfactory; and we have examined samples from several dairymen in Kensington, which prove that the milk dealers are far from being the very black sheep they are so commonly represented to be. Last month we had to record very poor results, and we should have exposed one or two of the most shameful cases of dilution had we the opportunity of repeated examinations. This month we have been more fortunate in every respect, as the subjoined list indicates:

NAME AND ADDRESS.	TOTAL SOLIDS DRIED AT 212° FAHR.	ASH.
Tunks and Tisdall, Newland Terrace, Kensington	12.12	0.61
Clarke, Kensington Place, High Street	12.16	0.65
Watson, Russell Gardens, Addison Road, Kensington	12.51	0.66
Lunn, Church-street, Kensington	12.47	0.76
Knight, High-street, Kensington	11.25	0.74

"These are fair samples. The first four are virtually alike, and undoubtedly rich. The last sample of milk is poor.

"A sample of milk direct from the cow, obtained from the Victoria Dairy, gave:

Total solids.	Ash.
13.60	0.75

"This is very rich, and 'strippings' above referred to, with sp. gr. of 1025.1, yielded

Solids.	Ash.
18.74	0.62

"No comment is needed when these results are compared with many published analyses.

SPONTANEOUS CHANGES IN MILK.

"The remarkable diminution which the specific gravity of milk undergoes on keeping, noticed in last month's Journal, induced us to study the changes occurring in milk from the moment it is drawn. As it comes from the cow it is at the temperature of the body, viz., about 100° Fahr., and in the most perfect state of emulsion. There are some material differences in the chemical composition and physical characters of different portions drawn in successive quantities into separate vessels in the one act of milking. Thus a sample —the first eight ounces of milk drawn direct into a bottle gave:

In 100 parts.................... 17.33 solids.................... 0.70 ash.

The specific gravity taken the same day at 60° was 1020.4. The specific gravity taken two days later at 60° Fahr. was 1030.2.

"An average sample of the same cow's milk taken the next day, with due care that the whole secreted by the one quarter of the udder was drawn off and well mixed, yielded:

In 100 parts.................... 13.60 solids.................... 0.75 ash.

The specific gravity at 60° Fahr., was 1031.3.

"Lastly, the 'strippings,' after drawing the sample which gave the last result, and having well milked the cow, showed:

In 100 parts.................... 18.74 solids.................... 0.62 ash.

The specific gravity at 60° Fahr. was 1024.6.

"From the whole course of our experiments, it appears that the first change which milk experiences is a contraction. Specific gravity 1020 becomes specific gravity 1030. The next change is expansion—and this occupies some days—which is manifested by the specific gravity sometimes falling below 1000. We reserve further details for a future number. We have said enough to caution people against trusting to the lactometer in determining the nutritive value of milk."

ABSORPTIVE PROPERTIES OF MILK.

The following note on the remarkable properties of milk in absorbing and retaining exhalations such as those of tar, carbolic acid, and other ill-smelling substances, is from the pen of Mr. Lawson Tait, F.R.C.S., of Birmingham. He writes: "In the month of April last I was engaged with my friend Mr. M. E. Naylor, veterinary surgeon, in examining the conditions attending the spread of the foot and mouth disease in the West Riding; and, amongst other stations of suffering, we visited the farm attached to the West Riding Lunatic Asylum, under the superintendence of my distinguished friend Dr. Crichton Browne. I had a long conversation with the intelligent farm bailiff, Mr. Turner; and, amongst other experiences I tasted the diseased milk. I found that this had a peculiarly disagreeable, smoky taste, and at first I rashly set this down as due to the disease of the cows. I found, however, that this smoky taint was by no means confined to the milk yielded by the affected animals; and Dr. Browne told me that he had sometimes occasion to send away milk and cream from his table, which was unfit to use an account of this smoky taste. A little examination further showed us that this flavoring was due to the recent asphalting which had been done in and near the milk-house. It at once flashed across my mind that, if milk acquired this tarry flavor from absorption of the exhalations of asphaltum, it was just possible it might also acquire other things which were not so innocuous; and I at once set going a series of experiments which have led me to the belief that milk is an extremely dangerous agent for the spread of contagion. I need not say that I did not try any experiments, as they were all personal, with contagious matter; but by inclosing fresh milk under bell-jars with tar, turpentine, assafœtida, fæces, urine, &c., I found that in most instances the milk became impregnated with the smell, and sometimes with that intensely disagreeable sensation which we know as the 'taste like the smell' of the substances employed. The degree to which this was acquired seemed not so much to be in proportion to the amount employed either of milk or of infectant substance, but to the amount and quality of the cream which rose to the surface of the milk; the oleaginous molecules seeming to act as the menstruum of contagion. This is not unlikely, when we remember that the best solvent for nearly all odoriferous principles is oil. Clinically, this question will be most difficult and dangerous to work out. For one, I shall not attempt it. But, if we bethink ourselves of any instances of diseases which might in certain instances be communicated by milk, typhoid fever stands out with fearful probability." These observations are of obvious importance to the farmer, not only as indicating the infections of which he must beware, but the high-smelling sulphurous, chlorinated, carbolic, or tarry disinfectants—such as sulphurous acid, chlorine, chloride of zinc (Burnett's fluid), carbolic acid, and McDougall's powders, against which he must be equally on his guard, however much they may be pressed on his attention by interested or imperfectly-informed persons.

COLOR OF MILK.

Milk of average good quality contains about eighty-seven per cent. of water. It is for the most part an emulsion of fatty particles, in a solution of caseine and milk sugar. Thus the proportion may be stated to be very nearly, in one hundred parts, as follows:

Water,........	87.40
Butter,........	3.43
Caseine,........	3.12
Milk Sugar,........	5.12
Mineral matter,........	.93
	100

Milk varies in its composition in different cows, at different seasons, or when fed upon different kinds of food,—the greatest variation in either of its solid constituents being in the butter. The fatty particles are inclosed in little cells of caseine. In other words the butter is encased in curds. These milk globules are generally round or egg-shaped. They are of different sizes in different animals; and even in animals of the same kind they vary from the 1-2000th to the 1-4000th part of an inch. Viewed under the microscope milk appears as a transparent fluid, in which float these innumerable small round or egg-shaped globules—the so-called milk globules. The fluid constitutes the bulk, and the milk globules but a small fraction of the milk. The white appearance of the milk is due to the milk globules suspended in it. As these globules are separated in the shape of cream, the milk becomes clearer and acquires a peculiar bluish tint which at once indicates its character. "As blue as skimmed milk" is an old adage—a familiar expression, if not a familiar fact to most people, whether they be dairymen or otherwise. Completely separated from the milk globules, the fluid is a perfect solution of curd or caseine, albumen, milk sugar, and mineral matters.

These butter bags or cells, being lighter than milk, rise on standing, and are removed as cream. The less transparent the milk is, the better, and the more butter it contains. If it were possible to separate the cream completely by standing, the skimmed milk would be almost colorless; but as a certain number of milk globules always remain suspended in milk, even after long standing, skimmed milk is always more or less opaque. In the ordinary process of setting milk and skimming, the fatty matter is not wholly removed with the cream which rises; for if the skimmed milk be made into cheese, the cheese on analysis will be found to contain butter, though the quantity may be small. But that the butter is not all removed from the skimmed milk, will perhaps be as satisfactorily indicated to the dairyman, by observing the thin coating of cream which rises upon the whey obtained from the manufacture of "skim cheese." Skimmed milk and buttermilk, having a whitish appearance, still contain minute milk globules, with shells of caseine, or caseine in solution, which color the fluid.

TINT FROM THE FOOD COWS FEED ON.

It may be observed that the food which cows feed upon sometimes imparts its peculiar tint. It is a well known fact that food containing substances of a medicinal character which pass rapidly into the milk, imparts to it medicinal properties, similar to those in the substances themselves. Thus, if castor oil be given to a milch cow in considerable quantities, the purgative effects of the oil pass into the milk. The peculiar flavor of turnips, cabbage, or onions, used as food, passing to the milk, is of so common an occurrence to those in habit of handling milch stock, that it will be readily recognized as a fact. In like manner, the tint of some kinds of weeds passes into the milk and colors it. Most authors state that cow's milk is either neutral or slightly alkaline, and that the milk of carnivorous animals has always an acid reaction. The samples of milk taken from different animals of my own herd, when tested with blue litmus paper, have invariably shown an acid reaction. When milk is allowed to turn acid by keeping for some days, or when any acid or rennet is added to new milk, the curd of milk, contaminated with more or less butter, separates in the form of a white, flocky, voluminous substance, having a slightly acid reaction. When dried it shrinks greatly in bulk and becomes semi-transparent and horn-like. In this condition it is scarcely soluble in water, but dissolves with readiness in a weak solution of caustic potash and soda; and is again precipitated from its alkaline solution, by acetic or mineral acids, and restored to its former gelatinous condition.

CASEINE

exists in milk in a state of solution, and is distinguished from albumen, which it resembles closely in composition and general physical properties, by not coagulating on boiling, and by being precipitated by rennet. On boiling a solution of caseine it absorbs oxygen, and in consequence a pellicle which is insoluble in water is gradually formed upon the surface. A similar pellicle is formed when skimmed milk is boiled. New milk gradually heated to near the boiling point of water, throws up cream, while at the same time, a skin of oxydized caseine is formed on the surface. Thus in the noted "clotted cream" of Devonshire we find more curd than in cream collected in the ordinary manner. When I was in Devonsire, I was particularly interested in knowing how this highly esteemed English delicacy was made, and I shall describe the process, as I frequently saw it in operation among the Devonshire dairies.

DEVONSHIRE CREAM.

The dairy house is of stone, usually in connection with the dwelling; stone floors and stone benches for the milk to set upon, and all well ventilated, and scrupously neat and clean. The milk is strained in large, deep pans, and put in the dairy house, where it stands eight to ten hours, when the pans are taken out and the milk scalded, by placing the pans holding it in an iron skillet filled with water and set upon the range. At the bottom of the skillet there is a grate on which the pan of milk rests, so as to keep it from the bottom and from burning. The milk is slowly heated to near the boiling point, or until the cream begins to show a distinctly marked circle or crinkle around the outer edges When the first bubble rises on the surface of the cream, it must be immediately removed from the fire. Some experience is necessary in applying the heat, to have it just right, otherwise the cream is spoiled. When properly scalded, the milk is removed to the dairy, where it stands from twelve to twenty-four hours, according to the condition of the weather, when the cream is removed and is in a thick compact mass, an inch or more thick, and quite different from our ordinary cream. It is then divided with a knife into squares of convenient size, and removed with a skimmer. It is more solid than cream obtained in the usual way, and has a peculiarly sweet and pleasant taste. It is considered a great delicacy, and is largely used in England, with sugar, upon pastry, puddings, or fresh fruits, and especially upon the famous gooseberry pie. It makes an extensive article of commerce, and is really a delicious article of food. I do not know as this cream has ever been manufactured in this country, but it certainly deserves to be introduced, and perhaps would prove profitable.

SOLUBILITY OF CASEINE.

The solubility of caseine in milk, says VOELCKER, is generally ascribed to the presence of a certain small proportion of free alkali. But though it is quite true that alkalies are excellent solvents for caseine, and milk is frequently slightly alkaline, it may be questioned whether the solubility of caseine is due to the presence of free alkali; for even in milk which is slightly acid, and therefore does not contain any free alkali, all the curd occurs in a soluble form; nor does the addition to new milk of diluted acid in quantities which, though small, are sufficient to render it decidedly sour, cause the separation of caseine. This takes place only after a large qantity of lactic acid has been formed spontaneously, or an excess of free acid has been put into the milk. And he remarks further, that the action of rennet on the soluble form in which caseine occurs in milk is peculiar, and as yet unexplained. It was supposed for a long time that

RENNET COAGULATED MILK

by converting the sugar of milk into lactic acid, and that the lactic acid, by neutralizing the free alkali, was in reality the agent in effecting the separation of the curd in a coagulated condition. But this view is no longer tenable; for rennet *at once* coagulates new milk without turning it acid in the slightest degree. He affirms that he has even purposely made milk alkaline, and yet separated the curd by rennet, and obtained a whey which had an alkaline reaction. In my interviews with Professor VOELCKER in London, during the summer of 1866, he said to me that the chemists were as yet quite unable to explain the coagulating principle of rennet, or even to give it a name. Since that time, by the aid of the microscope, the coagulation of milk has been explained, and if the theory is correct it opens up a very interesting field of investigation. I shall presently refer to these microscopic investigations, and give the views now entertained by scientific men on this question. When curd is exposed to air in a moist condition, it undergoes partial decomposition and becomes a ferment, which rapidly decomposes a portion of the neutral fats of butter, separating from them butyric and other volatile fatty acids which impart the bad flavor to rancid butter. Caseine ferment also rapidly converts milk sugar into lactic acid. Pure caseine of milk has almost precisely the same composition as vegetable caseine or legumen, and possesses the same physical and chemical qualities.

ALBUMEN.

When rennet is added to milk it separates into curd and whey, and if properly conducted a perfectly clear whey is obtained. On heating the clear and filtered whey nearly to the boiling point of water, a flaky curd-like substance separates itself. This substance is considered to be albumen. It exhibits all the distinguishing properties of white of egg or albumen, but has not yet been subjected to ultimate analysis. The albuminous matter which is not separated by rennet, but coagulates on boiling the whey from which the curd has been previously removed, amounts in cows' milk to from one-half to three-quarters per cent., or about one-quarter to one-fifth part of the caseine. It is somewhat remarkable, says Dr. VOELCKER, that this albuminous matter does not coagulate when new milk is simply raised to the boiling point of water. In this case a pellicle of oxydized caseine is formed on the surface, but no albumen separates, and it thus appears that the curd of milk has first to be removed by rennet before the albuminous matter can be obtained in a coagulated form. Whether some practical method will yet be invented for arresting this highly nutritious constituent of milk and incorporating it in the cheese remains to be seen; but up to this time none of the ordinary methods of cheese-making have sufficed.

DENSITY OF CREAM.

I have said that the milk globules are small, round, or egg-shaped bodies, which inclose in a thin shell of caseine a mixture of several fatty matters. They are somewhat lighter than milk and consequently they rise on the surface when milk is set aside and remains at rest. Cream is slightly denser than pure water, and will therefore sink in distilled water. By churning the cream, the caseine shells are broken, and the contents of the milk globules made into butter.

MILK SUGAR

is contained in the clear whey from which curd and albumen have been separated, and is prepared by evaporating in shallow vessels until crystals begin to separate. The sugar of milk is less sweet than grape or cane sugar. It requires five to six parts of cold water for solution; dissolves readily in boiling water, and crystalizes again on cooling, in white, semi-transparent, hard, small crystals, which feel gritty between the teeth. In a pure state it may be kept, unadulterated, for any length of time, but if left in contact with caseine and air it gradually becomes changed into lactic acid or into fruit sugar, which in its turn enters into alcoholic fermentation, producing carbonic acid and alcohol. Most of the milk sugar of the shops is now manufactured in Switzerland. It forms an article of commerce, being used largely in the preparation of medicines. It is usually sold at the shops at from six to eight shillings per pound, and it has been suggested that it could be profitably manufactured here, and employed for various purposes, were its cost cheapened. A firm in Chicago have recently advertised for the whey of the Western cheese factories, and propose to enter upon milk sugar manufacture.

MINERAL MATTERS.

The mineral matters of milk consist mainly of phosphate of lime and magnesia, and the chlorides of potassium and sodium, besides a small quantity of phosphate of iron, and some free soda. A thousand pounds of milk, according to the analysis of HAIDLEN, would contain from five to nearly seven pounds of mineral matters. The relative proportions of the several substances are given by HAIDLEN as follows:

	LBS.	LBS.
Phosphate of lime	2.31	3.44
" of magnesia	.42	.64
" of peroxide of iron	.07	.07
Chloride of potassium	1.44	1.83
" of sodium	.24	.34
Free soda	.42	.45
	4.90	6.77

I have now given a very full account of the different constituents of milk as described by the chemists, and found by chemical analysis; and it is important that those who manufacture milk into dairy products, have some general idea of the component parts of the material with which they have to do.

QUALITY OF MILK—HOW AFFECTED.

The quality of cow's milk is affected by the age of the animal, as well as by the distance from the time of calving. Now, as to the milk of aged cows, the general impression in this country among dairymen is, that the milk of old cows is quite as good or even better than that of young cows. Hence the almost universal practice of our dairymen is to retain good milkers on the farm, and if no accident occurs, on account of which their milk fails, they are kept in the dairy until quite worn out with age and are then turned off—but little better than mere skeletons of hides and bones—at from six to ten dollars per head. In England I found a very different practice prevailing. When milch cows have attained an age of from six to eight years' they are put in condition for the shambles and sold. A good profit is thus realized on the animals for meat, irrespective of what may have been made in the dairy. They hold that the milk of old cows is of inferior quality to that of young cows, and chemical analysis, it seems confirms this opinion. Again, as old cows consume more food than young cows, and are therefore more expensive to feed, nothing appears so unprofitable as to keep cows until they grow old. VOELCKER affirms that generally speaking, after the fourth or fifth calf the milk becomes poorer. This is a very important question in the economy of dairy practice, and it is one which I hope will be thoroughly investigated at our agricultural colleges. Milch cows sell at from seventy to eighty dollars. If turned for beef at seven to eight years' old, there will be little or no loss, but if kept four years longer and sold for ten dollars, the loss on first cost of the animal is some sixty dollars, or fifteen dollars per year.

INFLUENCE OF FOOD IN CHANGING THE RELATIVE CONSTITUENTS OF MILK.

There is another interesting question which I hope to see investigated at our agricultural colleges, and that is, whether the food upon which the cow is kept, has much, or little, or *no* inufluence in changing the quality of milk, or the relative proportions of its various constituents. Dr. KUHN, a German chemist, in a recent communication to a meeting of agricultural chemists at Halle, Germany, answers this question in the negative. His opinion is based upon an experiment with eleven milch cows, and he believes the result to be correct, as the experiment was made with great care. He says:—" Green clover was fed with or without the addition of cut straw, so that the proportion of nitrogenous elements to the non-nitrogenous elements of the food varied from 1 to 2.5 to 1 to 3.5; nevertheless the relative proportions of the several constituents of the dry substance of the milk, as fat, caseine, albumen, and sugar, remained constant throughout.

The relative proportions of the several dry constituents of the milk appear, therefore, he says, to depend, not on quality of the food, but on special characteristics in the constitution of the animals themselves. Dr. KUHN says he has confirmed this result by experiments with a more varied mixture of food, since he has fed hay alone, then hay with starch, with oil, with beans, with bran, so that in one instance the proportion of the nitrogenous to the non-nitrogenous was as 1 to 8.1. It is not possible, he says, by any choice of food to modify the character of the milk so as to make it richer, for example, in fat or any other organic ingredient; this can only be done by a judicious selection of the breed of milch cattle. The proportion of water however, to the ingredients of the milk may be affected by the character of the food; so that the richness of the milk in any given constituent, as for example, oil, may be increased; but at the same time every other constituent except water is increased in the same proportion.

The following paper communicated during the past year (1871), to the New York Tribune, by a student of Scientific Agriculture, at one of the German Universities, will explain more in detail the theory referred to:

INFLUENCE OF FODDER UPON MILK PRODUCTION.

Some accounts of experiments on the best methods of feeding cattle, made at the Agricultural Experiment Station in Moeckern, Saxony, have already appeared in an article entitled " Best Food for Milch Cows." An account of another experiment, the object of which was to determine the effect of different kinds and quantities of food upon the milk production, will be interesting, from its practical as well as scientific bearings.

The question to be solved is this: *What effect does the quality—the composition—of the fodder, have upon the quality—the composition—of the milk?* If I have a dairy and make butter, it is worth while to know whether, by increasing the amount of fatty matter in the food, I can get a milk richer in butter, or whether in case I wish to make cheese, during the hot summer months, I can increase the amount of albumen and caseine in the milk, by adding albuminous material to the food. Here in Germany, when a question of this kind arises, they have a simple way of settling it. They "try and see." And the spirit in which this trying and seeing, this experimenting is done, is the same spirit that has made Napoleon to-day a prisoner upon German soil, and borne King William, with his victorious army to the gates of Paris; the spirit of System, of patient, systematic, thorough, intelligent work. How Dr. Kuhn and his assistants carried on this experiment, and what its plan and results were, we shall be better able to understand after a little reviewing of some of the fundamental principles of physiological chemistry.

The chemistry of the present day informs us that there are two general classes of substance which make up the great bulk of the organic matter of the plant, and of the animal body, or of its products, as milk. The main difference between them, as shown by chemical analysis, is that the one class contains nitrogen, while the other does not. Hence they are styled nitrogenous and non-nitrogenous substances. But the physiologist finds that they have very different uses in the animal system; that the non-nitrogenous or carbo-hydrates, as they are also styled, contribute more to the formation of fat, and make also fuel, whose combustion keeps up the animal heat—while the nitrogenous build up the muscles, the lean meat, and, at the same time, are believed to be especially efficient as a source of strength, in the same way that the carbo-hydrates generate heat by their consumption in the system. Let us, then, fix thoroughly in our minds the names and chief offices of these two classes of substances: 1. Nitrogenous, or albuminoids—flesh-forming, strength-giving. 2. Non-nitrogenous or carbo-hydrates—fat-forming, sources of animal heat. Meanwhile we will be content to know that in hay, in meal, in meat, in milk, indeed in all that makes up the food and flesh of animals or men, these two classes of substances constitute the most important part, and that this distinction lies at the foundation of that application of science to cattle-feeding, which is called, on this side of the Atlantic, "Rational Foddering."

Fat meat, the fatty portions of milk, and the butter are non-nitrogenous, but lean meat and skim-milk cheese are nitrogenous. So the question to be decided by our experiment is, *Will a ration, rich in carbo-hydrates, give a milk rich in butter, or will a milk rich in albuminoide be produced from a food of corresponding composition?*

In the stables of the Moeckern Station, are some stalls especially set apart for cows under experiment. During the course of the experiment these cows are fed and milked under the direct supervision of one of the chemists, Dr. Haase, whose duty it happens to be to attend to the feeding and milking. The cows are quietly eating their hay and oil cake, a cow-maid is milking one, and the Doctor is looking on to see that no milk is spilled, and is ready to take the milk and weigh it as soon as it is ready. The general plan of the experiment is to feed the cows during one period of two or three weeks, with a ration rich in albuminoids, the ration being made up of hay, which we consider normal fodder, to which is added bean meal or rape cake, or some other substance rich in nitrogen; and then change the proportions, and for the next period furnish a preponderance of carbo-hydrates, or hay, with oil, starch,

&c., and note the difference, if any, in the quantity and quality of the milk. That would seem to be quite a simple matter, but in fact it is a very complicated work. To feed a cow three weeks on the highly nitrogenous food, and then suddenly change to a highly non-nitrogenous ration would be too great a shock upon the internal system to allow the experiment to be reliable. And further, natural change, that takes place in the composition and amount of the milk, independent of the fodder, makes the work still more complicated. To get over these difficulties we must start with a period of normal foddering on good meadow hay, then gradually change, through a transition period, to the more or less nitrogenous feed, as the case may be, and continue this latter course of feeding for a long while, so as to be sure that it has a fair opportunity to work out its full effect; then, in a second transition period, pass gradually to normal fodder; then on to the second special ration, which, on the supposition that the former was over-rich in nitrogen, will have an excess of carbo-hydrates. When this period has run on long enough there comes another transition period, during which the carbo-hydrates will be removed, until at length we come back to meadow hay again, and this normal foddering is kept up through the last period. The actual rations in the different periods of the experiment were:

Period I. Normal Fodder—Meadow Hay. Transition, in which a highly nutritious material—bean-meal—was added in increasing quantities.

Period II. Nitrogenous Ration—Meadow hay, with bean-meal or rape-cakes. Transition, during which bean-meal was replaced by carbo-hydrates, oil, or starch.

Period III. Non-nitrogenous Ration—Meadow hay, with oil or starch. Transition, during which the carbo-hydrates were withdrawn.

Period IV. Normal Fodder—Meadow hay.

"The amounts and compositions of the different rations are estimated by accurate weighings and analysis. The yield of milk during the normal periods at the beginning and end of the experiment gives us a means of estimating the line of changes through which the quantity and quality of the milk would run, the natural variation in amount and composition during the whole time of the experiment—some three months and a-half—and the variations from this line during the periods of special foddering, give us the influence of the foddering upon the milk, the results aimed at in the experiment. And what seems to be the probable result of these experiments? Thus far, it appears that no change in the quality of the food is capable of materially affecting the quality of the milk, at least so long as the ration is of such quality as to be healthy, and is given in sufficient quantity."

Meanwhile one of the cowmaids has finished milking, and brings the pail to the Doctor. He weighs it carefully on a scale standing close by and notes the weight. "You will notice," he says, "that the cows are numbered one, two, three, four. For each one there is a separate set of measures for the fodder, and a separate milk pail. This is No. 3. The exact weight of pail is known, and that subtracted from the whole weight of pail and milk together gives the weight of the milk. As you see, I have the milk weighed from cow three. A portion intended for analysis is poured into a dish marked three, the date is also noted, and it is taken into the laboratory with similar portions from one and two and analyzed. The composition of the food given is also known from analysis, the quantities fed are regularly and carefully weighed out, and detailed accounts of the food given and milk obtained are kept, so that when the experiment is finished we have all the data from which to draw our conclusions."

Omitting further details we pass at once to the result. First, as to the natural changes that the milk undergoes during the milking period, that is to say, as the time from calving increases. The average amount of milk given was: First period, 18.1 lbs., with normal fodder, meadow hay; last period, 14.6 lbs., with normal fodder, meadow hay. Falling off in three months, 3.5 lbs. Otherwise than in this falling off about a pound per month in the yield, there was no especial change, save a very slight increase in the richness of the milk. Indeed, it appears from these and other investigations, that there is generally a very slight change in the composition of milk during the milking period—that it becomes somewhat richer, and that there is a slight increase in the relative amount of albuminoids, and decrease in that of fat and sugar. However, during the first three or four months at least, this change is too trifling to be of any practical consequence. Now as to the main result of the experiment, the influence of the nitrogenous and non-nitrogenous rations. The changes in the composition of the milk during the middle periods were so extremely small as to be of no real importance. In fact, the variation observed from day to day, and the differences in the milk from the different cows were greater than those found in the milk given in the different periods. To show how extremely small these differences were, and at the same time to give an illustration of the chemical composition of milk, I append the following figures, the first column showing the average composition, with the normal fodder of meadow hay, and the second with the addition of bran meal or rape cakes to the hay, the third with hay and oil or starch. In one thousand parts obtained from these articles were contained:

	Normal Ration.	Nitrogenous Ration.	Non-nitrogenous Ration.
Water	878	880	882
Butter	41	40	39
Milk Sugar	44	44	43
Albuminoids	28	29	29
Mineral Matters	7	7	7

In short, the differences are so minute as to be of no practical account whatever, and it appears that the variations in the quality of the ration were without effect upon the composition of the milk. Now, let us make sure that we understand this thoroughly. We have been talking of "quality" and "composition" of milk and fodder. By this we mean the relative amounts of the different ingredients of the milk, water, sugar, fat, albumen, caseine, &c. The more organic substance, sugar, fat, and albuminoids in the milk, the richer; the more water, the poorer it is. When we say that the milk grows gradually richer with the increase of time from calving, we mean that there is more organic substance and less water in a quart when the cow has been milked six months than when she has been milked only one month. The quantity, the *whole* "*mess*" yielded each day, will be larger at the end of one month than at the end of six months, and on that account the amount of the organic substance in the *whole* "*mess*" will be greater in the former case, while the amount in *one quart* will be greater in the latter. And when we say that variations in the quantity of the fodder are without effect upon the quality of the milk, we mean that the relative amounts of fat, sugar and albuminoids in the organic substance of the milk are unaltered thereby. Suppose now I feed a ration, say twenty-five pounds of second quality hay, from which my cows yield an average of twenty pounds of milk a day, containing two and a-half pounds of organic matter, of which forty per cent., or one pound, is butter. I increase this ration, or make it richer by the addition of turnips, oil-cake, &c., and obtain a yield of twenty-four pounds of milk, or one-fifth more. I have then a corresponding increase of one-fifth in the organic matter and the butter, and three pounds of the former and one and one-fifth of the latter.

There is just one more point to be explained. The experiments show that the composition of the organic substance remains unaltered by changes in the fodder; but how is it with the relation of water and organic substances—the richness in the milk? Will not green fodder, or pasture-feeding, give a more watery milk, and consequently a larger yield? I am not aware that this especial subject has been tested with sufficient thoroughness to decide the question. It has long been the opinion of practical men that a dry fodder would make a richer milk than green fodder. The later German experiments seem rather to oppose this idea, or at least to show that their effect is much less important than has generally been believed.

But so much is certain: When I have once found a ration upon which my cows will thrive, each one of them will give a certain amount of milk, the organic matter of which will have a certain composition. By varying the ration I can vary the total yield of milk and of organic substance—that is to say, of butter and cheese produced, and may possibly bring about a slight change in the relative amounts of organic substance and water; but the amount of organic substance in a quart of milk will vary but slightly, if at all, and the quality and the amount of butter in an ounce of organic substance will be practically unaltered.

Had but one experiment of this sort been made, the use of its conclusions for establishing rules for practice would be open to objection. But the better scientists of the present day have learned the fallacy of building conclusions on such narrow foundations, and taking warning of the fall of earlier and poorly supported theories, are loth to proclaim a theory to the world until it has a reasonable basis of experiment.

Dr. Kuhn has carried out quite a number of investigations similar to the one above described, and several other well known investigators have been for some time past at work upon the same subject. One of these latter, Professor Wolff, Director of the Experiment Station at Hohenheim, in Wurtemberg, gives the result of a long series of investigations in the following language:

"One interesting result of these experiments is, that the quality of the milk—the amount of butter it contains—leaving the taste out of account, has always remained the same, in spite of manifold and important changes in the quality of the fodder. In fact, the changes in the amount of butter in the milk, as determined by chemical analysis, are so unimportant as to be entirely unworthy of consideration. As the practical result of this, we are left to infer that the quality of the food exercises no influence upon the quality—the content—of butter in the milk, while, on the other hand, the effect of fodder becomes readily and distinctly manifest in the quantity of the milk yielded, and in the increase or decrease of the live weight of the animals. The quality of the milk seems, therefore, to be determined by the peculiarities of the breed or the individual animal, at least as long as the fodder is healthy, palatable and sufficient in quantity."

Dr. Kuhn gives the result of his own experiments, in so far as they are directly applicable to practice, in similar language:

"The influence of variations in the fodder in these experiments was manifested in the amount of milk yielded alone, and not in the quality. The influence upon the quantity is, however, quite apparent. As regards the desire of the farmer to increase the production of a certain element of the milk, as, for instance, butter, by a change in the quality of the fodder, the above law is fully valid. The farmer must, on the other hand, look to the peculiarities of different breeds of cattle for that quality of milk which is best adapted to his own special purpose. If he would increase the quantity of milk yielded he must select such individuals as give a good yield."

Foddering, then, if rightly managed, may increase the quantity of the milk, but will not alter its quality. Must, then, the milkman who sells his milk in the city, and the country dairyman who makes butter and cheese, be content with the same quality of milk?—or is there some other means by which each may obtain a milk adapted to his special purposes? Dr. Kuhn suggests the answer to this question at the close of the paragraph just quoted. The subject is an important one; let us pursue it a little further. Every man who will realize the largest profits from his cows must see to it, *first*, *that he has good milkers; second*, *that he feeds them well.* If he desires a large yield of butter, he must select breeds and individuals whose milk is rich in butter. If he sells his milk in the town, and does not care so much for the quality, as long as the quantity is large, he will do best with other breeds and other individuals. At least so say the best German authorities, and they have experimented enough upon the subject to entitle their opinions to confidence.

What is believed here in Germany concerning the best method of foddering, and how science and practice have contributed to the grounding of German theories on "rational foddering," will perhaps form the subject of another article. It will be more appropriate here to notice something of what statistics, experiments and practical experience say as to the milk and butter-producing qualities of different breeds.

In Saxony and Prussia, where a great deal of attention has been given to this matter, the Hollander, the Holsteiner and Oldenburger breeds, from the lowlands of North-western Europe, the Allgauer, from the mountainous regions of Southern Bavaria, and the English breeds—the Ayrshire, Suffolk, Cheshire, Yorkshire, &c.—are the most popular as milkers; while the Short-Horns, &c., are preferred for fattening.

The statistics of a large number of farms in the Kingdom of Saxony, for the year 1853, show that the average yield per cow in the year 1853 was:

	Qts. of milk.	Lbs. of butter.	Lbs. of butter in 100 lbs. of milk.
Allgauer	2,664	269	10.1
Hollander	2,859	252	8.8
Native Saxon Cattle	2,110	190	8.5

Whence it appears that the Hollanders are the largest milkers, but that the Allgauers give a milk much richer in butter; one hundred pounds of milk from the former making 10.1 pounds of butter, of the latter only 8.8 pounds. A very natural conclusion from this would be for the butter-makers to select Allgauers, and the milkman who sells his milk in town to fill his stables with Hollanders. And, indeed, among the milkmen in this region, Hollanders are the most popular breed.

As to the qualities of the English races as butter producers there seems to be a lack of accurate statistics. The best sources represent the average butter production in England at one hundred to two hundred pounds per cow, yearly; and in the lowlands across the Channel—Holland and Holstein—at considerably less, or some one hundred and twelve pounds, which would make the English cows better butter-producers than the Hollanders. Von Weckerlein, a noted German cattle-breeder, who has made this subject a matter of a great deal of observation and experiment, puts the English breeds, the Yorkshire and Suffolk, a little below, and the Devons and Herefords somewhat above the Allgauers, but finds them all superior to the Hollanders in richness of milk. The Short-Horns have likewise the reputation of giving better quality but smaller quantity of milk than the Hollanders.

In general in Germany, where English, French, and German breeds of cattle have been tried quite thoroughly, the Short-Horns are, as far as my own observation goes, looked upon as most excellent for fattening; the Allgauers, Devons, and Herefords are much liked for butter and cheese-making, while the Hollanders are special favorites among milkmen.

It seems to me that these two breeds, the Allgauers and Hollanders, deserve rather more attention among our cattle-raisers in America than they have as yet received. We are quite well acquainted with English breeds, but the German are almost unknown to us. And yet the most intelligent German farmers, who can import Devons and Durhams as well as Hollanders and Allgauers, and who have tried all these races faithfully, give the decided preference to the Allgauers and Hollanders as milkers, and consider the Short-Horns superior only in fattening qualities.

The Allgauers are small or medium-sized, fine-boned, thick-set, and very finely built. The large amount of milk yielded by this breed, its richness, and at the same time their small consumption of food, make them most desirable cows for the dairy. Some herds average between two thousand five hundred and two thousand six hundred quarts per head yearly. For regions where fodder is uncertain, and not over good quality, the Allgauers can be very highly recommended. The Hollanders, on the other hand, are large and stout built—the cows often weigh sixteen hundred and fifty or even seventeen hundred pounds, and are remarkable for their very large milk production, amounting in some cases to nearly four thousand five hundred quarts per year, though not very rich in butter. They require, however, rather high feeding, but, on the other hand, are very easily fattened. On these accounts the Hollanders are specially adapted to the neighborhoods of large towns where brewery, and distillery refuse and commercial food, as oil-cakes, are cheap, and the fresh milk finds ready sale."

Now this differs from the opinion expressed by Prof. Voelcker, who says that: "Milk may be regarded as a material for the manufacture of butter and cheese, and according to the purpose for which the milk is intended to be employed, whether for the manufacture of butter, or the production of cheese, the cows should be differently fed." And he remarks further, that "Butter contains carbon, hydrogen or oxygen, and no nitrogen. Cheese on the contrary, is rich in nitrogen. Food which contains much fatty matter, or substances which in the animal system are readily converted into fat, will tend to increase the proportion of cream in milk. On the other hand the proportion of caseine or cheesy matter in milk is increased by the use of highly nitrogenized food. Those therefore who desire much cream, or who produce food for the manufacture of butter, select food likely to increase the proportion of butter in the milk. On the contrary, when the principal object is the production of milk rich in curd—that is, when cheese is the object of the farmer, clover, peas, and bean meal, and other plants which abound in Legumin—a nitrogenized organic compound, almost identical in properties of composition with caseine, or the substance which forms the curd of milk —will be selected. As a matter of pure theory, the latter position seems to be the more reasonable. And in practice it has been observed by our dairymen, that when pastures have a good proportion of the finer clovers, especially the white clover, the cows feeding upon them yield abundant returns in cheese. So also in spring feeding, when bran and pea and oat meal are used in connection with hay, a much larger percentage of cheese is produced than when fed upon Indian meal. But carefully conducted experiments, with accurate analyses of the milk, would add much to our stock of knowledge on this vexed question of animal foods. Indeed, Voelcker remarks in some of his more recent investigations, that we cannot increase or improve, *ad infinitum*, the quantity or quality of milk. Cows which have a tendency to fatten when supplied with food rich in oil and in flesh-forming materials, like linseed cake, have the power of converting that food into fat, but they do not produce a richer milk, and they may even produce it in smaller quantity. It is this which renders all investigations on the influence of food upon the quantity and quality of milk so extremely difficult. According to theory, it would appear that food rich in oily or fatty matter would be extremely useful in rich milk, but in practice we sometimes find that it produces fat and flesh instead. Sometimes its influence is even injurious, for cows supplied too abundantly with linseed cake produce milk which does not make good butter; and he refers to an instance of this kind where the milk of cows so fed furnished cream that could not be made into butter, and when put into the churn it beat up into froth, nor by any manipulation would the caseine separate from the butter. Voelcker says, on examining this milk, and trying to separate as much as possible, the solid or crystalized fat from the liquid fat, I found that the latter was very much in excess of the former.

CLIMATE

has a most marked effect on the quality of milk. In moist, cool seasons, though a larger quantity of milk is produced, it is poorer, the amount of solid matter being less than in dry, warm seasons. This peculiarity has often led to serious errors in estimating the probable yield of dairy products in New York. In cool, moist seasons when pastures are abundant and cows are yielding a comparatively large flow of milk, a largely increased product of cheese is predicted, but at the close of the season, to the great surprise of many, the quantity falls below that of dryer seasons. I have known the annual product of cheese to fall off in Herkimer county, in such seasons, very considerably. As to the causes of this variation, something no doubt is due to the greater amount of water in the food present in wet seasons, but how much is due to temperature and moisture of the atmosphere, or its effect on the health and condition of the animal, we do not know. That the general state of health and condition of the animal has an influence on the quality of the milk need hardly be stated.

THE SIZE AND BREED

of the animal, as we have previously remarked, have an important influence on the quality of milk, and generally speaking the small breeds are better for butter, and the larger breeds for cheese.

THE FIRST MILK

after the cow has given birth to her young, contains an unusually large quantity of caseine. Bossingault found on analyzing such milk, that it contained, in one hundred parts, about four times as much caseine as in ordinary milk, the constituents being as follows:

Water,	75.8
Butter (pure fat),	2.6
Caseine,	15.0
Milk sugar,	3.6
Mineral matter,	3.0
	100.

This peculiarity disappears after eight or ten days, and the milk assumes its ordinary condition.

THE STRIPPINGS.

What are the "strippings"? Probably about one-half of the people in cities, or a large share of those born and brought up in cities, if they were to choose milk as drawn from the cow, would take that which is first milked. I was looking over a somewhat noted dairy recently, while the hands were milking. In this particular dairy it was customary to save the "strippings" by themselves, keeping them separate for a special purpose. While one of the milkers was drawing the strippings, a very intelligent gentleman who was visiting the family, came out with a cup to get a drink of warm milk. Following the milker to the dairy, where the milk was to be strained in pans, our visitor was invited to hold his cup under the strainer of the "strippings." "No," said he, "I do not care to take the dregs; I want the richest milk, and will take that which was drawn first, in the other pail."

When the milkmaid told him the "strippings," or last drawn milk, was nearly all cream, and that it was set apart for making choice butter, he manifested the greatest surprise, and said the thing was entirely new to him. A great many people are no wiser. Now, cream being lighter than milk, the denser or heavier portion of the milk is drawn first from the udder, while the lighter parts, rich in butter, remain back, and make up what is known among dairymen as "the strippings."

It will be seen, then, how important it is that the last drop of milk in the udder should be drawn while milking, and that when particular attention is not given to this point the loss is much more serious than a waste of the same quantity of first drawn milk; for the one is thin cream, while the other is nothing more than plain milk. There is another loss, of course, in not milking clean, as it has a tendency to dry up the cow, or lessen the secretion of milk from day to day. It is very difficult to impress milkers with the importance of drawing the "strippings" from the udder. Many milkers are in the habit of finishing their work just as soon as the free flow of milk ceases. Such milkers, it is needless to say, entail a heavy loss on the dairyman in the course of the year, and if they milk many cows they waste more than their wages. The "strippings" make a very nice quality of butter, and some butter makers think it pays well to keep them separate from the first drawn milk. It is a little more trouble to the milker to separate the "strippings," as it necessitates having a "stripping pail," but there is no doubt that it educates milkers to *milk clean*, if of no other advantage.

THE MILK OF DISEASED COWS.

I am convinced from extensive observation that great ignorance or thoughtlessness prevails among many in regard to the use of bad milk. From numerous experiments during many years, in feeding the milk of "ailing cows" to pigs and calves—the milk from those cows that happen to be ill from time to time in my own dairy—I long since became satisfied that such milk is a much more fruitful source of disease than is commonly imagined. In dairies, whether the milk is to be delivered at the factory, or made up on the farm into butter and cheese, or sent to the town or city for consumption, what is the usual practice of the milk producer? Is it not to be feared that the milk of diseased cows—of cows whose feet or udders are affected with sores or ulcers, and discharging corruption—is sent forward to be used as human food in the majority of instances? Many doubtless have a faint notion that the milk of a sick cow, or one afflicted with sores or ulcers, is not just the kind of milk to be used, and is not such as they would care to use in their own families; still, as there would be a loss in throwing such milk away, the conclusion is that it can do no injury to other people, and so long as the consumer is ignorant of all the facts no harm is done. Others affirm, and doubtless believe, that the milk of a sick cow when mingled with other milk and made into butter and cheese, becomes in some way purified in the process of manufacture, so that nothing unwholesome remains in the butter or cheese. The difficulty of always tracing disease to its true source and of detecting the poisons thrown off in the milk of diseased animals, may help to hide the culpable practices of dairymen and milk producers, but the moral wrong remains the same; and I cannot but think that the nuisance would in part become abated, if people were fully convinced they were sending out food heavily freighted with the elements of disease and death. If the loss from bad milk must be in some way mitigated, would it not be better to make the saving by feeding it to pigs or calves upon the farm, since the health or life of an animal is less valuable than that of human beings?

Prof. Gamgee, in his address before the American Dairymen's Association, in referring to the foot and mouth disease, then so prevalent in England, says:—"The poison of this disease is found in the vesicles within the mouth, and is discharged with the gallons of saliva secreted daily, under the irritation produced by the eruption on the tongue, palate, cheek and lips. It is also formed in vesicles on the teats, and finds its way into the milk, and thus it kills young pigs, calves, and even children that get milk fresh or undiluted." And he remarks further, that although he "has no facts to indicate whether cheese and butter would retain the virus for any length of time, yet in all probability they would; and a trustworthy observer assured him some years since, that a pudding made with milk from a sick cow, though boiled, produced the disease in a family of five grown persons." The unwholesomeness of milk from city dairies, where the cows are kept in underground stables and fed largely on distillers' slops and refuse garbage, has been proved over and over again, from the investigations of scientific men. Country milk has been generally supposed to be perfectly wholesome and harmless, but if all the facts concerning its production were known, I fear it would often be found very objectionable as an article of food.

INJURY TO MILK FROM COWS INHALING BAD ODORS.

The injury to milk from cows inhaling bad odors is not well understood, or at least has not elicited much attention from those who have had the care of milk stock, and made dairying a specialty. It is only of late years and since the inauguration of the factory system, that American dairymen have had their attention called to the various causes influencing the quality of milk. We have now a class of men following a distinct and special calling —men whose time and thoughts are almost wholly given to the manipulation of milk in butter and cheese manufacture.

The competition between different factories and the discrimination made by dealers in dairy products, have stimulated these workers in milk to make close observation and inquiry concerning the condition of milk; and their investigations have brought to light many things that are new respecting the material upon which they are employed. From the investigations of these men, old theories, long promulgated as truths, have been exploded and shown to be false. As we become better informed as to the nature of milk, and the causes influencing its quality, our dairy products improve, and any one who has watched the progress made in this department during the last half-dozen years, cannot but come to the conclusion that American dairy products are destined to reach a standard of flavor and quality surpassing in excellence anything that has hitherto been produced.

Among the new class of questions now claiming the attention of intelligent cheese manufacturers, is the one we have named, viz.: the influence upon milk resulting from cows breathing bad odors while at pasture. That milk is often tainted in this way has long been suspected by observing cheese manufacturers, though it was difficult to trace out the cause and establish the principle. A few years ago Mr. FOSTER of Oneida Co., N. Y., brought this question prominently before the American Dairymen's Association and gave undoubted evidence that bad milk could come from such a source. He was having considerable trouble with the milk at his factory, and finally traced it to his own dairy, where the greatest care was taken in milking, in the cleanliness of milk vessels, and everything pertaining to the dairy. This fact led him to investigate the matter thoroughly, to examine the water and feed with which the cows were supplied, together with the health and treatment of the stock, in the hope of discovering the cause. Finding nothing at fault in these particulars, and the trouble still continuing, the conclusion forced itself upon him that the cause must come from the cows inhaling bad odors. In a field adjoining one part of his pasture a neighbor had left exposed a dead horse, which in its decomposition carried a bad odor over that part of the pasture. Here the cows in feeding inhaled a sufficient quantity of the offending gases to taint the milk, as he concluded; for on calculating the time it was found that the trouble with the milk dated at about the period the horse was left so exposed. Arguing from these premises he had the putrifying carcass removed and buried, when the trouble in the milk immediately disappeared.

Mr. L. B. ARNOLD, a very close observer and of much experience in handling milk, gives a similar account of tainted milk caused by cows breathing air polluted by carrion. In this case the trouble in the milk was traced to one particular dairy, and a committee was appointed to visit the premises. The committee found nothing at the stable, in the milking nor in the general care of utensils, to cause tainted milk. But on examining the pastures they did find the air polluted by carrion, upon the removal of which, as in the other case, the taint in the milk at once disappeared. I could enumerate other cases of similar character, and the evidence warrants the conclusion that milk can be tainted in hot weather by cows inhaling a polluted atmosphere like that we have named. If the facts are worthy of credit, and the conclusion is correctly drawn, it opens up a very important question for dairymen, in the production of milk.

IS MILK IMPROVED BY EXPOSURE TO THE AIR WHILE COOLING?

One of the leading questions now being discussed by cheese manufacturers is, the importance of cooling milk at the farm and as soon as drawn from the cow, if it is to be carried to the factory. I was the first to bring the subject to the attention of New York dairymen several years ago, and though I have persistently urged its importance from time to time, it is only quite recently that its necessity has been generally acknowledged.

That milk properly cooled at the farm will arrive at the factory in better condition than it would had the animal heat been retained, no one having any experience in handling milk at a factory for a moment doubts. Experiments upon this point have been numerous, and results have demonstrated the fact in the most positive manner. But while it is now universally admitted that cooling has a preservative influence upon milk, it is not so clear to all that a free exposure of it to the air during the cooling process improves its flavor. There are those who contend that the cooling of milk by any process, will at the same time deodorize it; in other words, that the animal odor is a "bugbear"—that milk as soon as drawn from the cow may be placed in an air-tight vessel, and cooled down to 60°, and may then be carted to the factory, and will be as perfect in flavor and condition as it would if all its particles had been freely exposed to the air during the process of cooling. The question is one of considerable importance, since there are two classes of coolers before the public; one representing the first and the other the last principle. I have always held that freshly-drawn milk is improved by being exposed to a current of pure air; that the health of the cow, her food, water, and various other circumstances have an influence upon her milk, rendering it at times imperfect, and rank in flavor; and that its exposure to the air takes out, in some degree at least, disagreeable gases, making it more palatable. We know that other substances infected with a disagreeable odor are often improved by being exposed to the air, or are freed of it altogether; and it is not easy to see why milk may not be subject to the same law. Perhaps if milk was always in perfect condition an exposure to the atmosphere while cooling would not be deemed so important.

I cannot say that with all milk at all seasons, an exposure to the air for the purposes referred to would be necessary. That must be a matter of experiment and investigation. But the fact that milk is produced often under unfavorable circumstances; and that it sometimes possesses a taint before it is drawn from the cow, would seem to favor the notion that airing it would be beneficial. The exposure to the air of milk coming from cows fed upon turnips may not free it altogether from the turnip flavor; but the chance for its improvement, I think, would be greater from this treatment than to shut it out from the air, and to cool it in a way that permits no gases to escape. A few years ago I prevailed upon Mr. Arnold to investigate and experiment in this matter, in order to see if my own experiments and conclusions were correct. He arrived at the same results. In order to show that there is no necessary connection between animal heat and animal odor, and that animal heat does not differ from heat derived from other sources, he made the following experiments, which I give in his own words:

"By abstracting the heat rapidly by an application of ice and cold water, I easily succeeded in removing the heat and leaving the odor in the milk. It is true that in experiments for this purpose, the odor was not so apparent to the olfactory nerves as to the organs of taste. The animal *odor* became an animal *flavor*. But upon warming the milk again the odor revived. Then by the use of a filter of pulverized charcoal, I succeeded perfectly in removing every trace of animal odor from milk when first drawn and leaving the animal heat in the milk."

After pointing out what animal odor is, he says:—"Because the *cowy* smell has died away when the milk is down to 70° or below, it has usually been supposed that the odor or cause of the odor was wholly removed. But it is by no means necessarily so; for unless the cooling has been very slow, or the milk has been spread so thin as to make the exit of the gases easy, the cause of the odor (the condensed gases) will be there, and be readily detected by the taste; and at 58° or 60° it will remain there until the milk sours. The cowy flavor is most effectually preserved when milk is cooled in a close vessel shut out from the air, and the heat absorbed away by an application of ice and cold water."

Again: "The gas in milk varies both in quality and relative effect. For instance, it is in the smallest amount when the cow is in good health and quiet. It is more abundant when actively exercised, as when sharply driven to the yard by dogs. It needs but little hurrying, especially in the morning, to make the effect apparent in cheese. It is different in health and disease, and very abundant and very infectious in cases of fever. There is more in a state of debility than of strength; and more when pinched with cold than when comfortably warm.

"The most marked effects that I have observed, have been produced by the odor of milk from cows in a feverish state—a state that may generally be detected readily by smelling the milk. It becomes so infectious that a small quantity—the milk of a single cow even—will infect a whole vat full of good milk. In connection with the rennet, it becomes a ferment, inducing rapid changes in the milk and curd. New gases are evolved, which, becoming more elastic as the temperature is raised, swell out the lump of curds, giving them a soft spongy feel, till at length their bulk is so much increased that they float in the whey. But perhaps some will say this is the result of diseased milk; it is not chargeable to animal odor; the milk is faulty. I once thought so too, but I have found since that I was mistaken. In the worst cases I have seen, the milk, for aught I can discover, is as good as any other. It may be somewhat altered in the proportion of its elements, perhaps it is, but it does not differ materially from other milk when new. I filtered a sample of feverish milk in the fore part of August, when the weather was so very hot and dry, and floating curds were so very common; the result was very striking. The filter was all ready and the milk turned in as soon as drawn, and though it stood at about 90° when it issued from the filter, it was free from any offensive odor, and its flavor was delicious," and very different, he remarks, from milk cooled by ice-water to a low temperature.

The remedy he suggests, is to give the gases from which the odor arises a chance to escape as soon as possible after the milk is drawn; for the reason that they are then more elastic and escape more easily, as well also to keep them from imparting an influence to the milk from their presence. And he remarks that this should be done at the *dairy*, because it is generally a little too late when milk gets to the factory. The question is one of much interest to cheese-makers, and should be studied.

CANNING AND KEEPING MILK IN GOOD ORDER.

The Food Committee of the Society of Arts in England, has been discussing, recently, the means to be employed for preserving milk in good order during the transit over long distances to the city. It appears that milk passing over the Great Western Railway to London, is in cans holding sixteen imperial gallons. An effort has been made to reduce the size of the cans to a capacity of about four gallons each, similar to those adopted in France.

THE FRENCH CAN

has a tight-fitting cover, and the vessels are completely filled, so as to prevent disturbance of the particles of milk, by motion in transit. It is said the milk passing over the railways in France, arrives at its destination generally in good order. The question therefore arose as to the advantage of these cans, over those of larger size, if any, in the preservation of milk during its transit to the city. Mr. Geo. Braham, managing director of the Express Country Milk Company, and who appears to have had large experience in this business, and to have been also a close observer as to the condition of milk under various circumstances, opposed reducing the size of the cans, on account of the greater trouble in moving to and from the milk vans. He stated that the great secret in having milk in good condition was in allowing it to cool sufficiently before being placed in the cans. The shaking of the milk in the conveyance would not be greater in a large can than in a small one, provided in both cans they were filled thoroughly full. It was his opinion if milk was packed at a temperature of fifty to sixty degrees, the shaking would have no prejudicial effect upon it. If the milk was packed at seventy or eighty degrees, the agitation would tend to separate the butter and to promote the deposit of caseine; and if the temperature of the air was no higher than that of the milk, no injury would be occasioned by the admission of the air to the milk, while it remained in the cans. He stated that a large quantity of milk arriving at night was left standing at the station until four o'clock next morning. The milk that was put in the cans warm and the lids kept on all night, acquired a bad smell, and it would take from *two to three hours' exposure* for that smell to pass off.

EFFECT OF AGITATING MILK IN TRAVELING.

As to the question whether the agitation of the milk in traveling destroyed the cream in the milk brought into London, Mr. Bartlett replied that the globules would not be destroyed if the milk was put into the cans at a sufficiently low temperature, say sixty degrees.

EFFECT OF SOILS ON KEEPING QUALITY OF MILK.

The Express Country Milk Company received milk for two years from Wareham in Dorsetshire, a distance of one hundred and thirty miles by rail, and seven miles by road. It arrived in London in fine condition. This result was attributed in part to the chalky nature of the soil where the milk was produced, and to the thorough manner in which the milk was cooled before being packed. He stated that it was a well known fact, that the milk of cows fed off heavy clay land, would not keep so long by several hours, as that produced on light or chalky soils. The influence of soil upon the keeping qualities of milk, is a question which has received but little attention from the American Dairyman, and it would be well if experiments were made to determine this point.

EFFECT OF CARRIAGE UPON THE CREAM PRODUCT.

Milk that is carried does not throw up so much cream when set, as it would if placed in the milk house at the farm. From the experiments in England, the amount of cream which rose to the surface of the milk when set, was rendered less by about twenty per cent. through traveling, that percentage being retained in the milk. As to the advantage of cooling milk before canning, in order to prevent cream from rising and churning into butter while traveling; Mr. B. said that the express company received ten cans of milk from one dairy every day last summer, and there was not a particle of butter in them, though they traveled two miles by road to the station, forty-eight miles by rail to the metropolitan terminus, and three miles by van to the place of business. Some of the cans were only three parts full, and yet the cream was retained in the milk, although from being cooled it would take some hours longer for the cream to rise.

HOW ENGLISH CREAM IS TRANSPORTED.

When cream is sent in a separate state to London it is packed solid in bottles prepared for the purpose, and kept cool by grass or cabbage leaves fastened around the bottles.

MILKING FOR THE LONDON MARKET.

For supplying the London market with milk, the system of twelve hours milking is generally adopted. The milk supplied in the early morning is milked during the night, say from seven P. M. to two A. M., the hour depending upon the time the last train at night, or the early train, calls at the country station. The afternoon milk is milked from nine to eleven A. M., and is distributed between two and four o'clock, P. M.

OPEN OR CLOSED CANS.

The English milk can has holes in the lid of the can, through which air is admitted to the milk. The Parisian milk is generally acknowledged to keep longer than that supplied in London, and this has been attributed to its being hermetically closed in the can while traveling. It was stated, however, that the real secret of the matter was, that the French dairymen mixed bicarbonate of soda with their milk, which served to avert decomposition, and hence the milk was kept in good order, for a longer period than milk in its natural state. I give the main features or substance of remarks brought out, as they have a practical bearing on the great question now agitating the dairymen of America—the means of getting milk in good order to the factories.

COAGULATION OF MILK.

We have now come to that part of our subject in which some of the phenomena connected with the coagulation of milk, and its separation into curd and whey, may be considered. I shall speak in another place of rennet; a term used by dairymen to designate the stomach of the young calf after it is properly cleansed, dried, and prepared for the purpose of coagulating milk for cheese making. But the explanation of its action on milk, as well as the thickening or curdling of milk from souring, together with other somewhat peculiar behavior of milk, which has not been satisfactorily accounted for on the old theories, will perhaps best be treated in this connection. I have alluded to the aid which has been given by microscopic investigations in the elucidation of these questions, and to the theory now set up by scientific men in regard to the coagulation of milk. In the discussion of this topic, I can only give briefly the outline of the theory, and I shall draw largely in what I have to say from the recent address of Prof. Caldwell, before the American Dairymen's Association. But in the first place, let us go back a little to the point where the coagulation of milk was alluded to. If we take a piece of the dried rennet, soak it in water, and pour the liquid into a portion of warm milk it soon begins to thicken, and turns into a jelly-like clot, and after a while it separates into whey and curd. Scientific and practical writers on milk have stated that the caseine is held in solution by a small quantity of alkali, that when in warm weather the milk curdles, lactic acid, which is always found in sour milk, is formed from a portion of the sugar of milk, and this lactic acid, by neutralizing the alkali which holds the caseine in solution, causes its separation from the milk.

Rennet is supposed to act as a ferment, which rapidly converts some of the sugar of milk into lactic acid. Whether, therefore, milk coagulates spontaneously after some length of time, or more rapidly on the addition of rennet, in either case the separation of the curd is supposed to be due to the removal of the free alkali by lactic acid. This theory, says Voelcker, is not quite consistent with facts. The caseine in milk cannot be said to be held in solution by free alkali; for although it is true that milk often has a slightly alkaline reaction, it is likewise true that perfectly fresh milk is sometimes slightly acid. We might as well say, therefore, that the caseine is held in solution by a little free acid as by free alkali.

Again, newly-drawn milk is often perfectly neutral; but whether milk be neutral, or alkaline, or acid, the caseine exists in it in a state of solution, which cannot therefore depend on an alkaline reaction. We all know that milk when it turns sour curdles readily. It is not the fact that a good deal of acid curdles milk, which I dispute; but the assumption that the caseine in milk is held in solution by free alkali.

"THE ACTION OF RENNET UPON MILK,

then, is not such as has been hitherto represented by all chemists who have treated this subject. Like many other animal matters which act as ferments, rennet it is true, rapidly induces the milk to turn sour; but free lactic acid I find, makes its appearance in milk after the curd has separated, and not simultaneously with the precipitation of the curd. Perfectly fresh and neutral milk, on the addition of rennet, coagulates, but the whey is perfectly neutral. I have even purposely made milk alkaline, and yet succeeded in separating the curd by rennet, and, what is more, obtained a whey which had an alkaline reaction."

And he says further:—"What may be the precise mode in which rennet acts upon milk I do not presume to explain. I believe it to be an action *sui generis*, which as yet is only known by its effects. We at present are even unacquainted with the precise chemical character and composition of the active principle in rennet, and have not even a name for it."

"Now, we know," says Professor CALDWELL, "that any structure that has been built up by the vital forces acting in the vegetable or animal world, from the simplest plant that grows in water to the most perfect animal that walks on land, will, after life has departed, begin to suffer change if left exposed to the air under ordinary circumstances; and this change will go on unless stopped by some artificial application, till the structure has nearly disappeared, and nothing more is left than would remain of the body were it at once put into the fire and burned—only a few ashes—while carbonic acid and ammonia have passed off into the atmosphere. Before this final change is reached, however, a great many intermediate products are formed, some of which are useful to man, some are poisonous, some have foul or agreeable odors, and some have peculiar flavors." "These changes and compositions are usually classified under three heads—

DECAY, FERMENTATION AND DECOMPOSITION.

"Decay is simply a slow combustion or burning of the body; it depends upon a free supply of air from which the necessary oxygen is absorbed. In both fermentation and putrefaction, on the other hand, there is nothing but a re-arrangement of the particles or elements already in the body, sometimes with and sometimes without the evolution of gaseous products. If these gaseous products have no offensive odor, or if no ammonia is formed, the process is called fermentation, and generally some useful application of a part of the product of a fermentation is made—thus, sugar is converted by fermentation into a gas, carbonic acid and alcohol; and in the preparation of bread we cause sugar in the dough to ferment by means of yeast, so as to produce carbonic acid, that in its attempt to escape makes the bread light; while for beer and wine we cause sugar to ferment for the sake of alcohol. If, on the other hand, a part of the products have an offensive odor, or ammonia is found among these products, we call the change putrefaction. Ammonia is always one of the products of true putrefaction, and the offensive odor nearly always, though it may sometimes be weak. All substances which are liable to decay (fermentation or putrefaction), may be separated into two great divisions, namely:—Those that are composed of three elements, carbon, hydrogen, and oxygen, and those which in addition to these three have one more, nitrogen. Compounds of the first class, like sugar, starch and fats, are usually very stable; their elements are firmly united together, like the links of a strong chain. Compounds of the second class, on the other hand, like white of eggs, flesh and the caseine of milk are unstable; the introduction of the element nitrogen has made a weak link in the chain.

"Now it has been found by experiment, if the white of an egg or a piece of meat is boiled in a glass flask with water for an hour or so, and the mouth of the flask is then closed with a plug of carefully cleaned cotton, or with a cork through which a glass tube passes, that is drawn out to a fine orifice at both ends, and outside the flask has a long arm bent downward, the substance will remain unchanged for months, even in a place where all the circumstances are made favorable as possible for putrefaction—free access of air through the interstices of the cotton plug, or through the glass tube—a plenty of moisture, and a suitable temperature; and that no essential change has been produced in the substance by the boiling, may be shown by simply removing the plug, when putrefaction and decomposition will set in. On the other hand, if the experiment is varied only to this: that if the substance is not thoroughly heated to the temperature of boiling heat, putrefaction may speedily set in, even though the flask be closed air-tight. Now, microscopic examination has revealed the fact, that every case of fermentation or putrefaction is attended with the development or growth of living organisms; most of which at least belong to the vegetable kingdom, and the present most generally accepted view—that which has the balance of evidence in its favor—is, that these organisms are the cause of all fermentation and putrefaction; that the dust of the atmosphere, as well as all fermenting or putrefying matter, contains either the germs of the microscopic fungi, or the fungi themselves in one stage of development or another; that these germs fall on all substances exposed to the air, and that if the substance so exposed is one that can nourish their further development, they will vegetate and increase, and in so doing cause the substance itself to decompose—that these fungi like all others, and like all plants, require moisture and a moderately elevated temperature for their growth, as well as food for their sustenance—are killed by exposure to a temperature of two hundred and twelve degrees, Fahrenheit, and that they live at the expense of a portion of the substance in which they grow, while the rest is decomposed, that is, fermented or putrefied, with the final result of the breaking down of the whole structure. Accordingly, the reason why the meat in the flask closed with a plug of cotton is not attacked, is that the germs, minute as they may be, are yet entangled among the fibers of the cotton, so that none reach the meat; they do not attack the substance in the flask closed with a cork and glass tube, because the germs being heavier than the air, can be transported only by currents in it, or by cohesion to some moving body. There is no current of air passing through the glass tube into the flask that is sufficiently strong to carry them up through this long arm.

"The reason why previous boiling is necessary is, that every substance that has been exposed to the air has some of the atmospheric dust containing these germs adhering to it, which, if they are not killed, will begin to vegetate and excite decomposition as soon as outward circumstances are favorable. The reason why substances of the second class will decompose more readily than those of the first class, containing no nitrogen, is, not only that the elements of the second class are more feebly held together, as before said, but also that these fungi must have nitrogen iu their food, and that although they can, to a limited extent, draw it from the large supply in the atmosphere, if exposed to that, yet they can get it far more easily and naturally from the nitrogeneous matter in which they take root.

"The result of the growth of these fungi on or in a substance, or in other words, the products of the fermentation or putrefaction which that growth induces, depend mostly on the nature of the substance, and the particular stage of development of the fungus, and often, but not always, upon the species of fungus; not always, for in some cases several different species of fungi produce the same effect upon the same substance. On the whole, the result depends more upon the chemical composition of the substance that is decomposed, than upon the species of fungus producing the decomposition. The transformation which these fungi undergo is very remarkable. They assume many different forms, adapting themselves to the chemical composition of the substances with which they come in contact."

THE FUNGUS AFFECTING CHEESE.

The particular fungus intimately connected with the art of cheese-making is said to be the *Pencillium crustaceum.* It is found almost everywhere on the surface of the earth, constituting generally the greenish-blue mold that appears on vegetable and animal matters, and is concerned in all the common processes of fermentation and putrefaction. It is composed of delicate white filaments or threads that bear on their ends the groups of spores or germs, which to the naked eye appear like a fine, bluish-green dust. If these spores are scattered over substances similar in chemical composition to that which produced the mold, it can be reproduced again and so on from generation to generation. But if these spores be sown on distilled water, they swell up and burst, expelling a great number of minute bodies, called zoospores. These soon begin to grow by elongation, and as each elongates partition walls are thrown across, so that one sac or cell becomes several, and the multiplication of cells is so rapid that from a single zoospore an almost incredible number of new cells can be produced in a few hours. According to HALLIER these cells, forming delicate, brittle chains, are found in great numbers every night, in the mouth or throat of all the digestive organs. If the spores of the mold are put under a liquid rich in nitrogen they swell up and expel the zoospores, and then each zoospore sends out a little bud that soon becomes detached from the mother cell and in its turn produces another cell, and so each new cell goes on multiplying.

To this form of the fungus the name of *micrococcus* has been given, and Hallier considers it the cause of all putrefaction, and calls it *putrefactive yeast.* According to him both rennet and cheese are highly charged with this yeast. If the *micrococcus* cell be put in a liquid poor in nitrogen, it produces the common yeast of the housewife, which multiplies as the *micrococcus*, and causes the common alcoholic fermentation. This form of the fungus is called *cryptococcus.* Again, if the *pencillium* spores be put in milk which has been boiled to kill all germs in it, we have within two days the same result as when they were sown in a liquid rich in nitrogen, viz.: the *zoospores* and the *microocccus* cells, and so soon as this *micrococcus* appears we have souring and curdling of the milk. And when a small quantity of lactic acid has been thus formed a new condition has been assumed by the fungus. The minute *micrococcus* cells enlarge as they do when about to pass into the *cryptococcus*, but with quite another result, viz., the production of elongated cells, four-sided and often with abrupt square ends, possessing a peculiar luster and multiplying by subdivision into chains of cells, and this form is called *arthrococcus*, or jointed yeast, and is the ferment which attends the formation of lactic acid in the souring of milk.

If the *pencillium* spores be sown in completely fermented wine or beer, wherein all the sugar has been converted into alcohol, we have another form of yeast which is concerned in the formation of vinegar. Under different circumstances at least six forms of cells can be obtained from the spores of the *pencillium crustaceum*, and any of these forms, if sown on a substance similar to that which produced the mold, will produce the same mold again. The wonderful rapidity with which these fungi produce new cells is shown by the fact that one single *pencillium* spore to start with will produce in the space of twenty-four hours, at a low estimate, four hundred million *micrococcus* cells. The spores also have a strong hold of life. They can be dried, frozen and heated to any temperature short of 212°, without injury, and will retain their germinating power a long time, in some cases three and a-half years."

Enough has been said, I think, to indicate the basis of this theory and the line of argument adopted. Were I familiar with microscopic examinations, and the peculiar habits of fungi or this low order of life, I might be able perhaps to present this matter more clearly; but from a long and intimate acquaintance with the behavior of milk in its relation to dairy practice, I can judge somewhat as to these views, and they give at least a plausible explanation to many things connected with the action of milk that have been shrouded in mystery. If the cause of the conversion of sugar of milk into lactic acid is due to fermentation, or the result of the action of living organisms on the substance fermented, we should have such organisms here. Hallier and Pasteur, and others, have proved that the souring of milk is accompanied by a species of yeast ferment, different from the ordinary yeast or alcohol ferment; it is started by the *micrococcus* yeast, and its continuance is attended with the production of regular lactic acid yeast cells or *arthrococcus* below the surface. In the milk as it comes from the cow we have the *micrococcus* cells already formed. Hallier proved their presence in sow's milk, and has always found them in the blood, even of healthy animals; hence it is reasonable to suppose they are in all milk. And it appears so long as these cells remain unchanged and do not grow and multiply, the milk will not be affected by their presence. Hallier asserts that the action of rennet is due simply to the fact that it, or its extract, contains in an extraordinary measure the *micrococcus* of the particular fungi which produce the change in milk called coagulation; that without this *micrococcus*, or the germs that give rise to it, the change will not take place in the manner that we ordinarily bring it to pass; and that the reason why if the extract of rennet is boiled a few minutes it will no longer coagulate milk any more than it will turn it sour, is because we have killed the fungus; and that the coagulation is attended with, or is the result of a rapid growth and multiplication of the *micrococcus*; consequently the curd must contain it, and by still further increase in the ripened cheese, that is saturated and penetrated through and through with it.

HEAT AFFECTING RENNETS.

When I first commenced cheese-making, twenty years' ago, I lost a large number of rennets by hanging them near a stove-pipe that was kept very hot. The vells were exposed to this heat for several weeks, and when I came to use them they would not coagulate the milk. Of course I learned a lesson from this; but I could not fully satisfy myself then why their action was lost; but upon the theory here suggested it is evident the fungus was destroyed. We know, too, that excessive washing of the stomach when taken from the calf will almost wholly destroy its virtue; hence the experienced dairyman is careful only to wipe off with a cloth any dirt that may adhere to it. The washing evidently removes a large number of *micrococcus* cells, thereby accounting for its loss of strength.

Now, it appears so long as we cultivate a friendship with the *micrococcus*, giving it good, pure milk to feed upon and controlling its action by temperature, air and cleanliness it is harmless, and we make it subserve a very useful purpose. But if by any means we allow other fungi, or such as originate in putrid matter, to get possession of the milk, their influence is harmful in the highest degree. Nothing is of more common observation in the practical handling of milk than its especial susceptibility to emanations from putrid matter, and so readily can these minute germs make their way anywhere and everywhere, that if the air containing them in unusual quantity is inhaled by the cows, their milk may be infected before it leaves the bag. We see then how important it is that the utmost cleanliness be observed with everything that comes in contact with milk.

A PARTICLE OF TAINT

in the air or on the walls of the dairy, or in the pails or vats, means a quantity of fungus germs, often a multitude of them, all ready and most willing to take possession of the milk and to hold it too, when once in possession, so that no process will expel them, except such as will ruin the product which we are manufacturing. From what has been said I think it will be plain that in this single subject of milk alone, there is ample field for investigation, investigation that will tax all our skill, all our talents, and which will afford ample material for study for a long time, and to master which in all its details is no holiday affair. And I must confess after twenty years' practical experience and observation in handling milk, after years of labor in correcting old abuses and errors, and leading our dairymen up to the improved manufacture of to-day, I can still see an immense field for investigation and improvement. And I think there is some inducement for young men to study these questions and perfect themselves in dairy practice.

FIRST-CLASS CHEESE-MAKERS

in New York command a salary of from $1,000 to $1,300 for the season of eight months, and the demand for good cheese-makers has been for several years larger than the supply. I am in receipt of many applications from factories every year for cheese-makers, only a part of which can be filled, and if the business continues to prosper it must continue to offer a fair field of employment for young men who have nothing but their hands and brains with which to make their way in the world.

CONDENSED MILK.

Within a few years past milk has been put upon the market in a form or condition to keep sound and fresh in flavor for long periods. The importance of the discovery of condensing and preserving milk can scarcely be estimated at the present time, but there can be little doubt, as the article becomes better known among consumers of milk in cities, that it is destined to revolutionize the prevailing system of the milk trade. Before proceeding to give some of the processes for condensing milk which have come under my observation, the following brief history of the origin and development of the condensed milk trade, from the London Milk Journal, will be in place.

ORIGIN AND DEVELOPMENT OF THE CONDENSED MILK TRADE.

Condensed Milk should, with greater propriety, be styled "Preserved Milk," since, although the milk is condensed, the main object sought is, its preservation from decay. For many years there have been upon the market preparations called "Desiccated Milk," "Milk Powders," "Milk Essence," etc. But these were articles prepared from milk, rather than actual milk. They found, however, prior to the introduction of condensed milk proper, considerable demand for use at sea and in the colonies, where anything that has the appearance of milk will in the nature of the case command more or less sale. Still they did not enter into family consumption to any extent in England. The desideratum was a preserved milk which should be so pure, wholesome and palatable, as to take the place of crude milk in large cities.

To Mr. Gail Borden of New York, should be awarded the credit of first producing preserved milk that filled all these conditions. Indeed, all the brands of good or even fair quality now sold, are prepared substantially under the system originated by him. A man of intense energy and unyielding tenacity of purpose, and an inventor of great ingenuity if not of marked scientific attainments, he added to all this the enthusiasm of a philanthropist who believed that preserved milk would be a boon to humanity. As long ago as 1846 he began his experiments, conducted simultaneously with others whose aim was the preservation of meat. It may be mentioned here that in the London Exhibition of 1851, a gold medal was awarded to Mr. Borden for his "Meat Biscuit." We believe that he did not at this time exhibit his condensed milk. It was not until about 1856 the he himself arrived at the conviction that he had obtained the quality he had been seeking. Meanwhile he had expended energy, time, and quite a fortune in his experiments, for he at length saw that to experiment to advantage a large amount of material, involving much expense, must be used in each instance.

At an early stage of his experiments, he decided that milk could not be preserved in a dry form as "desiccated," or "powdered," or "solidified," but must be left in a semi-liquid state. That some preservative agent must be added, and that nothing but water must be eliminated, also became apparent. The result is that condensed milk, as now known to the trade and consumers, consists of milk from which only water has been taken, and to which nothing but sugar has been added, the product being of the consistency of honey, and by dilution in water reconvertible to milk itself, somewhat sweetened. It may be stated in this connection, that all the dry preserved milks require to be dissolved in hot water, while the condensed milk prepared under the Borden system readily dissolves in cold water.

By 1861 Mr. Borden had quite extensively introduced his article, and four or five factories were in operation, capable of producing in the aggregate five thousand cans of one pound each per day. During the War of the Rebellion, large quantities were required for the Northern Armies, the officers and many privates purchasing it of the sutlers, while the hospitals were supplied by the Government and the various Christian and Aid Societies. This gave an impetus to the trade, at the same time that the shipping demand steadily increased. About this time Mr. Borden put upon the market for city use, what he calls

PLAIN CONDENSED MILK.

This is prepared in the same way as the other, except that no sugar is added, and it is not hermetically sealed. It will remain sound from one to two weeks, and it is so convenient, as well as economical, that it is stated that now more than one-third of the milk used in New York City is of this kind. With the end of the war and the dissolution of the armies, the demand for sugared condensed milk fell off, and the manufacturers, who had been stimulated to too great a production, turned their attention to this "plain condensed milk." It would be well if enterprise and capital and philanthropy could be enlisted in supplying London with this form of milk, to the extent that New York and other American cities are now supplied with it. We have no means of estimating the present extent of the manufacture of condensed milk in the United States. For this we must wait for the returns of the census of 1870. However, we know that the capacity of the eight or ten factories on the Hudson, in Connecticut, Pennsylvania and Illinois, is not less than five hundred cases of four dozen pound cans per day, equal to eight million five hundred thousand pounds per annum. It may be stated that one pound of the condensed is equivalent to four or five pouuds of crude milk.

THE EXPORTS OF CONDENSED MILK

(combined with sugar,) from the United States during the twelve months ending September 30, 1870, amounted to a declared custom house valuation of $200,000, equal in round numbers to £40,000. In the year 1869 it was imported into England from New York to the value of upwards of £16,000. The bulk of the remainder exported from New York was sent to South America, India, Australia, and China, while that sent to London and Liverpool was mainly held in bond, and sent eventually to the colonies or disposed of as ship's stores. We now pass to the introduction of the manufacture of the Borden kind of condensed milk this side of the Atlantic, and to the development of its manufacture and sale in Europe. In 1865 an American gentleman who had noted the advantages of the article in the American army during the four years of the war, became resident in Switzerland in the capacity of U. S. Consul. Remembering the cheapness and richness of Swiss milk, the cheapness of labor, and other facilities afforded in that country, he conceived the idea of preparing

CONDENSED MILK IN SWITZERLAND.

The ultimate success of his project has abundantly proved the soundness of his conception. He promoted the "Anglo-Swiss Condensed Milk Co.," the extent of whose present business is set forth in the following extract which we take from the "Grocer" of Dec. 31, 1870. The facts seem to have been compiled from statistics procured at the Board of Trade, which were doubtless obtained from the Report of the British Legation at Berne:

"In the Canton of Zug there has of late grown up a new mode of preserving the milk, which, owing to the good pasturage of that locality, is very excellent in quality. In the Commune of Cham the Anglo-Swiss Condensed Milk Co., with a capital of £12,000, employ about sixty operatives in their factory, the tall chimney of which may be seen by the railway traveler passing over the line from Lucerne to Zurich. The number of cows hired for the year is fourteen hundred and forty, and the average amount of condensed milk prepared daily during the three hundred and sixty-five days of the year, as it is necessary to include the Sundays, is one hundred and ten cases of four dozen each of one pound cans; these equal one million nine hundred and twenty-seven and two hundred cans as the produce of the year. The price of the crude milk is seventeen cents per mass, or about one cent per quart, and the daily cost of the cans made in the establishment amounts to £16 10s. About one-half of the produce is sent direct to London, where one-half of this is consumed, while the remainder goes for ship's stores, is exported to the colonies and sent to the provincial towns of England. Entering as it does into the daily food of the masses no duty should be imposed upon it; at present it is classed with confectionry and pays accordingly, whereas it is milk; at all events only the quantum of sugar which it contains should pay duty, and this quantum is uniform and can easily be ascertained. The half of the produce not sent to London is distributed over Germany, and there is some demand from France and Russia. We have been informed that a large shipment was placed in Paris two days before the investment of the city, and balloon letters beg that a large supply may be ready to be sent in so soon as the siege shall terminate. Owing to the demands from the sutlers who supply the armies of Germany and France and the various aid societies for the moment, this company is only able, with great difficulty, to keep an adequate supply for their regular demands. The process of condensation has already been fully described to our readers, who are now asked to patronize not only other Swiss condensed milks but Irish condensed milk also.

"It should be mentioned that this company was the first in Europe to introduce condensed milk to family use. Until its advent the article was known as only for ship's stores and for colonial consumption. By extensive and systematic advertising, and through the boundless energy which characterizes your business Yankee, this company has received a large demand for ordinary family consumption, not only in England but also in Germany and Russia. In this respect its success may be largely attributed to the fact that Baron LIEBIG and other authorities on questions of food, supported it heartily from the first, and allowed the patronage of their names for publication. Its success led naturally to the springing up of competitive companies. These have been established at Gruyeres and half-a-dozen other places in Switzerland, in Bavaria, in Holstein, in Ireland, and in England. But failing to produce a standard quality, and wanting in *prestige*, they have nearly all ceased to manufacture."

All now known to the London trade are the "Anglo-Swiss" (Milk-maid brand), Mr. Newman's "Irish Condensed Milk," at Mallow, near Cork, (Harp brand), and the "English Condensed Milk Company," (Lion brand), whose works are at Aylesbury, Buckinghamshire. At one time the milk prepared at Gruyeres had a good sale in London, but since the outbreak of the war, in July, none of its brand has appeared here. In the spring of 1869 it was announced that the

IRISH CONDENSED MILK

(Mr. Newman's) was about to be put upon the market. However, it was not introduced until the spring of 1870, but then under powerful patronage. We cannot say definitely what quantity Mr. Newman has prepared, but we have reason to believe that it was about ten thousand cases of four dozen one pound cans each.

THE "ENGLISH CONDENSED MILK COMPANY"

began to manufacture about the 1st of September, 1870. The editor of the Food Journal recently visited its works at Aylesbury. He seems to have been very much struck by the system under which this Company prepares its condensed milk; he remarks upon the "almost absurd cleanliness" observed. We gather from his statement that this Company makes about twenty cases of four dozen one pound cans six days per week. It seems that, unlike the Swiss Company, they do not work Sundays. This company was registered June, 1870, under the Limited Liability Act, as having a capital of £5,000 only, but it is fair to suppose, considering the extent of its works, that its capital has since been considerably increased. It will doubtless still add to its facilities as the demand increases. We have good authority for stating that neither the Swiss nor the English Company has lately been able to supply the call for their products. On the other hand, the competition between the companies is so eager and keen, and prices thereby have been so reduced that any new company will have to encounter great difficulties before it can establish itself.

It would be invidious in us to express any opinion as to the comparative merits of the condensed milk offered to the public by these several companies. That is the public's own concern; the best and cheapest will in the end win, as it is the nature of trade. The value of the condensed milk sold in London daily is not less than £150. It is to be found at most shops in London, for sale at tenpence per can, which is cheaper than ordinary crude milk."

THE BORDEN FACTORIES—PROCESS OF CONDENSING.

Persons proposing to enter upon the business of condensed milk manufacture should visit some establishment of the kind, and make themselves familiar with the various parts of the process, obtaining a knowledge of the buildings and machinery in detail. There are several factories in operation on the Borden plan, which is now considered the best, as with proper care a very fine flavored and superior article is manufactured. The principal factories are at Wassaic, N. Y., Livermore Falls, Maine, West Brookfield, Mass., Winstead, Conn., and at Elgin, Illinois. The Elgin factory is quite noted for its fine product under the management of Mr. C. Church. I have examined this factory and its operations several times, and present here some of the leading features of the establishment, and its process of condensing.

The main building is sixty-five feet by one hundred feet, three stories high. Upon the ground floor there are four rooms. The bath room is forty-five feet by sixty feet. Here the milk is prepared and condensed. The room contains a milk receiver, heating vat and well, vacuum pan and pump. The second room on the ground floor is to the right of the bath room, and here the milk is cooled. It contains three vats for cooling milk, with capacity for cooling fifty cans at a time. Spring water of the natural temperature of fifty degrees at all seasons of the year, is used for cooling the milk. The third room is used for a hall and store room, where sugar and tin are stored. The fourth room is called the meat room. Here meat is prepared for cooking and condensing. It has a meat chopper and force pump, the latter of which is used for elevating rain water from a cistern located about ninety-five feet from the building, and which is used for meat purposes. The boiler and engine rooms are attached to north side of main building. It contains two boilers and an engine of fifteen horse power. The chimney is eighty-five feet high. In the rear of the boilers is the coal house. The cheese manufacturing room is in the rear of the bath room, and is twenty by thirty feet. The receiving room, where milk is delivered, is on the left of bath room. Here the dairymen unload their milk and have their cans washed, steamed and rinsed, so as to be prepared for milk the next day. A department like this should be attached to every cheese or butter factory in the land, as the cans are thoroughly cleaned, and the steaming effectually destroys all germs of ferment. The second story is divided up into a room for preparing extract of beef; tin room, where cans are made for putting up the milk; sealing room, where the condensed milk is filled into the smaller cans and sealed up, and lastly, a room used for an office. The third story or floor, is used for general store room, and together with the part leading over the boilers, is used for curing cheese. Connected with the establishment is an ice house, thirty-eight by fifty-five feet, and a box shop; thus rendering the whole very complete for doing the various kinds of work which belong to the condensing business.

When I was last at Elgin, I found the Elgin Condensed Milk Establishment putting up large quantities of condensed milk for the Boston and New York markets. This business is yet in its infancy, but the time is not far distant, in my opinion, when a very large trade will be done in this direction. City consumers who are in the habit of using condensed milk tell me they prefer it for ordinary use; that they are sure of getting a pure, unadulterated article, and that it is cheaper even at a high price than milk ordinarily sold in cities, because of the shameful adulterations practiced by milkmen, and the liability of the milk getting sour; losses of this kind continually occur-ing more than make up the difference in price, so that condensed milk is the cheaper of the two. Besides the convenience of always having sweet, pure, milk in one's house, in small cans ready for use, is an important consideration to the city consumer.

THE CONDENSING PROCESS

at the Elgin Works, is that under the patent of GAIL BORDEN, and all his plans and suggestions are here strictly carried out. At this establishment the very greatest attention is paid to having milk delivered pure, and in perfect order. They have an admirable set of rules as a guide to each patron, and he is required to follow out the instructions to the letter. As these rules will be valuable to every dairyman who handles milk, I shall present them here at length.

RULES FOR THE TREATMENT OF MILK.

I. The milk shall be drawn from the cow in the most cleanly manner and strained through wire-cloth strainers.

II. The milk must be thoroughly cooled immediately after it is drawn from the cow, by placing the can in which it is contained in a tub or vat of cold water, deep enough to come up to the hight of the milk in the can, containing at least three times as much water as the milk to be cooled; the milk to be occasionally stirred until the animal heat is expelled as below.

III. In summer or in spring and fall, when the weather is warm, the bath shall be spring water not over fifty-two degrees temperature (a day or a night after a heavy rain excepted), constantly running or pouring in at the bottom necessary to reduce the temperature of the milk within forty-five minutes, to below fifty-eight degrees; and if night's milk, to remain in such bath until the time of bringing it to the factory, to below fifty-five degrees. The morning's milk not to exceed sixty degrees when brought to the factory.

IV. In winter or in freezing weather, the bath shall be kept at the coolest point (it need not be running spring water) by the addition of ice or snow sufficient to reduce the temperature of night's milk speedily below fifty degrees.

V. In spring and fall weather a medium course will be pursued, so that night's milk shall be cooled within an hour below fifty degrees, and morning's milk below fifty-five degrees.

VI. The bath and supply of water shall be so arranged as to let the water flow over the top to carry off the warm water. The can in which the milk is cooled shall be placed in the water immediately after the milking, and shall remain therein until the process of cooling shall be finished.

VII. The night's and morning's milk shall be separately cooled before mixing.

VIII. No milk shall be kept over to deliver at a subsequent time.

IX. The milk shall be delivered on the platform at the factory in Elgin every day except Sunday.

X. Suitable cans of proper dimensions to transport the milk from the dairy to the milk works shall be furnished by the seller and the cans shall be brought full.

XI. The Company shall clean and steam the cans at the factory free of charge, but customers shall keep the outside clean. The pails and strainers employed shall be by the seller thoroughly cleaned, scalded in boiling water, and dried morning and night.

XII. Immediately before the milk is placed in the cans they shall be thoroughly rinsed with clean, cold water, and great care shall be taken to keep the cans and milk free from dirt or impurities of any kind. When the cans are not in use they shall be turned down on a rack with the tops off.

XIII. All the "strippings," as well as the first part of the milk, shall be brought. No milk will be received from a cow which has not calved at least twelve days, unless by consent of Superintendent or Agent, who may determine its fitness sooner by a sample of the milk.

XIV. The cows are not to be fed on turnips or other food which would impart a disagreeable flavor to the milk, nor upon any food which will not produce milk of standard richness.

XV. It is further understood and agreed by the parties hereto, that if the Superintendent or Agent of the Company shall have good reason to suspect, either from evidence furnished or from the state of the milk itself, that water has been added, or that it has not been cooled as provided, or that it has been injured by carelessness, he shall have a right to refuse to receive such milk, or any further quantity of milk from the person so violating these directions and stipulations. The outlines of

THE CONDENSING PROCESS

are briefly as follows: Each man's milk is examined as it is received, and if all right it is strained and passes to the receiving vat. From this it is conducted off, passing through another strainer into the heating cans, each holding about twenty gallons. These cans set in hot water, and the milk is held here until it reaches a temperature of 90°. It then goes through another strainer and into a large wooden vat, at the bottom of which is a coil of copper pipe, through which steam passes, and here it is heated up to near the boiling point. Then the best quality of white granulated sugar is added in the proportion of one and a-quarter pounds of sugar to the gallon of milk, when it is drawn into vacuum pan having a capacity of receiving three thousand quarts at a time. This pan is a copper cylinder with a coil of copper pipe inside and jacket underside also for steam. The milk remains in the vacuum pan subjected to steam for about three hours, losing about seventy-five per cent. of its water, when it is drawn off into cans holding forty quarts each. The cans are then set in a large vat containing cold water, the water being of a hight equal to the milk in the cans, where it is stirred until the temperature of the condensed milk is reduced to a little below 70°.

It is then emptied into large drawing cans with faucets, and from them drawn into small cans holding a pound each, immediately soldered to exclude the air, and when properly labeled is ready for the market. There are

TWO KINDS OF CONDENSED MILK,

that containing sugar as above described, and simply the plain milk without the addition of the sugar. The wholesale price received at this factory for their milk is $3.50 for a dozen cans, or a trifle over twenty-nine cents per pound. It will be seen that four pounds of fresh milk as drawn from the cow, or about two quarts by measure, when condensed by taking out seventy-five per cent. of water, will make one pound condensed milk, and therefore a little more than fourteen and a-half cents per quart is realized for it. I am not prepared to give the expense of manufacturing, but if four and a-half cents per quart be taken to cover all expenses and this is doubtless too large an estimate—we have the milk worth ten cents per quart to the producer.

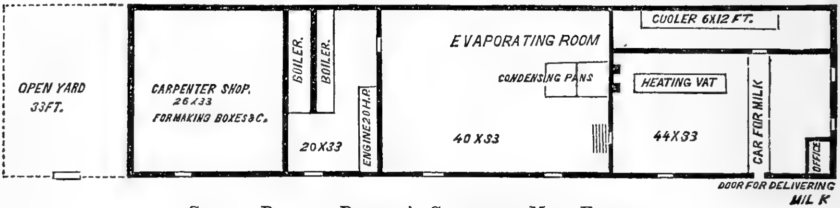
THE CONDENSED MILK

is about the consistency of thick sirup, has a pleasant taste, and when used for tea or coffee is not to be distinguished from pure, fresh country milk. From what I saw of this establishment, and from a test of its products, I was convinced of its great benefits to all parties concerned, and could not but wish that more establishments of the kind were in operation throughout the country. The factory at Elgin is managed by a company, and it was paying farmers in the winter nineteen cents per gallon for milk.

PROVOST'S CONDENSING FACTORY.

In 1865 I was at the Provost Condensing Works, in Middletown, Orange Co., N. Y. The establishment was then under the management of Dr. C. E. CRANE, a very intelligent gentleman, who went over the premises with me and explained the various apparatuses for manipulating the milk. The process of evaporation here is different from that of BORDEN'S, and was claimed to take less heat. We give briefly a description of the process. Milk is reduced and prepared in two forms at the factory. That which is run off without the addition of sugar is called condensed milk, and when sugar is used, concentrated milk.

During the summer about three thousand six hundred quarts per day are received at the factory. The milk is weighed and tested when received, and emptied into long pails holding twenty quarts, similar to the pails used at the butter factories for cooling the milk. About eighteen quarts are put in each pail, and after the milk has been cooled to 60° in order to divest it of animal heat and expel the ammoniacal gas, the pails are immediately plunged into a vat of water heated to a temperature of 185° to 190°. Refined loaf sugar is added at this stage at the rate of four pounds for each pail or can. It is kept in the vat of heated water about thirty minutes, when it is poured into an immense pan having fifty corrugations which sets over water and upon a furnace in the adjoining room. Here are arranged two large fans, directly over the milk, which are kept in motion by machinery, the temperature of the milk while evaporation is going on being 160°. The fans carry off the water, forcing it through ventilators, out of the building, as fast as it is formed into vapor. It takes about seven hours to condense the milk, seventy-five per cent. of its bulk in water being driven off. The faucets at each end of the pan are then opened and the condensed fluid passes through fine wire strainers or sieves into large cans. These cans, when filled are rolled away



GROUND PLAN OF PROVOST'S CONDENSED MILK FACTORY.

to the tables where their contents are drawn off into small tin cans holding a pound each, and are immediately sealed up. The milk when condensed has the consistency of thick molasses, and is then sold at from twenty-five to forty cents per pound, according to the price of milk in the New York markets. The cans are packed in barrels with saw-dust, and are thus shipped to the markets—the milk being used in the navy and in hospitals, and in warm climates.

Dr. CRANE informed me that milk thus prepared will keep good for years without the least trouble He opened cans in my presence that contained the preparation a year old, and I found it of good flavor and apparently not injured by age. It had a rich, creamy taste, rather sweet, with a flavor of boiled milk, but by no means unpleasant. The price paid for milk at the factory during the summer had ranged from four to five and a-half cents per quart. In winter the price paid was seven and a-half cents per quart.

EXPORTS FROM NEW YORK.

The exports of condensed milk from New York alone in 1869 amounted to $79,652, of which England took $21,770; Austria $9,494; the States of Columbia $9,176; China, $8,166; Brazil $3,087, and Cuba $3,093.

USE AND MANAGEMENT OF MILK AS A DIET FOR INFANTS AND CHILDREN.

The following paper by Dr. ALFRED WILTSHIRE, M.R.C.P., of London, Physician to the British Lying-in Hospital, and late Medical Inspector to H. M. Privy Council, is a brief but valuable treatise upon this important subject:

"It may with truth be said that the value of milk as a food for infants and young children is incalculable. Not only is it the pabulum which thrifty nature provides for the nourishment of the young of the highest order of animals, the mammalia, among which man is the chief, but it is the single article of diet upon which alone life can be sustained, and the body kept in perfect health and vigor. Most people know something of this, yet seldom think how variable a fluid milk may be or become according to the source whence it is derived or its subsequent treatment. Few, among the millions who daily use milk in their ordinary diet, reflect that the milk of each species of animal possesses peculiar and distinctive characters specially fitting it for the nourishment of the young of the same species, and fewer still that the milk of different individuals of a given species varies considerably; nay, more, that the milk of the same individual may vary materially at different hours of the day, or be changed by circumstances under which it is secreted. Thus, the state of health, the kind of food, passion or emotion may greatly modify the constitution of the fluid for better or worse, though the changes thus induced be, especially in the case of passion or emotion, so subtle as to elude detection by ordinary methods of examination, and only betray themselves by their effects when consumed as food. It is obvious then that when we speak of milk we speak of a fluid which may differ essentially, as it is obtained from the cow, the goat, the ass or the mare, not to speak of the alterations in its composition which may be induced in individuals by the conditions just mentioned.

"Without dealing with the subtle changes of which milk is capable, and to which woman's milk is more liable than that of any other animal, owing to her great susceptibility to emotion, or indeed without considering human milk at all, except by reference to it as a standard, I desire to say a few words upon the use and management of cows', goats' and asses' milk as food for infants and children, but chiefly of cows' milk, that being practically the most readily obtainable, if not the best. The foregoing remarks are made with the view of impressing upon the non-professional reader, the fact that there are important differences in the chemical and physical constitution of milks, and that the milk of any animal may not be indifferently taken, in the belief that being milk it is all one, whether it be yielded by a cow or a goat, an ass or mare. As regards results, scarcely any of us live entirely without milk; either as a luxury or as a necessary of life, nearly all partake of it. But there is a great host of little ones, to whom indeed it is a necessary of life, to whom it is one of the very first conditions of existence, to whom it is meat and drink. As the constitutional vigor and health of adults are largely influenced by the conditions of their existence as children, it becomes important that children, who in their turn become men and women, should be reared in the healthiest manner possible, so as to secure for them that vigor which, in after life, is so essential to their own well-being and that of the community of which they are members. We say advisedly that this cannot be done, that is, good sound health cannot be secured without milk—good milk. And this valuable article should be properly used if we would get from it all the benefits it undoubtedly will afford if rightly used and treated. It is upon this part of the subject I would particularly dwell:—the proper use and management of milk as a diet for infants and children.

"It is hoped that it will not be requisite to insist upon scrupulous cleanliness in the treatment of milk. Taint of any kind, and acidity, should be looked upon as destroyers of its good properties. Milk, fresh, sweet and pure, is a most wholesome diet; putrefying, it is harmful.

"Before going further, it will, perhaps, be well very briefly to consider the chief characteristics of woman's milk, and to compare them with cow's milk. This will enable us to see the difference between the two; and we shall then be in a position to say how cow's milk may be made more nearly to resemble human milk, and thus fitter for the consumption of children. Clearly this is a matter of some importance. The chief thing to be borne in mind about cow's milk is, that it is much richer in cheesy matter than mother's milk. The value of this knowledge will be shown presently. It is also somewhat richer in butter, and decidedly richer in salts. On the other hand, mother's milk is richer in sugar. It may be said with some truth, that cow's milk is "stronger" than mother's milk, for one pint of the former will contain more solid matter than a like quantity of the latter. To bring cow's milk to a condition resembling mother's milk, as regards the cheesy element, it is necessary to dilute it with water (I much prefer lime water as a rule) in the proportion of a third or a fourth of water, to two-thirds or three-fourths of milk. But then the resulting mixture will not be rich enough in sugar and fat, and to remedy this a little sugar of milk (which is now easily procurable) and some cream should be added. Lump sugar should be very sparingly used in the food of children; it is much abused in this respect. Better not use sugar at all than use too much. Sugar of milk should only be used to the extent of slightly sweetening the prepared milk. To repeat, two-thirds or three-fourths pure, new cow's milk mixed with a third or fourth of water (the proportion may be varied according to the age, requirements or peculiarities of the child; very young children, for instance, often thriving best on half and half), to every half pint of which two teaspoonsful to a tablespoonful of fresh cream and a little sugar of milk are added, will form a fluid resembling, as nearly as may be, mother's milk. If cream cannot be procured, a few drops of sweet olive oil will be a good substitute. I make mention of this, as I consider fat to be of the highest importance to children. Now, having brought cow's milk into a condition as nearly as possible resembling mother's milk as regards *proportion* of ingredients, we may go a step further and endeavor to improve it as regards the *quality* of one of its principal ingredients, viz., the curd or cheesy element. The curd of cow's milk is much denser and therefore far less digestible than that of mother's milk. This is a fact of great practical importance. How can it best be obviated? Before stating this I would refer, *en passant*, to a matter upon which much ignorance prevails. It is commonly believed that if a child brings up curdled milk it is a sign that it does not agree with it. The truth is, that it would not agree if it did not curdle after its reception into the stomach, for curdling by the gastric juice (an acid fluid secreted by the stomach, and endowed with peculiar properties) is one of the first and most important acts of digestion. The vomiting may be wrong, but the curdling is not, for as just stated, the first act in the digestion of milk is the coagulation of its curd. The curd formed from mother's milk is very light and delicate; it is feathery, or like snow flakes, and thus permits of easier digestion. If a child fed upon cow's milk vomits *lumps* of curd, there must be something wrong, but the bringing up of a little curdled milk need not generally be taken as indicative of mischief. How then can we bring the dense curd of cow's milk into the flocculent condition observed in mother's milk? My own observation and experience lead me to believe that this can best be done by diluting the milk with lime-water. Usually I advise the substitution of lime-water for the third or fourth part of water alluded to, and I have witnessed the best results ensue upon the adoption of this plan. If plain water be not wholly replaced by lime-water, I always direct that a portion of it shall be. I believe I have the strongest grounds for this recommendation. In the first place, as already stated, lime-water renders the curd of cow's milk lighter and more digestible; secondly, it helps to neutralize acidity, to which hand-fed children are especialy exposed; thirdly, it helps children to form teeth, often backward and fourthly, it is an excellent remedy against that bane of childhood, rickets, in which too common disease there is, as is well known, a deficiency of lime in the bony tissues, owing to defective assimilation of lime salts, the supply of which, moreover, is frequently inadequate. Lime-water, then, is a valuable addition to the milk diet of children, on several grounds. The addition of a small quantity of well prepared baked or boiled flour; Chapman's entire wheat flour; Liebig's food, or Robb's biscuit, may also tend to keep the curd from clotting into large, hard masses, and in this way such articles may prove useful; but I am persuaded, that as a rule, nothing but milk diluted with water, or lime-water, as directed, should be given to infants for the first six months after their existence.

"There is a very strong reason why starchy matters, such as arrowroot, etc., which can scarcely be called food, should not be given in early infancy. It is this: for about the first three months of life, infants do not secrete saliva, and unless starchy matters are mixed with saliva, they cannot contribute any nourishment to the body; on the contrary they become active sources of acidity. Farinaceous foods are, as a rule, more or less injurious on this account, and milk is often unjustly stigmatized as bad, owing to the admixture with it of some kind of starchy material, which is apt to excite intestinal disturbance in young children. Milk should not be blamed when used under such conditions; to try it fairly it should be used as already pointed out. Some children have an aversion to milk, and for them various diets may be devised. It is not my intention to speak of such diets here; but I would remark that children who take milk reluctantly, or with indifference, may be induced to take it more kindly by the addition of a very little *pure* cocoa or chocolate. Much of the trash sold as cocoa consists of a compound containing starch, etc., and should accordingly be carefully avoided. VAN HOUTEN'S, SCHWEITZER'S or CADBURY'S, are excellent. Or a little flavoring by vanilla, cinnamon, carraways, or a very few drops of brandy or rum, will occasionally render milk extremely palatable to children. All these require to be carefully and sparingly used, especially the latter.

A word or two further may be said upon the treatment of milk. It should never be boiled; this renders it less digestible; indeed, it should not be more than slightly warmed, and ought never to be kept long in that condition, as fermentation is favored by warmth. It should never be exposed to objectional effluvia or odors. The feeding-bottles and appurtenances, and all receptacles for milk, should be kept scrupulously clean; the slightest acidity from such sources tainting the whole fluid, and thus rendering it hurtful. It need hardly be said that pure milk, the produce of healthy animals, should alone be used. The milk of asses, when procurable, is excellent. Goat's milk is useful, but is perhaps a little strong in curd, and may require to be treated accordingly.

THE USE OF SKIMMED MILK AS AN EXCLUSIVE DIET IN DISEASE.

In regard to the value of milk as a curative agent in disease, the Medical Times, Philadelphia, has the following interesting statement from Dr. S. W. MITCHELL. He says:—"My design in this and the brief papers with which I hope to follow it, is to give my own experience in the use of skimmed milk as an alterative diet in certain cases of disease. After reading CAREL'S paper some years ago, I began to employ this very useful method of treatment, and since then have found repeated reason to congratulate myself upon the success which, in my hands, it has attained whenever the cases for its use were selected with discretion. In dealing with the subject I shall first make some general remarks upon the mode of using milk and upon the effects observed in nearly all cases. Next, I shall relate histories of its employment in gastric disorders, in diarrhea, in malarious and renal dropsies, and finally in nervous maladies. I hope to conclude with a study of the influence of the milk cure upon the secretions and excretions. In following this path I shall in some cases differ from Dr. CAREL; but in general my views will be found to correspond with those held by this physician. The milk is to be used as free as possible from cream; and if, as is generally the case in our cities, there is an abundance of ice to be had, I prefer to let the milk stand in a well-chilled refrigerator for twenty-four hours. It should then be carefully skimmed, after which it is fit for use. As CAREL remarks, the quality of the milk goes for something, and perhaps too the surroundings, since I have found persons who could not bear the treatment in a city, while in the country they throve under it admirably. As to temperature, it may be given warm, not hot or cold, as suits the taste. In rare cases, where at first it caused nausea, I have had to use it with more or less lime-water during the first few days. In other instances the repugnance to its taste is a difficulty, and this may be overcome by faintly flavoring it with a few drops of coffee or with caramel. Other patients prefer to add to it a little salt; but as a rule I desire to give the milk alone as soon as possible.

"*Quantity.*—The patient takes, to begin with, one or two tablespoonsful on rising, and every two hours during the day. When I followed Carel's rule of giving at once half-a-tumbler to a tumblerful (two to six ounces) four times daily, I found that few patients would bear it without nausea and early disgust. I increase each dose by a tablespoonful every day—say three the second day and four the third day. Thus, if the patient begins at eight A.M. he takes up to ten P.M. eight doses, that is to say about sixteen ounces. Now, this is the lower limit; nor have I been able in the cases of females or delicate men to give it more largely at first. Indeed, few women of sickly or sedentary habits are able to exceed at any time a pint and a-half daily. After the fourth day it is better to separate the doses as you increase their amount, until they are taken at four equal intervals daily, and the maximum quantity is attained. This varies greatly. I had one patient, a railroad contractor, who, living an out-door life of the most active kind, took daily for more than a year fourteen tumblers of skimmed milk, and this alone. Two quarts a day is the limit with most of my patients. I suspect, from Carel's account, the Russian patients must have more hardy stomachs.

"Where people are well enough to live afoot I have had little difficulty in the use of milk; but in very feeble persons—and I have often given to such—I have found it absolutely necessary to use with it for a few days, brandy or whisky, and even beef soup, all of which I expect to abandon as soon as the patient can take milk enough to sustain his strength. It is needless to say that for a patient to take steadily a diet of skimmed milk alone, requires the utmost fortitude and all the moral aid which the physician can give. Carel thinks the first week the most difficult one, and this is usually the case; but sometimes the whole period of milk use is one long struggle, even after we begin to allow a partial use of other diet. It is not in these cases hunger, but simply the craving for other food which tortures the patients. Most of them avoid the sight of food in order to control their desires, and in one case I was much amused by a gentleman who said to me in a guilty tone, 'Indeed Doctor, but I could not help it; I stole an egg this morning.'

"Dr. Carel begins to alter the diet of milk after two or three weeks. I prefer to reach the latter limit before giving other food, but this, after all, is a matter for separate decision in individual cases. My own rule, founded on considerable experience, is this: Dating from the time when the patient begins to take the milk alone, I wish three weeks to elapse before anything be used save milk. After the first week of the period I direct that the milk be taken in just as large amount as the person desires, but *not allowing it to fall below a limit which for me is determined in each case by his ceasing to* *lose weight.* Twenty-one days of absolute milk diet having passed, with such exception as I shall presently mention, I now give a thin slice of stale white bread thrice a day. After another week I allow rice once a day—about two tablespoonsful—or a little arrowroot, or both, as circumstances may dictate. At the fifth week I give a chop once a day, and then in a day or two another at breakfast; and after the sixth week I expect to return gradually to a diet which should still consist largely of milk for some months. In children I sometimes use raw in place of cooked meat for a time, but grown people will rarely take it, although very often they are willing to take raw soup (Liebig's.)

THE SYMPTOMS DEVELOPED

under the use of milk are very interesting, and not all of them are told by Carel. In no case have I seen any one gain weight duriug the first few days; but where the treatment succeeds, the patient soon ceases to lose, and then slowly gains in weight. This is usually the case in severe gastric and intestinal cases; but in some cases the loss of weight continues even after they are taking an amount of milk usually sufficient to sustain the body in an equilibrium. This is remarkably the case in very fat persons, who, as every one knows, are quite commonly small eaters. Taking three cases of dyspepsia at random (all women) I find this record: The first lost in two weeks fourteen pounds of a weight of one hundred and thirty-one; the second lost eighteen pounds of a weight of one hundred and twenty; and the third eleven pounds of a weight of one hundred and seventeen, her total weight at the start. In another case where the quantity of milk taken was two quarts daily, and the exercise small, the man lost weight steadily up to the time that I began to give bread, when the gain was immediate and speedy (case diarrhea.) Mrs. S., aged forty-seven, weight one hundred and ninety-four pounds, inactive, sallow, feeble, dyspeptic, and a very small eater, lost in four weeks thirty pounds, with general gain in strength and vigor.

THE STATE OF THE SKIN

has seemed to improve in all cases of chronic, gastric, or intestinal disease, but in others there has been no change. The urine, in a few cases is somewhat annoying during the first week, the patient having frequent calls; but commonly no such complaint is made, although in certain dropsies I have found the milk to act strictly as a diuretic. The changes in the urine we shall have occasion to study in future.

"The tongue is apt to become furred, and be white and rough two or three weeks,—in some cases so long as milk is taken; but so far is this from representing a disturbed state of stomach, that the dyspeptic after a few days usually finds himself in the enjoyment of an amount of digestive comfort long a stranger to his viscera. The stools begin to show the milk tint—a yellowish or salmon hue—after forty-eight hours, and when the milk disagrees they are apt to be loose, while usually they are intensely tough and constipated. This feature of the use of skimmed milk is at times most obstinate and annoying. After some weeks of creamless milk, I have often resorted, in such cases, to unskimmed milk, and with good effect; but it is quite clear that even this, in adults, may constipate, as it never does in the child. Carel says that a little coffee in the morning is often sufficient to relieve the bowels; and where a small cup of pure coffee can be used, this is true. I give it without sugar. Later in the treatment, fruit, fresh or stewed, may be used; but as a rule, I find that a little Saratoga water on rising, and a half grain of aloes, with a grain of ginger at night, will answer; or if these do not, then an enema is required. In some cases, this symptom is simply unconquerable by any constant treatment, and twice it has forced me to abandon the milk. In another case—a lady who undertook the milk cure unassisted—I was sent for on account of violent rectal and sciatic pain which followed every effort at defecation. She said she had a daily stool, which was true, but the amount passed was trifling, and her rectum was packed with feces so tough as utterly to defy injections, until I had mechanically broken up the mass. The pulse is usually quickened, until the milk diet is large enough to sustain the weight unchanged, when it falls again. In certain cases of hypertrophied left ventricle with palpitation of the heart, the immediate effect is to lower the pulse and quiet the heart. The nervous system is not strikingly affected by milk. I have once only, in a very stout and hysterical lady, seen vertigo and faintness follow its use, and forbid its continuance; but as a rule, it is in such persons soothing alone. Carel makes no mention of one symptom of which many have spoken to me: this is an intense sleepiness. It is common, but not universal, and soon passes away.

"In this brief sketch I have told plainly my own experience, and this I shall illustrate by cases—only some few of which I shall relate in detail. In no diseases has the value of milk-treatment been more clear than in certain instances of stomachal disorders. It is needless to add that I have quoted here only such instances as had proved rebellious to all ordinary methods. Y. C., aged fourteen, a frail and pallid lad, employed as errand boy in a sugar refinery, where he had contracted the habit of continually eating sugar. After some weeks he began to have a sick stomach, and at length incessant vomiting, for which a variety of treatment was employed, without relief. Finally it was found that he was able to keep down small quantities of milk diluted with equal parts of lime-water. The amounts taken were still too small to sustain life, and he wasted rapidly. At this time he fell under my care, and was at once put upon an exclusive diet of skimmed milk, taking two tablespoonsful every two hours. The vomiting ceased at once, and as the milk was increased in amount and the interval lengthened, he began in a week to gain weight. In two weeks he was doing well on a quart a day, and on the twenty-first day he began to take bread. At the fourth week a chop was added, and at the fifth week he went to the country. At this time he was gaining weight and color. He felt none of the gastric distress after the third day, but the sleepiness was well marked for two weeks. At the second week a slight return of emesis obliged him to lessen the dose for a few days. In him, as in most young people, the constipation was readily overcome by a rhubarb pill at bed time.

"Miss C., aged fifty-two. Has had for a year, attacks of violent pain, which are referred to the pit of the stomach, or rarely lower. They had no relation to her meals, but were easily brought on by fatigue. The natural ending of these spells seemed to be in slight emesis, and for a long time the very least vomiting gave instant relief, which however ceased to be the case after a year, when the attacks had become as frequent as two to four a week. The most careful research discovered no gall stones in the stools, and only once was there bile in the urine. The matter vomited was rarely the food, but only thin mucus, not acid, and containing no sarcinae or other substance which cast any light on the case. Alkalies, tonics—for she was very pale and feeble—stimulants, acids, pepsin, arsenic, and bismuth, were used in vain. Hypodermic injections, and opiates internally, alike failed. In this therapeutic despair—even change of air having produced no good result—I advised the use of milk treatment; and as her case illustrates alike the value and the difficulties of this plan of diet, I conceive it to be very instructive. At this time her attacks were of almost daily occurence. The milk was given cautiously—a tablespoonful every two hours—for two days, when it was doubled. On the fourth day she took four tablespoonsful at each dose, and at the same intervals, but was manifestly not losing weight, although weak. A little whisky added thrice a day bridged over this trouble, and was abandoned on the seventh day. Up to this time she had no attack, nor had she any up to the beginning of the fourth week, when the milk was given up. The reason for this was twofold. Her disgust at the diet was unconquerable; nor was I able by slight changes to secure good continued results. More complete alteration of diet brought back the attacks. I yet believe that these difficulties might have been overcome, but in her the milk caused a constipation so invincible that not even the most powerful purgatives or enemas were of any avail. Needless to say that, from the promise of so much good from milk, no means were left unused to enable her to take it, but all alike failed us, and I was forced in this case to confess myself beaten. Mechanical means were finally needed every few days to break up the tough rectal accumulations, and so the milk was given up. The case was probably gastrodynia.

"Somewhat like it in certain respects, was the history of a man who was sent to me from Elkton, Maryland, by my friend Dr. ELLIS. About nine months before I saw him he began to have increasingly severe attacks of pain, which came on an hour or two after meals, and lasted nearly up to the next meal. The pain was sharp and was referred to the epigastric region and to the left side below the ribs. There was a good deal of wind, occasional acid stomach, and no tenderness anywhere; bowels regular, urine high-colored, but free from albumen and depositing urates abundantly. He had been skillfully treated with a variety of drugs, but with no relief. On explaining to him the milk-diet, he professed himself able to carry it out. About two months later he returned to show himself, when I learned that he had lived on milk alone during the whole of this time, with immediate, enduring and absolute relief from all his pains. He was then directed how to return to his usual diet. Several months afterwards I learned that he was still living partly on milk, and was well and vigorous.

"Mrs. B., widow, aged thirty-three, had for years suffered from constant acid dyspepsia, for which she had been treated by several physicians, both at home and abroad. Her only relief consisted in the most careful choice of a minimum amount of food, and in the constant use of bismuth. She weighed one hundred and eighteen pounds and was sallow and disfigured by an eczematous eruption. During the first day of the milk cure she only took one tablespoonful every two hours, and after this it was increased as I have described. In a week she was taking a little under a quart daily, and her weight was down to one hundred and fourteen pounds. A little whisky was now added, and left off at the fifteenth day, when she was taking over two quarts of milk. The weight continued nearly up to the end of the third week, when she declared that even the perfect ease obtained as early as the third day of the treatment was scarcely a compensation for the horrors of this exclusive diet. A little persuasion, however, enabled me to continue its use another week, when I began to give stale bread, and in a few days later venison. Her gain in weight from this time was strangely rapid, and five weeks and a-half after we began, the milk brought her up to one hundred and twenty-nine pounds, with a perfectly clear and spotless skin. The aloes pill and enema answered throughout to control her bowels. It is now nearly a year since this time, but despite her final abandonment of milk she retains alike her good looks and comfort in digestion, having had in this time only one relapse which yielded to a brief return to the diet. I was very much struck in another case, with the same remarkable improvement in the clearness and beauty of the skin which I have just mentioned.

"Miss L., a young lady aged twenty, of remarkable personal attractions, was seized with a violent attack of inflammation of the ileo-cæcal region, with the common accompaniments of intense pain, swelling, tenderness and fecal accumulation, with violent vomiting. After a week or ten days the bowels were moved and the attack subsided. The experience of several such illnesses finally taught me that the local use of ice over the diseased region, chloral internally, and no purgatives for a week, gave the best and shortest curative result; but by this time the attacks recurred so easily and her general health had so suffered as to make some permanent relief imperative. At this period all the usual alteratives had failed to effect this end, and she was wasted, thin, and excessively sallow, with dark stains beneath the eyes. During three weeks only she took the milk, and I was then obliged by her urgency to add a chop daily. The effect of this diet was both to me and to her friends astonishing, in the sudden gain of weight, and in the return of clear and delicate skin tints. No less marked were the ease of digestion, previously much impaired, and the total disappearance of the hardening about the ascending colon. The bowels, somewhat to my surprise, were easily managed by a little rhubarb twice a day. In this case I did not hope for permanent relief save by six months of milk treatment. So soon, however, as she felt well I found it impossible to secure a continuance of its use, so that after some months I was not surprised to see her in a new attack. The case has value chiefly as showing that, with a tendency to a constipative disease, milk may still be used, and is illustrative of the profound change which milk sometimes effects in the nutritive system. The above cases, selected for various reasons, are merely representative of difficulties or successes, and it would be quite possible for me to multiply either class. Suffice it to say that in old and unmanageable cases of dyspepsia, and in neuralgic disorders related to the gastro-intestinal viscera, the treatment by milk has been sometimes a reliable resource when without it I must have been in therapeutic despair."

ASSOCIATED DAIRYING—ITS RISE, PROGRESS, &C.

I HAVE said that the dairy has become an important branch of national industry, that it is rapidly spreading over new fields, and is engaging the attention of farmers in the western, northwestern and middle States, wherever the lands are adapted to grazing, and there are springs and streams of living water. It is true, there are extensive plains at the south and southwest where the business of dairying cannot be carried on, but broad belts and isolated patches of land are scattered over our vast domain, well adapted to grazing, and such lands, when taken in the aggregate, cover a wide extent of territory.

There are two causes that have been operating the past few years to stimulate the development of this branch of industry, and have brought it to assume proportions that give it a distinctive feature of nationality. The first is a large and increasing foreign demand for dairy products; the second is the American system of "Associated Dairies," now brought to such wonderful perfection that the business can be readily introduced into new sections with all the ease and certainty of success in producing the qualities attained in old dairy districts.

The foreign demand for cheese, it is believed, will be permanent, and exportations from year to year must largely increase, since the finest American grades are acknowledged to be equal to the best manufactured abroad. This fact alone gives confidence to those about entering upon the business of dairy farming—that it will be remunerative and enduring.

In addition, as the texture and flavor of cheese have been improved, a large home demand has sprung up, which requires large quantities to meet its wants. It is believed by many that the home demand, for years to come, will more than keep pace with increased production; and home sales for the past few years would seem to prove that this view is not without foundation. With a constantly increasing home trade and a reliable market abroad, no branch of farming to-day offers prospects of better or more permanent remuneration than the dairy.

COMMENCEMENT OF CHEESE DAIRYING AS A SPECIALTY—ITS HISTORY, ETC.

The history of American Cheese Dairying has never been written, and perhaps a brief glance at its rise and progress will not be out of place.

Cheese making began in Herkimer county, New York, more than sixty years ago. For upwards of twenty years its progress was slow, and the business was deemed hazardous by the majority of farmers, who believed that over-production was to be the result of those making a venture upon this specialty. The fact, however, gradually became apparent that the cheese makers were rapidly bettering their condition, and outstripping in wealth those who were engaged in grain raising and a mixed husbandry.

About the year 1830 dairying became pretty general in the towns of Herkimer county north of the Mohawk, and some years later spread through the southern district of the county, gradually extending into Oneida and adjoining counties. Up to this period and for several years later, little or no cheese was shipped to Europe. It was not considered fit for market till fall or winter. It was packed in rough casks and peddled in the home market at from five to eight cents per pound. All the operations of the dairy were rude and undeveloped; the herds were milked in the open yard; the curds were worked in tubs and pressed in log presses. Everything was done by guess, and there was no order, no system and no science in conducting operations.

In 1840 the value of the dairy products of New York—butter, cheese and milk—was estimated by the United States census returns at $10,496,021, and in all the States at $33,787,008. Some idea of the comparative increase will be found when it is known that the value of the butter products of New York alone, in 1865, was more than $60,000,000. From 1840 to 1850 cheese began to be shipped abroad, the first shipments being inaugurated under the auspices of Herkimer county dealers.

In 1848—'49 the exports of American cheese to Great Britain were 15,386,836 pounds. Much of the cheese manufactured this year was of poor quality, and British shippers claimed to have sustained heavy losses. There was a more moderate demand the following year, and prices fell off a penny a pound, varying from fair to strictly prime, from six to six and a-quarter cents for Ohio, and six to six and three-quarters for New York State. The exports in 1849—'50 were 12,000,000 pounds, and continued to vary, without important increase, for several years. From September, 1858, to September, 1859, the exports of cheese to Great Britain and Ireland were only two thousand five hundred and ninety-nine tons, and in the following year, for the same corresponding period, they were increased to seven thousand five hundred and forty-two tons.

During the early part of the year 1860, Samuel Perry of New York city, a native of Herkimer, and one of the earliest operators in the cheese trade, endeavored to control the market, purchasing the great bulk of cheese manufactured in the country. He was reputed to be wealthy, and had for years enjoyed the confidence of dairymen, and being liberal in his dealings he was enabled to secure the dairies by contract, making his purchases at from nine to ten cents per pound. Then commenced the exportation of American cheese on a scale hitherto unknown in the history of the trade; and to him belongs the credit of opening up a foreign market for this "class of goods." The exportation of cheese from New York to Europe during 1860 was 23,252,000 pounds, which was increased on the following year to 40,041,000 pounds.

About this time (1860) the associated dairy system began to attract attention. Several factories were in operation in Oneida county, and were turning out a superior article of cheese. The system had been first inaugurated by Jesse Williams, a farmer living near Rome, in that county, and was suggested from mere accidental circumstances. Mr. Williams was an experienced and skillful cheese-maker, and at a time when the bulk of American cheese was poor. His dairy, therefore, enjoyed a high reputation, and was eagerly sought for by dealers. In the spring of 1851 one of his sons having married, entered upon farming on his own account, and the father contracted the cheese made on both farms at seven cents per pound, a figure considerably higher than was being offered for other dairies in that vicinity. When the contract was made known to the son he expressed great doubt as to whether he should be able to manufacture the character of cheese that would be acceptable under the contract. He had never taken charge of the manufacture of cheese while at home, and never having given the subject that close attention which it necessarily requires, he felt that his success in coming up to the required standard would be a mere matter of chance. His father therefore proposed coming daily upon the farm and giving the cheese-making a portion of his immediate supervision. But this would be very inconvenient, and while devising the means to meet the difficulties and secure the benefits of the contract, which was more than ordinarily good, the idea was suggested that the son should deliver the milk from his herd daily at the father's milk-house. From this thought sprang the idea of uniting the milk from several neighboring dairies and manufacturing it at one place. Buildings were speedily erected and fitted up with apparatus, which, proving a success, thus gave birth to the associated system of dairying now widely extended throughout the Northern States.

The system of associated dairies, during the last eight years, has been carried into the New England States and into the Canadas. It is largely adopted in Ohio, and has obtained a foothold in Wisconsin, Illinois, Iowa, Kansas, and other States. It is known abroad as the "American System of Dairying," and its peculiarities are so well adapted to the genius of our people as to give it a distinctive character of nationality.

PROGRESS OF THE FACTORY SYSTEM IN THE STATE OF NEW YORK, AND CAPITAL INVESTED IN THE BUSINESS UP TO 1866.

The number of cheese factories in the State of New York at the commencement of the season of 1866, was more than five hundred. The following table will show the number of factories erected in the State each year from 1850 to 1866:

YEAR OF ERECTION.	NO. OF CHEESE FACTORIES ERECTED EACH YEAR.	YEAR OF ERECTION.	NO. OF CHEESE FACTORIES ERECTED EACH YEAR.
1851	1	1860	17
1852	......	1861	18
1853	......	1862	25
1854	4	1863	111
1855	2	1864	210
1856	3	1865	52
1857	3	1866	46
1858	4		
1859	4	Total, April, 1866..........	500

These five hundred factories would probably average four hundred cows each, making a total of two hundred thousand cows, which, at the low cash value of $40 each, give an aggregate of $8,000,000. The lands employed in associated dairying in New York in 1866 would not be less than a million of acres, which, at an average of $40 an acre, would amount to $40,000,000.

COUNTIES.	NO. OF FACTORIES.	COST OF BUILDINGS AND APPARATUS.	PERSONS EMPLOYED.		AVERAGE NO. OF COWS.	POUNDS OF MILK USED.	POUNDS OF CHEESE MADE.
			MALES.	FEMALES.			
Allegany.......	6	$17,000	9	11	1,395	1,006,445	104,374
Broome........	1	3,000	1	2	500	643,510	74,000
Cattaraugus.....	3	8,000	6	7	1,474	192,730	....
Cayuga.........	1	3,500	1	2	270	837,550	82,216
Chautauqua	11	43,720	27	24	3,003	6,423,689	625,382
Chemung.......	3	1,800	5	4	107	764,850	25,075
Chenango......	19	54,556	31	41	6,505	17,917,494	1,879,363
Cortland	8	36,354	19	26	5,000	13,714,985	1,406,157
Erie...........	7	18,925	13	22	2,248	4,128,380	435,774
Essex	1	3,500	2	5	1,000	2,648,657	264,865
Fulton.........	2	8,500	3	4	800	....	....
Herkimer......	31	79,975	57	63	11,499	32,157,583	3,092,268
Jefferson	78	76,858	101	77	14,088	32,618,713	3,357,546
Lewis..........	32	52,546	55	63	12,084	33,531,746	3,171,721
Livingston.....	2	1,200	4	2	68	....	19,900
Madison	34	72,100	55	74	11,635	33,037,450	3,420,057
Montgomery ...	9	33,500	17	19	3,250	5,747,902	474,622
Niagara	1	225	3	2	36	....	9,606
Oneida	80	156,084	135	178	27,146	70,414,328	8,107,018
Onondaga......	4	12,200	5	6	825	2,631,304	1,272,633
Orange	20	57,583	54	26	5,837	9,962,949	724,854
Oswego........	21	40,100	31	38	6,815	13,450,857	1,386,005
Otsego.........	35	44,500	40	47	7,055	15,455,437	1,559,591
St. Lawrence...	4	9,000	6	9	1,375	2,348,322	322,615
Steuben........	1	175	3	2	31	....	10,372
Sullivan	2	1,050	4	....	235	....	4,500
Tompkins	2	7,200	5	11	1,550	3,237,512	340,260
Washington....	2	5,580	3	5	450	461,696	46,229
Wyoming......	5	14,200	10	11	2,245	4,343,153	446,011
Total......	425	$862,931	705	781	128,526	307,677,242	32,663,014

We give the preceding table, collected from official sources, showing the amount of capital invested in factory buildings, the number of hands employed at the factories, average number of cows delivering milk, pounds of milk, and pounds of cheese made during the season of 1864, at four hundred and twenty-five factories. The summary is made by counties.

From the foregoing statistics it would not be practicable to deduce general results to show the relative products and profits of manufacturing in the several counties, since some of the factories were in operation only part of the season. A better estimate can be made from the following statistics, gathered from the New York State census returns, showing the operations of one hundred and thirty-three factories selected from the whole number, and working through the season of 1864. The tables were made up and published in the New York Tribune soon after the returns were completed, and for convenient reference the factories are numbered from one to one hundred and thirty-three, inclusive:

Table showing the capital invested in buildings, persons employed in manufacturing, number of cows, season of beginning and closing operations, pounds of milk and pounds of cheese, at one hundred and thirty-three different factories in various parts of the State of New York, for the year 1864:

Counties.	Number.	Capital invested in buildings and apparatus.	Persons employed.		Average number of cows.	Season began—	Season ended—	Pounds of milk used.	Pounds of cheese made.
			Male.	Female.					
Cattaraugus,...	1	$2,500	2	2	420	May 5, 1864	Nov. 3, 1864	1,192,730	124,284
Chautauqua,..........	2	5,500	3	2	475	May 10, 1864	... .do.....	1,436,192	141,728
	3	5,000	3	2	350	May 3, 1864	Nov. 1, 1864	1,178,553	122,415
	4	3,120	3	2	508	May 2, 1864	Oct. 10, 1864	1,408,832	138,852
	5	3,500	3	4	520	Jun. 28, 1864	Oct. 15, 1864	842,693	82,214
Chenango, ...	6	2,000	1	2	375	Apr. 11, 1864	Nov. 18, 1864	1,403,356	114,429
	7	2,500	2	1	350	May 2, 1864	Nov. 12, 1864	1,154,504	121,800
	8	3,000	2½	3	550	Apr. 18, 1864	Oct. 31, 1864	1,755,000	175,146
	9	4,000	2	5	500	May 10, 1864	Nov. 3, 1864	1,012,692	136,271
	10	3,000	1	3	450	Apr. 14, 1864	Nov. 1, 1864	1,171,911	113,564
	11	4,000	1	3	380	April 5, 1864	Nov. 15, 1864	1,172,590	122,966
	12	2,600	2	2	415	Apr. 27, 1864	Oct. 29, 1864	1,227,786	127,345
	13	3,683	1	2	400	May 9, 1864	Nov. 1, 1864	1,162,252	126,254
	14	2,460	1¼	2½	400	May 10, 1864	.....do.....	1,124,485	111,799
	15	5,000	3	3	700	May 11, 1864	Oct. 20, 1864	1,481,840	148,174
Cortland, ...	16	5,000	3	2	600	May 9, 1864	Oct. 28, 1864	1,982,801	207,634
	17	5,000	3	4	800	April 9, 1864	Nov. 10, 1864	2,076,340	209,360
	18	5,937	3	3	550	May 26, 1864	Oct. 31, 1864	1,717,600	171,760
	19	4,500	2	4	900	Apr. 10, 1864	Nov. 1, 1864	2,067,399	208,747
	20	2,847	1¼	3	400	Apr. 19, 1864	Oct. 29, 1864	1,261,119	128,478
Erie,........	21	2,400	2	4	534	May 14, 1864	Oct. 22, 1864	1,122,844	111,539
	22	1,000	2	6	851	May 8, 1864	Dec. 10, 1864	2,458,633	249,603
Essex,................	23	3,500	2	5	1,100	Apr. 15, 1864	Nov. 15, 1864	2,648,657	264,865
Herkimer,............	24	4,000	2	3	460	Apr 21, 1864	Nov. 7, 1864	1,502,723	151,960
	25	5,000	2	4	448	May 24, 1864	Nov. 25, 1864	1,728,169	178,152
	26	3,000	3	2	400	May 12, 1864	Dec. 1, 1864	1,367,266	136,809
	27	2,500	2	2	475	Mar. 15, 1864	Dec. 10, 1864	1,760,000	176,000
	28	4,000	3	2	690	Mar. 9, 1864	Dec. 18, 1864	1,764,119	173,815
Jefferson,............	29	4,000	3	2	600	May 15, 1864	Oct. 29, 1864	1,418,351	142,518
	30	....	3	3	450	Apr. 26, 1864	Oct. 31, 1864	1,327,074	134,050
	31	700	2	3	300	May 19, 1864	Oct. 8, 1864	493,866	49,386
	32	2,000	1	1	300	May 28, 1864	Oct. 22, 1864	598,756	58,875
	33	5,000	2	2	325	May 27, 1864	Nov. 1, 1864	747,393	71,000
	34	2,000	1	2	540	Apr. 20, 1864	Oct. 15, 1864	1,282,621	128,846
	35	2,500	2	2	750	May 1, 1864	.....do....	1,700,000	165,000
	36	4,000	3	3	625	May 9, 1864	Nov. 1, 1864	1,636,644	162,000
	37	1,500	2	2	325	May 11, 1864	Oct. 31, 1864	505,600	50,560
	38	2,156	2½	1	425	May 3, 1864	Nov. 7, 1864	1,033,485	106,268
	39	1,500	1	2	325	May 11, 1864	Oct. 28, 1864	765,388	75,004
	40	2,538	3	2	480	May 9, 1864	Oct. 31, 1864	1,244,428	127,685
	41	1,000	2	2	450	May 1, 1864	Nov. 1, 1864	1,306,144	124,649
	42	1,000	1	3	319	Apr. 22, 1864	.....do.....	872,378	91,639
	43	4,000	5	5	1,200	May 1, 1864	Nov. 15, 1864	3,977,720	364,000
Lewis,....	44	3,000	3	3	850	Apr. 10, 1864	.....do.....	2,369,112	247,120
	45	3,600	3	4	600	May 22, 1864	Oct. 22, 1864	1,376,964	150,437
	46	2,196	3	2	327	May 3, 1864	Oct. 23, 1864	839,824	87,536
	47	3,000	2	4	750	Apr. 14, 1864	Oct. 27, 1864	1,902,295	207,121
	48	2,500	2	3	580	May 11, 1864	Nov. 5, 1864	1,379,871	165,165
	49	1,500	1	2	400	May 10, 1864	Nov. 1, 1864	994,730	102,835
	50	2,500	2	3	580	May 11, 1864	Nov. 5, 1864	1,379,871	165,165
	51	1,500	1	2	400	May 10, 1864	Nov. 1, 1864	994,730	102,835
	52	2,550	2	3	425	May 2, 1864	Oct. 25, 1864	1,507,373	155,559
	53	3,000	2	4	700	Apr. 25, 1864	Nov. 5, 1864	3,079,262	296,259
	54	3,500	3	3	600	May 20, 1864	Nov. 1, 1864	1,397,076	145,941
	55	3,300	2	3	730	Apr. 18, 1864	Nov. 2, 1864	2,024,503	210,010
	56	1,000	1	3	460	May 5, 1864	Oct. 15, 1864	1,235,000	130,000
	57	2,500	3	3	625	May 19, 1864	Nov. 4, 1864	1,700,653	177,115
	58	1,200	1	3	300	May 3, 1864	Nov. 1, 1864	899,254	89,016
	59	2,500	2	2	540	May 16, 1864	.....do.....	1,738,437	182,111
Madison,............	60	5,000	3	3	900	Apr. 22, 1864	.....do.....	2,772,188	272,460
	61	2,000	2	2	450	Apr. 25, 1864	Nov. 5, 1864	1,566,872	155,400
	62	3,000	2	3	500	Apr. 12, 1864	Nov. 4, 1864	1,703,670	170,284
	63	5,000	2	3	850	April 4, 1864	Nov. 23, 1864	2,824,179	284,379
	64	3,000	2	3	600	April 7, 1864	Nov. 5, 1864	2,046,083	199,839

Table showing capital invested in buildings, &c.—*Continued.*

Counties.	Number.	Capital inves'd in buildings and apparatus.	Persons employed.		Average No. of Cows.	Season began—	Season ended—	Pounds of Milk used.	Pounds of Cheese made.
			Male.	Female.					
Madison,............	65	3,200	2	2	400	Apr. 12, 1864	Nov. 7, 1864	1,356,000	135,621
	66	1,600	2	2	350	Apr. 25, 1864	Oct. 25, 1864	1,220,000	122,105
	67	3,000	2	3	575	Apr. 20, 1864	Nov. 1, 1864	1,200,000	120,000
	68	1,000	1	3	450	May 1, 1864	Oct. 20, 1864	705,990	70,600
	69	3,000	4	2	575	Apr. 22, 1864	Oct. 28, 1864	1,880,000	199,400
	70	2,500	3	3	650	May 21, 1864	Nov. 15, 1864	2,265,543	225,341
	71	2,300	1	4	400	Apr. 18, 1864	Nov. 4, 1864	1,175,117	115,175
Montgomery, ...	72	2,500	2	2	325	May 23, 1864	.....do.....	975,625	98,101
	73	3,400	3	2	500	Apr. 16, 1864	Nov. 10, 1864	1,473,619	147,361
	74	5,000	2	3	450	June 6, 1864	Nov. 7, 1864	1,308,069	134,161
	75	3,000	2	2	340	Apr. 11, 1864	Nov. 1, 1864	990,589	103,640
Oneida,..............	76	2,400	2	2	330	May 2, 1864	Oct. 22, 1864	849,852	86,556
	77	1,800	2	2	450	May 27, 1864	Oct. 17, 1864	826,282	86,156
	78	1,800	2	2	538	May 1, 1864	Oct. 31, 1864	1,639,910	164,875
	79	4,000	3	7	1000	Apr 20, 1864	Nov. 1, 1864	3,027.943	295,115
	80	2,000	2	2	350	Apr. 25, 1864	Oct. 25, 1864	802,500	78,000
	81	2,000	2	2	300	May 2, 1864	Oct. 22, 1864	802,359	75,000
	82	2,000	2	2	400	Apr 11, 1864	Nov. 10, 1864	1,000,000	100,000
	83	1,200	2	3	400	Apr. 25, 1864	Oct. 24, 1864	850,000	82,534
	84	3,000	2	3	425	Apr. 18, 1864	Nov. 1, 1864	1,399,330	135,858
	85	2,600	2	3	650	Apr. 11, 1864	Oct. 31, 1864	1,665,621	166,585
	86	2,100	2	3	350	April 8, 1864	Oct. 29, 1864	1,028,799	102,392
	87	2,000	2	4	600	Apr. 14, 1864	Oct. 1, 1864	1,670,000	167,720
	88	3,500	2	5	900	Apr. 11, 1864	Nov. 20, 1864	2,227,295	222,678
	89	1,500	1	2	350	Apr. 18, 1864	Nov. 15, 1864	1,059,579	102,350
	90	1,000	1	2	300	May 1, 1864	Nov. 1, 1864	832,252	81,123
	91	5,000	1	3	530	May 3, 1864	Oct. 29, 1864	1,419,251	141,645
	92	4,000	2	3	525	May 20, 1864	Dec. 18, 1864	1,866,917	181,082
	93	4,000	2	4	500	April 1, 1864	Dec. 1, 1864	2,020,409	264,161
	94	2,500	2	3	400	April 5, 1864	Oct. 29, 1864	709,908	68,431
	95	2,000	1	1	400	Apr. 12, 1864	Nov. 20, 1864	915,562	55,000
	96	1,500	1	2	350	May 11, 1864	Nov. 1, 1864	1,777,500	180,000
	97	3,400	2	4	725	Apr. 17, 1864	.....do.....	1,883,004	180,000
	98	2,500	2	3	550	May 1, 1864	.....do.....	1,484,443	184,721
	99	3,000	3	3	550	April 4, 1864	Oct. 31, 1864	1,746,784	173,691
	100	3,000	3	3	400	Apr. 29, 1864	.....do.....	1,416,750	130,545
	101	3,000	2	3½	325	Apr. 28, 1864	Nov. 1, 1864	745,692	78,976
	102	3,000	3	2	675	Apr. 18, 1864	Nov. 12, 1864	2,177,920	208,260
	103	2,400	2	2	350	Apr. 25, 1864	Nov. 5, 1864	1,114,238	107,805
	104	1,800	2	2	430	Ayril 4, 1864	Nov. 30, 1864	1,331,048	128,045
	105	3,000	2	5	500	Apr. 18, 1864	Nov. 10, 1864	1,440,590	144,059
	106	1,500	2	2	400	Apr. 25, 1864	Nov. 1, 1864	1,184,591	121,701
	107	2,300	2	2	480	.....do.....	Oct. 29, 1864	1,318,412	129,604
	108	5,000	2	3	700	Apr. 11, 1864	Oct. 31, 1864	1,900,000	185,000
	109	2,200	2	2	420	Apr. 20, 1864	.....do.....	1,453,352	136,606
	110	3,000	2	3	575	April 1, 1864	Nov. 30, 1864	2,051,688	204,025
Onondaga,...........	111	3,200	1	3	400	May 1, 1864	Nov. 1, 1864	1,331,304	123,734
Oswego,..............	112	2,200	2	2	475	.....do.....	Oct. 1, 1864	1,400,000	97,700
	113	2,000	2	1	500	Jun. 13, 1864	Oct. 15, 1864	800,000	88,888
	114	2,500	2	3	500	Apr. 15, 1864	Oct. 3, 1864	488,288	46,476
	115	1,000	1	2	300	Apr. 19, 1864	Sept. 29, 1864	382,804	35,009
	116	2,000	2	2	400	Apr. 15, 1864	Oct. 15, 1864	1,443,032	142,500
	117	2,500	2	1	350	May 25, 1864	Nov. 15, 1864	803,718	84,662
	118	3,500	2	4	600	May 12, 1864	Oct. 29, 1864	1,714,269	155,180
	119	2,700	2	1	375	April 7, 1864	Oct. 15, 1864	1,117,873	110,365
	120	1,600	1	2	350	Apr. 15, 1864	Oct. 22, 1864	1,137,948	119,784
	121	2,500	1	3	300	May 16, 1864	Oct. 1, 1864	515,430	51,543
	122	2,000	1	3	400	May 10, 1864	Nov. 2, 1864	1,215,185	126,625
Otsego, ...	123	4,200	2	4	500	April 1, 1864	Sept. 1, 1864	1,226,700	136,300
	124	3,000	1	2	500	Mar. 9, 1864	Dec. 12, 1864	1,749,974	172,894
	125	3,000	2	2	400	Apr. 25, 1864	Dec. 6, 1864	1,446,871	137,886
	126	2,000	2	2	500	Apr. 19, 1864	Oct. 29, 1864	1,140,000	114,000
	127	3,200	2	2	280	.....do.....	Oct. 31, 1864	881,539	86,533
St. Lawrence,.......	128	3,000	1	2	375	May 17, 1864	Oct. 23, 1864	1,107,373	109,518
Tompkins,...........	129	1,200	3	7	900	May 2, 1864	Nov. 3, 1864	2,871,042	302,215
Wyoming, ...	130	3,000	2	2	400	June 8, 1864	Nov. 2, 1864	820,803	84,142
	131	3,000	2	3	600	May 31, 1864	Oct. 29, 1864	1,243,469	125,664
	132	3,000	2	2	350	May 15, 1864	Oct. 25, 1864	990,000	100,000
	133	2,500	1	2	505	Apr. 25, 1864	Nov. 12, 1864	1,139,121	120,205

The above statistics present the following aggregates:—Cost of buildings and apparatus, $378,187; persons employed (males), two hundred and fifty-eight; persons employed (females), three hundred and sixty-two; number of cows used, sixty-seven thousand and thirty-four; pounds of milk used, one hundred and eighty-seven million, eight hundred and twenty-two thousand, eight hundred and thirty-eight; pounds of cheese made, eighteen million, nine hundred and forty-three thousand, four hundred and thirty-five; average number of pounds of milk for one of cheese, 9.915; pounds of milk to a cow, two thousand eight hundred and two; pounds of cheese to a cow, two hundred and eighty-three; value of cheese at twenty cents per pound, $3,788,687; average value of cheese to a cow, $56.52.

The prices at which cheese sold in 1864 ranged from ten to thirty cents, and averaged about twenty cents.

The quantity of salt used to one hundred pounds of cheese was reported from three hundred and seventy-seven factories. In one hundred and one of these the amount used was three pounds; in eighty-seven, two and a-half pounds; in fifty-one, two and three-fourths pounds; in forty, two and seven-tenths pounds; in nineteen, two and four-fifths pounds; in nine, two pounds, and in six, five pounds. The least quantity used was three-tenths of a pound. In Limburg cheeses the quantity was much greater, ranging from fourteen to seventeen pounds.

It would be proper to remark that since 1864, considerable improvement has been made at many of the factories, in securing a better quality and larger quantity of cheese from a given quantity of milk. In comparing the quantity made per cow, as deduced from the foregoing statistics, with that made in family dairies, it should be remembered that the factories are not in operation during the whole milking season, and therefore due allowance should be made on this account. These statistics are of interest, and will be found of great value, as comparisons can be made of the product of cows in different parts of the State.

COST OF MANUFACTURING CHEESE IN FAMILIES, ETC.

In many counties of the State, family dairying is still largely in practice, and in order to compare the two systems understandingly, it will be well to make an estimate of the actual cost of manufacturing cheese in families, after the ordinary method—say from a dairy of forty cows—together with the care and marketing of the same. We estimate from the point when milk is in the vats, putting values, &c., on a gold basis:

Original cost of cheese house, including tables, &c.,	$410 00
Vats and heater,	50 00
Press, hoops, curd knife, &c.,	40 00
	$500 00

Annual interest on original outlay,..	$35 00
Dairymaid, say half time, for nine months, including board,......................	60 00
Man's time about the dairy, turning cheese, &c., say average of one hour each day for nine months—twenty-five days, at one dollar,...........................	25 00
Annual cost of fuel and its preparation for vats and curing room,................	15 00
Man's time boxing and marketing cheese, including team, say two days per month —eighteen days, at one dollar and a-half,..................................	27 00
Annual wear and tear of dairy utensils, and keeping buildings, &c., in repair,.....	15 00
	$177 00

Forty cows, averaging five hundred pounds of cheese per cow, gross amount, twenty thousand pounds; cost per pound for manufacturing, nine mills; thirty cows, fifteen thousand pounds, say eleven mills; twenty cows, ten thousand pounds, seventeen mills.

It will be seen then, that the cost of barely manufacturing cheese in single dairies will average a little more than one cent per pound; and this sum, for the most part, is the actual cost in cash paid out, for we have not taken into account the general care and supervision necessary in the manufacture and curing of cheese, which cannot be entrusted to domestics, but must daily occupy the time and attention of the proprietor or some member of his family who has something beyond mere wages to stimulate to action. And here it may be proper to observe that one of the inconveniences which is widely felt among dairymen, results from the difficulty of obtaining careful and reliable hands for the management of the dairy. If it is desirable to make first class cheese, that will command in market the highest price, all the operations of manufacture must be performed by tried and skillful hands—hands that can rarely be obtained for hire, and when obtained commanding comparatively large wages. Now, as cheese making is an art which must be learned like other trades, and as most of its operations are performed by females, the dairy farmer may be said to have, for the most part, nothing but apprentices in his employ; for when his dairymaid has been carefully taught the trade, she marries, and is at once lost to him. This scarcity of skilled cheese makers is severely felt throughout the whole dairy region, necessitating the farmer and his family, and more especially the female portions, to arduous labor; taxing their strength to a degree that tells heavily on health and constitution. The result is, that persons prematurely aged and with broken health, are more frequently found in a dairy region than in other farming communities, The introduction of improved dairy apparatus has, it is true, lessened the labor of cheese making, but the business still demands the same skill and careful oversight; the want of one or relaxation of the other, resulting not only in immediate loss, but exerting a damaging influence upon the reputation of the dairy.

There is no desire to say one discouraging word of a business which has added so much to the wealth of the country, and in which those who are engaged generally prosper, and soon become independent in worldly goods, but the truth must be told, nevertheless. Wealth has its advantages, but its price should be kept in view, and if overtasked muscle, incessant care without relaxation, and, finally, disease, is to be the patrimony of wives and daughters, its charms, to say the least, are very much diminished.

A point of some moment to those engaged in cheese making is high skill and perfection in manufacture. It is not deemed necessary to enumerate all the reasons why this does not generally obtain. The fact is patent that choice cheese is made by a comparatively small number, rather than the majority of dairymen. Even among those noted for producing a strictly prime article, the process of manufacture, as well as other work of the dairy, is at times hurried and neglected, and must be necessarily so from the nature of things. It does not pay to keep an extra force on hand to take the place of those who may be disabled by accident or sickness, or who from other causes are obliged to suspend work. Occasional periods of farm labor, too, demanding immediate and pressing attention occur more or less frequently; the result of which is imperfect cheese, which must be marketed as such and at corresponding prices. One or all of these causes have been in operation in every farm dairy, and must continue to occur from time to time. What the losses from this source may be through the year depends of course on the many and various circumstances that have controlling influence in each particular case. We have known it to be large enough, in many instances, to cover the whole cost of manufacturing the entire cheese of the dairy for the year. Dairymen are conversant with these facts, and they are points to be considered, and should have their proper bearing in making up our estimate of the two systems.

ADVANTAGES OF THE FACTORY SYSTEM.

The advantages claimed for the factory system are, superior quality, uniformity, higher prices, saving, by buying at wholesale, such materials as salt, bandage, annatto, boxes, &c., and, finally, relieving the farmer and his family from the drudgery of the manufacture and care of cheese. It is not pretended that a better quality of cheese can be made at the factory than in families, but that it is quite as fine as the best, and therefore above the average of that manufactured in small parcels. We have enumerated some of the causes that conspire to depreciate the quality of cheese when made in single dairies; these are not present in the factory system. The agent or superintendent makes it his business to see that all parts of the work are properly performed. He employs skillful workmen, and his interest and reputation are at stake, prompting him at all times to do his best. He knows that neglect or mistakes will not be tolerated, and the desire to satisfy persons interested, in order to secure their patronage, stimulates him to make every exertion to build up and sustain a reputation for "fine goods." He has every convenience at hand for manufacturing to advantage and making the business a sole employment. He is not liable to be disturbed by other matters which might serve to call his attention away from time to time, to the prejudice of the immediate work at hand.

The same rule must hold good with him as among those engaged in other professions and arts; for he who gives his whole attention and energies in a certain direction is likely to become more skilled, and arrive nearer to perfection in his calling, than he who is striving to do many and diverse things at the same time—more especially in cheese manufacture under this system, as a high degree of skill is expected, and jealous and interested eyes are daily watching and noting every short-coming. Uniformity and fine quality are more likely to obtain under this system, and whatever progress can be made towards improvement will naturally develop itself more rapidly here than among persons scattered over a broad extent of country, and who are so occupied with a variety of work as to have little time to spend in the improvement of any one particular branch. The factories, so far as we are acquainted, have acquired a high reputation for fine quality and uniformity.

At some of these establishments we have seen a large number of cheeses, making in the aggregate more than one hundred thousand pounds, so uniform in appearance as they lay on the tables, that the most practiced eye could detect scarcely any difference in their manufacture. Such a quantity of cheese uniform in size and quality will command a higher price in market than that of single dairies, from the fact that in the latter an allowance is always made by the purchaser for unequal or imperfect cheese. We have alluded to some of the causes that operate to increase the price of well-made factory cheese over that of private dairies. Another may be added the—saving of time, trouble, and expense in purchasing. The whole quantity made from six hundred or a thousand cows can be bargained for and bought in the same time and at no more expense than a "twenty-cow dairy." This item amounts to a considerable sum in the aggregate, as experts are employed by the principal commission houses in cities, by shippers and dealers, to select and purchase cheese, under salaries ranging from $500 to $1,000 or more per year. Others, again, get a certain percentage on what they buy. These sums, of course, come out of the produce, and hence by so much must depreciate the price of cheese.

We come now to consider the most important advantage to farmers in this union arrangement. It is the relief from the drudgery of cheese-making and the constant care and attention necessary in properly curing and fitting the cheese for market. It would be difficult to estimate this in dollars and cents, since health enters into the account more largely than is generally suspected. It is believed, and we speak advisedly, that the old method of cheese-making has done more to injure the health of women in cheese-dairying districts than any other cause. Much of the work about the dairies ought to be performed by men; but too often the manufacturing and most of the care of cheese are left wholly to females, overtasking their strength by hard and exhaustive labor, thereby laying the foundation of weakness and disease.

As the same process has to be gone through with in manufacturing cheese, whether the quantity of milk be large or small, and as nearly the same time also is occupied, it will be seen that what requires the labor of a great many persons to do, when cheese-making is divided up in families, can be accomplished with but few persons on the factory system—some five or six being sufficient to do all the work about an establishment manufacturing the milk of a thousand or more cows.

OBJECTIONS TO THE FACTORY SYSTEM.

The objections urged against cheese factories are, difficulty of detecting adulterated milk; the carrying of milk to the factory, and liability of sour milk; difference in quality of milk, arising from the manner in which cows are fed and managed; the cartage of whey; and the necessity of manufacturing the early and late made cheese in the family. These are the principal objections urged by dairymen. As the milk is measured at the factory and each credited with the amount daily furnished, it is evident that, when there is a considerable quantity, a dishonest person could add water, and thus increase the number of gallons. Such cases have occurred, and the individuals cheating have been summarily expelled from the association. We now have devices that will detect watered milk, and therefore a watchfulness on the part of the superintendent, and the exclusion from the association of persons of doubtful honesty, are sufficient means of meeting the difficulty.

Some object to the labor and trouble of carrying milk to the factory, and the necessity of keeping regular hours for its delivery under all circumstances of weather, &c., since no delay at the factory can be made for the milk of a single dairy without hazarding the acidity of a large quantity—at least that contained in one vat—besides deranging in some degree the regular factory works. Others contend that, having the milk, the cheese can be made by the family with but little more trouble and labor than that of carting the milk, while one's own time and convenience can be studied at pleasure, and the cheese be at all times under immediate control.

Without extra care and cleanliness as to the pails and milk cans there is liability of sour milk from time to time, which, of course, would not be received at the factory, as milk only slightly acid would damage that with which it came in contact. The milk cans for carrying the milk, it may be observed, are somewhat difficult to cleanse and to keep sweet; and the confinement of the milk and its agitation while being carried in hot weather, render it susceptible to change, especially if there be the least taint of acidity about the cans.

Dissatisfaction often occurs at the factory with regard to the condition of milk, the superintendent being certain that the milk is slightly and perhaps perceptibly changed, while the farmer stoutly insists that it is perfectly sweet; and he goes home in no pleasant mood, complaining that his cans were not perfectly cleansed, laying the fault of the sour milk upon some member of his family, or disbelieving that the milk was changed. If the milk is not received at the factory there is a loss to the stockholders. Hence it will be seen that more or less trouble is brought about on this account. Not unfrequently bad feeling is engendered on the part of the farmer and his family, and he withdraws from the association.

Another objection is urged, and with some apparent reason, that the quality of milk varies with different persons, according to the manner in which the cows are supplied with food and are managed throughout the season. It is contended that clean, sweet, upland pasture, an abundance of food, and plentiful supply of pure water, cattle wintered well and receiving careful treatment in every respect, will produce a better quality of milk, from which more and better cheese can be made, than when the reverse is practiced. And yet the poor herd that has been wintered improperly, that is pastured on the coarse herbage of low lands, with general bad treatment on the part of the owner, is credited according to the quantity furnished on an equality with the better herd. It is not easy to see how this can be remedied without excluding such from the association.

Then there is trouble with the whey, which is regarded by some to be an important item in pork making, or as a feed for cows—for the whey in some cases is the property of the person who runs the factory, but even were it given the farmers, there is the trouble and expense of carting it home. An objection is also urged against the system, that in fall and spring, when the cows are "coming in" or being dried off, the quantity of milk is too small to be carried with profit to the factory; that the family butter is to be made; that it pays better to take off the cream for butter and turn the skimmed milk into cheese; and that, therefore, as the factory does not do away wholly with cheese making in families, cheese apparatus and implements are necessary; and if the spring and fall cheese are to be made at home, the other portion of the dairy may as well be made there also. This objection could be partly met be setting the milk and taking off a part of the cream and delivering the milk every other day, or at longer intervals. We have now presented both sides of the question, and are prepared to advance another step in the discussion, which brings us to

THE ORGANIZATION, SELECTION OF FACTORY SITES, ETC.

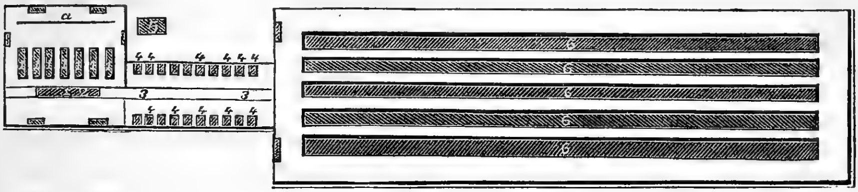
Cheese factory associations are organized in neighborhoods of ten or a dozen or more farmers. When it is proposed to start a factory, if enough are found willing to turn in their dairies, so as to make a fair start, say three hundred cows, a committee is appointed to look further into the matter, to visit factories, and get all the information on the subject that can be had. The favorable report of the committee being had, they then organize, choose directors, and adopt some general rules or plan for the guidance of the association. The next step will be the selection of some experienced cheese-maker as superintendent, and the plan for the erection of the factory building. Sometimes a person proposes to put up the building on his own account, and to manufacture and take care of the cheese at a fixed price per pound, demanding a contract on the part of the farmers to furnish the milk of the requisite number of cows for a certain number of years. The milk of about three hundred cows, it is believed, is the smallest quantity that can be employed by the manufacturer (when cheese making is his sole business) to obtain a fair living compensation for services, while the milk from a thousand cows can be manufactured at but little extra expense, comparatively.

FACTORY SITE.

In choosing the place for the erection of the factory buildings two requisites are sought after—good water and convenience of access and distance for the dairies furnishing the milk. The site, above all, should command an abundance of pure spring water. This is regarded by those who have had longest experience at the business as imperative. Even in family cheese making a considerable quantity of water is needed in various ways about the dairy, for cooling milk, cooking the curd, and keeping the buildings clean and sweet; but, for the factory, the quantity of water should be abundant and unfailing. In the old factories it was usual to have a considerable stream of water passing under the manufacturing room, so as to carry off the drippings of whey and refuse slop, so that there be no accumulation of filth or taint of acidity hanging about the premises. At the modern factories this is obviated. When whey and slop are allowed to collect from day to day about the milk room, the stench at times becomes intolerable and must do great damage to the milk, which absorbs taints of every character with great readiness. Hence means must be taken to have all the refuse matter swept far beyond the premises. Some factories are being built where dependence for water is placed upon wells of large capacity. At all events it will be seen that much more labor will be required, with greater liability to taints, when water is deficient or too warm in temperature.

THE EARLY CHEESE FACTORIES.

The buildings consisted of a manufactory or place for making the curd, a press room, dry house or curing rooms, and an ice house. The dry house was thought best to be a separate building, so as not to be affected by dampness, and in case of fire, that the cheese could be more readily removed. At one of the early establishments near Rome, Oneida Co., and where the milk of six hundred cows was used, the sizes of the buildings were as follows: Manufactory, twenty-six by twenty-six feet—story and a-half; press room, thirty-nine by thirteen feet; dry house, twenty-six by one hundred feet—two stories high. Cost of the buildings, with fixtures, about $2,500. These buildings consisted in nothing but frames, shingled and covered with nothing but rough siding, and even not lathed and plastered. The curing house, where it is not proposed to lath and plaster, should be sided with matched floor plank and provided with ventilators at the sides and top. In 1863 Mr. FRAZIE built a factory at Truxton, Cortland Co., N. Y. Mr. FRAZIE had formerly conducted a factory near Rome, N. Y., and had there made considerable improvement over the original or early built factories. The buildings at Truxton were a great improvement over the Rome establishment. The ground plan of these buildings is here represented in the following cut:



GROUND PLAN OF TRUXTON FACTORY.

1 1, Vats; 2, Sink on rails; 3, Truck for Sink; 4, Presses; 5, Engine and Boiler; 6, Ranges in the Curing Room; *a*, Platform and Delivery Windows.

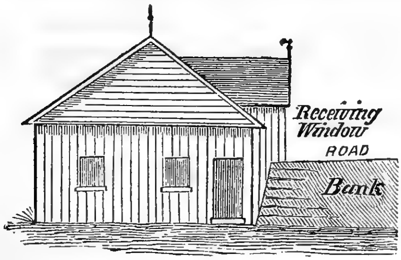
The factory has capacity for manufacturing the milk of fifteen hundred cows. The manufacturing room is thirty-two by forty feet, and contains seven vats fifteen feet long by three and a-half feet wide, of six hundred gallons capacity each. There are two places at which the milk can be delivered, so as to keep the wagons waiting the least possible time. Adjoining the work room is the press room, fifty by sixteen feet; there are ten presses on each side. The sink containing the curd stands on rails, so as to be run into the press room opposite the presses. There is a space of four feet behind the sink, so the hands can work the curd and not interfere with those who are dipping it out. The engine of eight-horse power stands in a separate building. There is a (horizontal) main steam pipe, six feet from the floor, to which are attached six steam pipes connecting with vats. The hands can in this manner go round each end of the vats.

The buildings are on a level, so the cheese can be run from the press room on trucks into the curing house, between the counters; no carrying by hand of the cheese as at the original factories. The back side of work room is built of masonry, and the water, fifty feet fall, brought into a large reservoir directly under the platform upon which stand the receiving cans. Under the work room is laid flagging, over which flows a stream of water to keep it free from any matter that might collect there if the soil under the building was soft. The whey vats are a long distance from the building, so that the milk may not absorb any impurities from the atmosphere. Hog pens are dispensed with entirely, for Mr. Frazie was of the opinion that if cheese is properly made, there is not enough nourishment left in the whey to make it profitable for pork-raising.

The accompanying cut shows the ground plan and buildings of the factory near Herkimer, Herkimer Co. The cut shows the bank or mound supposed to be necessary with the early factories, where the teams deliver the milk. This is now obviated by the use of a crane. The floor of the manufacturing room should incline a little towards the center, so that in cleaning the slops may be discharged into the creek.

THE HERKIMER FACTORY

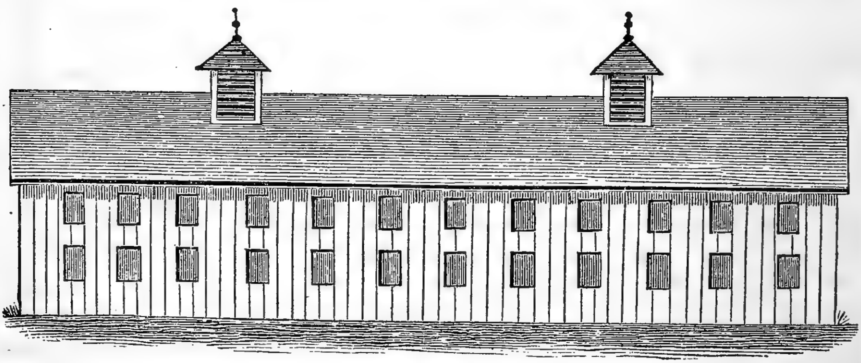
had facilities for manufacturing annually three hundred thousand pounds of cheese. The manufacturing room is twenty-eight by forty-eight feet and the curing house twenty-eight by one hundred feet, and two stories high. There are four tin cheese vats, placed inside an equal number of wooden vats, the milk heated by steam; each vat holds four hundred gallons.



END ELEVATION MANUFACTURING DEPOT HERKIMER FACTORY, SHOWING OLD STYLE DELIVERY WINDOW.

COST OF MANUFACTURE AT THE FACTORY.

The cost of manufacturing cheese is, to the farmer, one cent per pound, rennet, salt, bandage, annatto and boxes, as well as carting the cheese to market, being charged to the association and paid by each dairyman in proportion to the quantity of milk furnished during the season. The whey, as has been before observed, usually is a perquisite of the factory. All other expenses, including the care of the cheese while curing, &c., is paid by the manufacturer. To run a factory using the milk of six hundred cows will give constant employment to at least four persons, half or more of whom may be females. Before the war, when prices had not become inflated, the actual cost of manufacturing the milk from six hundred cows was about eight hundred dollars for the season. This sum does



FRONT ELEVATION OF HERKIMER FACTORY.

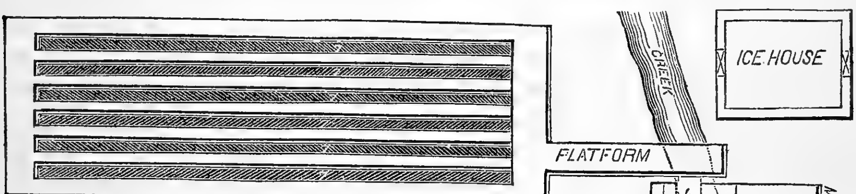
not cover interest on capital invested for buildings and fixtures, but was the amount paid for labor, board, fuel, &c. From these data it will be easily estimated what amount of money can be realized from the business of manufacturing. Allowing that the six hundred cows produce, on an average, four hundred pounds of cheese each, there will be in the aggregate two hundred and forty thousand pounds. The cost of a well-constructed factory will not be far from three thousand dollars.

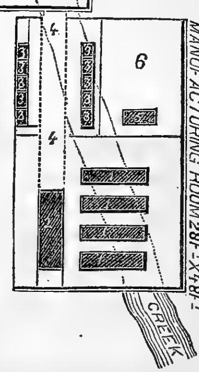
We have then two hundred and forty thousand pounds, at one cent,		$2,400
Cost of running factory, say	$800	
Interest on buildings, &c.,	210	
Annual wear and tear, or depreciation of property,	200	
		$1,210
Profits,		$1,190

Now, for three hundred cows, nearly the same expense would be incurred, and the factory account would stand thus:

One hundred and twenty thousand pounds of cheese, at one cent,		$1,200
Expense of running factory, say	$700	
Interest on capital invested,	210	
Annual depreciation of property,	200	
		$1,110
Profits,		$90

We do not pretend to give the exact figures in the above estimate, but it will be seen that a factory manufacturing the milk of a less number than three hundred cows will not be a very paying business, unless the manufacturer can have most of the work performed by members of his own family.





Ground Plan of Herkimer Factory.

1, Vats; 2, Sink on Rails; 4, Track; 3, Presses; 5, Engine and Boiler; 6, Engine room; 7, Ranges in Curing room.

DELIVERING THE MILK.

When a factory is located in a neighborhood where all or nearly all the dairymen are on one street, some one of the number may be employed to gather up the milk of the several dairies, and deliver it at the factory. Neighbors living near each other may take turns, each delivering one day out of the week. When men are hired to gather up and deliver the milk for a neighborhood during the season, the price paid for such delivery is one dollar per cow.

TREATMENT OF THE EVENING MILK.

In cheese manufacture an important point to be considered is the proper management of the evening milk, and to do this to the best advantage the state of the atmosphere must be observed at the time the milk is placed in the vats. The milk room should be cool, airy, and free from impurities. In hot and sultry weather much care must be given to have the evening's milk well exposed to the atmosphere, and thoroughly cooled down before it is left at rest for the night. When there are large quantities of milk to be attended to in hot weather it will be better to spread it thinly over a considerable surface, rather than deeply, as in filling the vats the temperature of the evening's milk should be so reduced that it will stand in the morning at about sixty-two or sixty-three degrees, and it should be reduced to at least sixty-two degrees before leaving it for the night. At the factories, where carrying the milk and mingling it together from several dairies has a tendency to hasten its acidity, there is more necessity for care and attention than in families; or, rather, there is more danger of souring.

It may be proper to observe that the requisite degree of acidity in milk to the time of setting it with the rennet for a cheese is imperfectly understood by the generality of cheese makers, and must be learned by well and carefully-conducted experiments. It is not possible to make so good a quality of cheese from milk recently drawn from the cow, or from any milk that has been kept too sweet, as from milk that has acquired proximate acidity—that is, after the ordinary method of cheese manufacture. Neither will it be possible to obtain the greatest quantity of curd from the milk so manufactured. Such milk will require a treatment of sour whey, which will be considered under its appropriate head, further on.

At the factories, it is believed there is more danger from too much acidity than otherwise, since there are many causes to hasten that condition of the milk which are not present in family dairies. In the factories it is usual to cool the evening's milk to about sixty degrees, by letting in water between the vats, by the use of ice, and by lifting and stirring the milk with an agitator which is moved by the waste water from the vats. This, under all circumstances is, or should be, attended to. The lifting or stirring of the milk and exposing it to the atmosphere, not only serves to cool it down to the desired temperature, but also operates favorably on the condition of the milk for the production of fine cheese, since the stirring and lifting process allows the animal odor and impurities to pass off more readily. If a considerable quantity of milk directly from the cow be placed in the vat and cooled down without proper exposure to the atmosphere it retains more or less of this taint, and more especially if the cream soon rises to the surface, forming a barrier to escape and holding it in the milk. We urge, then, that the lifting, stirring, and moving of the milk, so as to come freely in contact with the atmosphere, is of material benefit.

Some idea may be had of the effect of this animal odor by placing milk recently drawn in a vessel where it is closely confined and excluded from the air. In a few hours it becomes fetid and putrid. In family dairies too little attention is given to this point in the treatment of milk.

PROXIMATE ACIDITY OF MILK FOR FINE CHEESE.

The requisite acidity in milk for producing the best results in cheese manufacture has not been fully treated by American writers on the dairy, and is very imperfectly understood by most dairymen who make up their milk at the farm.

Experienced cheese makers have observed the fact that milk which has been cooled down to a low temperature and kept very sweet, requires more rennet to form the curd, and when coagulated is longer in cooking, and often will not work down firm, but will be soft and spongy, forming what is termed a "honeycomb cheese." Many times a superabundance of whey is retained and cannot be pressed out; this soon becomes sour and putrid; the cheese does not cure evenly, but goes on depreciating in quality until it reaches a high state of decomposition, giving off an offensive odor, and not unfrequently requiring an immediate removal from the shelves to the pig-pen. When cheeses swell and puff up, the whey oozes out, carrying a portion of the butyraceous matter, changed to oil, and are saved with difficulty, and when saved, cannot be marketed at half the ordinary price of good cheese.

The principal features of this character of cheese are given, that it may be identified, and because large quantities are annually made, during spring and fall, many farm dairymen not knowing where the trouble lies or how to obviate the difficulty. Now, this results from manufacturing from milk that is *too sweet*, and which should have been treated with sour whey. The use of sour whey in cheese manufacture, when the temperature of the evening's milk has been kept low, we deem of imperative necessity, if uniform cheese of firm quality be desired. It may be observed that milk should never have acquired sensible acidity at the time for setting with rennet, but should nevertheless be well on its way to that point. By sensible acidity, we mean acidity that can be detected by the taste or smell. Some milk is more acid than other soon after being drawn from the cow, and often, *when freshly drawn*, will redden litmus paper, yet to the taste is perfectly sweet. The milk from cows fed with whey or slop, is more acid than that from those which get nothing but grass on sweet upland pastures. But if by chance or accident the milk is sensibly changed when about to be made into cheese, it should be set at a low temperature, and all the subsequent operations hastened as far as practicable.

APPLICATION OF SOUR WHEY AT FARM DAIRIES.

When the evening's milk stands in the morning at or below sixty-two degrees, the morning's milk may be added to it, and at the time of putting in the rennet a quantity of sour whey may be added, and stirred into the mass, in the proportion of two quarts whey for sixty or seventy gallons of milk. If the night's milk stands below sixty degrees a large quantity of whey may be used, and the quantity of whey always graduated according to the degree of the sweetness of the milk. If the evening's milk stand at or above sixty-five degrees in the morning, no sour whey need be used, as the milk is on its way towards a change, or has acquired a sufficient acidity to render the use of the whey not only unnecessary, but a damage, from excess of acid.

When milk has not been treated with sour whey at the time of adding the rennet, and there is a difficulty in cooking the curd, it will be better to add to the mass while cooking a sufficient quantity of sour whey to harden up the curd; but it is always better, when practicable, to use the whey at the time of setting the cheese, as by that means the coagulation is rendered more perfect, while more of the butyraceous matter is retained, and the cheese is consequently richer and of finer texture and flavor.

When acid is used in this way to assist the rennet in its work of coagulation, it passes off in the whey, and in pressing, and in the cheese room, leaving the cheese sweet, mild, firm, rich, and of the finest texture. It has none of the characteristics of cheese made from milk sensibly sour; as in that case, it will be hard and retain an acid taste.

In hot weather there will be no occasion to use the whey, unless the milk is cooled down with running water to a low temperature and so held through the night. We may remark here that it is presumed that the milk room, dairy utensils, &c., are kept sweet and clean; for if otherwise, it will be useless to attempt uniformity of manufacture—for no degree of skill in manufacture can counteract all the damage done when the milk is constantly absorbing sour or putrid emanations, or where taints are received from unclean dairy utensils.

The whey should be distinctly acid, about like that coming from a sweet curd in summer weather and standing thirty-six hours. If the weather be cool the whey must be kept in a warm atmosphere to acquire the requisite acidity.

Milk treated as above with sour whey will produce curd that will be all that can be desired, which will work down evenly and without trouble, the cheese curing with a firm, compact texture, retaining more of the butyraceous matter, and having that mild, rich, pleasant flavor peculiar to first-class cheese. Attention to this matter, and a little experience and observation in the use of the whey, will, we are convinced, work a marked improvement in the quality of spring and fall cheese, while at the same time it will add in quantity, and save that which would otherwise go off in the whey and be lost.

SIZE OF CHEESE.

In starting a manufactory some little anxiety will be had in regard to the most suitable size of the cheese to be made. This doubtless must be controlled from time to time by the market for which the cheese is manufactured. The southern home trade prefers a medium-size, flat cheese—say from thirty to forty pounds, and pressed in fifteen, sixteen, or seventeen-inch hoops. This style of cheese should be about five inches thick. For shipping to Europe there seems to be a growing demand for cheese of moderate size. The cheddar is now very much in favor for exportation—a cheese fifteen and a-half inches in diameter and twelve and a-half inches high, and when made smaller, in like proportions. In former years cheeses weighing from one hundred and forty to one hundred and fifty pounds were in favor among the American dairies, but this size is now considered too large for the foreign trade, and a size not beyond fifty or sixty pounds in weight is more salable. Small cheeses are easily handled, and in case of accident either at the factory or in carrying to market, the loss is not so great as in the larger cheeses. Some of the factories for several years past have been making a limited number of immense cheeses, weighing seven hundred and more pounds each, and the sales of such have been in advance of the small size; but for extensive sales, the market generally would regard them as objectionable. Ready sales of small lots of these large cheeses are doubtless made at an extra price, because being rare, they excite more or less curiosity and induce purchases at the shop where they are cut and sold. But such cheeses are of no better quality than the smaller size; they are more liable to be broken; are too large for families that are in the habit of purchasing a cheese from time to time, and therefore can never become popular for the general trade. We shall have more to say on this topic in another place.

COST OF PRODUCING MILK IN OLD DISTRICTS.

The question of the cost of producing milk should be determined on every dairy farm. The estimates should be carefully made and compared with the sales, and it will then be seen whether the business is profitable or not. We have entered upon an extraordinary phase in the history of American taxation, and our necessary annual expenditures must for years to come be greatly above those of the past. They must be met manfully, and ways devised for providing for these extra calls upon our earnings and profits. They cannot be met by poor herds and a shiftless and improvident mode of farming.

The average annual yield of the cows must be brought up to six hundred or more pounds of cheese per head. We must learn the means of keeping more stock on a less number of acres, and at the same time supplying the herds with a greater abundance of food at a less amount of labor in obtaining it.

It has been remarked by Liebig that cows driven long distances to pasture, unless they get an extra supply of food, yield milk poor in caseine or cheesy matter; the materials which would otherwise have formed that constituent of the milk being used in repairing the waste of muscles and other parts employed in locomotion. This fact is lost sight of by many farmers. Herds that are compelled to travel long distances for water, or which are occupied a considerable portion of the day in getting a supply of food, yield less milk, and of a poorer quality, than when they can fill themselves quickly and lie down to rest and manufacture their food into milk. In administering food to milch cows the first consideration should be the maintenance of a healthy, robust condition. That secured, the increase and improvement of their milk may be realized by paying due attention to securing quiet among the herds, and supplying the requisite food from which good milk may be produced.

OLD DISTRICTS UNFAVORABLY AFFECTED—A FOREIGN MARKET NOW DEMANDED.

But it is claimed that there is one feature with regard to cheese associations that operates injuriously on the interests of old dairy districts. Cheese dairying is no longer a privileged business, narrowed down to a few places, where high skill in manufacturing has built up an enviable reputation. It is opened up to many localities. What has been acquired by long years of patient toil, by science and experience, is at once opened to whole communities, where the art of manufacture is unknown. They pick off the best cheese makers, they erect factories, and meet in the market on an equality. So long as dairying was conducted on the old system, this could only be done so slowly and gradually as not to influence the trade for years. Doubtless in this respect the factories act unfavorably on those who would prefer to see dairying confined within narrow limits, and the fears that the business may be overdone are not altogether groundless. But the step has been taken, and it is too late now to look back. It remains for us to make a market sufficiently large to take all our produce. In what manner this can be done is obvious. The quality of American cheese must be improved, so that it will be sought after in all the markets of Europe. There is no reason why American factory cheese may not become as noted in its line as the wines of Johannisberg, the porcelain of Sevres, the sword blades of Damascus, or the shawls of Cashmere. We can compete with the dairymen of the old world as to prices, and if we are able to outdo them in quality, a market for our "goods" is secured for all coming time.

The business of cheese dairying is now assuming large proportions, and will increase rapidly under the stimulus of rapid sales, high prices, and the facilities offered for manufacture under the factory system. How far this influx of business is to influence prices remains to be seen. Without a market in Europe, at least for the present, the supply, it is evident, will be so great as to glut the home trade and render cheese dairying unprofitable. It is true, nature seems to have hedged the dairy within certain limits.

The immense plains of the West and the South, as well as large portions of the Middle States, are not adapted to dairying. The lands are deficient in springs and streams of living water; the soil is of such a character that grasses soon run out, and pastures become brown and dried, or afford scanty herbage long before midsummer.

These lands are better adapted to wheat and corn, or the production of beef, or mutton and wool, and hence will not naturally be employed for the dairy. But still there are large tracts of lands suitable for milch cows, and should they be generally devoted to the dairy, we may possibly find the annual supply of cheese so great as to sensibly affect prices. There is no question of more importance, none of more vital interest to the dairyman, than this matter of market—a market that is enduring and remunerative.

PERMANENCY OF THE SYSTEM.

The questions have been frequently asked: Is the factory system destined to stand the test of years? Is it to continue to prosper, or will it soon break up and dairymen return again to the old order of cheese-making? In my opinion it is to live. The system is a progressive step, and all history teaches that when that is taken it is difficult to retrace it.

Doubtless some may remember when the wool and the flax grown on the farm were spun and woven by the family. We shall never return to that again, because we cannot afford it. They can be more cheaply manufactured by associated capital, substituting the untiring arm of the machine for one of living muscle. The flesh and blood of our wives and daughters are of too much consequence to be worn out by this ceaseless toil, when the spindles and looms driven by steam or water power can relieve them of the burden at a fraction of what it costs in home manufacture. Why, then, should a neighborhood of dairymen do the work of cheese-making in families, employing many hands, when it can be performed equally well by half-a-dozen persons in a well-constituted factory?

Progress is a law of nature. From the earliest dawn of creation there has been a constant series of developing improvements. Geology reveals that the lower orders of sensitive beings gave way to those of higher grade, until the last result of physical creation was attained in the creation of man, whose improvement, as a rational creature and an immortal soul, is still destined to be onward and upward.

The inauguration of associated dairies is rapidly producing a revolution in old customs and heretofore fixed ideas. It teaches the important lesson that farmers can adopt successfully the same means that have proved so beneficial to the merchant, the banker, and the commercial man of the world. By a consolidation of interests, the dairymen of to-day can wield a power and influence never before reached. The vast capital in lands and herds is of a substantial and permanent character, while the aggregate product of the farms, annually amounting in value to millions of dollars, compels respect from those who would assume that the proper province of the farmer was merely to till the soil, leaving for others to divide the profits realized in marketing his productions.

It has been suggested that an arrangement could be made by which leading European houses would take choice factory brands direct from the producer, and advance, through an agent in New York, the stipulated price. Whether more could be realized in this way than by the present system, under which the country buyer gets one commission, the house in New York another, and the shipper another, is a matter that needs investigation.

But the dairyman with his herd of fifty or one hundred cows, standing alone, has a circle of influence whose radius extends but little beyond his farm. He is, in a measure, at the mercy of corporations and speculators, who, by operating together, may fix prices and control the trade. When associated with others in neighborhoods, in towns, in counties, and in the State, he becomes formidable, and meets on equal terms the community of dealers with whom he is operating.

THE ORANGE COUNTY, N. Y., BUTTER FACTORIES.

Another feature springing out of the system of associated dairies, and of national importance, is the production of butter at factories in connexion with the manufacture of cheese. Its importance will be more readily seen when it is known that the finest quality of butter can be produced under this system, thus avoiding immense losses resulting from a poor article, as manufactured in private families, together with the saving effected by turning the skimmed milk into cheese. It takes more skill and science to make cheese than butter. Cheese-making is a chemical process; butter making is mechanical.

The cheese-makers are, as a class, inferior butter-makers. Some have attempted to account for the poor butter in cheese-producing counties, on the ground that no limestone region can produce a prime article. They assert that soft water is indispensable in butter manufacture.

There are many errors afloat in the world—errors so old and so well established that they are difficult to be overthrown. I do not propose to argue the point, or to waste breath upon fine-spun theories. Facts are opposing forces of more power than words, and, with due respect to the opinions of others, it is believed that as nice butter can be made in the hard water districts as in the far-famed butter regions. But the cows must be good, fed upon old, sweet, rich upland pasture, with abundance of pure water, the milk and manufacture perfect. Cows fed on leeks and onions will not make good butter, even if it be washed in the softest water.

BUTTER IN HARD WATER DISTRICTS.

There are butter-makers, even in the hard water districts of Oneida county, New York, who pack in Orange county pails, who manufacture specially for consumers in New York and Philadelphia, and whose butter is pronounced by competent judges equal to the best brought into those markets. I have seen as good butter made upon the black slate hills of Herkimer county, New York, as any in the soft water regions—butter that would keep at least nine months, as sweet as a nut and as nice as could be desired. These are facts. I have no theories to advocate, and no feeling in the matter further than stating the truth.

The cheese-makers have no conveniences for making butter; they have no order nor system in managing the milk. Their milk is often set in a tainted atmosphere, in cheese vats, or mixed up with cheese utensils, and the butter therefrom has an unpleasant, and often a cheesy flavor. They do not intrust the butter making to careful manufacturers, but set their raw hands to the work, pack it any kind of a tub that will carry it to market, and get the best price for it they can. A great deal of this butter soon becomes rancid, and is a miserable grease, unfit for anybody to eat. It is sold at comparatively low prices, and hundreds of thousands of dollars are thus annually thrown away. It is hard to remedy the evil on the old system of private dairies, since the farmers tell you it wont pay to build a spring room and hire a skillful butter-maker for a few tubs of butter, spring and fall; and even should he go to extra expense and care, it is not certain that the butter would sell any higher. The wife and daughters have more labor than they can attend to, without slaving over the butter-making, and so a good deal of poor butter goes to market.

The associated dairies have the means of remedying this defect, in the establishment of butter factories in connection with cheese manufacture. Butter making at factories is of recent origin. It was inaugurated in Orange county, New York, about ten years ago (1861), and, in connection with the manufacture of skim-milk cheese, has proved a success. A number of factories have been put in operation in that county, and the system has been adopted to some extent throughout the whole dairy region.

If the system is managed judiciously, it will prove a source of profit to the producer and a great blessing to consumers. There is danger, however, that too many in the cheese producing counties may rush thoughtlessly into the manufacture of skim cheese, and thus, by over-production of both butter and a poor character of cheese, make the whole thing a failure—that is, render it unprofitable. How far markets may be opened for the disposal of skim cheese remains to be seen; but it is evident that the great bulk of American cheese must be made of whole milk, or at least of milk that has been but lightly skimmed.

Dr. Voelcker's analysis of the best samples of English and American cheese shows that ours is about two and a-half per cent. richer in butter than the English samples, the latter containing more moisture. Whether, therefore, we may be able to remove a portion of the cream and yet manufacture a nice, palatable cheese, equal to the best English cheddar, is for future experiments and skill in cheese making to determine.

It is believed that as we progress in the science, great improvements will be made in this direction, and a superior quality of cheese be made from milk not particularly rich in butter; but until the facts are fully established, and the processes of manufacture generally understood, there is danger of an excess of butter factories depreciating the standard of American cheese, by throwing upon the market a surplus of the poorer grades. Though in favor of butter factories, and fully in the belief that the public necessities demand them, in limited numbers, and that the system is an advanced step in dairy progress, there is necessity for caution, that we may not overdo the work and get "too much of a good thing" at once. This danger of an excess of butter and skim cheese factories will be more apparent when the comparative profits of the two systems, at present prices, are taken into account.

MILK TO A POUND OF BUTTER.

In November, 1865, when in Orange county, I was told by Mr. ALLISON, superintendent at one of the factories, who had kept a record of work, that the average product during the season, up to October, from fourteen quarts of milk, wine measure, was one pound of butter and two of skim cheese. The cheese factories do not produce more than three pounds of cheese from the same quantity of milk. Now the average sale of factory cheese in 1865 was only a little over fifteen cents—call it sixteen cents—and we have forty-eight cents as the value of the milk by that system. But by the other system the average prices at which butter was sold in the fall would nearly cover that amount, leaving the two pounds of skim cheese as clear gain. These are the facts which serve as a basis for estimating the relative profits of the two systems. We may assume that a given quantity of milk will yield an equal weight of product by either system, but in one a third of the weight is in butter. To be exact, I suppose that by the Orange county system the milk is worked up more perfectly, or with less waste, and hence there is really a larger product by that system; but as some cheese makers claim to be able to work milk without much waste, the excess need not be named here. The cost of manufacturing butter and cheese combined, is slightly in advance of manufacturing cheese alone, but the difference is not so great as to be of much account.

It will be seen, then, that the success of butter and cheese factories will depend upon the price by which butter is to rule in the market above that of cheese, and the facility in disposing of skim cheese. The Orange county factories have sometimes sold their butter at seventy cents, and their skim cheese at prices slightly in advance of whole milk cheese from the best factories of Herkimer and Oneida. But such a condition of things may not occur again, and it would not be fair or safe to make these figures a basis for future operations.

The dairy region has been trying to make a finely flavored, high priced cheese, such as will sell in the markets of Great Britain along with improved English cheddar, at eighty-four to one hundred and twelve shillings per hundred—that is, from twenty to twenty-five cents in gold. Some of our factories, during the last two years, have come up to the required standard, and American cheese now stands equal to any manufactured in the world. If we can prove to our English customers that we are able to supply them with the best cheese, they will take of us from fifty to one hundred millions of pounds annually, and pay us well for it. But we must not get back on a poor grade, and lose the reputation we have labored so hard to obtain. These points should enter properly into the consideration of this subject, with those contemplating a change to butter and skim cheese manufacture.

The advantages of butter making on the associated dairy system over that of private families are very great. In the first place, a uniform product of superior character is secured. Every appliance that science or skill, or close attention to business is able to obtain, is brought to bear upon the manufacture, and prime quality necessarily follows as a result. If you could assume that, in a neighborhood of one hundred families, each was possessed of the skill and conveniences of the factories, and that each would give the subject the same close attention, there doubtless would be no difference as to quality of product; but such a state of things rarely exists.

Again, the factories are able to obtain a larger price, because it costs the dealer no more to purchase of the one hundred dairies combined, than it would of an individual dairy, and the uniformity and the reliability of the product does not entail the losses that are constantly accruing in different lots on account of inferior quality. The factories, too, relieve the farmer and his family from a great deal of drudgery, and unless the work is to be done by members of the family who cannot be employed profitably at other labor, it is a matter of economy to have the butter or cheese made at the factory; since what would employ a hundred hands scattered over the country, is performed in the same time by three or four when the milk is worked up together at one place.

The only serious complaint against the factory system is in hauling the milk. This has been obviated, in many instances, by establishing a route of milk teams, where the milk is delivered for the season by the payment of a small sum. The associated system, applied to butter-making, has all the advantages, and will do as much for the improvement of butter as it has for cheese; and no one at this day will deny that in the latter it has brought about a wonderful improvement. The butter-making departments can be easily applied to cheese factories. There need be scarcely any alteration in the buildings. A spring room, churn room, and butter cellar must be added, but these need be but small and cheap structures. The spring room is to be provided with vats or tanks for holding the water. They should be sunk in the earth in order to secure a lower and more even temperature of the water, as well as for convenience in handling the milk. The vats may be about six feet wide, and from twelve to twenty-four feet long, arranged for a depth of eighteen inches of water. There should be a constant flow of water in and out of the vats, so as to secure a uniform temperature of the milk after it has been divested of its animal heat. The milk is set in tin pails, eight inches in diameter by twenty inches long, each holding about fifteen quarts of milk. As fast as the milk is delivered, the pails are filled to the depth of seventeen inches and plunged into the water, care being taken that the water comes up even with or a little above the milk in the pails. The temperature of the water should be from forty-eight to fifty-six degrees.

The old notion that cream cannot rise through a depth of milk greater than seven inches, it is believed, is an error. The Orange county farmers say they can get as much cream by setting in pails on the above plan, as they can to set the milk shallower in pans, and the cream is of better quality, because a small surface being exposed to the air, there is not that liability for the top of the cream to get dry, which has a tendency to fleck the butter and injure its quality. Desiring to test this matter, I took glass cream jars, on which were graduated scales, and set milk of the same quality at different depths, from two to eighteen inches. The depth of the cream was always in proportion to the quantity of the milk.

When the butter department is to be added to cheese factories already built, about a third of the cost will be in pails, two of which are required for every cow from which milk is delivered. To build a butter and cheese factory combined, of a capacity for four hundred cows, fitted up with the necessary machinery complete, the cost is estimated at ten dollars per cow. It will hardly pay to build and run a factory for less than three hundred cows, and it is not desirable to have the number of cows above a thousand.

In the working of any new system, practical men always desire statistics of results. I have seen the statement of receipts and expenditures of the Wallkill factory, Orange county, for the year 1865. The quantity of milk received from April 1 to December 1 was six hundred and twenty-seven thousand one hundred and seventy-four quarts, of which twenty-seven thousand three hundred and eight quarts were sold at a little above seven cents per quart, leaving five hundred and ninety-nine thousand eight hundred and sixty-six quarts to be made up into butter and cheese. The product was as follows: thirty-one thousand six hundred and thirty pounds of butter, eighty-one thousand seven hundred and seventy-eight pounds of skim cheese, five thousand nine hundred and eight pounds of whole milk cheese, two thousand two hundred and sixty-one quarts of cream, sold at nineteen and six-tenths cents per quart, and one thousand five hundred and sixty-one quarts of skim milk, at one and five-eighths cents per quart. The net cash receipts, after deducting transportation and commissions, were as follows:

For pure milk sold	$1,926 22
skim milk	24 02
butter	13,344 21
skim cheese	11,659 08
whole milk cheese	1,065 44
2,261 quarts cream	443 33
hogs fed upon whey	446 24
buttermilk and sundries	207 49
Making a total of	29,116 03

The expense account was as follows:

For labor	$1,476 40
fuel	79 96
cheese boxes	653 17
20 sacks salt	89 25
rennet, bandage, &c.	483 55
carting cheese	273 10
hogs	179 90
	3,235 33

This gives an aggregate net receipt of $25,880 70.

From these statements it appears that the butter averaged forty-two and a-quarter cents per pound, the skim cheese fourteen and a-quarter cents, and the whole milk cheese eighteen cents per pound, while the average amount received on the whole quantity of milk was four and one-tenth cents per quart. The expenses of the factory were a little over half-a-cent per quart.

From a report of average sales of cheese from the New York and Ohio factories, it appears that fifteen and a-half cents per pound was all that has been obtained by a majority of the best whole milk cheese factories during the year 1865, and the comparative profits may be thus stated:

Fourteen quarts of milk, making three pounds of cheese, (at fifteen and a-half cents,) forty-six and a-half cents; deduct cost of manufacturing, boxes, &c., six cents—leaving forty and a-half cents.

At the butter and skim cheese factory, fourteen quarts of milk, at four and one-tenth cents per quart, amount to fifty-seven and two-fifths cents; deduct cost of manufacturing, &c., seven cents, and we have a difference of ten cents in favor of the butter and skim cheese on every fourteen quarts of milk.

It may be asked, How do the butter and skim milk factories compare with those dairies where butter alone is manufactured from the milk? I have no statistics from dairies in Orange county showing the quantity of milk for a pound of butter, but was told that by the factory system of taking off part of the cream and working up the skim milk, greater profits were realized.

The Hon. ZADOCK PRATT, in the account given of his butter dairy in Green county, gives the average quantity of milk required for a pound of butter during the season of 1860, to be eleven and twenty-hundredths quarts, and in 1861, ten and forty-two hundredths quarts. In 1859 it took fourteen and fifty hundredths quarts, and in 1858, sixteen and sixteen hundredths quarts, for one pound of butter. The milk in this dairy is set in shallow pans, and the cream skimmed off after the milk has soured and begins to thicken. At the Orange county factories it is not desired to take all the cream from the milk, since a portion of it is needed in the skim cheese. That which is taken off is fresh and sweet and is in condition to make the finest flavored butter. The management of the milk is without doubt the best that has yet been discovered, and should be generally adopted whenever good butter is sought after. The churning and working of the butter does not differ materially at the factories from that of other experienced manufacturers. The cream is churned in the barrel and a-half dash churn, and the butter worked with a lever upon an inclined slab. The whole system commends itself to the dairy public, especially to the butter districts, and if the cheese-makers would adopt it at their factories for making spring, fall, and winter butter, large sums would be annually saved, and the public greatly benefited by being able to secure readily a desirable article.

TOPOGRAPHICAL FEATURES OF ORANGE CO.—CHARACTER OF THE SOIL, ETC.

Orange county is broken up into numerous hills and valleys. The southern and eastern parts are mountainous. The great valleys run in a northeasterly and southwesterly direction. The Shawangunk mountains are at the north-west, and along the northern boundaries of the county flows the Shawangunk-kill, a considerable stream which empties into the Wallkill. The Wallkill, rising in New Jersey, passes in a northerly direction through the central portion of the county and into Ulster county, emptying into the Hudson at Rondout. It is a sluggish stream, except in times of high water, in spring and fall, but furnishes abundant and durable water power along its entire course. Along the valley of the Wallkill are some of the best farming lands in the county. There is a diversity of soil in the county, gravelly and sandy loams, light and heavy clay loams, and alluvial soils. The interior of the county is a rolling upland, broken in many places by abrupt and isolated hills, and the valleys and streams. In the town of Blooming Grove, the land is undulating, but in some places broken by ridges of rocks. The soil is generally a clayey loam, running sometimes into a gravelly loam, and, adjoining the ridges of slate rock, becoming a sandy loam. West of the valley of the Wallkill, the prevailing soil is a clayey loam, well adapted to grazing. It is in this district that the famous Goshen butter is produced. Here abound the natural meadows that have not received a plow for more than a hundred years. The soil on these meadows is a black earth, made up from the wash of the hills and slopes, and is rich in vegetable mold. In some parts the soil is slaty, and strips of land occur that are stony, being filled with boulders and fragments of rock, but the whole section seems to be fertile and productive of grasses that are sweet and nourishing. The water is pure and the climate healthy. Soft and hard water are often found upon the same farm. A considerable portion of the surface of Orange county is occupied by the Hudson river group of rocks, which takes a north-east and south-west direction. On the banks of the Hudson, above Newburgh, is found the Utica slate. The Trenton limestone is found near Mount Lookout, in Goshen, and in the adjoining town of Hamtonburgh. The Black river limestone is found in Goshen, and is the rock of which Mount Lookout is made up.

THE BUTTER GRASSES OF ORANGE COUNTY.

In the old pastures there are several varieties of grasses, that spring up spontaneously, and afford sweet and nutritious feed, and from which the best qualities of milk and butter are produced. These grasses form a rich, thick turf, leaving no intervening spaces. In our conversation with farmers, much importance was given to these natural grasses as a means of securing the richest milk and the finest butter, and some affirmed that it was impossible to obtain the best flavored butter or so large a result from recently re-seeded grounds of clover and timothy. These grasses are similar to those found in the old pastures of Herkimer, Lewis, and Oneida—they embrace the June or blue grass, the fowl meadow grass, *poa serotina*, meadow fescue, *festuca pratensis*, red-top, *agrostis vulgaris*, the wire grass, *poa compressa*, and the sweet-scented vernal and vanilla grass. Timothy, orchard grass, red clover, and other forage plants are also grown in pastures and meadows. The sweet-scented vernal grass grows best upon the moist soil of the old meadows; it starts very early and gives off an agreeable odor. The June grass is regarded as very valuable, throwing out a dense mass of leaves, highly relished by

June Grass.

Red-Top.

cattle, and from which a superior quality of butter is made. It is found growing throughout the butter districts of the county. The wire grass is deemed one of the most nutritious of the grasses, is very hardy, eagerly sought after by cattle, and is one of the best grasses for fattening. Cows feeding upon it yield milk of the richest quality, and from which the nicest butter is made.

It flourishes well upon gravelly knolls and in shaded places, and its stem is green after the seed has ripened. It is found growing in all parts of the county. The meadow fescue is common in the old grass lands where the sod is thick and grasses of different variety mingled together. It starts up early in spring, is relished by stock, and furnishes good early feed. The milk

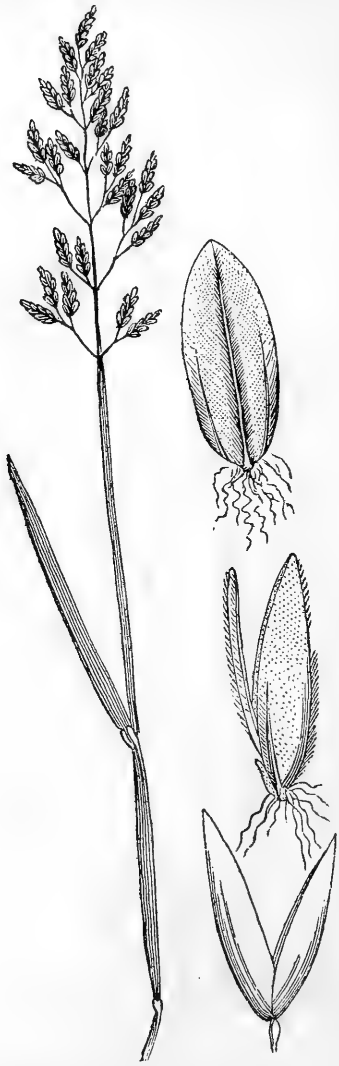
ORCHARD GRASS.

MEADOW FESCUE.

farmers hold it in high estimation as a reliable grass, tenacious of life, and not running out like timothy or clover.

I have been thus particular in describing the soil and grasses of Orange county, that farmers in other sections may make a comparison with their own lands, and be better able to judge wherein the one differs from the other. I may remark here, that weeds common in other sections are common also in Orange county. The white daisy, the thistle, the golden rod, the fire weed, the snap-dragon and other weeds, seem to be common in the county. West of the Wallkill, farmers complain of the snap-dragon as the worst weed

SWEET-SCENTED VERNAL.



POA COMPESSA.

against which they have to contend. The daisy is not regarded as formidable, since manuring with barn-yard manure, salt and plaster, it is said, will rid the land of this pest. The rag weed, we observed, was common in cultivated grounds, but it was said, did not trouble grass lands.

THE STOCK.

The herds are usually made up of native and grade cattle. In the milk dairies there is no particular prominence given to thorough-breds any more than in other localities of the dairy region. There is a sprinkling of Short-Horns, Ayrshires, Devons and Alderneys, and occasionally some Dutch cattle.

The farms are not generally above an hundred acres. Mr. SLAUGHTER, who has an excellent farm about a mile and a-half west of the Wallkill, will carry forty-five head of cattle upon one hundred and fifty acres. His farm contains a hundred and seventy-five acres, twenty-five of which are in timber. He usually has about twelve acres annually under the plow, raising corn, oats, and wheat in rotation, and then seeding down to grass, and this is the rotation usually followed in this section of the county. The soil here, and generally through the county, is well adapted to corn, and the average crop will reach fifty bushels per acre. Wheat yields twenty-five bushels per acre, and oats from sixty to seventy bushels. Farmers generally do not believe in feeding down pastures close, so as to expose the roots of the grass to a burning sun, but rather seek to have the ground covered at all times with a good growth of herbage.

SYSTEM OF ORGANISING FACTORIES.

The farmers of a neighborhood join together and erect the buildings, each one paying in proportion to the size of farm or number of cows from which milk is to be delivered. After the structure is completed and furnished, a superintendent is chosen, and help hired for running the factory, and the expenses are shared by stockholders, in proportion to the amount of milk delivered. Repairs, additions, &c., from year to year, are added to the expense account.

THE CAPTAINS—MARKETING BUTTER.

The manner of marketing butter differs from that practiced in other sections. Consignments are not generally made direct to the New York dealers, but shipments are entrusted to captains, as they are called, or persons who make it a business to collect freight and take it in charge to New York, making the sales and returning the proceeds to the manufacturer. These captains go with their freight twice a week, are men of standing and responsibility, who are well posted in the trade, and know how and where to obtain the best prices. They receive a commission for their labors, and find it to their interest to make good bargains, otherwise they would lose the confidence of those entrusting freight to their charge, and would therefore be displaced. These captains often receive proposals or offers for large lots of butter, which are submitted to the factories, when they are rejected or accepted, as seems best to the parties interested.

THE MILK BUSINESS.

Since the construction of the New York & Erie railroad, large quantities of milk are daily shipped to New York from the several depots. The milk trains start out of Goshen and Middletown late in the afternoon, and milk is shipped only once a day. A portion of the milk, when it arrives in New York and is ready for the milk carts, is thirty-six hours old. To carry milk sweet for that length of time, in hot weather, requires some art in handling, and this seems to be well understood by the Orange county farmers. The milk, as soon as it comes from the cow, is strained and put in long tin pails, which are set in water, care being taken that no portion of the milk be higher than the water. These pails look like sections of stove-pipe, being eight inches in diameter, and from seventeen inches to twenty inches long. The milk is occasionally stirred so as to keep the cream from rising It is deemed important that the animal heat be removed as soon as may be, at least in an hour's time after it comes from the cow. The old plan, which is yet practised by some, is to cool the milk in the cans, but it is regarded as a very unsafe way when it is designed to have the milk keep sweet for a considerable length of time. The milk stands in the pails until ready to be carted to the trains, when it is put in cans holding from fifty to sixty gallons. These cans are filled full, and the cover, which fits close, adjusted.

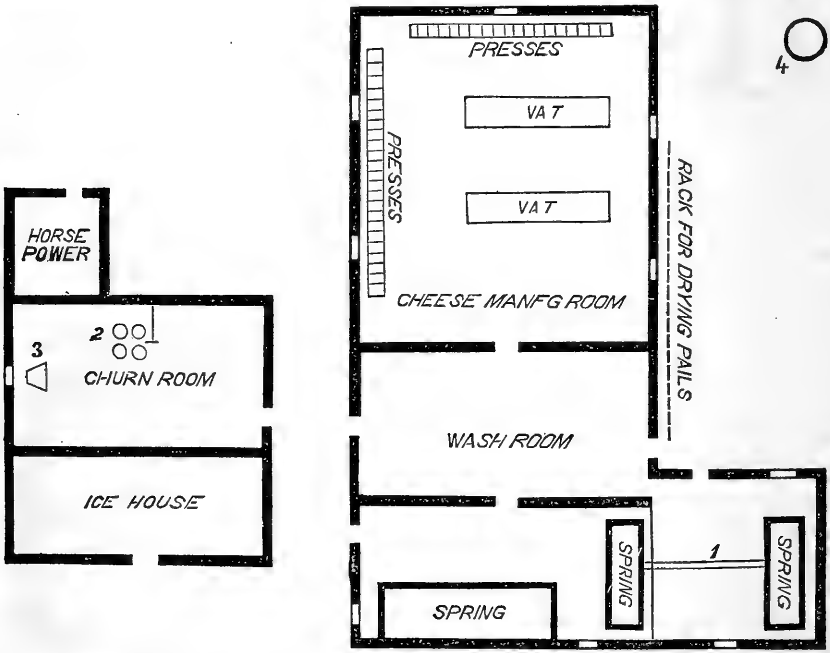
Within a few years past *creameries* have been established within convenient distance along the route of the railroad, where the milk is cooled, and from thence shipped to the depot. Here farmers daily deliver their milk, night and morning, as at our cheese factories, where it is measured and credited, and no further trouble is had with it on their part. At the creameries a part of the cream is taken off the milk, put up in cans which, when ready for shipment, are set in wooden tubs, made so as to be tapering towards the bottom. The space between the cans and tubs is then packed with ice, the cover fastened, and it is ready for shipment.

WALLKILL CREAMERY ASSOCIATION.

The main building consists of a two-storied structure, arranged on a plan similar to our cheese factories. Below are the vats, presses, &c., for making cheese, and above is the dry room. On one end of this building is erected the spring house, containing two rooms, the one twelve feet by sixteen feet, and the other fourteen feet by twenty-four feet. It has windows and doors for ventilation. The packing and churning room is a separate building, twelve feet by twenty-four feet, and stands opposite the spring room, with a narrow alley between. Adjoining to and connected with this is the horse-power for churning, and a store room. The establishment receives the milk from four hundred cows, and after the cream is taken from the milk, the milk is made up into skim cheese.

THE SPRINGS AND MANNER OF TREATING THE MILK.

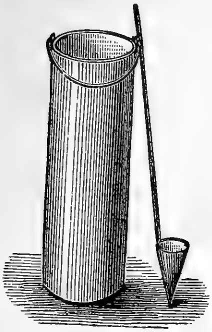
There are two springs in the spring house. Vats are constructed about the springs for holding the water. They are three in number, twelve feet long by six feet wide, set down even with the floor, and with racks in the bottom for holding the cans. The water flows up through these racks and above them to the depth of seventeen inches. The pails are twenty-two inches long, and eight inches in diameter, and as fast as the milk is received they are filled within five or six inches of the top, and immediately placed in the water. Care is taken that the surface of the milk in the pails is not above that of the water in the spring. The pails are set close together, and one spring will hold two thousand and forty quarts of milk. The spring should have a sufficient flow of water to divest the milk of the animal heat in less than an hour. Mr. SLAUGHTER regards fifty-six degrees as the highest temperature that the water of the spring should be, for conducting operations successfully. He has not determined the precise temperature of water best



GROUND PLAN OF WALLKILL CREAMERY—THE FIRST BUTTER FACTORY ERECTED.
1, Water Pipe; 2, Churns; 3, Butter Worker; 4, Whey Cistern.

adapted for obtaining the most cream from the milk, but is satisfied from his experiments that the natural temperature of the water should not be below forty-eight degrees, nor above fifty-six degrees. He says, more cream, and that of better quality for butter making, can be obtained by setting the milk on the above plan, than in shallow pans. The object is to expose as little of the surface of the milk to the air as possible, in order that the top of the cream may not get dry, which has a tendency to fleck the butter, and injure its flavor.

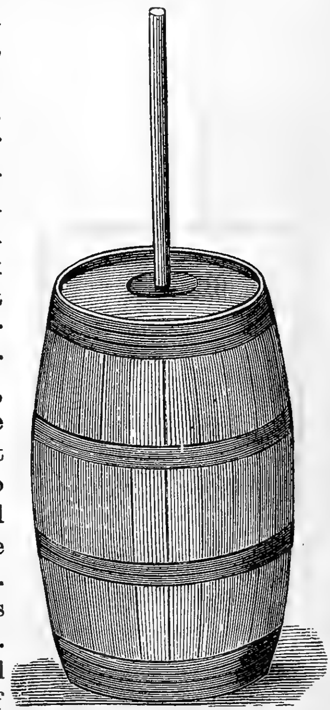
The milk of one day is left in the spring until next morning, when it is taken out, the cream dipped off and put immediately in the churns. In removing the cream a little tunnel shaped cup, with a long upright handle, is used. It is gently pushed into the pails and the cream dipped off. It is very expeditiously effected, and the milk line easily determined by the appearance of the milk. The cream in the fall of the year, and in spring, is churned sweet. In summer, the cream is dipped into the same pails and returned to the spring, and kept there until it sours. As fast as the cream is removed, the milk in the pails is emptied into the vats for making skim cheese.



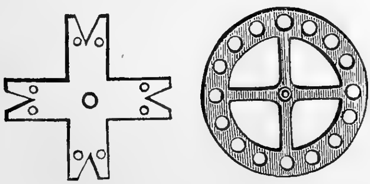
PAIL FOR SETTING THE MILK, AND CREAM DIPPER.

THE CHURN-ROOM AND CHURNING.

The churning is done by horse power. The churns are the common barrel and a-half dash churn, four in number, and are placed on each side of the power, so as to be all worked together. About fifty quarts of cream are put in each churn, and each then receives a pail of cold spring water and the mass is brought to a temperature of sixty-three degrees to sixty-four degrees. In warm weather ice is sometimes broken up and put in the churn to reduce the temperature to fifty-six degrees, but it is deemed better to churn without ice if the cream does not get above sixty-four degrees in the process of churning, as butter made with ice is more sensitive to heat. It is, however, a less evil to use ice than to have the butter come from the churn white and soft. It requires from forty-five minutes to an hour to churn, when the butter should come solid and of a rich yellow color. It is then taken from the churns and thoroughly washed in spring water. In this process the ladle is used, and three times pouring on water is generally all that is required. It is then salted at the rate of one pound and two ounces of salt to twenty-two pounds of butter. In making winter butter a little more salt is added at the last working. The butter, after having been salted and worked, is allowed to stand till evening, and is then worked a second time and packed in sixty pound pails and shipped twice a week to New York.



ORANGE COUNTY CHURN.

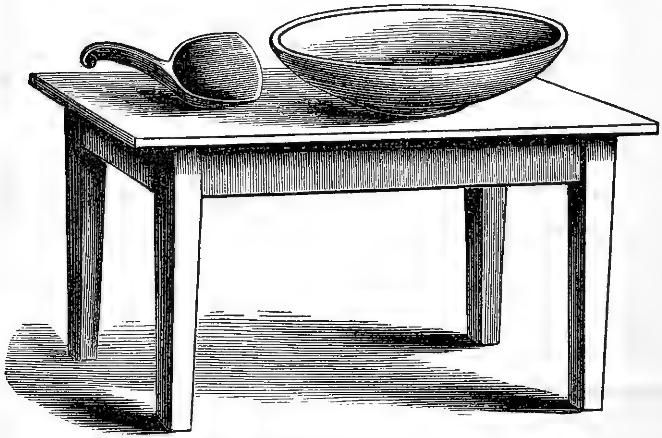


CHURN DASHERS.

At this factory in hot weather, after the butter is salted and worked over, it is taken to the spring and immersed in the water where it remains until evening when it is taken out and worked over and packed. For winter butter a small teaspoonful of pulverized saltpetre and a large tablespoonful of white sugar are added for the twenty-two pounds of butter at the last working. No coloring matter is used in butter at this establishment.

The butter is worked on an inclined slab with beveled sides running down to the lower end and within four inches of each other. A long wooden lever, so formed as to fit in a socket at this point, is used for working the butter. It is very simple and does the work effectually. In churning, the dashers are so arranged as to go within a quarter of an inch of the bottom of the churn at every stroke, and rise above the cream in their upward stroke.

When butter is packed in firkins, none but those made of white oak are used. These firkins are very handsomely made, and are tight so as not to allow the least leakage. Before using they are soaked in cold water, and



THE BUTTER BOWL AND LADLE.

after that in hot water, and then again with cold water. After being filled with butter they are headed up and strong brine poured in at the top to fill all the intervening spaces. The pails for holding the milk in the springs are daily cleaned with soap and hot water, rinsed in spring water, and put on a rack to dry. In furnishing a factory two pails are allowed for each cow, as it is necessary to have a double set.

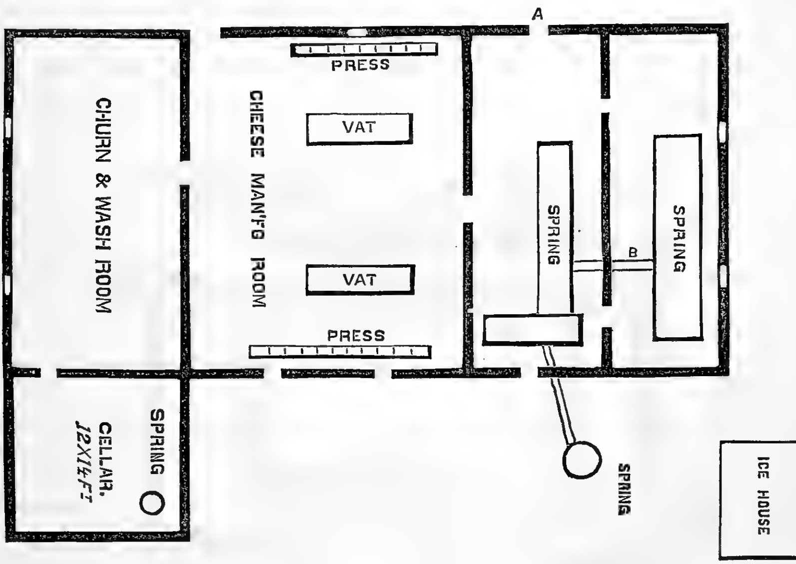
THE CHEESE.

In making the cheese, the milk is set at eighty-two degrees; highest heat, ninety-six degrees to ninety-eight degrees, and three pounds of salt to one hundred of curd. The curd is pressed in fourteen inch hoops, and cheese made four inches high. They are of a very good flavor, and by no means unpalatable—though of course, inferior to pure milk cheese. These cheeses are shipped to warm climates, and many of them go to China in exchange for tea.

ORANGE COUNTY MILK ASSOCIATION.

This establishment commenced operations in 1862. The main building is sixty feet by twenty-four feet, and is located about four miles northeast from Middletown. The number of cows from which milk is delivered is five hundred and fifty, and the farmers owning the building number thirty. The construction of the building and spring house is similar to that of the Wallkill Association. There are two spring rooms, each ten by twenty-four feet. The water here is soft, and stands at a temperature of fifty degrees.

The factory stands near or adjoining a wet and springy piece of ground, covered with fragments of rock from the Shawangunk Mountains. At this



Ground Plan of Orange County Milk Association Butter Factory.

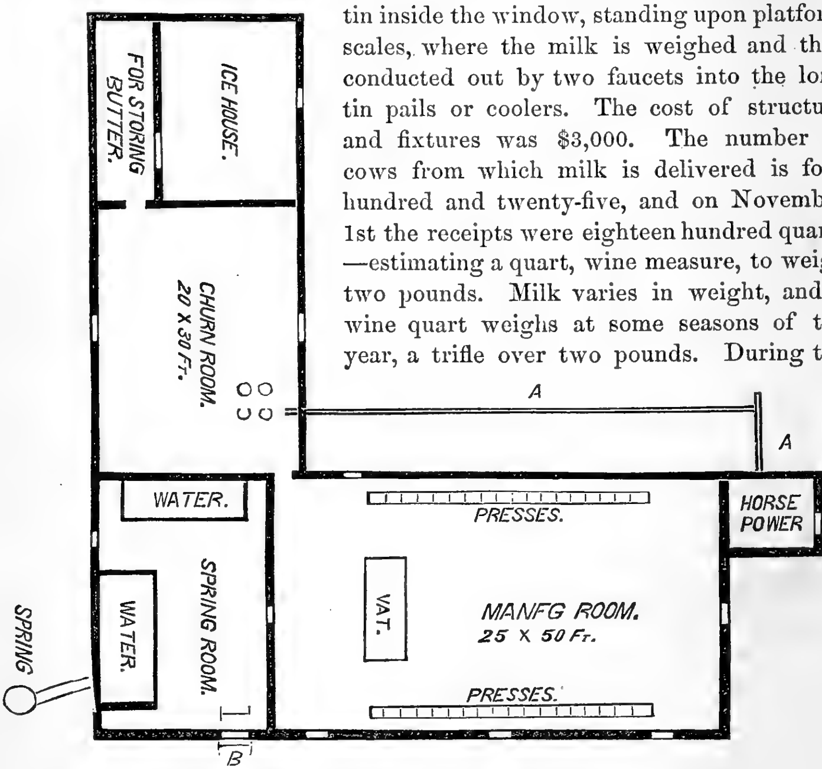
establishment, in addition to the spring room there is a cellar twelve feet by fourteen feet, with walls nicely laid up with stone, and extending into the bank, at the rear end of the building. Here the butter is stored in summer as soon as packed, where it remains until ready to be shipped.

In the fall of the year, when cream does not readily sour, it is put in the churn in the evening and a can of water raised to 100° set in the cream. It is left there over night, and by morning the cream sours.

ROCKVILLE MILK ASSOCIATION.

The main structure is twenty-five by fifty feet—two stories, which are used for manufacturing and curing cheese—adjoining this on one end, is the spring room, and on the side running back in the shape of L, is the churn room, twenty by thirty feet. On the end of the churn room is the ice house, which is arranged so as to lead out of the churn room with a broad hall or alley, which serves as a cellar for storing butter.

This hall has double sides packed in with tan-bark, and the ice-house being on one side, with communication by door, makes it a cool and nice place for keeping butter or cream in summer. In the spring room there are two vats, one nine feet by twelve feet, and the other eight feet by twelve feet, sunk even with the floor, and arranged so as to be filled from one spring. The temperature of the water is 48°. It is soft water, but less so than those at the other factories to which we have referred. The delivery of the milk is at a window and on a platform the hight of the wagon. As the teams drive up, the cans are slid upon the platform and emptied into a large receiving box or can of tin inside the window, standing upon platform scales, where the milk is weighed and then conducted out by two faucets into the long tin pails or coolers. The cost of structure and fixtures was $3,000. The number of cows from which milk is delivered is four hundred and twenty-five, and on November 1st the receipts were eighteen hundred quarts—estimating a quart, wine measure, to weigh two pounds. Milk varies in weight, and a wine quart weighs at some seasons of the year, a trifle over two pounds. During the month of May, when cows are in pasture, Mr. SLAUGHTER finds that one hundred quarts, wine measure, will weigh two hundred and eleven pounds. The milk here is kept in the spring from twenty-four to thirty-six hours, when the cream is taken off and allowed to sour, and then churned. Mr. UPTEGROVE, the Superintendent of the factory, says that about one-tenth more butter is obtained from the cream when churned sour than when sweet.

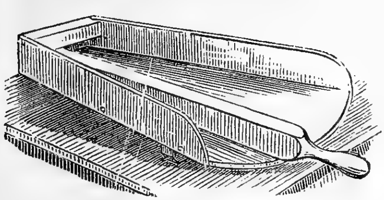


GROUND PLAN OF ROCKVILLE BUTTER FACTORY.

BUTTER MAKING AT THE ORANGE COUNTY FACTORY.

The churns are the barrel and a-half dash churn, and are filled about half full of cream, which is diluted by putting in cold water in summer and warm water in cold weather, at the rate of sixteen to thirty quarts for each mess or churning. The temperature of the cream in summer, when the churns are started is about 60°, but in cold weather they are started at about 64°. When a mess of cream is to be churned the churns are filled about half full, and a pail of spring water added to dilute the cream; in warm weather cold water is used and in cold weather warm water, so as to make the mass at a temperature of 60° to 62°. The temperature of the cream while churning is kept below 65°, for if at the close of the churning the buttermilk should be at a temperature above 64° the flavor and color of the butter are injured. When the butter begins to come, the churn is rinsed down with cold water. After the butter is taken from the churn, care is taken not to touch it more than is necessary with the hands. The butter trays are elliptical in shape, and the ladle is used for turning over the butter while it is being washed. In salting and working over, the whole is done by the butter-worker heretofore described, and great care is taken not to work it too much, as overworking spoils the grain and makes the butter salvy. A twenty-two pound batch is laid upon the inclined slab or butter-worker, and the lever applied, first beginning at one side, until the whole is gone over. Only a few manipulations of this kind are required, and one is surprised at the expedition with which this part of the process is effected. The salting and working of the butter is by the same rule adopted at the other factories, eighteen ounces of salt being used for twenty-two pounds of butter.

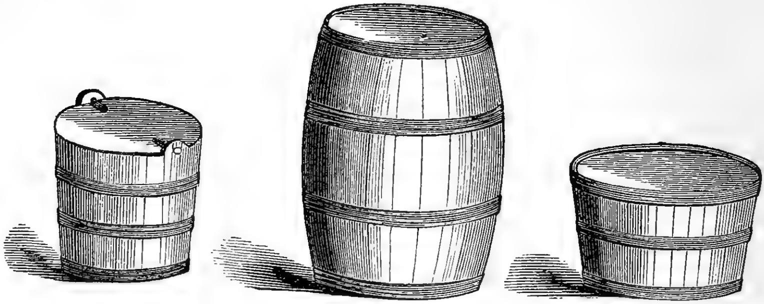
The butter-worker is similar to the one alluded to, except that the lever is diamond-shaped, which it is claimed is an improvement. The inclined triangular slab on which the butter is worked stands upon legs, and has beveled sides about three inches high. It is four feet long and twenty-five inches wide at the upper end, tapering down to five inches at the lower end. At this point there is an opening for the escape of the butter-milk into a pail below. In salting, the butter is washed and then spread out with the ladle upon the worker, and fine, pure Ashton salt sprinkled over the mass. It is then turned over a little with the ladle and afterwards worked with the lever.



Orange county Butter-Worker.

At this factory there was a little contrivance consisting of a wheel and lever and weight for regulating the stroke of the dashers when churning. The trays are elliptical, being two and a-half feet long and one and a-half feet across, and will hold twenty-five pounds of butter. The butter is packed in Orange county pails or tubs holding sixty pounds, or in oak firkins of eighty pounds, as at the other factories, and shipped twice a week to New York, bringing seventy cents per pound. The association is composed of twenty-eight farmers who have dairies running from five to ten and up to thirty cows.

Four farmers not belonging to the association deliver milk here and are charged $1.50 per cow extra.



RETURN BUTTER PAIL. FIRKIN. HALF FIRKIN.

ORANGE COUNTY BUTTER PACKAGES.

DAIRY PRODUCTS OF THE UNITED STATES.

The following tables give the number of pounds of butter and cheese made in different sections of the Union, according to the census returns of 1850 and 1860. The total production of butter in the United States and Territories in 1850 was 313,345,306 pounds, and in 1860, 469,681,372 pounds. Of cheese, the product in 1850 was 105,535,893, pounds, and in 1860, 103,663,927 pounds, showing an increase in the production of butter, and a decrease in cheese during that decade. From the tables it will be seen which States are largely interested in this branch of industry. For convenience of reference we have arranged the States in groups:

Amount of Butter and Cheese made in 1860 and 1850.

STATES.	BUTTER.		CHEESE.	
	1860.	1850.	1860.	1850.
NEW ENGLAND STATES.				
Connecticut,........................	7,620,912	6,498,119	3,898,411	5,363,277
Maine,........................	11,687,781	9,243,811	1,799,862	2,434,454
Massachusetts,........................	8,297,936	8,071,370	5,294,090	7,088,142
New Hampshire,........................	6,956,764	6,977,056	2,232,092	3,196,563
Rhode Island,........................	10,211,767	995,670	181,511	316,508
Vermont,........................	15,900,359	12,137,980	8,215,030	8,720,834
Total,....................	60,675,519	52,924,006	21,620,996	27,119,778
MIDDLE STATES.				
New York,........................	103,097,280	79,766,094	48,548,289	49,741,413
Pennsylvania,........................	58,653,511	39,878,418	2,508,556	2,505,034
New Jersey,........................	10,714,447	9,487,210	182,172	365,756
Delaware,........................	1,430,502	1,055,308	6,579	3,187
Maryland,........................	5,265,295	3,806,160	8,342	3,975
District of Columbia,..............	18,835	14,872	....	1,500
Total,....................	179,179,870	134,008,062	51,253,938	52,620,865

Amount of butter and cheese made in 1860 and 1850.—*Continued.*

STATES.	BUTTER.		CHEESE.	
	1860.	1850.	1860.	1850.
WESTERN STATES.				
Indiana,........................	18,306,651	12,881,535	605,795	624,564
Illinois,........................	28,052,551	12,526,543	1,848,557	1,278,225
Iowa,........................	11,953,666	2,171,188	918,635	209,840
Michigan,........................	15,503,482	7,065,878	1,641,897	1,011,492
Minnesota,........................	2,957,673	1,100	199,314	....
Missouri,........................	12,704,837	7,834,359	259,633	203,572
Ohio,........................	48,543,162	34,449,379	21,618,893	20,819,542
Kentucky,........................	11,716,609	9,947,523	190,400	213,954
Wisconsin,........................	13,611,328	3,633,750	1,104,300	400,283
Kansas,........................	1,093,497	....	29,045	....
Nebraska,........................	343,541	....	12,342	....
Total,....................	164,786,997	90,511,255	28,428,811	24,761,472
SOUTHERN STATES.				
Alabama,........................	6,028,478	4,008,811	15,923	31,412
Arkansas,........................	4,067,556	1,854,239	16,810	30,088
Florida,........................	408,855	371,498	5,280	18,015
Georgia,........................	5,439,765	4,640,599	15,587	46,976
Mississippi,........................	5,006,610	4,346,234	4,427	21,191
Louisiana,........................	1,444,743	683,069	6,153	1,957
North Carolina,........................	4,735,495	4,746,290	51,119	95,921
South Carolina,........................	3,777,934	2,981,850	1,543	4,970
Tennessee,........................	10,017,787	8,139,583	133,575	177,681
Texas,........................	5,850,583	2,344,900	275,128	95,299
Virginia,........................	13,464,722	11,089,359	280,852	436,292
Total,....................	60,242,258	45,206,392	808,397	959,802
PACIFIC STATES AND TERRITORIES.				
California,........................	3,095,035	705	1,343,689	150
Oregon,........................	1,000,157	211,464	105,379	36,980
New Mexico,........................	13,259	111	37,240	5,848
Washington,........................	153,092	....	12,146	....
Utah,........................	316,046	83,309	53,331	30,998
Total,....................	4,577,589	295,589	1,551,785	73,976

We have not the exact figures on hand for giving the statistics of butter and cheese made in the Union during the year 1865, but the production of cheese in the middle and western States alone, it is believed, was more than two hundred millions of pounds. From facts gathered by the American Dairymen's Association, it is known that there are now upward of a thousand cheese factories in operation throughout the United States. If the number of cows to each be estimated at five hundred, we have half a million cows employed in the associated dairies, and if the average annual yield per cow be put at three hundred pounds, we have in the aggregate one hundred and fifty million pounds. But there are a large number of private or family dairies in operation, especially in the eastern or middle States, the production of which, it is believed, will more than make up the estimated annual product of cheese for 1865 to two hundred million pounds.

If the value of the cheese product of 1865 be put on an average of fifteen cents per pound, it shows a total of $30,000,000, while the butter product, if no larger than that of 1860, at the low price of twenty-five cents per pound, would amount to over $114,000,000. In the estimate of the cheese product it will be proper to remark that the quantity is presumed to be the amount sold, and does not include that consumed in the families of producers.

EXPORTS OF CHEESE AND BUTTER.

The statistics of trade show that the dairy products of the country are becoming an important branch of commerce. The following table gives the quantity of butter and cheese exported from New York for a series of years:

	LBS. OF BUTTER.	LBS. OF CHEESE.
1858	....	5,098,000
1859	2,494,000	9,287,000
1860	10,987,000	23,252,000
1861	21,865,000	40,041,000
1862	29,241,000	38,722,000
1863	23,060,793	40,781,168
1864	14,174,861	46,755,842
1865	22,000,000	47,101,000
1866	5,000,000	45,000,000
1867	....	58,000,000

The decrease in the cheese exports of 1865 from those of the year previous, resulted from an extraordinary home demand, which took large quantities of cheese at a price in advance of what shippers felt warranted to pay for it to export. The shipments abroad have been mostly to Great Britain. A light exportation for a number of years has been kept up with the West Indies and with South America, the trade with the latter being for the most part in a a poorer grade of cheese made from skimmed milk. Recently this character of cheese has found a favorite reception in China, where parcels have been sent in exchange for tea. It is believed there is a wide range of market yet unopened for the disposal of American cheese, needing only a little enterprise on the part of dealers for its introduction; and that when once introduced, it will increase steadily until a heavy foreign demand is reached. Great Britain alone can now take considerably more than our surplus, and since the qualities and adaptation of styles to her needs meets, year by year, greater favor, the time cannot be far distant when America will be regarded, if she be not already, the great cheese-producing country of the world.

ENGLISH AND AMERICAN DAIRYING—THEIR POINTS OF DIFFERENCE AND COMPARATIVE MERITS.

Associated dairying is now conducted on so large a scale, and has so wide a range in America, as to give it distinctive features of nationality.

European writers have asserted that this system was inaugurated in Switzerland, and that America simply borrowed the idea, putting it into successful operation, and therefore is not entitled to any merit as to its originality. Without stopping to point out the great dissimilarity between the associated dairy management of Switzerland and that of America, the truth of history demands the statement, that whatever excellence may attach to the American system, nothing in it has been borrowed from abroad. In the report of the Department of Agriculture for 1865 I gave a brief account of the origin of the cheese factory movement. Having been familiar with its early history, with the men and causes that led the way to this improvement in dairy practice, I feel competent to speak authoritatively on the subject, and claim its originality as wholly American.

The American factory system now stands pre-eminently in advance of dairy practice in the Old World. By it a more uniform and better product of cheese and butter can be made. These must soon take the lead in European markets, and European nations will adopt the system or be content to see their own products rank as secondary, and sold at inferior prices. Since the adoption of the factory system a large export trade has grown up between America and Great Britain. The value of American cheese now sent abroad is from seven to ten millions of dollars annually, and as factories improve in the quality of their manufacture, a much larger trade, it is believed, will be inaugurated.

England is old in dairy husbandry, and always claimed superiority in dairy practice. A great many styles of cheese are manufactured, and some of them sell in their principal markets at better prices than that made at our factories. American dairymen, previous to 1866 had never been able to find out wherein this superiority lay. In view of the large trade already existing, and likely to increase, it was deemed important that a better knowledge of English dairy husbandry and cheese-making be obtained. The American Dairy Association, therefore, engaged the writer to go abroad for this purpose, and the following pages are briefly the result of observations over the dairy districts of Great Britain during the summer of 1866. The dairy lands of Great Britain, it is believed, are no better than in the best dairy districts of America. Pastures, there, it is true, will generally carry more stock than ours, because theirs are freer from weeds and better managed. The yield of hay from permanent meadows is no larger than from our best lands, two tons per acre being considered a good crop, but theirs is composed of a greater variety of grasses, is finer, and doubtless more nutritious than ours on account of less waste in woody fiber. Their dairy stock is generally no better than in our first-class dairies. I think there is no county in England or Scotland where the average yield of cheese per cow is so large as in Herkimer county, New York.

In the management of farms they are generally far in advance of us, but in cheese-making their appliances are inferior, their work more laborious, and they have but really one style of cheese that competes with the best grades of our factory make. This is the cheddar, of which the leading features in manufacture will be found under its appropriate head. In the cheddar process as well as in the management of stock of milk and dairy farms, there are doubtless suggestions which will be adopted in our practice when their superiority is demonstrated. I have endeavored to call attention to the fact, and to state the point clearly.

THE CHEESE DISTRICTS OF ENGLAND.

The cheese districts of England are grouped together in counties lying contiguous. Thus in the south are found Gloucester, Somerset, Wilts, Dorset, &c., while in the north there are Cheshire, Lancashire, Derbyshire, Leicestershire and Shropshire. Other counties produce cheese in limited quantities, but not to such an extent as to make it a leading business. I went into the southern districts first, and found three styles of cheese, each having a different shape and character, and differently manufactured. They were the Cheddar, the double and single Gloucester, and the Wilts.

I had never seen any large tract of country so beautiful as this part of England. It was in June, when the hedges were covered with dark green foliage, the pastures flecked with the daisy and butter-cup, flowers celebrated by the poets. But the English daisy is not to be confounded with that pest of our fields, the ox-eye daisy, for it is small and unpretending, and does not suck up the life of the land. Then the smooth roads, the villas, the farm-houses, and the hamlets, with their adornments, together with the garden-like cultivation of the land, formed a picture ever to be remembered. For quiet, pastoral scenery, England is surpassingly beautiful. Everything seems to be "picked up" and in place. You see no tumble-down fences, no unsightly stone heaps, disfiguring the land, no cheap wooden houses falling to pieces, no remains of wood-piles and other accumulated trash, like a cancer blotching the premises, but everything seems to be swept up and in order, or, to use a homely phrase, "prepared for company."

SOMERSET AND ITS SYSTEM OF FARMING.

Somerset has a rolling, undulating surface, and it is in this county that the famous Cheddar cheese originated. In form the county is difficult to describe, perhaps partaking more of an oblong figure than any other. According to recent returns of live stock, &c., its area is one million seventy-four thousand two hundred and twenty acres, containing four hundred and forty-four thousand eight hundred and seventy-three inhabitants; eighty-four thousand two hundred and sixty-two cows; eighty-nine thousand two hundred and fifty-seven young stock; six hundred and thirty-six thousand nine hundred and seventy-five sheep; and seventy-five thousand four hundred and sixty-nine pigs. The surface of the country is generally uneven, and towards the west, on the borders of North Devon, approaching to mountainous. The principal hills lie east and west, and are nearly parallel with each other. These ranges are generally poor, affording pasture for a coarse kind of sheep and some young cattle. The hill-tops of the south and south-west are covered with heather. The geological features of the country are varied, and are chiefly composed of mountain limestone, inferior oolite, the white and blue lias, and the new red sandstone. The highest hills are mountain limestone, which has been forced up from its proper place, and is found overtopping the upper strata to a hight of six or seven hundred feet. The eastern part of the country is generally oolitic, stretching away northward to Bath, at which place it produces some of the finest building stone in the kingdom. The lias comes next in rotation, cropping out from under the oolite westward. The red sandstone is not so prevalent. This, with the oolite, is the lightest soil upon which large flocks of sheep are kept, which in the south, are chiefly of the South Down breed, but in the northern district, towards Bath, are crossed with the Leicester, forming a larger and more remunerative animal. The method of farming is the four or five-field shift—1st, wheat: 2d, green crop (turnips, vetches, etc.); 3d, barley; 4th and 5th, clover first and second year. The wheat crop is from twenty-four to forty bushels per acre; barley from thirty-two to sixty bushels, sometimes more. A heavier kind of land is found on the lias formation. A team of four horses, or six or eight oxen, is employed in plowing it. This is more productive of grain than the lighter land, and is farmed in a similar manner.

In some places what is termed a dog-flock, that is, young sheep of a year or so old, are fattened for the Bristol and Bath markets. The lowlands and valleys are rich and productive. Between the ranges of hills before noticed are some of the richest plains in England. The vale of Taunton Dean, in the south of the county, is extremely rich. Another nearly level plain extends from the town of Bridgewater to the Mendip hills, and eastward to the city of Wells. Another plain, but rather more uneven, stretches north of the Mendip towards Bristol. These plains are largely devoted to the fattening of beef and mutton for the supply of the local, and also the London markets. Somerset is noted for its cheese, of which large quantities are made. It bears the name of Cheddar from a small village at the foot of the Mendip hills. The name originated from the farmers of the village uniting the milk of their cows for the purpose of making a larger cheese. This was done at each other's houses in turn. From that time, which was about one hundred years ago, the thick cheese made in Somersetshire has borne the name of Cheddar, and bears the highest quotations of any English cheese in the London and other markets. It is made much thicker than was at first anticipated. The size that now is in request ranges from forty to eighty and up to one hundred pounds; the shape is from ten to fourteen inches in depth, and fifteen and a-half inches in diameter.

This county, and the others south, have suffered very little from the cattle plague. Dairy cows, however, during the season (1866) have been high, commanding from eighteen to twenty pounds sterling per cow, or from ninety to one hundred dollars. The dairy cows are motley grades, and so far as I have seen, do not show any better milking qualities than the first-class dairies of Herkimer and Oneida counties, New York.

DESCRIPTION OF STOCK.

The cattle kept in the county at this time are the Devon and Short-Horn, the former pure of their kind, the latter rarely so, but have been employed to improve the original stock of the country. The Devons are said to have been formerly (with few exceptions), a small, three-cornered, nondescript animal, of little use to the dairyman, and less to the breeder and grazier. Their home is South Somerset and North Devon. The race is wonderfully improved through the energy and perseverance of some farmers, who have taken the best animals they could find and bred from them, until they have succeeded in producing one of the best animals of which England can boast. In the opinion of some no beef is equal to it, the fat and lean being so nicely intermingled. Their milking qualities are not yet equal to those of other kinds. A few years since there was a breed called the Hampshire cow, a useful animal for any purpose, of good constitution, size, milk, and beef. Mr. HARDING gave me a description of a cow of this breed, nearly the last of the race, which was twenty years old, and had been milked the previous summer, and in the March following went to the butchers at £20 1s. I was told that fifty years ago, in the neighborhood of the Mendip hills, they had what was termed the "Mendip cow," of little service but to milk; but both these good, and inferior animals have passsed away, and they have scarcely any cow but what partakes, in a greater or less degree, of the Short-Horn breed.

QUANTITY OF CHEESE, ETC.

The increased quantity of cheese supplied by this county is not due, it is said, to the change of stock, so much as to the superior management of the present day in feeding stock, clearing the hedge-rows, and draining the wet land, &c. Fewer cows were kept thirty years ago than now. It was then generally supposed that no more could be kept with advantage beyond what half of the pasture or grass land would supply with grass in the summer, and the other half cut for the winter. Now they keep more cows, mow less, and in winter do with less hay; they feed with straw and oil cake while the cows are dry, so that they get little or no hay till they calve. Three pounds of cake per day (the best American) they say will keep a cow in fair condition if straw be given *ad libitum*. In some particular districts as much as six hundred weight or six hundred and seventy-two pounds of cheese per cow, it is said, are made. This is on the best cheese-producing land; and this, from long observation, is chiefly on some one of the oolite formations. Not only does it produce the largest amount of cheese, but also of butter. There are no statistics of the quantity of cheese made annually in the county, but from all I can gather, it is from eighteen million to twenty-five million of pounds.

WILTSHIRE.

For diversity and beauty of scenery Wiltshire is not equal to Somerset. Its geological formation, in general terms, may be classed in three divisions, namely, the white lias, which is lowest, the several classes of oolite, and the chalk. According to the late returns the area is 865,092 acres. The number of cows kept is 44,760 ; young stock and oxen, 32,967 ; sheep, 596,822 ; and pigs, 61,012. The natural division of the county is so *remarkably* distinct, that it must be described accordingly, viz., north and south. The south part, with a few exceptions, is the chalk district, and forms what is called the Wiltshire downs. Lying high, the land is very thin ; still the valleys and slopes are rich for growing grain and turnips. The farms are large, some 1,000 to 2,000 acres. Large numbers of sheep, known as the South Downs, are kept upon these farms. They have black faces and feet, the wool short and fine. The mutton commands the highest price in the London market of any in the kingdom. Though small in size, they will frequently load themselves with flesh, so as to reach 120 pounds in weight. In this district is the celebrated Salisbury Plain, also on the chalk. It is not strictly a plain, except in general appearance ; but is beautifully undulating, not unlike the ocean with its long swells after a storm. The farming of this district is generally the four-field system. In some places, such as on the white clay and the sandy loam at the bottom of the hills, it is worked in the three-field system. All the light land is plowed with two horses. Neat and good farming is everywhere seen, and it is claimed is scarcely surpassed in England. North Wiltshire is very different in appearance from the south. The broad uninclosed downs are no more seen, but rather inclosed fields with numbers of trees in the hedges, giving the appearance of forests from the surrounding hights. This is the oolite district, and is farmed in much the same manner as the south, being all light lands. The temperature of the climate being warmer, the grain ripens earlier and is therefore less liable to blight.

THE WHITE LIAS AND DAIRY DISTRICT.

The lias is a very small portion and may be merged into the dairy district, which is principally in the middle and northern parts. The cows are Short-Horns, and regarded here as the most useful in England, excellence in milk and meat being alike sought for. A large quantity of cheese is made which finds its way to the London and other markets. The quality of the cheese is not the best ; a little milk butter is usually taken out, but not always, but a large quantity of whey butter is often made. The method of cheese making is laborious, not so much in the manipulation of the curd as in the salting and pressing and the preparation for market, all being unnecessary labor. The salting, which might and ought to be in the curd, is continued over two or three days, rubbing it in with the hand over the external parts of the cheese, which receives a fresh cloth every time it is salted, which in some instances is twice a day. The cheese is then continued in the press, turned every morning for from four to six days, after which it may venture to the cheese room, which is a large, airy room, supposed to be requisite for properly drying. The cheese is then allowed to throw out a coat, generally blue. This coat must be scraped off and a new one formed, after which it goes to the market, realizing from ten to fifteen shillings, under the improved Cheddar price. Wiltshire, up to the 21st of April last, had lost but ninety-nine cattle on account of cattle plague, and I heard of no cases in the county during the summer.

The principal dairy district of Wilts ranges from Westbury, in the south, to Chippenham, northward, around Chippenham and towards Swindon, from forty to fifty miles in length. It is generally narrow from Westbury to Chippenham, and from Chippenham to Swindon from ten to twelve miles wide, and a pretty level tract of country. Before reaching Salisbury to the south you strike the chalk formation which underlies the "Salisbury plains." In going to Salisbury from the north, the chalk first shows itself in a range of high bluffs or hills. The chalk lands are rather light and are worked with two horses, while with the heavier lands three or four horses are attached to the plow. Upon the lowlands the soil is of richer character. In passing through this county one is continually coming upon large flocks of sheep in charge of shepherds—mutton sheep, of course, since the production of meat is always an important element in the resources of British agriculture.

MANNER OF MAKING WILTS CHEESE.

There is nothing in the manufacture of Wilts cheese that would be of any account to the dairymen of America, and it is a matter of surprise that the people of this district are so bound up in old practices as to waste their time and substance in manufacturing cheese of this character. Comparing the Wiltshire method and the apparatus in use with our factory system, the latter is about a century in advance. I give some of the leading features of the Wilts method of manufacture, not for the purpose of benefiting anybody, but rather as a matter of *curiosity*, if I may so term it. I was upon some of the best farms of Wiltshire, and among some of the most intelligent of its cheese makers, and shall give their best practice.

The night's milk is skimmed in the morning and added to the morning's mess; milk set at 80° and left about an hour to coagulate. It is then broken up with a circular breaker having an upright handle and used as you would push a churn dash up and down. The breaking is done gently at first. In cooking the mass is raised to 100°, stirring all the time with the breaker. It is then left to rest, and as soon as the curd can be handled it is taken out of scald and put to press. It remains in press twenty minutes; is then taken out, ground and salted at the rate of two pounds of salt to the hundred weight of curd. It is ground again and put to press. The next day the cheese is taken out of press and salted on the outside, receives a new cloth, and is put back to press, the same course being pursued for two successive days, after which it gets no more salting, but is kept in press eight days, each day being taken out and turned. It is then put into a stone cheese room and left for a week or two and turned every day. At the end of this time the cheese will be covered with mold, when it is put in a tepid bath or moistened and the mold scraped off, when it goes to the dry room. Here it is turned every day until fit for market, say from sixty to ninety days old, or according to the demand and price. The Wiltshire cheese is less solid than the Gloucester, to which I shall refer hereafter.

At one of the farms I visited, where sixty cows were kept, *and very nice stock, too*, the product was a trifle over two pounds of curd per day from each cow, and one and a-half pounds of butter for each cow per week. Cockey's cheese apparatus was in use, which consists of a tub having a double bottom, the upper one copper, heat being applied between the two, either with hot water or steam; but generally the old-fashioned tubs hold sway. The hoop for pressing the cheese is turned out of a solid block of wood, with a bottom to it pierced with holes for the whey to escape. When put to press, some eight cheeses are piled up together, one above the other, and the pressure applied to the lot at one time. The milk pails are made of tin, and hold about twenty-four quarts; they are formed with a projection or handle on one side and are carried upon the head while taking the milk to the dairy.

The Wiltshire dairies are very cleanly. The dairy rooms are built of stone, with stone floors and whey vats of lead, and everything kept in the neatest possible manner. In this respect they are models, but the amount of labor in cheese making is very great, and the dairywomen adhere with pertinacity to the old customs, giving no reason for this waste of labor, except that "that is the way we always do." In Wiltshire I found the stock better than in Somersetshire, some attention being paid to breeding. Wiltshire has a great cheese market at Chippenham.

THE CHEESE MARKET AT CHIPPENHAM.

The market place is an open court surrounded by buildings, one side of which is open and supported by pillars, thus giving a spacious place for the stowing of cheese under cover. The open court is nicely paved, and the arcades on either side have a stone floor, The cheese is brought in carts, packed loosely in straw, without boxing. They are taken from the cart and placed upon the stone floors in the arcades, spread out or piled up. Each dairy farmer has his lot together, and they are thus exposed for sale. The cheesemongers or dealers come down from London, Bristol, Bath and other places, and make their purchases. There is a constant hum of voices and tread of feet, as one can readily imagine where a large number of people are collected together intent on selling or purchasing, or are here out of curiosity, or perhaps to meet persons on other business beside the cheese trade. The dealers go about testing the cheese, making their purchases and ordering it to be sent away as sales have been made. No boxes are used in the transportation of cheese as with us in America. The market days here are twice a month, and often, I was told, as much as two or three hundred tons of cheese are in the market during the fall sales. There was a considerable quantity on sale at the time of my visit, all new cheese, and most of it Wiltshire. The Wiltshire cheese is a small, flat cheese, from four to five inches thick, fifteen to sixteen inches in diameter, and taking four to make one hundred weight (one hundred and twelve pounds). They are inferior to the Cheddar, and very much inferior to American factory cheese, and the highest prices are only occasionally realized.

GLOUCESTERSHIRE.

I think there are no statistics giving the number of pounds of cheese annually produced in Gloucestershire, but some estimate may be made from official returns of the number of cows in the county. It is put at 34,744; loss from cattle plague up to 21st of April, 116. I understand that the losses since that time have not been of much account. The geological features are the oolite, the lias and the new red sandstone, the former comprising the principal part of the hills and high lands, the lias the more level and the latter the richer and deeper soils of the valleys, which are chiefly pasture lands, upon which butter, cheese and meat are largely produced. The oolite strata in its varied character runs from north to south, forming the Cotswold hills. Entering Somersetshire at Lansdown, near Bath, where it furnishes the beautiful Bath stone, passing outward into North Somerset, widening as it enters Wiltshire, soon after which, in the neighborhood of Westbury, it is no longer the surface soil, but becomes loaded with the green sandstone and chalk formation, like the snail which bears its shell upon its back. The Cotswold hills are well farmed in the four, five or six course systems, according to the capability of the soil. Wheat, barley and turnips are successfully grown. The hills give the name to the Cotswold sheep—which have long been bred and fed there—beautiful animals, with white face, and of highly improved quality, both as regards meat and wool, the latter being long and fine, the fleece weighing from five to ten pounds. A ram will sometimes turn off fifteen or sixteen pounds of wool. They are generally heavier in mutton than the Downs.

On the western side of the Cotswold hills, extending to the Severn River, and fifteen to twenty miles in length, is what is called the vale of Berkeley. It has every appearance of having been, in past time, covered with the sea. This valley is the chief dairy district of the county of Gloucester. The native cow is of dark color, with a black nose, short legs; is a thick-set, well-built animal; altogether a very useful beast; but the Short-Horns and Herefords are displacing her.

In the regular Gloucestershire dairies the cheese is made thin, eight of them only weighing one hundred and twenty pounds. They are made twice a day, the work beginning about seven o'clock in the morning, and being finished about ten or eleven o'clock. At five in the afternoon they commence with the evening milk, and finish between eight and nine o'clock. This cheese is known in the cheese-consuming world as the famous Berkely cheese. If well made it is rich and sweet, and the makers are quite as tenacious of their reputation as those who make cheese worth from ten to twenty shillings per hundred weight more money. Cows are generally kept, more or less, over the county except on the uplands. The south and south-west, around the neighborhood of Bristol, are the coal meadows. This district is not farmed so well, comparatively, as the other sections, from various circumstances; being in the coal district, the surface is uneven and the enclosures small, as are also the farms; besides it is near Bristol, at which place hay, straw and milk are continually sold.

CHEESE APPARATUS AND MODE OF "SINGLE GLOSTER" CHEESE MANUFACTURE.

At a nice farm in the southern part of Gloucestershire, which I visited in June for the purpose of seeing the operations of making "Single Gloster" cheese, the dairy consisted of thirty-five cows. These were Short-Horns, large, handsome, but not showing extraordinary capacity for milk. The dwelling, dairy and buildings were all of stone, large, commodious, and everything kept in the neatest manner. The place where the cheese was made was a spacious room with stone floor, clean and well ventilated, and as cool and sweet an apartment as the most fastidious cheese-maker could desire. The utensils or appurtenances for cheese-making consisted of an unpainted tub for holding the milk, leaden vats for holding the whey, a circular wire curd-breaker, having an upright handle springing from the center, dippers, skimmers, &c., with two box presses for pressing the cheese. The last were unlike anything I had ever seen, and consisted of large square boxes moving up between standards by means of pulleys and ropes attached to a windlass. The boxes were filled with stones, iron, &c., making a weight of several hundreds pounds, and applied directly on the cheese. These presses were very nicely made of dark wood, and varnished, evidently intended to be ornamental as well as useful. From the manner of their make and the power to be applied in raising the weight, the services of a strong man would be required. The milk was being made up twice a day, making eleven cheeses of fourteen pounds each for every two days, each cheese being about two and a-half inches thick by fourteen or fifteen inches broad. There was no heating apparatus in the room, and none is required in the "Single Gloster" process of cheese-making. As soon as the milk is all deposited in the tub the rennet is added, when it is left to coagulate. As soon as properly coagulated it is broken up with the wire breaker, by moving it up and down, which has a tendency to *pulp* the curd rather than break it, as the word breaking is generally understood by our cheese-makers. The mass is then left for the curd to settle, and after it has arrived at a proper degree of firmness to be handled the whey is dipped off down to the curd, the tub canted up to drain off what whey remains, and the curd gathered to the upper edge of the tub. The whey being removed, the curd is cut across and heaped up, and pressed with the hands to expel as much of the whey as possible, when it is put to press. It remains in press till morning, when it is taken out, turned and salted on the outside. It is then returned to the press and goes through the same operation from four to six successive days. When taken from the press it is put upon the shelf for a few days, to be turned every day, and finally goes to the cheese room, when it will be ready for market in two or three months, if prices suit. This cheese or drying room is in the upper part of the dwelling house, and the cheeses, when taken here, are placed close together on the floor.

A chance dealer from Bristol, who was present, made a test of the cheeses by walking upon them as they lay spread out upon the floor, which we were assured was the usual method of determining their firmness and solidity. They stood the test of his weight and boots, and were pronounced among the best in Gloucestershire. The hoops in which the cheese is pressed are turned out of a solid piece of wood, and each has a stationary bottom pierced with holes, similar to the hoops used in Wiltshire. In one of the presses I counted fifteen cheeses piled up one upon another, all of which were being pressed together. I think from the above description none of our dairymen will care to make "Single Gloster" cheese and I cannot see why people there will continue to keep along in the same old rut of their forefathers without making some effort to improve.

I have now presented some of the general features of this great district. The country is well watered by springs and streams, but no better than, if as well as, many parts of the central counties of New York. Where watering places are constructed the plan is somewhat different from ours—small ponds being more numerous. The pastures produce, perhaps, more feed than with us, from several causes. In the first place they are more free from weeds; they are better cared for in top-dressings of manures, while the humidity of the climate produces fresher feed and a greater quantity of verdure.

The permanent pastures have a fine thick sod, filled with a variety of nutritious grasses, among which the following may be of interest in this connection. The sweet-scented vernal grass (*Anthoxanthum odorato*) flowers in May, and grows freely in all soils and situations. It is one of the earliest of grasses, and the fragrant odor it affords when dried gives to meadow hay much of its sweetness. Meadow foxtail (*Alopecurus pratensis*) flowers in May and June. Its early, abundant, leafy produce is much liked by cattle and sheep, and renders it one of the most valuable of pasture grasses. It forms part of the best pastures and thrives under judicious irrigation. Meadow fescue (*Festuca pratensis*) flowers in June, likes a good soil, and does not attain its full growth until three years from the time of sowing. The produce is nutritious and abundant, and it forms a uniform and abundant turf. Cocks-foot grass (*Dactylis glomerata*) flowers in June and July, grows three feet high and upward, and forms a large portion of all the best natural pastures, and is regarded superior to most grasses in the quantity and quality of its produce. Its coarse and tufted character makes it unsuitable for lawns. Crested dogstail (*Cynosurus crystatus*) flowers in July, and is found in all pastures. It suffers but little from dry weather, but produces only a moderate quantity of fine herbage. Hard-fescue grass (*Festuca duriuscula*) grows two feet high and forms a portion of all dry pastures, and retains a permanent verdure. It flowers in June. Sheep fescue (*Festuca ovina*) is found in all dry soils from the sea land to a great elevation; flowers in June. Meadow grass (*Poa pratensis*), or Kentucky blue grass. It produces an early, nutritious herbage, and is regarded as particularly suited to light soils. Rough-stalked meadow grass (*Poa trivialis*), fibrous-rooted, rough stalks, forms a portion of almost all mixtures for permanent pasture-grasses, and is particularly desirable in grounds shaded with trees. Timothy is also found in pastures and meadows, but is not grown to the same extent as with us. Then there are the clovers, red and white, which are so largely grown with us; and the Alsike clover (*Trifolium hybridum*), a true perennial, very productive on moist, rich soils, and will succeed where red clover fails. It is regarded by many as superior to white clover in bulk and quality of produce, and equals it in duration. These are among the leading grasses; and in seeding for permanent pastures, a compound of the best grasses and clovers is used, often as much as two bushels of the light and twelve pounds of the heavy seed to the acre.

I think the question of pastures is better understood in England than with us, and it is a point on which we have something to learn from them. I cannot say that the quantity of grass from permanent meadows, or those long in grass, is larger than is often found with us, but the quality is finer and better—that is, the hay has less woody fiber than with us. At Rothamstead—Lawes' celebrated experimental farm—my attention was particularly called to the fineness of the grass made into hay. The old stocks which had been cut down, presented a solid mass of hay almost as fine as hair, and its nutritive quality must have been a third more than our timothy, on account of less waste of woody fiber.

Allusion has been made to permanent meadows, but generally what we term meadows, that is, land devoted to the production of hay, are treated very differently from ours. Much of the hay is grown on what is termed the four or five course shift. It comes in regular rotation after grain crops. It is mowed once or twice, and then broken up for a crop of wheat. Various mixtures are sown, and large yields often result. I went upon a splendid meadow in Devonshire, where the yield of grass upon the ground must have made at least two and a-half tons of hay per acre, and perhaps more, and it was the first crop. The seeding per acre was as follows: Eight pounds of red clover; two pounds of white clover; four pounds of trefoil; three pounds of Peek's Italian rye-grass. This is not given as an illustration of the best mixture, but rather as a specimen of what our farmers would term heavy seeding.

Lands often get more and a greater variety of seeds. Perhaps I am occupying too much space by going so minutely into details; but I feel earnest for the success of American farmers, and have thought that it might be of interest for them to get a little insight into the manner in which dairy farms are managed abroad. Perhaps this may be appreciated the more, when they are told that a farmer in the dairy regions of England often pays from $3,000 to $3,500 per annum in rents and taxation for a two-hundred-acre farm. He pays this for the land alone, and gets no use of any personal property whatever. He then stocks it at his own expense. He is at all the cost of utensils, labor, and of keeping the farm in repair. As the wealthy or "well-to-do" farmer, for the most part, never lays his hand to any labor beyond superintendence, one might naturally conclude, as I did, that pretty shrewd management at least is required to pay this sum, support his establishment, and lay up money from his business.

By the judicious use of capital and the liberal use of fertilizers, and by a system of mixed farming, he is able to accomplish these results. It is true, labor is cheap. He pays his laborers from thirty to forty cents per day, and in harvest a little more; but he does not board them. They have cottages —good, substantial buildings—and little gardens. These cottages, like the more pretentious mansion of the farmer, are erected by and at the expense of the landlord; but a certain number of people go with the farm, and they pay rent to the farmer for their cottages, say about a shilling per week.

The condition of the peasantry is, in many respects, most wretched; but that need not be discussed here. The farmer's position is infinitely above them, and he lives, for the most part, the life of a gentleman. He is a man who is expected to have some means, say from £8 to £10 per acre; or, in other words, a floating capital of from forty to fifty dollars for every acre of his farm. This he uses in his business, purchasing stock and fertilizers, and making such improvements as he judges will pay him back remnuerative profits. And here I cannot do better than introduce the reader to Mr. HARDING, of Marksbury, the great exponent of Cheddar cheese-making in England. Mr. HARDING is perhaps sixty years old, and learned the great and essential principles of cheese-making from his ancestors. He has simplified the process of manufacture, and helped to reduce it more to a science; but he does not claim to be the originator of the Cheddar style. He is an intelligent, companionable man, with a rich vein of humor in his composition. A brief view of his mode of management will serve as an illustration of the manner in which dairy farms are conducted in the south of England, although in some respects, Mr. HARDING's practice differs from that of others.

MR. HARDING'S FARM.

The farm may be regarded as of rather inferior land, some of it a compact, tenacious soil, requiring a four-horse team to plow it. Comparatively, he places the farm under the head of middle-class lands, and when he first came upon it, it was considered unadapted to the dairy. But, for illustration it will serve our purpose better to take some extra farm, since a nearer approximation will be reached to average results. The farm consists of three hundred acres, two hundred of which are in permanent pasture and meadow, and one hundred acres arable land. The farm is hilly, and rises from the new red sandstone, which is the poorest part, to the white lias, which is level, and upon which lies the arable portion, and again rising to the oolite, which is the best part of the farm. The permanent grass lands are used alternately for pasture and meadow, the change being made annually. Mr. Harding making good cheese, which sells at a high price, believes it more remunerative to convert as much as possible of the arable land into milk. A considerable portion of the arable land is devoted to grasses that will come early to supply the cows in spring. The arable land is managed as follows: First crop, wheat; second, turnips, vetches, tares, &c.; third, barley; when the land is seeded with rye-grass one bushel, trefoil, ten pounds, red clover, four pounds, white clover, three pounds per acre. Upon these grasses the cows are pastured two seasons, when it is broken up in August or September and sown with wheat in October, without additional plowing. After the wheat is harvested, a portion of the stubble is immediately plowed and sown with winter tares for feeding sheep early in spring. Another portion is sown at the same time with *trifolium incarnatum* (Italian crimson clover), another part is sown in February with spring tares, and the balance to Swedes and other turnips. All this feed is to be consumed for the feeding and fattening of sheep, of which from one to two hundred are kept.

The sheep are purchased in August, at from six to eight months old, at prices ranging from seven dollars and a-half to ten dollars each, and the next season, after shearing, are sold at from fifteen to twenty dollars each. In fattening the sheep, they are hurdled and fed on the turnips, vetches, &c., with corn or cake, say of the latter at the rate of half a pound each per day. The turnips are grown in drills, with an application of from five to six hundred pounds of superphosphate per acre, leaving the principal part of the farm-yard manures for the permanent grass lands, upon which are kept from sixty-five to seventy cows, half-a-dozen heifers, and eight horses. Thirty-five dollars per ton are paid for the superphosphate.

The cows are grades partaking largely of the Short-Horn blood, of good size, with a view that, when failing for the dairy, they may be turned to good account for making beef. Mr. Harding keeps more stock than he grows hay for, in the winter, thinking that grass is far more valuable than hay, and he makes up the lack of fodder by giving two parts straw and one of hay, cut to chaff, with three or four pounds of oil-cake per day to each animal. The cows yield about four hundred and fifty pounds of cheese each annually. They "come in milk" in February, and cheese-making commences about the first of March. The calves are sold to the butcher when a few days old, as is the practice of some of our dairymen. The cows are not kept in barns or close stables as is the practice in New York, but are tied in sheds built of stone, the floors nicely paved. In these they take their place during summer—night and morning, for milking, and each milker is allotted seven cows. Tin pails are used for milking, and the milkers place them on the head when carrying the milk to the dairy.

The pig in this dairy forms an important item of profit. A hundred or more are fattened during the year on barley meal mingled with the whey, which annually realize about seven dollars and a-half per hundredweight, after paying for the meal. The hogs are of the Berkshire breed, and very fine ones. They are kept in a nice, spacious stone piggery, cleaned and bedded every day. The barn is a large stone building, provided with a water-wheel, to which is attached the threshing machine, chaff-cutter and stones for grinding the grain. The dairy-house is connected with the dwelling, and is a model of neatness, being built of stone, and provided with COCKEY's apparatus for cheese-making, a tolerably good apparatus, but much inferior to our factory vats. The milkers are not allowed to come into the dairy, but pour the milk into a receiver at the window, which conducts it to a tub. The whey passes off through pipes to a cistern in the piggery, where it is pumped for the pigs.

The production of hay on permanent meadows of this farm is generally at the rate of three thousand eight hundred pounds to the acre. Farm-yard manures are not allowed to accumulate in the yard, but are taken to the field where they are to be used and there piled. Here it is turned until pretty well rotted, when it is spread upon the lands to be mowed. It is applied at the rate of twenty cartloads per acre, and brushed down fine.

Results.—Under this system the annual average receipts and expenditures are as follows, the calculations of course, being upon a gold standard:

Cheese sold		$5,000
Profit on sheep, including wool and mutton		500
Profit on pigs		600
Grain sold		1,800
Calves and butter		250
Total		8,150
The expenses are:		
For rent	$2,500	
For tithes	450	
For poor rates and taxes	400	
For labor	1,750	
		5,100
Leaving an annual profit or balance of		3,050

The number of male hands employed, including boys, is ten. They get on the average thirty-three cents and three pints of cider each per day. In harvest the men get fifty cents per day; these sums always including the cost of board, since in England the hands do not live in the farmer's family, as with us, but find themselves in board. The two girls in the house are paid thirty and fifty dollars per year and board. These figures were given to me by Mr. Harding as his average result of profits. To this should be added, doubtless, the value of the food consumed in the family. No items were given for beef sold, since these were made to balance depreciation of stock, purchase of oil-cake, &c. No comment need be made on the foregoing, because among practical men each will make the necessary comparisons and draw his own conclusions as to whether his own or this is the best system of dairy farming. But if any can show a better balance sheet, in *gold*, from a poor farm of this size, he is doing well.

CHEDDAR CHEESE-MAKING.

Having described the Gloster and Wilts process of cheese-making, I will say something of the Cheddar process. The improved English Cheddar cheese is regarded by Englishmen as the finest cheese that is made anywhere. It suits the general taste better than any other description of cheese manufactured. The fact that Cheddar always commands the highest prices; that there is an immense demand for it; and that its manufacture has become more scientific and thorough than that of any other kind, make it important for us to study its character. I was among the Cheddar dairymen for more than two weeks, studying the process of manufacture, and saw some of their most noted dairies. I was at Mr. Gibbon's, who was awarded the gold medal for the best dairy at the international exhibition, at Paris, and at Mr. Harding's of Marksbury, Mr. McAdam's of Gorsly Hill, Cheshire, and others, and after having seen all the different styles of cheese in Great Britain, I am of the opinion that the Cheddar is the only process from which American dairymen can obtain suggestions of much practical utility.

I may here remark that John Bull, like his blood relation Jonathan, is a man of strong prejudices, and will often prefer a Cheddar cheese of no better quality than good American at ten to fifteen shillings per hundred weight more in price, simply because the English Cheddar has a better reputation. This feeling has very much to do in regulating the difference of price between the best samples of cheese of the two countries. But laying all prejudice aside I must, in truth, say that we have not yet been able to surpass in excellence the fine specimens of English Cheddar. It is a very high standard of cheese, and is deserving of all the encomiums which it has received from time to time. The quantity of extra Cheddar made in England is comparatively small, and its peculiar excellence has been rarely reached in American dairies. Its requisites may be briefly summed up in the following points: 1. Mildness and purity of flavor; 2. Quality, which consists of mellowness or richness under the tongue; 3. Long keeping qualities; 4. Solidity or freedom from eyes or holes; 5. An economical shape as regards shrinkage, handling and cutting.

It is not within the range of a brief paper like this to go minutely into all the details of Cheddar cheese-making, but rather to present points of difference between their points and our own. In the first place, English dairymen have a cleaner and better flavored milk than generally obtains with us. The milking is performed with great nicety in tin pails. The milk rooms are perfect models of neatness. They have stone floors and the joints of the flagging are cemented together, so that no slops or decomposed milk can have an entrance. They are situated in a cool, airy place, and the walls are of stone or of hollow brick, thus rendering them cool and of even temperature. Every part is well ventilated, and out of the reach of disagreeable or fetid odors. The floor, the utensils and cheese apparatus are kept as sweet and clean as the tables and crockery of the most fastidious housekeeper.

This condition of things I found universal wherever I went among the dairymen—at the royal dairy, near the Queen's palace at Windsor Castle, and radiating thence through all parts of England. Nothing connected with cheese-making abroad struck me with more force and admiration than this perfect neatness and cleanliness of the dairy. In this respect they are greatly in advance of us; and in my opinion it is one of the chief reasons why they are able to obtain that fine, clean flavor which is a distinguished characteristic of their choice cheese.

There is nothing, perhaps, which indicates the progress and skill of our manufacturers more than the fact that they are able to take imperfect milk from the hands of patrons, manipulate it among the fetid odors of whey slops and decomposed milk, and yet turn out a cheese that will compete with the great bulk of English make. But these conditions will not and *cannot* produce the fine, delicate flavor of the best Cheddar, and it is one reason why there is such a great bulk of American cheese condemned abroad as "not just right in flavor." Now this putrid inoculation does not show its whole character at first, but, like the insidious poison in the blood, increases from week to week, until it puts on a distinctive feature which spoils all the good material with which it comes in contact.

I saw American cheese abroad, perfect in shape and color, rich in quality, splendidly manufactured, and it had a bright, handsome appearance, that would have placed it on an equality with the best in the world; but the trier showed a flavor that could be plainly traced to a bad or imperfect condition of the milk before manipulation. I have been extremely mortified, while testing cheese abroad, to catch the taste or smell of putrid rennet and of the stables. This is one point of difference between the dairy practice of the two nations. In the Cheddar process the milk is at a low temperature—from seventy-eight to eighty degrees—using some whey with the rennet, according to the condition of the milk. After coagulation is perfected, which takes from forty to sixty minutes, the curd is cut in large checks, and soon after they commence breaking with a wire breaker attached to a long handle. The breaking is at first slow and gentle, and is continued till the curd is minutely divided. This is effected before any additional heat is applied. They claim that the curd cannot be properly broken at ninety or above ninety degrees, and that there is a better separation of the whey and condition of the curd by breaking minutely at about seventy-five or eighty degrees without an increase of heat during the process. This process of minute breaking in the early stages of the curd appears to me to result in loss of butter, and this is the chief reason, I think, why Cheddars have less butter in their composition than our best American. That it does not result from inferior milk is shown from the quantity of whey butter manufactured. The breaking at Mr. Harding's usually occupied a full hour. The heat is raised in scalding to one hundred degrees. Their cheese apparatus is inferior to ours, and hence I think that part of the process is not capable of being done so well as with us, since heat is not applied so evenly to all parts of the mass; but from this point there is a wide difference in the treatment of the curds. When the curd has reached a firm consistency, and the whey shows a slightly acid change—*a change so slight* as to be detected only by the experienced observer—it is immediately drawn and the curd heaped up in the bottom of the tub. I am not sure but this early drawing of the whey is an improvement.

When in London I had some conversation with Dr. Voelcker, the celebrated chemist of the Royal Agricultural Society. Among other things, he said:—" One of the greatest faults of cheese-makers is in the application of heat. Many use too high heat. The lower the temperature that can be used, and the more evenly it can be applied, the better flavor will obtain to the cheese. Another point of importance in cheese-making, and one not generally understood, is in relation to the whey. It should be drawn off, got rid of just as soon as possible, or as soon as consistent with the necessary operations." He would draw the whey sweet. The reason he gave was, that "you can never tell what matter you have or what you are dealing with in the whey. It may contain taints of the worst character. You cannot well determine the degree of its acidity, and hence great risks are run in steeping the curd for a long time in the fluid." He would prefer to draw the whey as early as possible and allow the curd to undergo the proper change and arrive at maturity heaped up in the bottom of the vat.

Soon after the whey is drawn and the curd heaped, it is cut across in pieces a foot or more square and thrown again in a heap to facilitate drainage and develope further acidity. It remains in this condition for half-an-hour, the whey meanwhile flowing slowly from the heap, when it is taken out of the cheese tub and placed in the sink or cooler. It is then split by the hand into thin flakes and spread out to cool. The curd at this stage has a distinctly acid smell, and is slightly sour to the taste. It is left here to cool for fifteen minutes, when it is turned over and left for the same length of time, or until it has the peculiar mellow or flaky feel desired. It is then gathered up and put to press for ten minutes, when it is taken out, ground in a curd-mill, and salted at the rate of two pounds salt to the hundred weight (one hundred and twelve pounds) of curd. It then goes to press, and is kept under pressure two or three days. The curd, when it goes to press, has a temperature of from sixty to sixty-five degreees, and when it is in the sink it is preferred not to get below this point. A proper temperature is retained in the curd during the various parts of the process, in cool weather, by throwing over it a thick cloth. It will be seen that, the whey being disposed of at an early stage, the attention of the manufacturer is to be directed only to one substance—the curd. By draining the whey and expelling it under the press, and then grinding, a uniform incorporation of this material is effected. The cooling of the curd before going to press, and the removal of the cheese after the pressure, to a cheese-room, where an even temperature is kept up, differing but little from that of the cheese when taken from the press, effects a gradual transformation of the parts into that compact, mellow, flaky condition which is characteristic of the Cheddar, and at the same time preserves its milky or nutty flavor.

Now, apparently, there is nothing difficult in the process; but the great art in this as in other methods of cheese-making, is to understand the condition of the milk and the state of the curds during their various manipulations. These cannot be described, but can only be learned by experience. The process, however, is more easily acquired than that usually practiced at the factories, since the whey being got rid of, the curd is placed under better control of the operator, and the pressing, grinding and salting must, in this respect, make a more uniform product. We can scarcely yet appreciate the part that chemistry plays in the manufacture of cheese. We use a chemical agent—rennet—the nature of which even the most learned chemists do not fully understand. We note the changes that this produces in the milk and manipulate it in its new condition. We then employ heat, another agent, and develope an acid; then another agent, salt; and what wonder that, in all these conditions and changes, the careless and unskillful operator should fail in the quality of the article which he produces or the standard which he sets out to reach?

The most profound chemists are often thwarted in their operations by inexplicable conditions which, at first sight, seem easy of solution. Thus, for instance, take four well-known substances, viz., grape-sugar, corn-sugar, starch, and wood, each of which is made up of only three elements, carbon, hydrogen, and oxygen, which it must seem easy to use so that either of these substances could be converted into the others. There is very little difference, it will be seen, in the composition of any of these substances, and yet how widely different are they to our senses. It would seem a very simple thing to convert one of these substances into another by merely adding or subtracting an element, yet we find that the most expert chemists experience the greatest difficulty in bringing about a result which nature is constantly accomplishing in her silent laboratories. The more we can reduce cheese-making to a science, and confine it within certain rules, the better will be our practice and the more uniform our product. It may not be advisable to adopt any one system exclusively, since fine cheese can be made by various methods;

but the study of the cheese-maker should be to seize upon a good point whenever he can find it, and combine it in his own practice. Mr. HARDING believes a sharp-cutting instrument in breaking the curd is injurious, and that the curd should be allowed to split apart according to its natural grain; other persons in England, quite as good cheese-makers, believe in sharp-cutting implements; of these I might mention Dr. VOELCKER of London, and Mr. McADAM of Gorsly Hill, who has not only written well on cheese-making, but has done much in introducing the Cheddar system into Scotland and Cheshire. Of this, however, we may assure ourselves: by no system can good cheese be made unless the manufacturer studies his business, and learns, by close application, by observation and experience, the changes that are going on in the process with the whey and curds, and can properly manipulate them.

CHESHIRE CHEESE-MAKING.

I suppose that many of our cheese-makers would hardly suspect that a really fine, delicious cheese could be made by the following process, which is the one in general practice in Cheshire; and yet some of this cheese cannot be surpassed in flavor and excellence. The Cheshire mode of cheese-making is somewhat peculiar, and, to an American, would be called decidedly antiquated. The night's milk is usually set in pans and added to the morning's mess, when it is set with rennet at a temperature of about seventy-five degrees. Often no heat is applied—the morning's milk being sufficiently warm to keep the mass up to the desired temperature for setting. After the rennet is applied, the coagulation is perfected in about an hour, when it is carefully broken up with a wire or tin curd-cutter, of similar make to the old American curd-cutter.

The breaking being perfected, and the curd becoming sufficiently firm, without any additional heat being applied, the whey is dipped off. The curd is then lifted into a drainer or kind of sink, where the whey can drain off more thoroughly, and from time to time the curd is cut across and heaped up, so as to facilitate a more thorough separation of the whey. It is then salted, by guess, and ground in a curd-mill, when it is put into the hoop, but not immediately to press.

The hoops filled with curd, are set in a warm place for a day or so, generally in a kind of oven constructed for the purpose; and, on the second day are put under press. Here they are kept several days, as in the Wiltshire and Gloucestershire districts. The hoops have no followers. They have a bottom pierced with holes, which is stationary. A strip of tin, four or five inches wide, is placed about the curd on the inside of the hoop, or above it, so as to raise the curd above the top of the hoop. A board is now thrown or placed on top of the curd, and as the press is applied, the tin sinks down with the curd until it is pressed even with the hoop. If the cheese is not found to be solid enough, another hoop of less hight, is used, and the tin put around that portion above the hoop, and pressed in a similar manner. Many of the presses are nothing but large square blocks of stone raised by a screw. They are rude affairs. The bed-pieces on some are of stone, with a flue beneath for conducting heat, in order to keep the cheese warm while pressing. The milk is worked up into curd, and the utensils cleaned up every day by twelve o'clock M.

It was really a matter of surprise to find that fine cheese could be made by this process, where everything is done by guess, and where all the operations are so different from our method. But a great deal of poor cheese is made in the Cheshire dairies, and as a whole is inferior to our factory make. That which is the best is as fine in flavor and quality as any cheese made, and will command the highest prices. The texture of Cheshire cheese is different from the Cheddar, being what is termed "open meated," that is, loose in texture without being porous. Their best cheese appears richer in butter than the Cheddar.

I have merely given the outlines of the Cheshire mode of cheese making, as a matter of curiosity. In my judgment there is nothing in the process adapted to America, we being at least fifty years ahead in our appliances and mode of manufacturing. I must say this, however, in favor of Cheshire dairymen: everything connected with the dairy is kept scrupulously clean. The floors, the utensils, and every part of the dairy are sweet and clean. And here, perhaps, is the secret, or at least a part of it, of the fine, clean flavor of their best cheese. During a portion of the time the Cheshire cheese is undergoing the process of curing, the cheese is placed on straw or hay upon the floor of the curing room.

APPEARANCE AND COMPARATIVE MERITS OF AMERICAN CHEESE ABROAD.

Having now described the manufacture of the leading styles of English cheese, it may be well to say something in regard to the appearance of American cheese in England, and what is thought of it in the foreign markets. I went into nearly all the principal market towns in England from the south to the north, and heard hundreds of people discuss the merits and faults of American cheese at the storehouses, the shops and at the table. I took much pains to get at the true state of feeling in the country, and I think I may safely say that American cheese to-day, as a whole, has more quality and is better manufactured than the bulk of English cheese.

I have given them the credit of producing a limited quantity of cheese of the finest type that has ever been reached by any manufacture, but the quantity is comparatively small, and when the whole bulk is considered, there is nothing like the richness and uniformity of that from our factories. This is not only my own opinion, but that of many of the best judges of cheese in Great Britain. I have been at hotels where American cheese is always purchased in preference to English, and I have been amused to hear Englishmen contend that no such cheese could be produced in America, and nowhere else except in the best dairies of England, but who were forced to give way on pointing out to them the bandage, which is an indisputable proof of American manufacture. Country dealers, cotters, middlemen, and shippers, admit that the highest grades of our factory cheese have more quality and are superior to the general run of English make.

I have often heard dealers declare in a spirit of vexation that if the Americans continue to progress in the ratio of the last four years, two or three years more will place their cheese at the top of the market, and English make must rank secondary. They say the Cheshire dairymen are "dough-heads" not to try to keep pace with modern improvements. I have seen a dealer look at American and English cheese side by side, and while admitting that the American was in every respect the best, take the English at a higher price, because, as he said, some of his customers had such foolish prejudices that they would not try the American, and therefore could not judge of its quality. A leading dealer in Manchester told me he had many times tried to introduce American cheese among certain of his customers, and that they would not purchase. By and by, when they sent up an order, he would slip in a few of nice grade factory make, and after that the customer would be eager to purchase, declaring he never cut up better cheese.

Now, this is the condition of things all over England; there is prejudice to overcome, because formerly our cheese was of bad character, and there is a feeling that it is of such perishable nature that it will spoil if not immediately consumed. These remarks apply to the nice grades of cheese. There is another class of our cheese which comes into market that does great injury to sales. It is cheese that is rich and well made but of bad flavor. This, and large shipments of inferior make,the accumulated refuse from good and indifferent lots which cannot be sold alone, are mixed up with good samples and shipped abroad to clean out New York storehouses.

These lots drag on the market; they are constantly accumulating, and sales are forced, which breaks the market, besides carrying a prejudice whereever they go, against American cheese. As to the outward appearance of American cheese, as I saw it abroad, it is generally good. Of course some of it comes to hand soft, melted, and in wretched condition, but generally the great bulk of factory make comes in store quite as bright and handsome as does the English manufacture. Many of the large dealers told me they had never had American cheese come to market with handsomer outward appearance than this year's (1866) make. And I think in getting the comparative merits of the cheese of the two nations we have often been misled and wrongly informed. Great condemnation has been made of our poor cheese, all of which was well deserved, but while great stress has been laid upon this, there has been a studied care to conceal the merits of our best goods. This is but natural. Men engage in the cheese trade to make money; they run great risks, and cannot be expected to post others up to their own disadvantage. The laws of trade are "to buy cheap and sell dear;" and so, after all, perhaps, they are not so much to blame.

Some of the dealers, acting in concert with parties in New York, take great pains to keep factories which make prime cheese, in ignorance of the fact. The factory names are erased from the boxes, and so customers are supplied with a line of cheese which they can only trace to the private brand of the dealer. Some have acquired in this way an enviable reputation for handling choice American cheese, and have made largely by the practice. It is a great damage to the factories, since other dealers are kept ignorant of the brands, and cannot enter into competition for the purchase. I know of no way for this to be remedied except by branding the name of the factory on the bandage. Perhaps a good way also would be to have the name of the factory neatly cut in rather broad letters upon the pressing follower, so that the cheese when pressed will show the name of the factory in raised letters. There is no difficulty in this, and no hurt will result to the cheese. I have seen samples of English cheese where elaborate figures were raised upon the surface in the manner suggested, but I would not advise any "gingerbread work"—nothing but plain carving.

STYLES OF CHEESE DEMANDED.

The styles of cheese demanded for the trade will depend somewhat upon the market for which they are intended. In London small Cheddar shapes of forty, fifty, sixty, and seventy pounds are popular, and will command an extra price over cheese of large size of the same quality. The true Cheddar shape is fifteen and a-half inches in diameter by twelve inches in hight, and by preserving this proportion for larger or smaller cheese that style is obtained. Cheddars are made varying in size from those named up to eighty and one hundred pounds, but the larger are not so common. A limited number of those weighing one hunded pounds would readily find sale. Those weighing about seventy pounds are not objectionable, but the smaller sizes are of readier sale, and often on account of their size bring better prices. It costs more, however, to manufacture small cheeses, and there is greater loss in shrinkage; and this ought to enter into the account in determining the size that will be most profitable. It would be well for factories to make two sizes of Cheddars, regulating each somewhat in accordance with their own convenience. The Cheddar shapes are popular all over England, and therefore may be regarded as best adapted as a general rule for our factories to make for exportation.

There is another style called the Derby shape, which, when made of fine quality, brings the highest prices. It is a small, flat cheese, fourteen to fifteen inches in diameter, and two and a-half to three inches thick, and weighing twenty-five to thirty pounds. If care be taken in boxing, two cheeses might be put in a box, and thus the expense on that score lessened. There should be two heavy scale boards between the cheese, and none but well-made, substantial boxes used. There is a moderate demand for our old-fashioned shaped cheese—that is, a cheese half as high as its diameter, and weighing from sixty to eighty pounds, but it should not exceed one hundred pounds. In Liverpool a variety of styles are worked off readily. Several of the dealers there told me they had no difficulty in disposing of cheese weighing one hundred and twenty pounds to one hundred and fifty pounds, providing it was all right as to quality and flavor; but I am satisfied, after going among the country dealers in different parts of England, that preference is always given to cheese of smaller size when the other qualities are satisfactory.

COLOR.

The matter of color is a question which has long occupied the attention of American dairymen, and upon which very indistinct notions have been entertained. This is not to be wondered at when the different markets in England give preference to a variety of shades, and different dealers ask only for the color of their particular market. The Londoner likes a cheese of considerable color, something like the rich shade of butter made when the dandelions are in bloom. It must be clear and pure; not lemony or dirty, or mottled through the cheese, but a rich shade of cream that gives a pleasing effect to the eye, thus serving to highten the imagination that a delicious morsel is before you.

London is the grand metropolis of the world, where wealth is unbounded. The best articles of food readily find a market here, and command the highest prices of any in the kingdom. If they can only get the *best* they are willing to pay for it, and this is the reason why choice cheese never goes begging at top prices. When I went through the Manchester cheese markets they told me that colored cheese was a drug and did not suit that market. A very extensive dealer had just returned from Liverpool disappointed in not obtaining a supply of pale-colored cheese. In prices, quality and shape, he said, there was no difficulty in being suited, but his customers insisted upon an uncolored article, and as that was not to be had he did not purchase. It was in this man's storehouses that I saw some of the Herkimer county, New York, "coarse curds," and they were commended for their texture and quality. There are large quantities of pale-colored cheese made in England, and considerable of the high-priced Cheddar has no color except that which results from the natural condition of the milk.

I went down to Chippenham to see the great annatto manufacturer, Mr. Nichols. His preparation bears the reputation of the best in England, and I thought it might be worth while to have him send over samples, and thus have an article that was approved by English dealers. Mr. Nichols was willing to send out samples on my assurance that they would be properly distributed; but when I reached London I learned from the chemists a secret which is worth a good many thousand dollars to American dairymen. It is, that all preparations of annatto depend for their excellence, not so much upon any patent for dissolving or cutting the crude annatto as upon the *purity* of the annatto itself. All the best English liquid annatto is cut with potash, so that American dairymen can just as well make their own coloring material as to send abroad at great expense for the English article. But it is important that we obtain a *pure article*, and this can only be secured by purchasing of a reliable person who is a good judge of it. If you use a bad article you are sure to get a bricky, uneven color, which is so objectionable, and which reduces the price of cheese.

BANDAGES, BOXES, ETC.

In regard to bandaging and boxing I may remark that no cheese should be made in America for shipping abroad without having a bandage upon it, and without being put up in a strong box with heavy scale boards. I have seen considerable quantities of English cheese in the storehouses split open at the sides, a prey to skippers, and upon which losses were sustained. The Cheddar dairymen put a coarse linen bandage upon their cheese during the process of curing. It is brought round tight and temporarily secured. Some work eyelet holes at the ends of the bandage and bring it snugly about the cheese by lacing, as you would fasten a shoe upon the foot. These bandages are stripped off when the cheese goes to market.

The cheeses would be better protected if they had permanent bandages, on our plan, and some of the English dairymen advocate its introduction in their dairies. By not bandaging something might, perhaps, occasionally be gained in helping the English dealer to deceive his customers by palming off our cheese as of English manufacture; but good factories would lose their identity, and the loss from breakage and other sources would overbalance by far, this advantage. Besides, it should be our object to make for American cheese a reputation that shall stand unchallenged as the best in the world.

DEFECTS IN AMERICAN CHEESE—BAD FLAVOR, ETC.

We come to consider the two leading defects in American cheese—porosity and bad flavor; and the last may be said to-day to overbalance all the other defects put together, *two* or *three* times over. I need not waste time upon that character of cheese known as soft, spongy, or salvy, or the poor grades which come from carelessness, inefficiency, or ignorance in manufacture. Good cheese-makers know at once how these may be corrected, but I refer to the better class of cheese made at factories. The English acknowledge that the American factories stand unrivaled as sending out a cheese full of *meat*—that is, full of butter or rich in quality. They speak in high terms of the improvements that have been made in texture, firmness and solidity; but to see a cheese handsome in appearance, the meat having scarcely any objectionable feature to the eye or finger, yet under the nose a disagreeable odor, is what they cannot well understand. The large exportation of this poor, indifferent, or bad-flavored cheese, more than anything else, breaks prices and does immense damage.

The causes of bad flavor in cheese are various—insufficient and uneven salting; a faulty separation of the whey from the curds before going to press and while pressing; putting the curds to press hot; high heat and a rapid manipulation of the curds, getting them in press before the proper chemical changes have been effected; but the chief causes of bad flavor in well-manufactured cheese, as I saw it abroad, are, in my opinion, bad milk, bad rennet, and bad curing of the cheese. I am satisfied that the cool, even climate in England, and the excellent condition of the milk, together with the uniform temperature of their curing rooms, enable them to succeed where we often fail. We have a hot-bed climate to contend with, and milk is often spoiled when it reaches the factory. If our dairy farmers would only look upon this matter in its proper light, instead of laying all the blame of bad-flavored cheese upon the manufacturer, there would be some hope of improvement. They send to the factory tainted milk and demand from it a perfect cheese. They impose upon the manufacturer conditions which no skill has yet been able to surmount. High skill and great experience in manipulating milk, together with favorable weather, and the putting the cheese in market at the right moment, may enable the manufacturer to counteract in part the faults of tainted milk; but with intensely hot weather, and under unfavorable circumstances, it is beyond his art. Bad rennet and tainted milk are prominent causes of the early decay of our cheese.

We are told that American cheese will decay early. I have seen American cheese in England more than a year old, perfect in flavor and in the best preservation, but it was not made in hot weather. The cheese made in July this year, 1866, and sent to England, was all of it, more or less of bad flavor. The complaint was universal, and against some of the most noted factories in America. We must look upon these things from the practical side. I will not deceive the dairymen of America with a fine-spun theory. We have been greatly led astray in regard to this matter of flavor—led to believe that the people of the Old World had discovered some wonderful process which would ensure a perfect cheese under all conditions of the milk; but I found the leading feature of their success was in cleanliness and an untainted condition of the milk.

It is well known that milk not divested of its animal odor, and closely confined in hot weather, soon becomes putrid. Cheese manufacturers tell me that milk often comes to the factory having a most fetid and sickening odor. In extremely hot weather, when cows have been exercised or unduly excited the milk is often of a rank odor as soon as drawn. The practice of putting warm milk in tight cans and conveying it a long distance to the factory is objectionable, especially in hot weather. Here is the commencement of bad flavor. The good milk is inoculated with putrid matter, which shows itself sooner or later, and carries with it decay like any other decomposition. Some plan should be adopted for cooling the milk, or exposing it so that the animal odor may pass off, especially in hot, sultry weather. I feel certain, from my observations both here and abroad, that this is a leading cause of bad flavor, and hence the practice of the Cheddar dairymen in getting rid of the whey as early as possible, and the exposure of the curd a long time to the atmosphere, is founded upon philosophical principles. It is important to the dairy interest of America that a reputation be maintained for producing the finest-flavored and best cheese made in the world, and, under our improved system of manufacture, with proper care as to the purity of milk, this will be of easy accomplishment.

Again, the cheese-producing sections of the Union are being developed so rapidly that competition every year must be greater and greater. Every factory should now establish a reputation for "extra fine goods." They should keep the best manufacturers in the country. Make it an inducement for them to stay with you. High skill and experience command ample remuneration the world over. Old and established factories can afford to pay for it, rather than let new districts pick off their best cheese-makers. The London dealers complain that there is too little probability of factories sending forward a uniform brand of prime cheese year after year. They want a brand that can be relied upon, and when they find such will pay an extra price for it. The curing rooms ought to be arranged so that the temperature may be controlled. The curing rooms of England have walls of stone or hollow brick. The climate is cooler, more moist and less variable than ours. These facts ought to afford suggestions in the construction of our curing-houses. There is another way in which flavor is lost; the shipment of cheese in hot weather, to lie in New York until heated through and through, and then stowing away in the vessel with cargoes of grain, oil-cakes, or some other freight from which taints are absorbed. Much of our nice cheese is injured in this way. In Bristol, Bath, London, Chester, Liverpool, Manchester—in fact, all over England, the commercial storehouses for cheese are well constructed for the purpose of preserving flavor. They have stone floors, are cool and well ventilated. Cheese that comes in bad condition is often taken out of the boxes, or the covers removed, and then laid upon the floor to cool.

The fine compact texture of English cheese, in my opinion, results, in a great measure, from their process of expelling the whey, grinding in the curd-mill, salting and pressing. I may remark that while porousness is an objection, if the texture is not of a *honey-comb* character, but will fill the trier with a tolerably compact mass, dealers do not urge a reduction of price, if the flavor and quality are perfect. Extreme porosity shows a defect in manufacture, and carries with it the impression that the cheese will sooner go to decay, and is therefore dangerous to handle, requiring quick sales.

THE PROSPECTS OF THE ENGLISH MARKET.

In closing, a word may be offered in reference to the prospect of future exportation and prices. The English are a great cheese-eating people. We have no conception of the extent to which this food enters into general consumption. Those who can afford to eat a good article purchase the best, and the poor take up with that which is inferior and bad. I have seen tons and tons of the most worthless stuff, apparently fit only for the pigs, in the shops and public markets, and it had a rapid sale. The cutters are extremely expert. They use a thin, circular knife, like a half moon, having an upright handle springing from the centre, and with this they cut the cheese upon the counter. They also use a fine wire, with handles at each end, for splitting a large cheese. I have been surprised at the accuracy with which they will cut the different weights. The crumbs are laid on one side, to be used for balancing the scales. There is an immense demand for inferior or low-priced cheese. If we could manufacture cheese so as to sell on the counter at four-pence to sixpence per pound, I think they would take our whole product. Cheese does not come upon the table with pastry, as with us, but is brought on as a separate and last course. A half or a quarter of a cheese, placed upon a silver dish, with a clean, white napkin under it, is set upon the table and cut as desired. I think there must be a good foreign demand for American cheese for some years to come. The production has been cut off in the northern districts of England. The cattle plague has been terrible in its ravages through this section. In Cheshire and the adjoining counties the losses have been fearful. The Cheshire people feel very melancholy, and many of the farmers are unable to pay their rents. Some of them are trying sheep-farming, but with indifferent results. They have been long a dairy people and understand the management of cows. I am convinced they will go back to dairy farming when the cattle plague shall be effectually eradicated—and that appears now to be almost accomplished—but they will hardly get established again for a year or two. They will not abandon dairying till we can furnish cheese so cheaply as to drive them from the market. The cost of transportation and the high prices of labor, and heavy taxation, are against the production of a cheap cheese on this side, at least in the older States. Holland, too, enters into competition with us. She is now shipping to England 80,000,000 pounds of cheese per annum. Last year (1865) the quantity imported was nearly 73,000,000 pounds. The passage can be made in a day, and the cost of exportation is a mere trifle. Their cheese is very good, but not equal to ours; but they are improving every year in quality. They make three styles of cheese, which are popular among the poorer classes. The Edams and Middlebaes are round, like a cannon ball, and weigh from six to twelve pounds. The Goudars are a small, flat cheese, of about twenty pounds weight. The agricultural laborers like Edams, as they can take a cheese into the field and cut it without waste. These cheeses sell at from eight to ten shillings per hundred weight, below American. There is less difference between the Derby Goudar and the American, the former often selling within four shillings of the price of ours.

Our future successes will depend upon our making fine cheese, and getting it to market at cheap rates. Something might be done in opening up new markets. The English export cheese to Australia, the Cape of Good Hope, Brazil, and various other points. Something should be done by the cheese makers and shippers in the way of regulating exportations. If we could give England a steady supply, without pushing forward an immense quantity to clog the market, prices would be maintained, and greater profits realized.

The following table gives the number of packages of cheese shipped from New York to Liverpool, from May, 1862, to September, 1866, made up so that the comparative weekly shipments of the different years may be seen at a glance:

Weekly Exports of cheese from New York to Liverpool.

WEEK ENDING		1862.	PACKAGES.	1863.	PACKAGES.	1864.	PACKAGES.
May	9	2,120		3,692		2,261	
	16	857		1,942		1,539	
	23	1,726		9,364		1,323	
	30	1,262	5,975	4,446	19,444	3,268	8,391
June	6	1,643		3,040		4,374	
	13	3,280		12,174		6,897	
	20	6,362		8,744		5,232	
	27	7,756	19,041	17,456	41,414	10,090	26,593
July	4	7,107		22,896		24,090	
	11	13,441		17,032		29,886	
	18	6,961		29,561		47,944	
	25	27,483	54,992	19,153	88,642	33,103	135,023
August	1	35,195		16,316		38,170	
	8	....		22,024		20,447	
	15	5,485		27,378		16,669	
	22	37,309		13,342		22,817	
	29	24,449	102,438	11,650	90,710	18,211	116,314
September	5	30,315		11,068		15,396	
	12	19,255		16,540		14,544	
	19	24,442		19,816		19,457	
	26	14,130	88,142	18,670	66,094	24,293	73,690
October	3	8,146		18,582		15,250	
	10	24,203		31,104		18,805	
	17	15,038		21,792		12,406	
	24	18,886		38,714		20,653	
	31	11,558	69,811	26,082	136,274	25,542	92,656
November	7	24,302		22,818		24,674	
	14	24,196		17,706		23,700	
	21	13,705		10,110		15,369	
	28	18,840	73,043	20,115	70,749	24,921	88,664
December	5	938		12,485		11,794	
	12	8,450		12,787		8,496	
	19	8,329		10,268		11,919	
	26	9,843	27,560	5,533	41,073	9,901	42,110
		1863.		1864.		1865.	
January	2	12,141		5,971		2,975	
	9	....		11,963		8,623	
	16	3,475		2,216		20,081	
	23	7,296		2,632		19,156	
	30	14,122	37,034	7,834	30,616	2,685	53,520
February	6	886		6,423		4,851	
	13	9,587		10,834		16,069	
	20	1,295		4,813		5,689	
	27	1,798	13,566	16,479	38,549	15,658	42,267
March	5	929		5,583		2,718	
	12	4,164		770		894	
	19	3,428		13,202		13,901	
	26	1,454	9,975	7,558	27,113	2,770	20,283
April	2	4,166		2,987		2,213	
	9	4,348		13,470		4,412	
	16	11,762		5,072		4,199	
	23	2,742		2,037		3,745	
	30	3,842	26,860	2,886	26,432	976	16,545
Total,		....	528,427	....	677,110	....	716,256

Weekly Exports of cheese from New York to Liverpool—*Continued.*

Week Ending		1865.	Packages.	1866.	Packages.		
May	9	2,278		927		...	
	16	4,404		656		...	
	23	253		1,170		...	
	30	214	7,149	4,869	7,622	...	...
June	6	3,861		2,614		...	
	13	6,091		6,168		...	
	20	20,714		11,374		...	
	27	11,751	42,417	14,480	34,337	...	...
July	4	36,345		20,994		...	
	11	16,391		21,447		...	
	18	35,097		27,875		...	
	25	25,314	113,147	30,423	100,738	...	...
August	1	30,334		17,068		...	
	8	23,769		11,939		...	
	15	27,476		23,882		...	
	22	25,367		28,138		...	
	29	51,466	158,412	21,975	102,822	...	...
September,	5	27,383		...		...	
	12	27,634		...		...	
	19	20,139		...		...	
	26	14,046	89,211	...	...	...	...
October	3	1,586		...		...	
	10	2,335		...		...	
	17	4,745		...		...	
	24	1,598		...		...	
	31	4,643	14,907	...	...	...	...
November	7	7,168		...		...	
	14	5,812		...		...	
	21	10,307		...		...	
	28	11,889	35,176	...	...	...	...
December	5	4,121		...		...	
	12	9,347		...		...	
	19	4.038		...		...	
	26	1,926	19,432	...	...	...	...
		1866.		1867.			
January	2	8,274		...		...	
	9	1,531		...		...	
	16	1,117		...		...	
	23	1,395		...		...	
	30	839	13,156	...	...	...	...
February	6	4,171		...		...	
	13	5,530		...		...	
	20	470		...		...	
	27	340	10,511	...	...	...	...
March	5	142		...		...	
	12	...		...		...	
	19	302		...		...	
	26	269	713	...	...	...	...
April	2	493		...		...	
	9	619		...		...	
	16	3,660		...		...	
	23	1,142		...		...	
	30	362	6,276	...	...	...	...
Total		...	510,507	...	245,520*	...	
					321,125†		

Shipments of cheese to London from May 1 to August 31, 1865, 21,000 boxes; 1866, 37,000 boxes.

* Total from May 1, 1866, to September 1, 1866.
† Total during same time, 1865.

In the foregoing table the average weight of the packages may be estimated at about seventy pounds each. The following table gives the quantity of cheese shipped from New York to Liverpool from May, 1865 to December 20, 1866, reduced to one hundred pound packages, with the average weekly price in shillings (English) at which American cheese is sold in London. The tables are valuable in showing how prices are influenced by excessive shipments at any one time:

SHIPMENTS OF CHEESE FROM NEW YORK TO ENGLAND, WITH PRICES IN LONDON.

1865–'66.					1866–'67.				
WEEK ENDING	BOXES.	100 LBS.	PRICE IN LONDON.		WEEK ENDING	BOXES.	100 LBS.	PRICE IN LONDON.	
1865.			1865.	*Shillings.*	1866.			1866.	*Shillings.*
June 6	3	45	June 22	64 to 68	June 5	3	218	June 21	76 to 82
13	3	850	29	64 to 66	12	3	393	28	76 to 82
20	9	703	July 6	64 to 66	19	4	457	July 5	76 to 80
27	8	219	13	56 to 62	26	7	649	12	74 to 78
July 4	20	158	20	60 to 62	July 3	10	272	19	72 to 76
11	14	607	27	60 to 62	10	12	506	26	70 to 74
18	18	67	August 3	58 to 62	17	16	299	August 2	70 to 74
25	24	544	10	58 to 62	24	16	234	9	70 to 74
August 1	20	95	17	56 to 60	31	10	627	16	70 to 72
8	9	809	24	58 to 62	August 7	11	527	23	70 to 72
15	18	278	31	56 to 60	14	13	313	30	70 to 72
22	30	779	September 7	58 to 60	21	12	983	September 6	68 to 70
29	26	998	14	58 to 60	28	16	466	13	66 to 70
September 5	17	546	21	56 to 62	September 4	17	374	20	66 to 70
12	12	342	28	56 to 62	11	17	126	27	64 to 70
19	16	531	October 5	56 to 62	18	4	914	October 4	62 to 68
26	4	486	12	56 to 62	25	7	716	11	62 to 68
October 3	4	486	19	60 to 63	October 2	15	82	18	62 to 66
10	2	325	26	60 to 63	9	16	391	25	60 to 64
17	2	201	November 2	60 to 63	16	10	787	November 1	60 to 64
24	6	596	9	60 to 66	23	19	705	8	60 to 64
31	3	838	16	65 to 70	30	8	261	15	60 to 64
November 7	4	175	23	65 to 70	November 6	8	154	22	60 to 64
14	6	10	30	65 to 70	13	11	660	29	60 to 64
21	11	636	December 7	65 to 70	20	8	858	December 6	62 to 66
28	7	361	14	65 to 70	27	10	847	13	66 to 68
December 5	4	640	21	65 to 70	December 4	11	551	20	66 to 68
12	6	329	28	65 to 70	11	15	506	27	66 to 68
19	5	683			18	10	981		
26	6	81	1866.		25	6	413		
1866.			January 4	66 to 70	1867.				
January 2	5	683	11	68 to 70	January 1	6	413	......	......
9	4	49	18	68 to 70	8	18	158	......	......
16	2	996	25	68 to 72	15	......	......	......	......
23	1	352	February 1	68 to 72	22	......	......	......	......
30	1	983	8	68 to 74	29	......	......	......	......
February 6	5	553	15	68 to 74	February 5	......	......	......	......
13	3	146	22	74 to 78	12	......	......	......	......
20	2	747	March 1	74 to 80	19	......	......	......	......
27	......	407	8	74 to 80	26	......	......	......	......
March 6	......	580	15	74 to 80	March 5	......	......	......	......
13	......	865	22	80 to 84	12	......	......	......	......
20	......	124	29	80 to 84	19	......	......	......	......
27	2	157	April 5	78 to 82	26	......	......	......	......
April 3	1	133	12	78 to 82	April 2	......	......	......	......
10	1	706	19	78 to 80	9	......	......	......	......
17	......	460	26	78 to 80	16	......	......	......	......
24	......	168	May 3	80 to 81	23	......	......	......	......
May 1	......	906	10	80 to 81	30	......	......	......	......
8	......	396	17	80 to 82	May 7	......	......	......	......
15	1	871	24	80 to 82	14	......	......	......	......
22	......	563	31	73 to 76	21	......	......	......	......
29	2	515	June 7	73 to 76	28	......	......	......	......
			14	76 to 82					

ENGLISH DAIRY PRACTICE.

RECENT IMPROVEMENTS.

The following account of recent improvements in English dairy practice is from the pen of Mr. Joseph Harding of Marksbury, England, who is well known as the great exponent of Cheddar cheese making in Great Britain. The paper will be of interest to American dairymen.

The spirit of improvement which has so largely pervaded the agricultural world during the last twenty-five or thirty years is not more manifest in the production of corn and meat than it is in the manufacture of butter and cheese; and though the latter branch has not derived as much benefit from the assistance of national or local agricultural societies as the former, it has yet made great progress both as to the quantity and the quality of its products. To the attainment of this object nearly every well-informed and intelligent dairy farmer has contributed his part. In detailing these improvements I may not, perhaps, be expected to go into all the dairy districts of England, and to particularize every improvement which has taken place in each of them; my experience, as a Somershetshire man, milking a dairy of my own of from seventy to seventy-five cows, will enable me to speak from personal and practical knowledge as to the improvements, in all their details, in the dairy practice of my own county, more especially in the manufacture of cheese.

I believe, however, from the knowledge which I have of other dairy districts, such as Gloucester, Wilts, Leicester, Derby and Cheshire, that any disinterested person taking upon himself to write upon the subject could not fix on a district better calculated to answer the requirements of the Royal Agricultural Society of England than the county of Somerset. It is true that this county is not much noted for its butter; but as a district for making cheese, due regard being had both to quantity and quality, it is not surpassed in Great Britain. Here is made what is termed the "Cheddar cheese," which is always quoted in the London market at a higher price than any other (Stilton excepted, which is not a fair example). Here, too, an example has been set in the improvement of machinery, utensils and mode of manufacture, which has given a stimulus not only to all the surrounding districts, but even to Scotland.

But my business is not so much to eulogize the dairy practice and produce of this or any other district, as to detail, in a simple and intelligible manner, any improvements which have tended to increase the quantity, improve the quality of these products, and at the same time to reduce the labor of manufacture.

INCREASE IN QUANTITY.

In order to show an increase in the dairy produce of any given district, it would be necessary to know its aggregate amount at different periods; but as, to the best of my knowledge, no records exist which furnish this information as derived from any dairy district in England, it will be impossible to contrast our present average produce with that of former years. The only course, therefore, which we can adopt is to take a single farm which may be considered a fair specimen of the district in which it is situated. A farm of one hundred and fifty acres in this county, of fair quality, divided into one hundred and ten acres of pasture and forty of arable, would, some years ago, probably have been stocked with thirty cows, five or six heifers (to keep up the stock), besides a few horses. The arable course would have been—one, fallow; two, wheat; three, beans; four, wheat again; five, clover mown twice, then fallow again; barley being grown occasionally on suitable soil. It was thought that on the pasture land no more cows could be kept than the one-half would maintain in summer, the other half being mown for winter-keep; that would give (allowing three acres per cow) ninety acres for thirty cows, and twenty acres would be left for the young stock and horses. The arable land at this time received the greater part, if not all, the manure.

A farm of this description would now keep fifty cows. The larger part of the arable land would be in grass and roots, corn being grown only on the decay of the grass plant, which, instead of being mown, would be grazed by the cows, and admit of being stocked a fortnight earlier in spring than the meadow grass: the straw would be cut into chaff and mixed with roots, meal, oil-cake, or some other substitute to make it equal in nutriment to hay. The roots would be chiefly grown by artificial manures, and a portion of them fed off by dry sheep, so that a considerable part of the yard manure could be spared for the pasture land. Although I have spoken above only of an increase of twenty cows, I know some farms on which the extra number is even larger.

Where the farm is wholly pasture, as is the case with a large number of the dairy farms in this county, there cannot be as large an increase of produce as is stated above. Yet even here, as the land is made to carry as much stock as possible, the increase in the number kept is considerable. Some farmers will feed nearly all their land and sell the cows in the autumn, looking forward to replacing them in the spring of the year. This seems to be an expensive mode of increasing dairy produce; but where the land produces a large quantity of milk the grass is of far more value than the hay.

Others, again, have adopted the plan of preserving a few acres of aftermath (after being fed once) till the spring; the young grass is thus drawn up by the shelter which the old affords, and consequently comes to feed earlier than it would otherwise do. This feed is valuable for turning out the cows by day; it thus both lessens the consumption of hay and increases the yield of milk. Among my acquaintance the farmer who realizes the largest amount of profit per cow, lives in Leicestershire, and makes both butter and cheese. His farm is a loamy soil, not much affected by drouth or wet, so that it is generally in a growing state throughout the summer. He keeps only cows and young stock. The cows have the first feed of every field, the heifers following them in the round of the farm. A man brings up the rear to clean up the droppings, so that the field is clean and fresh for the cows on their next round.

The building of houses and yards for the accommodation of the cows has not a little tended to an increase of produce, inasmuch as it has enabled us to keep the stock off the land during the winter months. The grass consequently grows earlier in the spring, and enables us to mow earlier, so as to secure a better feed on the aftergrass. The introduction of artificial manures has rendered us great assistance, especially for the arable lands, although the pasture likewise feels the effects of the change. Bones have been used on the pasture, but not to such an extent nor with such success as in Cheshire. Besides all this, nearly all the wet lands have been drained, and the wide and useless hedge rows grubbed up, so that our atmosphere has become dryer and more healthy. Nature has lent a helping hand, and we have in consequence a longer summer and a shorter winter. A large quantity of cheese is made from some of the hills which formerly only fed a few half-starved sheep and cattle. Some of these improvements may seem to be of small importance to the casual reader; but when carried out through a whole district, as in this county, the effect is great, and these, I believe, are the chief causes which have led to the dairy produce of this county being increased, within a few years, twenty-five per cent.

REDUCTION OF LABOR IN THE MANUFACTURE.

Under this head, speaking first of butter, I may state that the improvements are not so great either in the mode of making, the utensils employed, or the reduction of labor, as in the case of cheese, because two very simple processes only are required to accomplish the object, namely, "churning" and "working." Churning is a simple process of agitation, and whether it be accomplished by a vertical, a longitudinal, or a rotary motion, the effect is the same; and notwithstanding the many attempted improvements in the construction of the utensil employed, there is not for general purposes, anything superior to, or that is likely to supersede, the old barrel churn. In it, either a large or a small quantity of butter, and that of the best quality, may be produced.

As to the working the butter—which is generally performed by the hand—the object is the extraction of all the buttermilk. Some persons use small wooden spades, others envelope their hands in a cloth, but nothing of this kind can be termed a "late improvemennt." The greatest step in advance consists in the fact that observation and the introduction of the thermometer has enabled us to lay down a rule for the temperature to be maintained in churning. It is found that if the cream be put into the churn at from 55° to 60° in summer, and not less than 60° in the winter, it will be churned in good time, that is, from half an hour to forty minutes, and, if properly worked, will produce good butter. If it be churned at a lower temperature it will be too long in churning, and will require heating during the process. If above that temperature, it will "come" too soon and will be frothy and oily; in both cases the butter will be inferior. Until a comparatively recent date, it was a difficulty in cold weather to get the butter churned; the process not unfrequently occupied several hours, and I have known the produce to be thrown away as utterly useless after all. This difficulty is now entirely overcome.

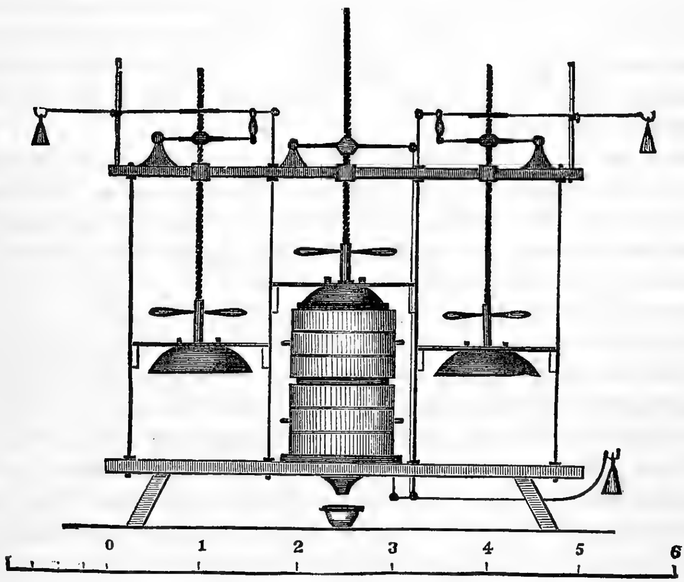
Experience, moreover, has taught us that although, if milk be allowed to stand till it becomes stale or sour before the cream is removed from it, the butter thus made will not be good; on the other hand, if the cream be taken while the milk is sweet, the cream may be kept until it becomes sour, without the butter being materially affected.

The process of butter making varies in different countries. In Scotland, Ireland and Wales they churn the milk, and, when this is done properly, I believe that the butter, for delicacy of flavor, cannot be surpassed.

In the making of cheese a much greater improvement has been effected, in consequence of its having received more attention than butter making, cheese being the staple commodity of the district, and, when well made, more remunerative to the farmer. For many years past it has been our object to produce the *best cheese* with the *least possible labor*—an object we have, in no small degree, accomplished. Within my own recollection, a week, at least, may be said to have been occupied in making a cheese—that is, from the time the milk was coagulated till the cheese was taken from the press to the cheese-room. During this time it was turned in the press twice every day, and had salt rubbed over it by the hand every morning. I have known, in a dairy of fifty cows, fifty-two cheeses to be thus turned thrice a day, giving a vast amount of unnecessary labor to the dairy woman and expense for cloths to the farmer. This state of things exists to this day in some of our largest cheese-making districts.

The machinery and utensils, too, were of a rude description. The presses were either a large stone raised by a screw, or a box filled with some heavy material and suspended between two upright posts and lowered or raised by ropes and pulleys. I should have thought it almost incredible that there should exist a cheese-making district in England that had not partaken of the universal improvement in the cheese-press, had I not learned a lesson the other day. A friend of mine was traveling in a railway carriage in Lancashire in which some farmers were discussing the merits of an improved cheese-press lately introduced into their district, when one of them, convinced of its superiority, said, "I do not think I shall lay out much money in a stone press again."

The utensils were generally made of wood, and the whey, however large the quantity, had to be ladled out of the tub with a heavy wooden bowl. The curd, when put into the vat, was broken into small pieces by the hand, —so laborious a work that I have seen dairywomen whose finger joints were grown large and stiff in consequence. After the cheeses were introduced to the cheese-room, they had to be washed and scraped before they became



Cheese Press—3-4ths of an inch to a foot.

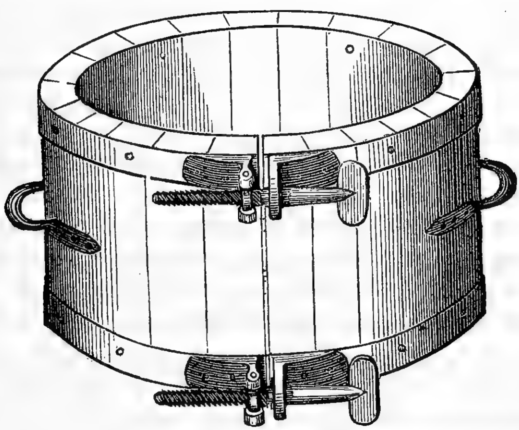
marketable, which was not generally the case until they were from four to six months old, although they were what we should now term *thin cheese.* In many instances the cheese was kept until the following spring. The process of manufacture was unsystematic and irregular, without regard to an even or proper temperature; consequently the cheese was of unequal quality —some good, some bad—from causes unknown to the dairywomen. This was the state of things when improvement in the machinery and utensils began to be studied. It is just, however, to state that, with regard to the cheese tub, a few wealthy and enterprising men thought it desirable to substitute copper in lieu of wood many years before this general movement took place. These tubs were made rough and at a great expense, many of them them costing from forty to sixty pounds apiece, according to the number of cows kept.

About thirty years ago the first improved cheese press was exhibited in Wells market, in this county, and, though extremely simple, proved to be a step in the right direction. I think that prizes have been awarded to it in its incomplete shape more than once by the Royal and other Agricultural Societies. The principle of its construction was that of the lever in its simplest form. The subject was immediately taken up by the mechanics of the neighborhood, who gradually improved upon the cheese press until the model now in general use was produced. It consists of a screw and a lever, the former working in a brass socket, and serving as a fulcrum for the latter, by which the pressure, produced and regulated by a weight attached to the opposite end of the lever, is conveyed to the cheese. When the screw is reversed the lever drops on to a pin, the pressure is withdrawn, and the cheese may be removed. This is decidedly the best implement for the purpose that has yet been invented. It is manufactured in large numbers by the best agricultural implement makers in this and the adjoining counties.

About this time copper, and sometimes brass, began to be used more frequently for making cheese tubs, but, being too expensive for general use, tin was successfully substituted and continues to be employed to the present time. It costs one-third the price of coppor, and will last for twenty or thirty years. All the other utensils of the dairy which were formerly of wood, such as bowls, pails, &c., are now made of tin, which saves a vast amount of labor and expense in brushes.

The vessels are in some cases improved in shape as well as in material; the cheese tub, which was flat at the bottom, is now made convex to facilitate draining off the whey. A large brass tap is soldered into the bottom of the tub, inside of which is a strainer made of fine gauze, wire or other material, to prevent small particles of curd from escaping. The whey flowing from this tap is conveyed in a pipe leading from the floor of the dairy to a tank or cistern in the piggery, from whence it is pumped for use. That the milkers may not enter the dairy, a tin receiver is placed outside the house, into which the milk is poured and conveyed to the cheese tub by a conduit, at each end of which is a strainer to prevent any filth from the yard from passing into the cheese tub. It is a mistaken notion with many practical cheese makers, and all theorists, than an exceedingly fine strainer is necessary in order to separate the whey from the curd. If the cheese be well made, the curd itself is the best strainer or filterer; but where there is a large bulk of whey to be drawn off from the curd, it will flow through the tap with great force, so as to carry away particles of curd, if something is not placed inside as a strainer. To obviate this, a new and valuable instrument, called the Whey Separator, has just been invented by Mr. ROBERT MCADAM of Garsty Hill, near Crewe, Cheshire, for which he has taken out a patent. It is made of brass, and is a telescopic tube, one end of which fits on inside the outlet in the bottom of the tub; to the other end is screwed a receiver, which floats on the surface of the whey, which enters its perforated brass under-surface, and is thus conveyed down the tube to the brass tap at the bottom of the tub, the tubes sinking into each other as the whey subsides. This separator costs about forty shillings; it is the best thing of the kind I have ever seen, as it takes the whey from the surface, where it is most free from curd, and prevents the mass of the curd from being disturbed by the whey on its passage to the outlet.

The curd breaker generally in use for breaking up the coagulated mass is either the shovel breaker or the revolving breaker. The former is made of wood in the shape of a shovel with a bent handle (); through the lower end of the handle, at right angles to it, nine or ten brass rods are inserted, extending about six inches on either side, and secured at each end by a strip of wood about fourteen inches in length. The revolver is made of rods of iron, set in a framework fitted to the inside of the tub, where it is made to revolve upon a vertical axis by a handle at the outside of the tub like that of a churn.



THE EXPANDING CHEESE VAT.

The vats, which were formerly made of turned wood, are now made of staves like a cask. In not a few instances tin is employed for the purpose, but I scarcely think it will come into general use for our thick cheeses. The stave vat has recently been improved by being made to open at the side at one of the joints between the staves, corresponding to opposite joints across the top and the bottom; the opening is sufficiently wide to allow of the cheese being easily liberated from the vat when reversed for the purpose. To accomplish this, there are four projecting screw-holes: one at each end of the two severed iron hoops which encircle the vat, and one at the top and one at the bottom. When the vat is closed, two of these screw-holes will be opposite each other, and through them a screw-bolt is inserted which keeps the vat together; by loosening these bolts the vat is enabled to expand and the cheese is easily liberated.

An apparatus has been invented for cheese making by Mr. KEEVIL of

Wiltshire, and is in use in that and some other districts, which, though not applicable to the Somerset or Cheddar mode of making, is, I believe, of service in making the Wiltshire cheese. It consists of a tin tub, down the side of which there runs a strip of gauze wire, three or four inches in width, which allows the whey to escape to a brass tap at the bottom. A breaker is used, similar to the revolver above described, but Mr. KEEVIL has altered the round rod to a flat, knife-shaped piece of iron, thus altering the principle of *breaking* the mass to that of *cutting*. Instead of a vat into which weights were put for the purpose of pressing the curd in the tub, a perforated circular piece of tin is used, fitting the inside of the tub, to which pressure is applied by a screw running through a strong cross-piece of iron, fastened to the opposite sides of the tub. The cheese tub is on a raised platform, and can be made to incline at pleasure, so as to allow the last drop of whey to escape.

A much more useful apparatus for our improved method of cheese making has been invented by Messrs. COCKEY & SON of Frome. Its object is to save the labor of carrying the milk to and from the boiler for heating previous to the introduction of the rennet, and also of carrying the whey for scalding the curd. A small boiler is placed in a desirable situation, from which hot water is conveyed by pipes to a chamber underneath the tub, where it can be turned off or on at pleasure, by stop-cocks. One advantage in this apparatus is, that during the summer nights cold water may be let into the chamber underneath the evening's milk, which is thus rapidly cooled down to the temperature of the water. This expedient is very valuable for keeping the milk sweet till the morning, as we make cheese only once a day. The apparatus is extensively used in this and some other countries. During the winter months the cheese-room and dairy are heated from the same boiler.

THE IMPROVEMENT IN THE QUALITY OF CHEESE

is due partly to what is here technically called "*slip-scalding*" and to increased attention bestowed on the manufacture, and partly to more careful storing in the cheese-room. In all these cases the thermometer and the clock have greatly assisted in reducing cheese making to a regular system. The process is now conducted in the following manner:—The morning's milk is mixed with the evening's at a temperature of about 80° (varying two or three degrees in the spring and autumn), the rennet then is added, and an hour is allowed for the curd to form, when it is carefully broken up; and here commences the system of *slip-scalding*, now generally adopted in preference to the old method. The scalding whey is now added to the curd in its pulpy state, before it has had time to subside and get hard. Experience has shown us that a finer description of cheese is produced upon this principle, which is adopted by the best cheese makers in this county. What is here called *scalding* is the raising the mass of curd and whey to the temperature of 100° Fahr. By COCKEY's apparatus, hot water is introduced into the chamber by pipes placed underneath the tub to accomplish this purpose;

otherwise, hot whey is poured into the mass, which in both cases is being well stirred, until the desired heat is obtained. The curd is then allowed to subside, and, after the whey is drained off and the curd becomes dry, instead of being broken by the hand, it is passed through the curd mill, after which salt is added and mixed with it in the proportion of one pound to fifty-six pounds. It is then put into the vat and press, where it remains three days, after which it is taken to the cheese-room. The cheeses are made from nine to fourteen inches in thickness, some even more. They are turned only twice in the press, and that is when the cloths are changed.

THE METHOD OF KEEPING THE CHEESE IN THE CHEESE-ROOM HAS ALSO BEEN IMPROVED.

At one time we thought it desirable to keep them in a low and even damp temperature, but the cheese was then a long time in getting ripe, and a fine mellow flavor was not readily obtained. We now introduce them at once from the press to the cheese-room, which is kept at a temperature of from 50° to 70°, as the case may be; and we find that the cheese ripens faster, acquires a richer flavor, and can be sold much sooner; so that our thick cheeses are often cut over the counter at three months old, sometimes even less; though a few years since the same sized cheese would have required eight or nine months to acquire the same degree of ripeness.

This system of making has diminished the make of whey butter. Where we made one pound per cow, we now make one pound for every seven cows, and sometimes less; the quantity is so reduced that we often do not think it worth the risk of imparting sourness to the cheese, but turn the whey off to the pig-tank. Some persons tell us that we lose a great deal of valuable food in our whey, as proved by the bacon fatted from it. When bacon is fatted from whey alone this must be the case; but the whey from a cheese well and carefully made would not fatten a pig in six months.

To the cheese consumers of London, who prefer an adulterated food to that which is pure, I have to announce an improvement in the annatto with which they compel the cheese makers to color the cheese. The improvement is not in the smell, which remains as unpleasant as ever; neither is it in the taste—that is as filthy as ever; but it consists in this—that we now get annatto in a liquid state, instead of a cake, which saves the trouble of rubbing out.

I have now enumerated the principal improvements in dairy practice that have enabled us to send into the market a superior article, increased in quantity twenty-five per cent., at a reduction of the original labor of more than half. Although we have attained this result by studying, as far as our observation and experience go, the state of the curd through the various stages and manipulations which it undergoes, and have acquired, so far, some knowledge of what we are doing, we have not yet arrived at perfection. *Cheese making, as a science, is not understood.* I could ask a dozen questions, which suggest themselves at the various stages of the process, and which cannot be answered.

We have now a body of valuable rules laid down for our guidance; though strict observation and practical experience are, of course, requisite for their successful application. But this is not enough. A wide and unexplored field is before us, into which we should enter. Milk, as taken from the cow, is of a peculiarly rich and delicious flavor. The object of the cheese maker should be to preserve that flavor throughout the process, and leave it to ripen in the cheese; but the accomplishment of this design is not always certain (especially in thunder weather), in the absence of an instrument with which we are not yet provided. Liebig and other chemists tell us that milk, in its pristine state, possesses a quantity of sugar, which, in the process towards decomposition, produces lactic acid. Alkalies are also present which neutralize the acid until an increased amount of the latter is generated, when the milk becomes sour. Believing this to be true, and knowing that heat promotes the formation of the acid, when the temperature of the atmosphere is 65° we act cautiously lest we should make the cheese sour, and, no doubt, our precaution is frequently attended with success. But there are other agents besides heat which promote the souring of the milk, even when the atmosphere is as low as 60°: over these we have no control at the time, besides being generally unaware of their existence until it would be too late to seek a remedy, if any such were known to exist. The instrument, then, which we want is one which will show us the exact amount of acid present, that we may know when to introduce the rennet, and in what quantity. It is true we have litmus-paper, but this only indicates the presence of acid without measuring the *quantity* present. While searching for such an instrument as this among opticians and chemists for several years past, I have been recommended to try one or two chemical methods, the best of which is by Dr. Cameron of Dublin. None of these tests, however, are sufficiently simple to be of much use to a practical dairywoman, who wants an instrument effective and simple, by which she can as easily test the amount of acid present, as she can by the thermometer ascertain the degree of heat.

Another desideratum is a chemical knowledge of the constitution of the curd and whey throughout the process. It is not likely that this investigation will be carried out by the unaided efforts of any practical man; but with assistance, such as the Royal Agricultural Society of England could render, this object might be attained, and the result would be that cheese could be made (as it ought to be) upon principles scientific and, consequently, unerring.

The press illustrated on page 297 is the only one I have in use for seventy-two cows; the other principal utensils are—cheese-tub, two milk-coolers, curd-mill, six vats for summer use, six smaller ones for the spring and autumn. The press was made by Stokes of Dean, near Shipton-Mallet, and cost about nine pounds.

COMPOSITION OF CHEESE.

The most recent and valuable chemical investigations that we have on the composition and manufacture of cheese, are those made for the Royal Agricultural Society of England by Prof. Voelcker. These papers hitherto have not been accessible to American dairymen. They are very suggestive and valuable, and will be found of important aid to those practicing the cheese-making art. I therefore introduce them in this connection. He says:

In the opinion of many persons English cheese is not what it used to be in the good old time, when it was far more common than now-a-days for farmers' wives personally to preside over the dairy and conduct the making of cheese through its various stages. Some people assert positively that the English cheese of the present day is inferior in quality to that which was made centuries ago. It is of course impossible to give satisfactory proofs of this supposed inferiority; but at the same time it must be admitted that the prevailing custom of leaving the chief dairy operations almost entirely in the hands of servants furnishes strong presumptive evidence in favor of those who maintain these views. As a rule, we have found the best cheese on farms where the mistress of the house was herself dairy-maid-in-chief, especially if industrious habits and scrupulous cleanliness were associated with superior intelligence. Indeed I have had recently frequent occasion to notice the intimate connection which appears to exist on the one hand between good cheese and cleanliness, order, general intelligence and desire to excel, and on the other hand between bad cheese, slovenliness, ignorance and practical conceit. In the best-managed dairies, however, cheese-making is practiced entirely as an empiric art, which is admitted by our best practical authorities to be capable of great improvement, the importance of which is obvious when we consider the large amount of capital directly or indirectly embarked in dairy-farming. Mr. Humberstone, member for Chester, has the merit of having first directed the attention of our Society to the importance of scientific investigation into the principles of cheese-making; and the Council, on the recommendation of the Chemical Committee, made a special grant to enable me to visit the principal dairy districts of England, to carry out certain practical experiments and obtain what practical assistance I required. The more direct laboratory experiments, which, like the whole investigation, are still in active progress, have been selected by the Chemical Committee as one of the regular subjects for investigation for the current year. During the last ten months I and two of my assistants have been almost exclusively occupied with the analytical work demanded by a thorough investigation into the principles of cheese-making. At the same time I have spent between four and five weeks at different times in visiting the dairies of Gloucestershire, Wilts, Somersetshire, Warwick, Stafford and part of Cheshire; and I purpose paying another visit to Cheshire and Derbyshire in the ensuing summer vacation. This paper will embody some of the practical conclusions to which I have arrived, partly from my visits and partly from my investigations.

The first point to be observed is, that cheese is often spoiled (to use an Irishism) before it is made—that is, before it is separated from the milk: in other words, the milk is spoiled. Then the cheese is spoiled during the making, and also in the keeping. Again I have learned that richer cheese may be made on some land, even when a portion of cream has been taken from the milk, than on other land where the whole milk is used. 3d. I concur, with our best and most intelligent cheese-makers in the opinion, that good saleable, though perhaps not very fine-flavored cheese, can be made on any description of land, provided proper care and attention are paid to the management of the milk at the beginning, to the treatment of the cheese in the tub, and to its after ripening. 4th. From all I could learn practically, and from what I have seen with my own eyes, I have come to the conclusion that bones improve the quality of the pasture and the richness of the milk, but also that more care is required to make cheese from boned pasture than on poor land. 5th. The flavor of the different kinds of cheese, such as Cheddar, Stilton, Cheshire and others, is much more dependent on the method in ordinary use in these different counties than on the quality of the pasture, although the latter exercises a considerable influence. The inferiority of the Boothy cheese, made from dry food, to that produced when the cows are at grass, is well known. Nevertheless, admitting that food does much affect the flavor of cheese, I still am of opinion that the various practical manipulations exercise a yet higher influence iu this respect. 6th. Each system of cheese-making, whether that of Gloucestershire or Somersetshire, appears to have its peculiar excellences, but also its peculiar defects. 7th. Matters altogether indifferent are frequently insisted upon as essential to success, while others of the greatest importance are either neglected altogether or much undervalued: unless, therefore, a person thoroughly understands the grounds of his selection and preference, it is better to adopt one empiric method than to attempt to combine the different plans. 8th. I found good makers of cheese who had never heard a word about chemistry. 9th. Although much mystery is thrown around this art, all that is mysterious about it is purely accidental: the process in itself is very simple, and accords well with scientific principles so far as these have been ascertained; but skillful management is perhaps rather the exception than the rule. 10th. Even good practice may be considerably improved, or, more correctly speaking, simplified, by the application of scientific principles to cheese-making. 11th. With respect to the recent mechanical improvements which have been introduced in the dairy districts, KEEVIL's and COQUET's apparatus, and others which have been described at some length in a former volume of our Journal, save, indeed, a great deal of labor and time, but otherwise effect nothing which may not be done by skillful hands. 12th. Milk, as I have ascertained by numerous analyses, varies much in its composition, for which reason great differences must also be expected in cheese. 13th. Considerable loss both in quality and quantity of cheese was found to arise from careless management. 14th. In studying the action of rennet on milk I find that misapprehension, if not altogether wrong statements, prevail in what has hitherto been said and written respecting its action. I shall have presently to advance proofs in confirmation of this assertion. 15th. I would observe, that generally the scientific principles involved in the manufacture of cheese are either misstated by scientific writers on the subject, or but imperfectly recognized by practical men.

These are some of the principal conclusions at which I have arrived in the course of my investigation. As it is not my intention to write a complete essay on cheese-making, I shall at present only endeavor to point out—1st, some of the chief errors made in the process, stating my reasons for speaking of them as such; and 2dly, to suggest some remedies and safeguards. But, in order to make my subsequent remarks a little more intelligible, I must briefly allude to the composition of milk, which, as is well known, is not a uniform white liquid, but a fluid owing its opaque character to a number of little cream gobules. Seen under a microscope of no very great power, milk appears as a colorless fluid in which there are floating innumerable little white globules or small bags containing fatty matter. The butter is encased in these microscopic bags or cells, which themselves are composed of very much the same material as the curd of milk. These, being lighter than water, rise on standing, and are removed as cream. If it were possible to separate the cream completely by standing, the milk would be almost colorless; but inasmuch as a certain number of milk-globules always remain suspended in milk, even after long standing, skimmed milk is always more or less opaque. We must find, therefore, in the cheese made from skimmed-milk a certain amount of butter, though much less than in whole-milk cheeses. On the removal of the cream the milk becomes bluer and more transparent; and hence the transparent and peculiarly blue appearance of some of the London milk is indicative of its poorness. On allowing milk to become acid, which it does readily in warm weather, one of its constituents, which, from its sweet taste, is called sugar-of-milk, is converted, at least in part, into lactic acid. This change is effected by simple transposition of the elementary particles of milk-sugar, without anything being added or detracted from them. This lactic acid again separates the next constituent, the caseine or curd of milk, which may also be separated by rennet. On the removal of the caseine, either artificially by rennet or naturally by the lactic acid, we obtain whey; and, provided this whey is perfectly clear and free from all butter and curd (which is not generally the case) in our dairies, we may, by evaporating the clear liquid, obtain milk-sugar and a certain quantity of matter which is incombustible, and constitutes the ash of milk. These then are the principal constituents of milk—curd or caseine, butter, milk-sugar, and mineral matters or ash. Now, in the preparation of cheese we separate the curd or caseine, and, if we want to make good cheese, also the butter and a small quantity of mineral matter contained in the milk. In the whey remains the milk-sugar and most of the mineral matter. A glance at the subjoined diagram, which gives the composition of different kinds of milk lately analyzed by me, will show the enormous difference that exists in the relative amounts of the various constituents of milk.

COMPOSITION OF NEW MILK.

	No. 1. Milk analysed Oct. 21, 1860.	No. 2. Milk analysed Nov. 29, 1860.	No. 3. Milk analysed Sept. 18, 1860.	No. 4. Milk analysed Aug. 7, 1860.	No. 5. Milk analysed Sept. 6, 1860. (Morn'g's Milk.)	No. 6. Milk analysed Sept. 6, 1860. (Even'g's Milk.)
Water,..........................	83.90	85.20	86.65	87.40	89.95	90.70
Butter,..........................	7.62	4.96	3.99	3.43	1.99	1.79
Caseine,..........................	3.31	3.66	3.47	3.12	2.94	2.81
Milk-sugar,..........................	4.46	5.05	5.11	5.12	4.48	4.04
Mineral matter (ash),............	.71	1.13	.78	.93	.64	.66
	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of dry matters,......	16.10	14.80	13.35	12.60	10.05	9.30

I have selected these analyses from a considerable number of milk analyses lately made in my laboratory. They illustrate strikingly the great differences that exist in the quality of new milk. It might readily be imagined that milk such as that which I examined on the 6th of September, containing ninety and a-half per cent. of water, had either been diluted with water, or at least produced by cows fed on mangold-tops, distillery-wash, or similar food. Such, however, was not the case. The cows which yielded this poor milk were out in pasture, and every precaution was taken to get a fair average of the milkings from some eight or ten cows. The milk was received by me almost directly after it had left the udder, and I can thus vouch for its being genuine, and its watery condition natural. The pasture, however, was poor and overstocked, so that the daily growth of grass furnished hardly enough food to meet the daily waste to which the animal frame is subject, and was thus not calculated to meet an extra demand of materials for the formation of butter and curd. The milk consequently became not merely deficient in quantity, but also poor in quality. It is well then to bear in mind that an insufficient quantity of food in the case before us caused the supply of milk to be small and unusually poor. This analysis illustrates and confirms a principle generally recognized by good dairy farmers, that it is bad policy to keep more cows than can be liberally supplied with food. The evening's milk on the 6th of September, it will be noticed, contained about three-fourths per cent. more water and somewhat less caseine and butter than the morning's milk of the same cows on the same day. From this and other instances some may be disposed to infer that the morning's milk is generally richer than the evening milk—a view which I myself was disposed to adopt until a larger range of experiments proved to me its inaccuracy. In truth, the comparatively greater richness of the morning or the evening milk depends on a variety of circumstances so complicated as to require a lengthened discussion, which I must postpone to a future paper.

The remarkably small quantity of butter in the milk of the 6th of September appears very striking when contrasted with the proportion of butter found in good milk, and still more so when compared with the unusually large quantity contained in the rich milk analyzed on the 21st of October. This milk, like that of the 6th of September, was produced by cows out in grass, without any additional food rich in fat, such as linseed or rape-cake, and yet it contained nearly four times as much butter as that of the cows kept on an insufficient quantity of poor grass. The beneficial influence of abundance of good pasture on the butter-yielding qualities of milk, and the contrary effect of a stinted supply of grass, are seen in bold relief in the first and the sixth analyses.

While the proportion of butter in different samples of milk varies exceedingly the relative amounts of curd or caseine, of milk-sugar and of ash, though liable to certain fluctuations, do not greatly differ in good, indifferent, or even very poor milk. It would thus appear that the quantity and quality of food, and other varying circumstances which affect the composition of milk, exert their influence principally on the proportion of butter. And as this is certainly the most valuable constituent of cheese, and one pound of butter suffices for about two pounds of salable cheese, we can readily understand that in one dairy a considerable quantity of cream may be taken off the milk, and yet a better quality and a greater quantity of cheese can be made than in another dairy, from the same quantity of milk, from which no cream has been removed.

The second analysis exhibits nearly five per cent. of butter, a proportion which is decidedly above the average. This analysis has been selected as an example illustrating the increasing richness of milk in the fall of the year. Practical cheese-makers are well acquainted with the fact, that in autumn, when green food becomes scarcer, the quantity of milk diminishes considerably, but that the weight of cheese which can then be made from a given quantity of milk is much greater than in spring or summer. An inspection of the second and fourth analyses affords a ready explanation of this fact.

Both these milks came from the same dairy. In August the milk contained scarcely three and a-half per cent. of butter, and, in round numbers, three per cent. of caseine; in November it yielded five per cent. of butter and one-half per cent. more caseine than in August. Rightly to appreciate this increase, it should be regarded, not so much as an addition of two and a-half parts in one hundred parts of fluid, as of two and a-half parts to twelve and a-half solid matter, the total percentage found in August, or an increase of twenty per cent. on the solid matter. And if we consider that most of the milk-sugar and of the mineral matters pass into the whey in the cheese-manufacturing process, the difference in the cheese-producing qualities of the August and November milk appears still greater.

In one of the milks we have three and a-half per cent. of butter and three of caseine, or five and a-half per cent. of solid cheese-producing materials in every one hundred parts of milk; in the other there are five per cent. of butter and three and a-half of caseine, or eight and a-half of solid cheese-producing matters. Thus the real proportion in the two milks is as five and a-half to eight and a-half—that is to say, the latter yields fifty-five per cent. more dry cheese-forming materials than the former; and as we find in good cheese about one-third of its weight of water, the fifty-five per cent of dry matter with this complement of water will amount to eighty-three per cent. In other words, one gallon of the November milk will produce nearly double the quantity of salable cheese which can be made from the August milk.

The third analysis represents the composition of good, rich milk, and the fourth the average composition of milk neither rich nor poor.

In rich milk the proportion which the butter bears to the caseine is always much greater than in milk of average quality. In the latter there is about as much butter as caseine, and in decidedly poor milk the proportion of caseine is larger than that of butter.

The preceding analyses have brought to light unexpectedly large differences in the amount of butter which is contained in different samples of milk. With proper care and skill in cheese-making nearly the whole of the butter becomes incorporated with the curd; and as the market price of cheese depends in a great measure, though not entirely, upon the proportion of butter which it contains, it is evident that the original quality of the milk must have a decided and direct influence on the quality as well as the quantity of cheese which can be made from it. Although precisely the same process may be adopted, and equal care and attention may be bestowed on the manufacture, it nevertheless happens that not only more but also a better quality is made in one dairy than in another from the same number of gallons of milk.

The food upon which dairy-stock is kept unquestionably exercises a great influence on the milk. It is, therefore, reasonable to expect certain pastures to be naturally better adapted for the production of rich cheese than others. Thus good old pasture not only produces richer milk than grass from irrigated meadows, but likewise a better quality of cheese, all other circumstances being equal in both cases. There is thus some reason in the almost universally received opinion that on some land good cheese can invariably be made, while on other land no amount of skill or care can bring about a like result. But at the same time I believe it is quite a mistake to think that good cheese can only be made in certain localities, and that the character of the pasture accounts entirely for the great differences found in the quality of this article. Good salable, and even high-priced cheese, I believe with Mr. Harding, can be made in any locality, whatever the character of the pasture may be, where an industrious and skillful hand, and an observant and intelligent head, presides over the operation; and, on the other hand, the best and richest milk, the produce of peculiarly favorable pastures, may be spoiled by a slovenly and ignorant dairymaid. But inasmuch as the nature of the herbage, as is well known, affects the richness, and especially the flavor of the milk, and the herbage is sweeter in one locality than another, and at one time of the year than at another, it is not likely that the very finest-flavored cheese should be made indiscriminately on all land and all the year round. Still, after every allowance has been made for these natural peculiarities, it is nevertheless true that the various processes which are adopted in different countries determine in a great measure the prevailing character of the produce, while the want or bestowal of care and attention in making cheese, whether it be on the Cheshire, Cheddar or any other plan, materially influences the quality of the produce.

Before I proceed to point out some of the practical errors which are often made in the manufacture of cheese, let us examine the composition and chief peculiarities of some of the principal kinds made in England.

English cheese is produced either from milk to which an extra quantity of cream has been added, or secondly from the whole-milk, or thirdly from milk from which more or less cream has been taken before the addition of the rennet. Accordingly we obtain—

1. Cream-cheeses.
2. Whole-milk cheeses.
3. Skim-milk cheeses.

The first class is made in limited quantities only, and constitutes a luxury which is found chiefly in the houses of the wealthy.

The second is produced in larger quantities; and the third furnishes our chief supply of this important article of food for the working-classes of this country.

To the first class belong Stilton, Cream-Cheddar, and the choicest quality of Cotherstone cheese, or Yorkshire Stilton. These, according to their quality, fetch more or less a fancy price in the market, as they are made in perfection only by few persons, and in limited quantity.

To the second class belong the best Cheshire, some Cheddar, good Double Gloucester, most of the cheese made in the Vale of Berkeley, as well as whole-milk cheese produced in Wiltshire and other counties of England.

In the third class we meet with ordinary Cheshire, Gloucester, Wiltshire, Warwickshire, Shropshire, Leicestershire, and other cheeses made in districts where its manufacture is combined with that of butter.

This division into three classes is to a great extent an arbitrary one, adopted more for the sake of convenience than on account of any definite line of demarcation. In reality the richer admixture often only compensates for the inferiority of the natural product. Thus the best Cheshire and Cheddar cheese is frequently as good and rich in butter as Stilton. Again, it is well known that in some dairies a richer cheese can be made from the mixed new morning's milk and skimmed evening's milk than in others from the whole milk. The classification, therefore, does not so much refer to the quality and value of the cheese as to the description of milk which is used.

STILTON AND COTHERSTONE CHEESE.

The following table embodies the results obtained in the analyses of two samples of Stilton and Cotherstone cheese:

	Stilton.		Cotherstone, or Yorkshire Stilton.	
	No. 1.	No. 2.	No. 1.	No. 2.
Water,..	32.18	20.27	38.28	38.23
Butter (pure fatty matters),........................	37.36	43.98	30.89	29.12
*Caseine,..	24.31	33.55	23.93	24.38
Milk-sugar and extractive matters,..................	2.22		3.70	2.76
†Mineral matters (ash),............................	3.93	2.20	3.20	5.51
	100.00	100.00	100.00	100.00
*Containing nitrogen,..............................	3.89	....	3.83	3.90
†Containing common salt,..........................	.89	.29	.79	2.55

The two Stilton cheeses are very rich in butter, especially the second, which contains forty-four per cent. of pure fatty matters; and as we have in common butter from fifteen to eighteen per cent. of water, besides caseine and other impurities, the pure fat in the second Stilton represents more than fifty per cent. of butter. The first analysis expresses the composition of a rather new Stilton. It was sold at one shilling per pound last October. The second analysis is that of an old Stilton, selling at fourteen pence per pound. There is about twelve per cent. less water in it then in new Stilton: more butter and less salt. Notwithstanding the smaller amount of salt, it had a more saline taste and much better flavor than the newer cheese. This saline taste is generally ascribed to the salt, and complaints are sometimes made by persons fond of mild-tasting cheese, that old cheese, in other respect rich and good, has been injured by too much salt. This is a mistake, of which the proof is found in the analysis of these two Stilton cheeses. The first was quite mild in flavor in comparison with the other, and yet it contained three times as much salt as the more saline-tasting older cheese. The fact is, the saline taste is developed during the ripening of cheese; newly-made cheese, though strongly salted, is always mild in taste. During the ripening of the cheese a portion of the caseine or curd suffers decomposition, and is partially changed into ammonia; the latter, however, does not escape, but combines with several fatty acids formed in the course of time from the butter. Peculiar ammoniacal salts are thus produced, and these, like most other salts of ammonia, have a pungent, saline taste. The longer cheese is kept, within reasonable limits, the riper it gets; and as it ripens the proportion of ammoniacal salts, with their pungent, saline taste, increases. It can be readily shown that old cheese contains a good deal of ammonia in the shape of ammoniacal salts. All that is necessary is to pound a piece with some quick lime, when, on the addition of a little water, a strong smell of spirits of hartshorn will be developed. In well-kept, sound old cheese the ammonia is not free, but exists in the form of salts, in which the base is ammonia, in combination with butyric, caprinic, caprylic, and other acids, generated under favorable circumstances by the fats of which butter consists. Ripe cheese, even if very old, but sound, instead of containing free ammonia, always exhibits a decidedly acid reaction when tested with blue litmus paper. Rotten cheese, on the other hand, is generally alkaline in its reaction, and contains free ammonia.

I have made a quantitative determination of the amount of ammonia in old Stilton cheese, and found it to amount to 1.81 per cent.

The first Cotherstone or Yorkshire Stilton was made near Barnard Castle, in the Vale of the Tees, and sold at one shilling per pound. It is highly esteemed in Durham and Yorkshire; but to my taste, the cheese which I analyzed is not to be compared with good, genuine Stilton, nor is it equal in flavor to Cheshire or Cheddar.

Cotherstone cheese, it will be noticed, contains a very much larger proportion of water than even new Stilton. This imparts to it a smooth and apparently rich texture, but the proportion of butter is not really as great as it appears to be, nor, in point of fact, equal to that found in an average Cheddar. It has usually a very strong taste, which would be decidedly objected to by Cheshire or Gloucestershire factors. In its preparation a good deal of whey appears to be left in the curd in mechanical combination, and to be the principal cause of the strong taste and smell which are its characteristics, and in which, more than any other English cheese, it resembles the foreign Rochefort.

CHESHIRE AND CHEDDAR CHEESE.

In making best Cheshire and good Cheddar cheese the whole milk is used, and cheese generally made but once a day.

The first analysis illustrates the composition of good ripe, and the second that of good new Cheshire cheese.

Since a good deal of water evaporates in keeping, the proportion of dry caseine, of mineral matters, and especially of butter (pure fat), must become larger with age.

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The following table shows the composition of two kinds of Cheshire and a number of Cheddar cheeses.

	CHESHIRE CHEESE.		CHEDDAR CHEESE.					
	No. 1. OLD.	No. 2. NEW.	No. 1. OLD.	No. 2. 5 MOS. OLD.	No. 3. 6 MOS. OLD.	No. 4.	No. 5.	No. 6.
Water,..........................	32.59	36.96	30.32	36.17	31.17	33.92	37.85	38.43
Butter,.........................	32.51	29.34	35.53	31.83	33.68	33.15	28.91	23.28
*Caseine,......................	26.06	24.08	28.18	24.93	26.31	28.12	25.00	32.37
Milk-sugar, lactic acid, and extractive matters,......	4.53	5.17	1.66	3.21	4.91	.96	4.91	2.10
†Mineral matters (ash),.........	4.31	4.45	4.31	3.86	3.93	3.85	3.33	3.82
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing nitrogen,..........	4.17	3.84	4.51	3.99	4.21	4.50	4.00	5.18
†Containing common salt,......	1.59	1.91	1.55	1.18	1.15	1.23	.52	.65

The rich appearance of old cheese, however, is by no means attributable entirely to a very large proportion of butter; nor is the poor condition of new or badly-made cheese referable solely to a deficiency of butter. One of the chief tests of the skill of the dairymaid is the production of a rich tasting and looking, fine-flavored, mellow cheese from milk not particularly rich in cream. That this can be done is abundantly proved by the practice of good makers. One of the finest Cheddars which I have ever examined is that mentioned as No. 4 in the above table. This was made by Mr. HARDING, Marksbury, Somersetshire, and analyzed by me when about six months old. Like all good cheeses, it of course contains a large amount of butter; though as I found by experiment, not nearly so large an amount as its appearance, rich taste, and fine, mature condition seemed to imply. Though only six months old, it had a much more mature appearance than the Cheddar cheese No. 1, which was at least eleven months old when analyzed; and, thanks to Mr. HARDING's skill and experience, had a much fatter and more mellow appearance and richer taste than a specimen which actually contained two and a-half per cent. more butter.

Thus we see that the proportion of butter does not entirely determine the value of cheese, since a high-priced Cheddar or Cheshire cheese does not necessarily contain more butter than another which fetches eight or ten shillings less per hundredweight in the market.

In the opinion of good judges the Cheddar cheese No. 1, notwithstanding the larger amount of butter, and the smaller amount of water which it contained, was worth less than No. 4 by one penny per pound—no inconsiderable difference in the returns of a dairy to remunerate careful and skillful management. The peculiar mellow appearance of good cheese, though due to some extent to the butter which it contains, depends in a higher degree upon a gradual transformation which the caseine or curd undergoes in ripening. The curd is hard and insoluble in water, but by degrees it becomes softer and more soluble, or, speaking more correctly, gives rise to products of decomposition which are soluble in water.

Now, if this ripening process is improperly conducted, or the original character of the curd is such that it adapts itself but slowly to this transformation, the cheese when sold will be, comparatively speaking, tough, and appear less rich in butter than it really is; while in a well-made and properly kept cheese, this series of changes will be rapidly and thoroughly effected. Proper ripening thus imparts to cheese a rich appearance, and unites with the butter in giving it that most desirable property of melting in the mouth. On examining some cheese deficient in this melting property, and accordingly pronounced by practical judges defective in butter, I nevertheless found in them a very high percentage of that substance—clear proof that the mellow and rich taste of cheese is not entirely, nor indeed chiefly, due to the fatty matters which it contains.

Good Cheshire and Cheddar, on an average, contain about the same quantity of butter; but of course inferior cheeses defective in this respect are to be found in both localities. The analysis No. 6 shows the composition of such an inferior Cheddar.

DOUBLE AND SINGLE GLOUCESTER CHEESE.

Gloucester, especially double Gloucester, is generally sold as a whole-milk cheese. It is, however, seldom made of the whole-milk. In most dairies more or less of the cream of the milk is made into butter; but unless the whole evening's milk is skimmed and added to the whole new morning's milk —in which case the cheese made is "half-coward"—the produce, whether single or double, is said to be whole-milk cheese. The distinction of single and double Gloucester is one merely of size and thickness, and has nothing to do with the quality.

The following tables embody the results of some analyses of double and single Gloucester cheese:

DOUBLE GLOUCESTER.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Water,	32.44	32.80	38.83	38.14	40.88	33.41
Butter,	30.17	27.22	26.77	24.16	22.81	32.69
*Caseine,	31.75		36.25	26.56		27.75
Milk-sugar, lactic acid, and extractive matters,	1.22	34.76	3.18	6.40	31.88	2.23
†Mineral matters (ash)	4.42	5.22	4.97	4.74	4.43	3.92
	100.00	100.00	100.00	100.00	100.00	100.00
*Containing nitrogen,	5.12	....	4.20	4.25	....	4.44
†Containing common salt,	1.41	1.27	2.04	1.28	1.45	1.01

SINGLE GLOUCESTER.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Water,................	28.10	31.96	37.20	31.81	32.42	37.91	36.50
Butter,................	33.68	31.37	27.30	29.26	27.42	22.70	28.75
*Caseine,..............	30.31	29.37	24.50	26.12	34.46	31.25	25.75
Milk-sugar, lactic acid and extractive matters,..............	3.72	2.85	7.44	8.63		3.30	4.68
†Mineral matters (ash),...	4.19	4.45	3.56	4.18	5.70	4.84	4.32
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing nitrogen,...	4.85	4.70	3.92	4.18	....	5.00	4.12
†Containing common salt	1.12	1.35	.85	1.50	1.46	1.23	1.38

The differences in the proportion of water and butter here are very large, though probably not greater than will be found in other descriptions of cheese on examining a considerable number of specimens. It is worthy of notice that the poorer the cheese in butter the more water it usually contains. Thus the first sample of double Gloucester, which contained thirty-two and a-half per cent. of water, yielded thirty per cent. of butter (pure fat), while the third sample, containing nearly thirty-nine per cent. of water, yielded twenty-seven per cent., and the fifth sample, with nearly forty-one per cent. of water, scarcely twenty-three per cent. of butter.

These analyses show that the distinction made between double and single Gloucester has no reference to quality. Indeed, the first analysis in the table of the single Gloucester shows that thin cheeses are made which are as rich in butter as any of the best Cheddar and Cheshire cheeses. No. 1 and No. 6 in the list of double Gloucester, and Nos. 1, 2, and 4 in the table of single Gloucester, alike establish this equality. Nevertheless the price that is paid for thin, *i.e.*, single Gloucester of excellent quality, was only seventy shillings per hundred weight, while Cheddar, not richer in butter, and containing nearly as much water, sold at ninety shillings per hundred weight. The latter, of course, was well-made and nicely flavored cheese, and nearly four months old, while the single Gloucester was only two months old. Still, making every allowance for loss in weight on keeping for two months longer, the difference in the price at which both were sold, amounting to exactly £1, leaves a handsome balance in favor of a system which I have no doubt will come more and more into favor.

We have here again presented to us striking examples showing that the difference in the quality and price of the cheese is not dependent merely on the richness or poverty of the milk, but that the process of manufacture exerts a decided and direct influence on its value. Different plans now followed have unquestionably various degrees of merit, but in our present state of knowledge it would be premature to lay down any absolute rule.

LEICESTERSHIRE, WARWICKSHIRE AND WILTSHIRE CHEESE.

Some excellent cheese is made in Leicestershire and Warwickshire, but the generality of the produce of these two counties does not rank equally high with Cheshire, Cheddar, or even Gloucester cheese.

Some parts of Wilts are celebrated for their rich pastures, and for an excellent delicate-flavored kind of cheese. In other parts of the county a good deal of butter is made, and here, as in all districts where much butter is made and dairy farms are small, the cheese produced is of an inferior character.

Whole milk cheese, I believe, is not generally made in Wiltshire, although in North Wilts a good deal is sold as such in the market.

Wiltshire and Gloucester cheese is commonly colored with annatto, while that made in Leicestershire and Warwickshire is mostly uncolored.

The following table shows the composition of some specimens from the three counties to which I have just referred:

COMPOSITION OF LEICESTERSHIRE, WARWICKSHIRE, AND WILTSHIRE CHEESE.

	Leicester.		Warwickshire.			Wiltshire.		
	No. 1.	No. 2.	No. 1.	No. 2.	No 3.	No. 1.	No. 2.	No. 3.
Water,....................	35.21	32.89	31.97	33.61	33.53	34.44	39.22	40.07
Butter,....................	27.28	29.28	29.08	30.04	30.89	28.71	19.26	25.55
*Caseine,....................	27.93	29.06	27.43	29.70	28.19	29.00	34.22	26.81
Milk-sugar, lactic acid, and extractive matter,.......	5.54	4.42	7.16	1.95	2.84	3.60	2.28	2.24
†Mineral matters (ash),.........	4.04	4.35	4.36	5.60	4.55	4.25	5.02	5.33
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing nitrogen,.........	4.47	4.65	4.39	4.74	4.51	4.64	5.38	4.29
†Containing common salt,......	1.03	1.21	.72	2.78	1.12	1.03	.60	1.14

The first analysis was made of an uncolored Leicestershire cheese, sold retail at ninepence per pound. The second was a much better specimen from the same county. The latter, it will be seen, is drier and richer than the former.

The difference in the composition of the three Warwickshire cheeses is not great. In all three the proportions of water, butter and caseine do not vary more than two and a-half per cent. The greatest difference is observable in the amount of salt used. In the second specimen we have nearly three per cent. of salt, a proportion far above the average, and the cheese was to a certain extent spoiled by this excess. I would direct special attention to this, which I know from experience is not a solitary instance. For no description of cheese, should more than two pounds of salt per hundred weight be used, and one and a-half pound per hundred weight will, I believe, in most cases be sufficient. This was by no means a good cheese; it had a strong taste, and was sold as common Warwickshire cheese. This and the third were uncolored, and the flavor of the latter, as well as its texture and shape, was very good indeed.

The first analysis was made of a colored cheese which was sold as best Warwickshire; apparently it was an old and very much richer cheese than No. 2, but on analysis it was found actually to contain one per cent. less butter than the common cheese of the same name, thus giving another instance of the fact that good materials are often spoiled by unskillful management.

Of the three Wiltshire cheeses No. 1 was decidedly the best flavored, and, as will be seen, also the richest. No. 2 and No. 3 contained too much water, showing that the whey had not been carefully pressed out, and when this has been the case the cheese is very apt to heave and to acquire a strong taste. No. 2 is very poor in butter, and, although not sold as skim-milk cheese for all I know may have been made of skimmed milk.

SKIM-MILK CHEESE.

Milk varies so much in quality that in one dairy a better and richer cheese can be made from milk which has been skimmed than in another where only the evening milk is skimmed and added to the whole new morning's milk.

The following analyses clearly bring out this important practical fact, but they also show that, as a rule, skimmed milk does not produce a good cheese:

COMPOSITION OF SKIM-MILK CHEESE.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Water	27.68	39.43	38.39	43.87	45.39
Butter	30.80	27.08	23.21	15.89	9.97
*Caseine	35.12	30.37	28.37	28.93	33.12
Milk-sugar, lactic acid, and extractive matters	1.46	.22	6.80	6.47	6.39
†Mineral matters (ash)	4.94	2.90	3.23	4.84	5.13
	100.00	100.00	100.00	100.00	100.00
*Caseine nitrogen	5.62	4.86	4.54	4.63	5.34
†Containing common salt	1.27	.23	.33	1.66	1.51

With the exception of No. 4, which was bought in a shop at Cirencester as skim-milk cheese at seven pence per pound, the other cheese, the composition of which is here given, were either made under my direction or according to a plan with which I was made acquainted.

No. 1, it will be noticed, though made from skim-milk, is as rich in butter as good Cheshire cheese. It was rather more than six months old before it was analysed, when its quality was pronounced by several good judges to be excellent; superior, indeed, to most of the Gloucester cheese which I have ever tasted.

No. 2 and No. 3, though not equal to No. 1, after keeping fcr six months turned out very good cheeses indeed.

No. 4, it will be seen, contained only sixteen per cent. of butter, in round numbers, and nearly forty-four per cent. of water. If such cheese can be sold at seven pence per pound, and butter at one shilling to one shilling four pence per pound, I can well understand that it must pay a farmer to make nothing but skim-milk cheese and to convert all the cream into butter.

No. 5 was made of milk skimmed at least three times, and sold on the farm where it was made to the laborers at three pence per pound. Such cheese cannot be kept for any great length of time, for it soon gets so hard and horn-like that a pickax must be used to break it into pieces.

AMERICAN CHEESE.

Of late years a good deal of cheese has been imported into England from America, some of which is by no means bad: indeed one or two specimens which came under my notice were excellent in quality. The majority, however, are inferior, and are sold at a low price, being generally badly made and deficient in flavor.

The following Table gives the composition of American cheeses:

COMPOSITION OF AMERICAN CHEESE.

	No. 1.	No. 2	No. 3.	No. 4.
Water,	27.29	33.04	31.01	38.24
Butter,	35.41	33.38	30.90	26.05
*Caseine,	25.87	27.37	26.25	26.81
Milk-sugar, lactic acid and extractive matters,	6.21	2.82	7.43	3.64
†Mineral matters (ash),	5.22	3.39	4.41	5.26
	100.00	100.00	100.00	100.00
*Containing nitrogen,	4.14	4.38	4.20	4.29
†Containing common salt,	1.97	.47	1.59	1.94

No. 1 was as nice a cheese as could be desired; in flavor it much resembled good Cheddar, and was found to contain even a higher proportion of butter and rather less water than good Cheddar.

The second cheese, though rich in butter, was retailed at seven pence per pound, and the third at only six pence per pound. Both were deficient in flavor and badly made.

The fourth cheese was the worst of the four, and had to be sold at five pence per pound. It was full of holes, badly made, and had a very strong smell. It was evident that the whey was not carefully pressed out in the making.

The examination of these and other American cheeses leads me to the conclusion, judging from our imports, that good materials are even more thoroughly spoiled on the other side of the Atlantic than in England.

Let me next direct attention to some of the principal mistakes which are not unfrequently committed in the manufacture of cheese. I have said in the beginning of this paper—1st, that cheese is sometimes spoiled even before it is separated from the milk; 2dly, that it is yet more frequently spoiled in the act of making; and, lastly, that it is sometimes deteriorated by bad keeping after it has been made.

I.—PRACTICAL MISTAKES MADE IN THE MANUFACTURE OF CHEESE BEFORE THE CURD IS SEPARATED.

The inferior character, and especially the bad flavor, of cheese owes its origin in many cases to a want of proper care in handling the milk from which it has been made. Milk sometimes gets spoiled by dirty fingers before it passes into the pail. If the vessels in which the milk is kept in the dairy have been carelessly washed, and the milk-pails and cheese-tub have not been well scrubbed, but merely been washed out, and if especially the dairy utensils have not been scalded with boiling-hot water, it is vain to expect that cheese of the finest quality can be made, let the milk be ever so rich in cream. The neglect of these simple but important precautions soon manifests itself in a dairy by a peculiar ferment which taints the whole milk, and afterwards affects the flavor and consequently the quality of the cheese. Cleanliness, indeed, may be said to be the first qualification of a good dairywoman.

The nature of every ferment is to produce in other matters with which it comes into contact certain chemical changes depending on its own character. Thus a little yeast produces in fermentable liquids large quantities of alcohol and carbonic acid; acid ferments containing acetic or lactic acid have a tendency to generate vinegar or lactic acid in other liquids. A small piece of putrefying meat in contact with a large mass of sound flesh soon spreads putrefaction over the entire mass; and other ferments act in a similar manner. Such ferments generally produce in other matters with which they are brought into contact changes similar to those which they themselves undergo. The disagreeable smell of dirty or badly cleaned milk-pails and cheese-tubs is due to a peculiar ferment, which is rapidly formed, especially in warm weather, when milk is left in contact with air and with the porous wood of the cheese-tub and milk-pails. In the rapid process of vinegar manufacture a weak alcoholic liquid is allowed to trickle through a barrel perforated all over with holes to admit the air, and filled with wood shavings. If the temperature of the room in which the vinegar casks are put up is sufficiently high, the alcohol, in trickling over these shavings when in contact with abundance of air, undergoes a complete transformation, and collects rapidly at the bottom of the cask as vinegar. But such a change does not take place if the alcoholic liquid is left for ever so long in a clean cask filled with such a liquid. Contact with air, subdivision of the liquid into drops, and the presence of the porous wood shavings, are necessary for the transformation. These casks do not at first produce vinegar as rapidly as after they have been in use some time and become thoroughly soaked with vinegar ferment. And this is another peculiarity of all ferments, that, under favorable circumstances, they reproduce themselves from other materials in immense quantities. Thus fresh and active yeast is generated in great abundance in fermenting malt liquor, while the original yeast employed in brewing is more or less decomposed and becomes what is called inactive yeast. These chemical facts, well known to the manufacturers of vinegar and to the intelligent brewer, have a direct bearing on cheese making.

At the very beginning of her operations a good dairywoman unconsciously carries on a steady and constant battle with these remarkable ferments, and it is very interesting to the chemist to see her proceed in the most rational and philosophical manner.

No milk is admitted into the cheese-tub before it has been carefully strained through a cloth, lest a little bit of dead leaf or any similar matter, accidentally blown into the milk in its passage from the milking place to the dairy, should spoil the flavor of the cheese. No sooner has the cheese left the tub than she begins to pour scalding water into it, to scrub it, and to make it as clean and sweet as possible. In good dairies no utensil is allowed to remain for a moment dirty, but hot water and clean brushes are always close at hand to scrub the pails and make them almost as white as snow. The dairywoman probably knows nothing about the nature of the ferment, which is rapidly formed when a little milk is left at the bottom and adhering to the sides of the wooden milk pails; she is unconscious that here, as in the vinegar process, the conditions most favorable to chemical change are present, and that the sugar of the milk, in contact with plenty of air and porous wood, is rapidly changed into lactic acid, while at the same time a peculiar milk ferment is produced; all this may be a perfect mystery to her, but, nevertheless, guided by experience, she thoroughly avoids everything that favors the production of ferment, or taint, as she calls it, by leaving no vessel uncleaned, by scalding all that have been in use with boiling water, and if ever so little milk be accidentally spilt on the floor of the dairy, taking care that it is at once removed, and the spot where it fell washed with clean water.

It is, indeed, surprising how small a quantity of ferment taints a large quantity of milk. The most scrupulous cleanliness, therefore, is brought into constant play by a good dairywoman, who never minds any amount of trouble in scalding and scrubbing her vessels, and takes pride, as soon as possible after her cheeses are safely lodged in the presses, in having the dairy look as clean and tidy as the most fastidious can wish. It is a pleasure to see one of these hard-working women at work, especially as such a sight is not often witnessed, slovenly dairymaids being unfortunately in a majority. This being the case, we should encourage the use of tin pails and tin or brass cheese tubs. Wooden pails, &c., are very good in the hands of a tidy dairymaid, but not otherwise. There is much less labor in thoroughly cleaning a tin or brass vessel than a wooden one, and boiling-hot water is not then required. Wood, being a porous material, inevitably absorbs more or less of the milk; tin or brass does not. The milk thus absorbed cannot be removed by simple washing. Inasmuch as all ferments are destroyed by water at the temperature of 212°, it is important to ascertain that the water is perfectly boiling; and yet it is strange that few women, comparatively speaking, though they may have spent many years in the kitchen, know to a certainty when the kettle is really boiling. This remark applies to some educated as well as uneducated females. They often mistake the singing noise of the tea-kettle accompanied by a certain amount of vapor for a sign that water is in a state of ebullition; so that if you would drink good tea you must be careful to whom you trust to make it.

In some dairies of Cheshire it is customary to paint the wooden cheese tubs in the interior. I confess I do not like this at all; lead paint is not a very desirable thing to be used in connection with cheese; and I am glad to find that the best dairy farmers are decidedly averse to this proceeding.

Milk sometimes gets tainted by the close proximity of pig-sties or water-closets, or by underground drains. Not very long ago I visited a dairy in Wiltshire, where every possible care was taken by the dairymaid to produce good cheese; but I noticed a peculiarly disagreeable smell in the dairy, and on making inquiries I found that there was a cesspool close at hand, which certainly tainted the milk, and rendered the making of good cheese an impossibility. In the third place, I would notice that if dairies are not well situated,—if they have, for instance, a south aspect, so that a proper low temperature in summer cannot be maintained,—the milk is apt to turn sour and to make sour cheese. It is important, therefore, that dairies should be built with a northern aspect.

These are some of the circumstances that spoil the cheese even before it is separated from the milk. The remedies are obvious. It is only with respect to the latter point—that of milk getting sour, that I would offer a few observations. If the situation of the dairy is bad, and a new dairy cannot be erected, we should employ all possible means to prevent the milk from getting warm. We should keep it in shallow tins or leads, or, better still, as I have seen in some parts of Somersetshire, in shallow tin vessels with a double bottom, through which cold water may be run during the warm part of the season. By this means we can keep the milk at a considerably lower temperature than we should otherwise be able to do. Having seen nitre and salt used with great advantage to prevent cream from turning sour, I would further suggest that they might probably be found serviceable in the same manner for the keeping of milk if used in moderate quantities. Some people, however, maintain that milk requires to become sour before it can properly be made into cheese. A great deal has been said and written with respect to the great utility to the dairymen of an instrument by means of which the amount of acid in sour milk might be accurately and readily determined. A careful study of the action of rennet on milk, however, has led me to the conclusion that the more carefully milk is prevented from getting sour, and, consequently the less opportunity there is for the use of an acidometer, the more likely the cheese is to turn out good. Indeed, the acidometer appears to me a useless instrument—a scientific toy which can never be turned to any practical account.

If by accident the milk has become sour, the fact soon manifests itself sufficiently to the taste. An experienced dairymaid will even form a tolerably good opinion of the relative proportions of acid in the milk on different days and arrange her proceedings accordingly. Moreover, the knowledge of the precise amount of acid in the milk does not help us much. When milk has turned sour, the best thing to do is to hasten on the process of cheese-making as much as possible.

II. PRACTICAL FAULTS COMMITTED DURING THE MAKING OF CHEESE.

1. Under the second head I would observe, first, that sufficient care is not bestowed upon noticing the temperature at which the milk is "set," or "run," as it is called in Gloucestershire. Thermometers, indeed, are seldom in use. Even where they are hung up in the dairy, they are more frequently regarded as curious but useless ornaments than trustworthy guides, and therefore are seldom put into requisition. In fact, most dairymaids are guided entirely by their own feelings; and as these are as variable as those of other mortals, the temperature of the milk when it is "set" (that is where the rennet is added) is often either too high or too low. They mostly profess to know the temperature of the milk to a nicety, and feel almost insulted if you tell them that much less reliance can be placed on the indications of ever so experienced a hand than upon an instrument which contracts and expands according to a fixed law, uninfluenced by the many disturbing causes to which a living body is necessarily subjected.

It is really amusing to see the animosity with which some people look upon the thermometer. It is true that there are not many dairies in which it may not be found; but if we took pains to ascertain in how many of these it is in constant use, I believe that the proportion would not exceed five per cent. This is a great pity, for a tolerably good one can now be bought or replaced at a trifling cost.

I have spoken frankly but unfavorably of the acidometer. With equal frankness I express my regret that the use of the thermometer is not more general, as I believe it is indispensable for obtaining a uniformly good product.

If the temperature of the milk when the rennet is added, is too low, the curd remains too soft, and much difficulty is experienced in separating the whey. If, on the other hand, the temperature is too high, the separation is easily effected, but the curd becomes hard and dry. The amount of water which is left in the curd when it is ready to go into the cheese-presses, to some extent indicates whether a proper temperature has been employed. When this has been too low, the curd will contain more than fifty per cent. of moisture; when too high, sometimes less than thirty-six per cent. How variable is this proportion of water (chiefly due to the whey in the curd) will appear from the following determinations made in the same dairy on the four following days:

AMOUNT OF WATER IN CURD WHEN READY TO GO INTO THE VAT.

Percentage of water in 1st Cheese	41.53
" " 2d Cheese	41.49
" " 3d Cheese	38.20
" " 4th Cheese	35.80

In this dairy the thermometer was not in daily use, and the heat employed in making the fourth cheese was evidently too high, for in good Cheddar when ready for sale the amount of moisture is hardly less than in this curd when put into the vat. The cheese from these four specimens of curd was made according to the Cheddar system. Five other specimens gave the following proportions of water:

PERCENTAGE OF WATER IN CURD WHEN READY TO GO INTO THE VAT.

1st specimen, percentage of water	59.67
2d " " "	56.93
3d " " "	53.40
4th " " "	52.80
5th " " "	50.01

These were produced according to the custom of Gloucestershire and Wiltshire, at a temperature varying from 72° to 75°; but, not having taken the observations myself, I am unable to speak more precisely. This much, however, is quite certain, that the lower temperature at which the cheese is usually made in Gloucestershire and Wiltshire, when compared with the Cheddar system, fully accounts for the large proportion of water that is found in curd made after the Gloucester or Wiltshire fashion. The cheese made from these five curds was best at the dairy in which I found the lowest proportion of water in the curd. The differences here noticed, however, are due not only to the higher or lower temperature employed, but also to the trouble and the time bestowed in breaking up the curd. Other circumstances being equal, the more thoroughly curd is broken up, and the longer time is occupied in this process, the more whey will pass out, and the better the cheese is likely to become. I consider fifty per cent. of moisture rather under the average, and fifty-three to fifty-four per cent. a proper quantity of water to be contained in the curd when it is vatted to form a thin or moderately thick cheese. In making thick cheese, it should not have more than forty-five per cent of moisture. Fifty-seven or fifty-nine and a-half per cent., the proportions of water in the first and second specimens of curd, are too high even for a thin cheese.

Curd being a very peculiar and delicate substance, which is greatly affected by the temperature to which it is exposed, I directed some special experiments to the investigation of its properties. First, I coagulated new milk at 60° Fahrenheit, and found that at such a low temperature it took three hours to complete the process, though the rennet was added in a very large excess. The curd remained tender, and the whey could not be properly separated. Milk at 65° F., on addition of rennet, curdled in two hours; but the curd, as before, remained tender, even after long standing. At 70° to 72° F. it only took from one-half to three-quarters of an hour, and the curd now separated in a more compact condition. The process was more expeditious, and the curd in better condition, when the temperature ranged from 80° to 84°. At 90° the rennet curdled the milk in twenty minutes, and at 100° F. an excess of rennet coagulated the milk in about a quarter of an hour, separating the curd in a somewhat close condition. By heating the curd in the whey to 130° F., I find it gets so soft that it runs like toasted cheese, and becomes quite hard on cooling. The limits of temperature between which curd can be improved and deteriorated in texture are therefore not very wide. The exact temperature to be adopted depends upon the description of cheese that is wanted—a lower range, *e. g.* 72° to 75°, being desirable when a thin cheese is made; while for thick cheese, such as Cheddar, it should vary from 80° to 84°; 80° being best adapted to warm weather, and a little increase in the heat desirable in the cold season. After a portion of the whey has been separated, it is advisable to scald the curd and to raise the temperature of the whole contents of the cheese-tub to 95° or 100°, but certainly not higher. I have seen much injury done to cheese by using too high a temperature in the making.

Secondly, apart from this influence of temperature, cheeses are often deteriorated by the frequently imperfect separation of the whey from the curd; by hurrying on too much the operation of breaking; and by too great an anxiety to get the curd vatted. The whey requires time to drain off properly, and hence the Somersetshire plan is a good one—to expose the curd for some time to the air, after it has been sufficiently broken and been gathered again and cut in slices of moderate size. A great deal of whey runs off, and the curd, moreover, is cooled, and runs less risk of heating too much after it leaves the presses.

When the whey has been ill-separated from the curd, no amount of pressure will squeeze out the excesss of whey, which then causes the cheese to heave and blister, and imparts to it a somewhat sweet and at the same time strong taste. This taste is always found in an ill-shaped cheese, which bulges out at the sides, the interior of which will be found to be full of cavities, and far from uniform in texture. Many cheeses imported from America are evidently spoiled in this way, for they are often full of holes, have a strong smell, and contain too much moisture—sure indications that the whey was not properly separated. The sweet taste is given to the cheese by part of the sugar of milk, of which a good deal is found in whey; another portion of this, on entering into fermentation, forms, among other products, carbonic acid gas, which, in its endeavor to escape, heaves up the semi-solid curd, and causes it to blister, producing the numerous apertures of considerable size which are found in badly-made cheese. If the cheese is colored with annatto, the excess of whey at the same time causes a partial separation of the coloring matter, so that more color collects in some parts than in others, and the cheese assumes that unequal condition in which it is called tallowy. A uniform color and perfect shape are therefore to a certain extent indications of a superior quality; while mottled, mis-shaped cheese, almost invariably proves tallowy, and in flavor, sweet when young, and very strong when older. The danger of leaving too much whey in the curd is especially great in warm weather, for it is then that the fermentation of the sugar of milk proceeds most rapidly.

There are three precautions to be taken against an undue proportion of whey in the curd:

1. Plenty of time should be allowed for the whey to drain off properly.

2. Before the rennet is added, the milk should be heated to a temperature of 72° to 75° for thin, or of 80° to 84° for thick cheese.

3. The best preventive is the practice of *slip-scalding*, as it is called. The operation, which is highly recommended by Mr. Harding, one of our best Cheddar cheese-makers, and extensively practised in Somersetshire, consists of heating a portion of the whey, and adding it or hot water to the curd, while it is still covered with some of the whey, until the temperature of the whole be raised to from 95° to 100°. This has the effect of making the curd run together into a much smaller compass, and enables the dairymaid to draw off the whey more perfectly and with very much less trouble than by the common method. If well done, no injury, but every advantage, results from this practice. The curd, when slip-scalded, settles down very readily, and its closer condition implies that it does not contain so much whey as it did before scalding. Hence, no skewers are required to drain off the whey from cheese that has been slip-scalded, and a great deal of subsequent labor and anxiety is avoided by this simple process. Slip-scalding, however, ought to be carefully performed, and the hot whey or water poured slowly upon the curd by one person, while another stirs up the contents of the cheese-tub, so as to ensure a uniform temperature throughout. The necessity for these precautions will be best understood from the following explanation: When curd, broken up and cut into slices, is suddenly and incautiously scalded with boiling water, the outer layer of the slices first melts and then becomes hard, enveloping the interior, which remains quite soft and full of whey. This hard covering acts like a waterproof wrapper, and prevents the escape of the whey, however strongly the curd may be pressed afterwards; hence the importance of a gradual and careful admixture of the hot whey. Better still is it to employ one of Coquet's jacketed tin or brass cheese-tubs, into the hollow bottom of which steam may be let in, and the curd and whey be raised by degrees to the desired temperature. This utensil is to be strongly recommended to all who adopt the Cheddar mode of cheese-making in their dairies.

Cheese is also spoiled by breaking up the curd too rapidly and carelessly. This delicate substance requires to be handled by nimble and experienced fingers, and to have a great amount of patient labor bestowed upon it.

Dairymaids, as a class, break up the curd in far too great a hurry. In consequence of their careless treatment some portions of the curd are broken into fragments so small that they pass into the whey when this is drawn off, while others are not sufficiently broken up and remain soft. The result is, that the curd is not uniform in texture, and that less cheese and of inferior quality is produced than when the curd is first cut very gently into large slices, and then broken up by degrees either by hand or machinery into small fragments.

COMPOSITION OF WHEY.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Water,	92.95	92.65	92.60	92.75	92.950
Butter (pure fatty matters),	.65	.68	.55	.39	.490
*Nitrogenous substances (caseine and albumen,	1.20	.81	.96	.87	1.425
†Milk-sugar and lactic acid,	4.55	5.28	5.08	5.13	4.491
Mineral matter (ash),	.65	.58	.81	.86	.644
	100.00	100.00	100.00	100.00	100.000
*Containing nitrogen,	.19	.13	.15	5.14	.228
†Containing free lactic acid,	.48	.41	.36	.41	.120

	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.
Water,	92.95	93.150	92.95	93.30	93.25
Butter (pure fatty matters),	.29	.546	.24	.31	.26
*Nitrogenous substances (caseine and albumen,	1.01	1.056	.81	1.01	.91
†Milk-sugar and lactic acid,	5.08	4.662	5.27	4.68	4.70
Mineral matters (ash),	.67	.586	.73	.70	.88
	100.00	100.000	100.00	100.00	100.00
*Containing nitrogen,	.16	.169	.131	.16	.148
†Containing free lactic acid,	.54	None.	.39	.41	.41

	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.
Water,	92.85	93.35	92.70	93.15	93.10
Butter (pure fatty matters),	.29	.25	.31	.14	.14
*Nitrogenous substances (caseine and albumen,	.93	.91	.96	.91	.76
†Milk-sugar and lactic acid,	5.03	5.00	5.31	5.06	5.31
Mineral matters (ash),	.90	.49	.72	.74	.69
	100.00	100.00	100.00	100.00	100.00
*Containing nitrogen,	.151	.148	.15	.148	.123
†Containing free lactic acid,	.60	.43	.40	.48	.46

The whey which separates from curd that has been gently broken up is as bright as Rhenish wine, provided the milk has been curdled at the proper temperature by a sufficient quantity of good rennet. On the other hand, if the curd has been broken up carelessly in too great a hurry, the whey is more or less milky, and separates on standing, a large quantity of fine curd of the choicest character, for this fine curd is very rich in butter. Thus the best part of the curd, instead of becoming incorporated with the cheese, finds its way into the whey leads. Be the curd, however, broken up ever so gently, and the whey drawn off ever so carefully, the latter always throws up, on standing, some cream, which it is worth while to make into butter. But the quantity of whey butter made in good dairies is very insignificant in comparison with that produced where less attention is paid to the breaking of the curd. I know it to be a fact, that in some dairies four times as much whey butter is made as in others. Where much whey butter is made the cheese is seldom of first-rate quality. Believing that this is a matter of some importance, I have visited many dairies, and repeatedly watched dairymaids breaking the curd, and noticed the gentle, patient manner in which a clever woman goes to work, and the hurried, dashing proceedings of a slovenly girl. On these occasions I have taken samples of the whey, and submitted them afterwards to analysis. The results, as recorded in the preceding tables, show how much the whey of different dairies varies in chemical composition as well as in physical character.

COMPOSITION OF WHEY TAKEN AT THREE DIFFERENT PERIODS.

	No. 16. 1st SAMPLE.	No. 17. 2d SAMPLE, TAKEN 10 MINUTES AFTER 1st SAMPLE.	No. 18. 3d SAMPLE, TAKEN 20 MINUTES AFTER 1st SAMPLE.
Water,	92.90	92.25	93.55
Butter (pure fat),	.18	.18	.03
*Albuminous compounds,	.94	.94	.94
Milk-sugar and lactic acid,	5.30	5.03	4.82
Mineral matters (ash),	.68	.60	.66
	100.00	100.00	100.00
*Containing nitrogen,	.15	.15	.15

When it is remembered that milk of good quality contains from three and a-half to four per cent. of butter, it will be readily seen that where samples of whey contain more than one-half per cent. of butter, the cheese is deprived of a very considerable portion of its most valuable constituent, and that its quality must therefore depend in a great measure on the care with which the curd is broken up and the manner in which the whey is drawn off. In some samples the amount of butter is so trifling that it is not considered worth the trouble to gather the cream and to make whey-butter. In the dairies in which this happy state of things exists excellent cheese is made. When the whey first separates from the curd it is always more or less turbid, but by degrees it becomes clearer; and if sufficient time is allowed, and it is then tapped off without disturbing the curd, it runs off almost as clear as water. By this means nearly the whole of the butter may be retained in the cheese. In order to place this beyond a doubt, I examined the whey which Mr. KEEVIL, the inventor of the excellent cheese-making apparatus which bears his name, allowed me to take on the occasion of a visit which I recently paid to his dairy farm at Laycock, near Chippenham. One sample of whey was taken at the stage in which it was usually tapped off in Mr. Keevil's dairy; the second when the whey had become a little brighter, about ten minutes after the first; and the third about twenty minutes after the first. It then was as clear as water. These three samples when analyzed gave results as shown on preceding page.

The first two samples are almost identical in composition; they both contain very little butter, but, small as that quantity is, it can be further reduced to a mere trace by letting the whey stand a little longer. In practice it may for other reasons not be desirable to let the whey stand at rest quite so long as the third sample stood; and a dairymaid may congratulate herself when she succeeds in breaking up the curd so carefully that the whey contains as little butter as that made under Mr. Keevil's personal direction and excellent management.

It may perhaps be supposed that the successful manner in which the butter is retained in the cheese in Mr. Keevil's dairy is entirely due to the use of his patent apparatus, and that by its introduction any dairymaid may be enabled to make good cheese. But this supposition is not correct. Keevil's apparatus, useful and good as it is in many respects, is no safeguard against carelessness. Cheese is spoiled with, as well as without it. It does not supersede patience and skill, but its merit consists in saving a great deal of hard labor and time. Beyond this, I may say, without disparagement to his ingenious contrivances for breaking the curd, straining off the whey, and other appliances, that it effects nothing which may not be done by hand. But this saving of time and hard labor is a great merit in an apparatus which can be bought at no great cost. Where from thirty to forty milking cows are kept, it may be safely recommended; in smaller dairies there may not be sufficient use for it. Having made frequent trial of Keevil's apparatus, I am anxious that its true merits should be known, but no unreasonable expectations be entertained. It has been said that it makes more and better cheese than can be made by hand. My own opinion is, that it makes neither more or less, neither better or worse cheese than a skillful dairymaid will make by hand, and that a careless one is as likely to spoil her cheese when using this apparatus as when making it according to her own fashion.

Some of the very best and some of the very worst of cheeses which I have examined were made in dairies where Keevil's apparatus is in daily use. The superior character of the one cheese is as little a proof of the merits of Keevil's apparatus as is the bad quality of the other an evidence against it.

Again, I may point to the composition of the whey analyses marked No. 2, No. 3, No. 8 and No. 14, in the preceding large table, and to the three whey analyses to which I have just referred:

No. 2, containing .68 per cent. of butter, was made from curd taken by KEEVIL'S apparatus.

No. 16, containing .18 per cent. of butter, was made from curd taken by KEEVIL'S apparatus.

No. 18, containing .03 per cent. of butter, was made from curd taken by KEEVIL'S apparatus.

Here, then, we have two samples of whey very poor in butter, and one sample containing more butter than any of the seventeen which I analyzed. On the other hand:

No. 3, containing .55 per cent. of butter, was made from curd broken by hand.
No. 8, containing .24 per cent. of butter, was made from curd broken by hand.
No. 14, containing .14 per cent. of butter, was made from curd broken by hand.

Here, again, we have two well-separated samples of whey, and one rich in butter, all three being made from curd broken by hand.

Passing on from the loss of butter to that of the curd itself, I find that, although no doubt some fine curd is lost when the whey is very milky in appearance, yet as a rule this loss is small in most dairies. Indeed, my analyses prove positively that whey seldom contains much caseine or curd which might be retained by ever so careful filtration. I have filtered whey from good milk through the finest blotting paper, and obtained it as bright as crystal. On heating the perfectly clear whey to the boiling point, however, a considerable quantity of a white, flaky substance, resembling in every respect albumen, or the white of egg, made its appearance. Collected on a filter, washed with distilled water, dried at 212° F., and weighed, this albuminous or curd-like substance amounted on the average to about .9 or nearly one per cent. in good milk; in very rich milk there may be a little more, in poor a little less. This albuminous matter is contained in the whey in a state of perfect solution, and differs from caseine or curd in not being coagulated by rennet. I have called it an albuminous matter, because, like albumen, it separates in flakes from the whey at the temperature of boiling water. Any one may prove the existence of this substance, which, however bright the whey may be, it invariably deposits in abundance at the boiling point.

Assuming, then, .9 to be the average proportion of this albuminous matter in whey, and deducting this proportion from the total amount of nitrogenized substances in the eighteen samples of whey, we obtain the amount of curd held in *mechanical* suspension. Thus we get for

No. 1 whey, .30 per cent. of curd, held in a state of mechanical suspension.
No. 2, 4, 8 and 15 whey, none.
No. 3 and 13 whey, .06 per cent. of curd, held in a state of mechanical suspension.
No. 5 whey, .525 per cent. of curd, held in a state of mechanical suspension.
No. 6 and 9 whey, .11 per cent. of curd, held in a state of mechanical suspension.
No. 7 whey, .156 per cent. of curd, held in a state of mechanical suspension.
No. 10, 12 and 14 whey .01 per cent. of curd, held in a state of mechanical suspension.
No. 11 whey, .03 per cent. of curd, held in a state of mechanical suspension.
No. 16, 17 and 18 whey, .04 per cent. of curd, held in a state of mechanical suspension.

Thus only in one sample out of eighteen there was about one-half per cent. of curd held in mechanical suspension, and one sample containing three-tenths per cent., all the other samples, practically speaking, containing no suspended curd. Thus it is not so much the curd as the butter which is lost when whey is badly separated from the curd.

4. When the curd has become sufficiently consolidated and is ready to be vatted, it is crumbled down into small fragments. For this operation every dairy should be furnished with a curd mill, a simple and inexpensive contrivance, which saves much labor, and produces, generally speaking, a more uniform material than the hand.

5. Cheese is also spoiled occasionally by badly made rennet, that is, rennet which is either too weak or has a disagreeable smell. In the one case the curd does not separate completely, and that which separates remains tender; in the other the milk is tainted, and the flavor of the cheese is affected.

The rennet used in different parts of England varies exceedingly in strength and in flavor. Even in the same locality the usage differs on adjacent farms. Although I have in my possession some dozens of rennet recipes, which were given to me by experienced dairymaids, each as the very best, I shall not give a single recipe for making rennet, as my object is rather to elucidate chemical principles than to prescribe details; and also because, as long as the smell of the rennet is fresh, and a sufficient quantity is used, it matters little, in my opinion, how it is made.

The ordinary practice in Cheshire is to make rennet fresh every morning by taking a small bit of dried skin, infusing it in water, and using this infusion for one day's making. In Gloucestershire and Wiltshire a supply is made for the pickled vells, which lasts for two or three months. Generally the rennet is made in these counties twice in the season. I have had a good deal of discussion with practical men respecting the comparative merits of these two methods. The Cheshire farmers almost unanimously object that the rennet does not keep well when made in any quantity of pickled vells. This, however, is quite a mistake. I have in my possession some rennet which is as nicely flavored now as it was some nine months ago, when it was made. It has, of course, a peculiar animal odor, but nothing approaching a putrid smell. The spices which are used in some localities, such as cloves and lemons, tend very much to keep the rennet in a good condition and give it an agreeable flavor. The objection, then, of the Cheshire farmers, that rennet, when a supply is made, does not keep, and spoils the flavor of cheese, is certainly untenable. I am much inclined to consider the practice of Gloucestershire and Wiltshire, of making a considerable supply of rennet, a good one; for, when once the strength of the rennet has been ascertained, it is merely necessary to take the proper quantity, one or two cupfuls, to produce the desired effect with certainty; whereas, when the rennet is made day by day, there is not the same certainty of obtaining an infusion of uniform strength.

Scientific and practical writers on milk have stated that the caseine is held in solution by a small quantity of alkali; that when in warm weather milk curdles, lactic acid, which is always found in sour milk, is formed from a portion of the sugar of milk; and this lactic acid, by neutralizing the alkali which holds the caseine in solution, causes its separation from the milk. Rennet is supposed to act as a ferment, which rapidly converts some of the sugar of milk into lactic acid. Whether, therefore, milk coagulates spontaneously after some length of time, or more rapidly on the addition of rennet, in either case the separation of the curd is supposed to be due to the removal of the free alkali by lactic acid.

This theory, however, is not quite consistent with facts. The caseine in milk cannot be said to be held in solution by free alkali; for, although it is true that milk often has a slightly alkaline reaction, it is likewise a fact that sometimes perfectly fresh milk is slightly acid. We might as well say, therefore, that the caseine is held in solution by a little free acid, as by free alkali. Newly drawn milk, again, is often perfectly neutral; but, whether milk be neutral, or alkaline, or acid, the caseine exists in it in a state of solution, which cannot, therefore, depend on an alkaline reaction. We all know that milk, when it turns sour, curdles very readily. It is not the fact that *a good deal of acid curdles milk* which I dispute, but the assumption that the caseine in milk is held in solution by free alkali. The action of rennet upon milk, then, is not such as has been hitherto represented by all chemists who have treated of this subject. Like many other animal matters which act as ferments, rennet, it is true, rapidly induces the milk to turn sour; but free lactic acid, I find, makes its appearance in milk *after* the curd has separated, and not simultaneously with the precipitation of the curd. Perfectly fresh and neutral milk, on the addition of rennet, coagulates, but the whey is perfectly neutral. I have even purposely made milk alkaline, and yet succeeded in separating the curd by rennet; and, what is more, obtained a whey which had an alkaline reaction.

What may be the precise mode in which rennet acts upon milk, I do not presume to explain. I believe it to be an action *sui generis*, which as yet is only known by its effects. We at present are even unacquainted with the precise chemical character and the composition of the active principle in rennet, and have not even a name for it. Finding the effect of rennet upon milk to be different from that which I expected, I made a number of experiments, which may here find a place.

1*st Experiment.*—To a pint of new milk, slightly alkaline to test-paper, and of 60° Fahr., one-fourth ounce of rennet was added.

Result—No coagulation after three hours.

Another quarter ounce of the same rennet was then added.

Result—The milk coagulated one hour after this addition, but the caseine was by no means well separated, and remained tender and too spongy, even after twenty-four hours. The whey was *slightly alkaline.*

2*d Exp.*—To another pint of milk, neutral to test-paper, I added one-half ounce of the same rennet. The temperature of the milk was 60°, as before.

Result—The curd separated (though imperfectly) after three hours. The whey was *neutral.*

N. B.—It will be seen that the curd separated more readily from milk which was neutral, than from that which was alkaline.

3*d Exp.*—To two pints of skimmed milk (twenty-four hours old), and very slightly acid, I added one-half ounce of rennet. Temperature of milk 59° Fahr.

Result—Curd separated in two hours; reaction of whey the same as that of the milk.

Thus, if the milk is slightly sour, rennet separates the curd more readily than when it is neutral, though the temperature may be low.

4*th Exp.*—To one pint of milk, slightly alkaline, and heated to 82° Fahr., one-fourth ounce of rennet was added.

Result—The milk coagulated in twenty minutes; the whey was slightly alkaline.

5*th Exp.*—To one pint of milk heated to 100°, and neutral on reaction, one-half ounce of rennet was added.

Result—Milk coagulated in one-quarter of an hour; whey perfectly neutral.

6*th Exp.*—Added to one pint of milk one-fourth ounce of rennet. The temperature of milk was 110°; its reaction alkaline.

Result—Milk coagulated in ten minutes; the whey was alkaline.

7*th Exp.*—Milk was raised to 120° Fahr., and one-fourth ounce of rennet added to one pint of milk, which was slightly alkaline to test-paper.

Result—Milk coagulated in ten minutes; the whey had the same reaction as the milk.

8*th Exp.*—One pint of milk was heated to 130°, and one-fourth ounce of rennet added.

Result—Curd separated in twenty minutes; whey had the same reaction as milk.

The experiment was repeated, and found correct.

It will thus appear that too high a temperature is not so favorable to the coagulation of the milk as a less elevated one. The separation, which at 120° took place in ten minutes, at 130° occupied twenty minutes.

9*th Exp.*—Heated one pint of milk to 150°, added one-fourth ounce of rennet.

Result—Milk did not coagulate after twenty-four hours.

10*th Exp.*—Heated milk to 140°, added rennet.

Result—No coagulation.

11*th Exp.*—Heated milk to 135°, added rennet.

Result—No coagulation took place, even after three hours. I then added another quarter ounce; the milk by this time had cooled down, and the fresh quantity of rennet caused the separation of curd in less than twenty minutes.

Thus, at 120°, milk coagulates most readily; at 130°, it takes a somewhat longer time; and at 135°, and upwards, it ceases to coagulate.

12*th Exp.*—Heated one pint of milk to boiling point, added one-fourth ounce of rennet.

Result—No curd had separated when examined, after twenty-four hours' standing.

13*th Exp.*—Heated another pint of milk to boiling point, and added one-fourth ounce of rennet.

Result—Milk did not coagulate after twenty-four hours. I then added a little more fresh rennet to the cooled milk, and again gently heated it, when the curd separated in less than one-quarter of an hour.

Thus the temperature of boiling water, and even a much lower heat, destroys the action of the rennet, but does not so permanently change the caseine of milk that it cannot be separated.

The whey in the last experiment, again, was neutral, like the milk.

14*th Exp.*—To one pint of fresh milk I added ten grains of carbonate of potash, raised the temperature to 88° Fahr., and added one-fourth ounce of rennet.

Result—Curd separated in half an hour. The milk and the whey were strongly alkaline. After twenty-four hours the whey was neutral, and then it became acid by degrees.

15*th Exp.*—To one pint of milk I added twenty grains of carbonate of potash, heated to 90° Fahr., and added one-fourth ounce of rennet.

Result—The curd separated in half an hour, but not so perfectly as in the preceding experiment, and in a softer condition. The whey was more milky in appearance, and strongly alkaline. Examined after twenty-four hours' standing, it was found to be neutral; after a lapse of two days, it was acid.

Even a considerable quantity of an alkali, therefore, does not prevent the coagulation of milk by rennet.

16*th Exp.*—To another pint of milk I added an unweighed quantity of potash heated to 84°, and then one-fourth ounce of rennet.

Result—No coagulation took place.

Much more alkali was used in this experiment than in the two preceding; an excess of alkali, therefore, prevents the separation of curd by rennet.

17*th Exp.*—To some milk, sufficient tartaric acid was added to make it distinctly acid.

Result—No coagulation took place in the cold. On the application of heat, the milk coagulated but imperfectly.

18*th Exp.*—To another portion of milk I added a good deal of tartaric acid.

Result—The milk coagulated after some time, but imperfectly; on raising the temperature, more curd fell down.

In order to precipitate the caseine from milk by tartaric acid, it is thus necessary to add a very large excess of acid, and at the same time to raise the temperature of the milk.

These experiments prove thus—

a.—That the action of rennet on milk is not the same as that of an acid, inasmuch as rennet coagulates new milk without turning it sour in the least degree.

b.—That rennet can precipitate curd from milk, even when purposely made alkaline.

c.—That the whey of milk, when produced from perfectly sweet or neutral milk, is at first perfectly sweet or neutral, but rapidly turns sour. If made from milk having an alkaline reaction, the whey at first is alkaline; when from milk slightly acid, the whey likewise is slightly acid.

d.—That rennet ceases to coagulate milk at about 135°, and upwards.

e.—That the action of rennet upon milk is more energetic when the milk is slightly acid. This, perhaps, is the reason why some persons recommend putting some sour whey into the milk before or after adding the rennet.

f.—That an excess of alkali prevents the coagulation of milk by rennet.

g.—That an excess of acid coagulates milk, but not perfectly in the cold.

h.—That a moderate amount of acid does not coagulate milk in the cold, and imperfectly at an elevated temperature.

6. Cheese, again, is sometimes spoiled when bad annatto is employed as a coloring matter. Annatto at the best is a nasty, disagreeable smelling substance; it would be well if it were banished altogether from the dairy. But, so long as a good many people will prefer colored to uncolored cheese, annatto will be employed for the purpose of imparting a more or less deep yellow color.

The annatto of commerce is derived from the Orelan tree (*Bixa orellana*). The seeds and pulp of this tree appear to contain two coloring matters; one, in a pure state, is orange-red, and is called bixin; the other is yellow, and called orellin. These coloring matters are insoluble in water, but dissolve readily in alkalies, and also in fixed oils and fats. Solid annatto, the annatto cake of commerce, is a preparation, which contains, besides the pure coloring matter, a great deal of potash or soda, carbonate of lime, pipe clay, earthy matters and rubbish of various kinds. Soap, train-oil and other disagreeable smelling and tasting matters are often used in preparing annatto cake. Hence the annatto of commerce is often a most nauseous material, which, when put into the cheese tub, is apt to give the cheese a bad taste and an unsightly color. Far superior to this annatto, and more handy in its application, is the liquid annatto, which is mainly an alkaline solution of the pure coloring matter of the *Bixa orellana*. An excellent solution of that description is manufactured by Mr. NICHOLS of Chippenham, which is perfectly clear, has a bright yellow color, and is free from any of the obnoxious and disagreeable substances which are frequently mixed up with annatto cake.

7. *In the next place I would observe that cheese is occasionally spoiled if too much salt is used in curing it.* Salt is a powerful antiseptic, that is, it prevents fermentation; hence we use it for pickling beef and hams. A certain amount of salt is necessary, not so much for giving a saline taste, as for keeping in check the fermentation to which cheese, like other animal matters, is liable. If no salt were used the cheese would putrefy, and acquire a very strong taste and smell, at least when made in the ordinary way. When an extra quantity of cream is put to the milk, it is not necessary, or even desirable, to salt the curd much; we might even do without salt altogether, for the large amount of fat (butter) in extra rich cheeses, such as Stilton or Cream Cheddar, sufficiently preserves the caseine.

If salt is employed in excess, the cheese does not ripen properly, or acquire that fine flavor, which depends upon the fermentation proceeding in a sufficiently active degree. Too much salt, by checking this chemical activity, is thus injurious to the proper ripening of cheese. The saline taste of old cheese, as already explained, is not due so much to the common salt used in its preparation, as to certain ammoniacal salts which are formed during the ripening process. It sounds strange, but it is nevertheless the case, that over-salted cheeses do not taste nearly so saline when kept for six or eight months, as under-salted cheeses kept equally long. If the milk is very rich, somewhat less salt should be used than when it is poor. On no account, however, should more than two pounds of salt be used per hundred weight of cheese; one and a-half pounds in most cases is quite enough, and even one pound will be found a sufficient quantity when rich cheeses are made.

8. *Lastly, an inferior quality of cheese is sometimes produced when it is imperfectly salted;* that is, when the salt is not properly applied to the cheese. I have often seen the salt put upon the curd in rough bits; more often proper care is not taken to mix the curd with the salt, and the cheese becomes unequally salted. The consequence is that some particles of the cheese ferment too much, others too little, and that the portions which are too much salted do not stick well together, and acquire a dry and crumbly texture. The salt used in dairies should be of the finest description, and should be sifted evenly through a fine sieve on the curd, after the latter has been passed through the curd-mill, and thinly spread in shallow leads to cool. This plan of spreading the salt saves a good deal of labor, and is greatly to be preferred to the system of pickling the cheese in brine after it is made, or of rubbing in salt. When salt is applied, either in solution or by rubbing it into the cheese after it has been in the presses, the outside is apt to get hard, and close up too much. It is, of course, desirable to get a good and firm coat, but, at the same time, the pores should not be too much closed, so that the emanations which proceed from the cheese cannot escape. Thin cheeses

may be salted after they have been in the press; but, in making thick cheeses, it is far better to salt the curd before it is put into the vat.

A rather novel way of salting cheese has lately been made the subject of experiments in America. As the following communication to the pages of the Country Gentleman and Cultivator, an American agricultural paper, may have some interest, I take the liberty of inserting it here:

IMPORTANT EXPERIMENT IN CHEESE-MAKING.

"The dairy season is about commencing again, and I desire the privilege of a corner in your paper, to give the result of extended experiments in cheese-making. In the first place I shall take it for granted that the whole process up to salting is well understood, for it is of *salting* that I wish to speak in this article.

"In June, 1859, I finished a few cheeses after the following manner: When my curd was scalded (I practice thorough scalding), I threw into the vat about four quarts of salt—sometimes only three—for a cheese of fifty to sixty pounds, stirring thoroughly. Those which went into the hoop before being well cooled off, acted badly; but when I took time and means to cool sufficiently, the cheeses were very fine. On the whole, I did not like the process and abandoned it.

"In 1860 I commenced again, changing the programme as follows: After scalding I drew off the whey, leaving just enough to float the curd, and began to cool off, hurrying the process by pumping in cold water and changing often. Then, to a curd of say sixty pounds, a little more or less, I threw in sometimes three and sometimes four quarts of salt, and stirred till well cooled—then drew off the salted whey, and threw it on the compost heap—put the curd to press, and pressed rapidly and thoroughly. And now for the result. I lost from my whey tub about three pails of whey and some salt. I gained in this, that my dripping tub under the press never had a particle of cream rise upon it, and in having a cheese that gave me no trouble in curing, and that when sent to market sold for the very highest price, and called forth the unqualified approbation of dealers as being perfect in all respects—fine flavored, very solid (not porous), and very fat.

"And now let me talk to the experience of dairymen. In the old-fashioned way of breaking up and salting a curd, more or less bruising of the curd to break the lumps, in order to get the salt evenly distributed, is necessary; and when put to press the white whey runs off freely, or in other words the cream runs off, and of course with it the richness of the cheese, and more or less of its weight; and if the curd is very dry you are liable to get your cheese too high salted, if not, the reverse.

"My experiments clearly prove that a curd salted in whey will retain no more salt than it needs, and that as every particle comes in contact with the brine through the operation of stirring, no bruising is necessary. Whether this is the philosophy of it or not, I am not chemist enough to determine, but I do know that if there is no discharge of white whey, or cream, it is retained in the cheese, adding to it both richness and weight as a remuneration for the extra salt and the wasted whey."

III.—PRACTICAL ERRORS MADE IN KEEPING CHEESE.

The following are some of the practical mistakes that are occasionally made after the cheese has left the presses and is placed in the store-rooms.

1. *Cheese is deteriorated in quality when it is placed in damp or in badly ventilated rooms.*

When beef or mutton is kept for a day or two in a damp and badly ventilated place, the meat soon acquires a disagreeable, cellar-like taste. The same is the case with cheese. Kept in a damp place, it also becomes moldy, and generates abundance of mites.

In some parts of Cheshire it is a common practice to keep cheese in dark rooms, carefully shutting out the free access of air. This is an objectionable practice, which no doubt has its origin in the desire to maintain in the store-rooms a somewhat elevated temperature, and to avoid draughts of cold air.

It is quite true that draughts are injurious to newly-made cheese, and a somewhat elevated temperature decidedly favors its ripening and the development of a fine flavor; but the one may be avoided, and the other can be maintained quite well, at the same time that due provision is made for the admission and circulation of fresh air.

During the first stage of ripening, a good deal of water and other emanations escape ftom the cheeses, which, if not allowed freely to pass away, make the air damp and injure the flavor of the cheeses. Why cheese should be kept in dark rooms is to me a mystery.

2. *Cheese newly made is spoiled by not turning it frequently enough.*

Thick cheeses especially require to be frequently turned, in order that the water which is given off from the interior warmer parts of the cheese may freely escape, and all sides be exposed at short intervals to the air. If this is neglected, that part which is in close contact with the board on which it rests becomes smeary and rots, and by degrees the whole cheese is spoiled. The boards, we need hardly say, should be wiped with a dry cloth from time to time as well as the cheese.

3, *Cheese does not ripen properly, and therefore remains deficient in flavor, if the temperature of the cheese-room is too low.*

The ripening of cheese is essentially a process of fermentation, which may be accelerated or depressed by a proper or by too low a temperature. Any temperature under 60° is unfavorable, and should therefore be avoided.

4. *Cheese is also spoiled if the temperature of the cheese-room is too high.*

If the temperature of the room rises above 75°, the fermentation becomes so active that a cheese is apt to bulge out at the sides, and to lose the uniform and close texture which characterises it when good.

5. *Lastly, cheese is sometimes spoiled if the temperature of the cheese-room varies too much at different times.*

A steady fermentation, which is essential to the proper ripening of the cheese, can only be maintained in a room which is not subject to great fluctuations in temperature. The more uniformly, therefore, the cheese-room is heated, the more readily cheese can be brought into the market, and the finer the quality will be. For this reason hot-water pipes, which give a very steady, gentle, and lasting heat, are greatly to be preferred to stoves in cheese-rooms; with the latter it is almost impossible to maintain an equable temperature. The cheeses nearest to the stove, again, are apt to get too much and those farthest off not enough, heat. Constant attention is moreover required; and firing in the room is always productive of more or less dust and dirt. These inconveniences are entirely avoided by the system of heating by hot-water pipes.

In every dairy hot water is in constant request; the same boiler which heats the water for cleaning the dairy utensils may be conveniently connected with iron pipes that pass in and round the cheese-room. Beyond the first cost of the iron pipes hardly any extra expense in fuel is thus incurred. An extra pipe likewise may be introduced which connects the boiler with Coquet's apparatus, and by this means the curd in the tub may be scalded much more conveniently and regularly than by pouring hot whey or water over it. I have not made a sufficient number of observations to say definitely which is the best temperature to be maintained in a cheese-room; but in my judgement a uniform temperature of 70° to 75° is highly favorable to the ripening process.

The proper regulation of the temperature of the cheese-room, and the general plan of heating by hot water, I believe, is one of the greatest of our recent improvements.

These are some of the practical mistakes which I have noticed in our dairies. I have endeavored to assign reasons why they must be so regarded, and have ventured to point out the appropriate remedies, many of which, however, suggest themselves naturally to any intelligent observer. My object has been, not so much to write a treatise on cheese-making, as to enable those interested in dairy operations to read the various treatises and pamphlets on cheese-making with profit, so as to be able to sift the recommendations which are worth imitating from the heap of empirical rubbish under which they are too often buried. No directions, however carefully given, can ever be of much service in an art which, like cheese-making, does not so much presuppose a great amount of knowledge as practical experience, dexterity and cleanly habits. Neither skill in manipulation, nor habits of cleanliness, nor experience can be acquired by reading. A good or a sensible pamphlet, no doubt, may be read with benefit even by an experienced hand; but the very best of treatises, in the nature of things, cannot teach a person who wants a rule or a receipt for everything, how to make a good cheese. A good cookery book, no doubt, is a useful literary production, but the best cookery-book is incapable of teaching an inexperienced person the art of making light and wholesome pie-crust. It is the same with cheese-making as with cookery, as we shall do well to bear in mind.

Lest these observations on publications on cheese-making should seem to disparage too much the merits of the different authors, I may state distinctly that a few papers contain valuable and plain directions for making good cheese; but I am bound at the same time to confess that the greater number, and more especially most of the prize essays on cheese-making which I have read, in my humble opinion, are next to useless to the dairy-farmer, inasmuch as they generally contain nothing good but what every dairy-farmer has long known ever since he began making cheese—and a great deal besides, which, though it may appear novel, ingenious or feasible, will at once be condemned by any man of sound judgement as visionary and utterly impracticable.

There are many topics intimately connected with the manufacture of cheese on which I have not touched at all, such as the influence of the food on the quantity and quanlity of milk, an important subject as yet hardly investigated at all. Again, the influence of the race on the production of milk deserves to be carefully studied, besides various other points on which practical men may wish to obtain trustworthy information. My passing them over in silence in the present paper will not, I trust, be taken as an indication of want of acquaintance with the real, practical wants of the dairy-farmer.

Hitherto scarcely anything directly bearing on dairy-practice has been done by scientific men; the whole investigation has, therefore, engaged my liveliest attention, and brought to light some unexpected chemical facts which have been recorded in the preceding pages. Others I hope to lay before the readers of the Journal of the Royal Agricultural Society when the researches still in hand shall be in a sufficiently advanced state to warrant their publication.

VOELCKER'S CHEESE EXPERIMENTS.

On Pasture Farms, where the milk is not all sold as new milk, nor used for fattening calves, the question arises, by what other means it may most profitably be converted into marketable produce, and there is still a choice between four different modes of proceeding:

1. The whole milk may be made into cheese.

2. The cream may be skimmed from part of the milk for making butter, and the skimmed milk added to new milk, and then made into cheese.

3. The whole of the milk may be skimmed and made into skim-milk cheese, and the cream into butter.

4. The whole milk may be skimmed, and made into skim-milk cheese; the cream from the skimmed milk be added to new milk, and made into extra rich cheese.

The question is, which of these four modes gives the best money return. Such a purely practical question can be tested satisfactorily in one way only, that is by actual trials. I therefore gladly availed myself of the kindness of my friend Mr. Thomas Proctor, who most liberally placed his dairy at my command, that I might institute a series of experiments calculated to further the solution of this inquiry. I am, likewise, much indebted to Mr. Tanner for the practical assistance which he rendered me by superintending the experiments which were made on a sufficiently large scale to furnish reliable data.

For each experimental cheese an equal quantity of milk was used, consisting of one hundred and thirty quarts of evening milk and one hundred and thirty quarts of morning milk. The first experimental cheese was made on the 11th of August, 1860; the others on the following days.

In Mr. Proctor's dairy at Wall's Court (now in the occupation of Mr. Richard Stratton) cheese is made in the Cheddar fashion. In making the different experimental cheeses, the same general process was adopted, being that usually employed in this dairy.

Immediately after the morning milking, the evening and morning milks were put together into a Cockney's tin tub, having a jacketed bottom for the admission of steam or cold water.

The temperature of the whole was slowly raised to 80°, by admitting steam into the jacketed bottom. No annatto was used for coloring; after the addition of the necessary quantity of rennet, the tub was covered with a cloth and left for an hour. Rennet, it may be remarked, when properly prepared and added in sufficient quantity, should perfectly coagulate milk at 80° in from three-quarters of an hour to one hour. If the milk fail to be coagulated within the hour, the curd produced will be too tender, and not easily separated from the whey without loss of butter and injury to the quality of the cheese. These results invariably follow when the rennet is not sufficiently strong, or too little of it is employed.

On the other hand, if the curd is completely separated from milk at 80° Fahrenheit in twenty to twenty-five minutes, the cheese produced is apt to be sour or hard. An excess of rennet always has the effect of separating the curd from the milk too rapidly, and in a hard condition.

As much depends upon the strength of the rennet, it is useful in daily practice to prepare a large quantity at a time, and to ascertain by a few trials the proper amount for mixing with a given quantity of milk. In experimental trials, it is absolutely indispensable to know the strength of the rennet, and to employ the same rennet in all the trials. At Wall's Court we took special care to fulfil these conditions.

Our plan of proceeding was as follows:—At about half-past eight o'clock, the curd was partially broken and allowed to subside for about half an hour, after which the temperature was raised very gradually to 108° Fahrenheit, by letting steam into the hollow bottom of the cheese-tub; the curd and whey, meanwhile, being gently stirred with a wire breaker, so that the heat was uniformly distributed, and the curd minutely broken. The heat was kept at 108° for an hour, during which time the stirring was continued; the curd, now broken into pieces of the size of a pea, was then left for half an hour to settle.

The whey was then drawn off by opening a spigot near the bottom of the tub. As the curd which is obtained by this process is quite tough, it readily separates from the whey, and no pressure whatever is at first requisite to make the bulk of it run off in a perfectly clear state.

The curd, collected in one mass, was then rapidly cooled and cut across into large slices, turned over once or twice, and left to drain for half an hour. As soon as it was tolerably dry and had cooled down considerably, it was placed under the press and much of the remaining whey removed by pressure. After this the cheese was broken at first coarsely by hand, and then by the curd-mill, which divides it into small fragments. A little salt was then added and thoroughly mingled with the curd.

The next operation was the vatting. The cheese vat, completely filled with the broken and salted curd, was covered with a cloth; the curd was reversed in the cloth, put back into the vat, covered up and placed in the press. The cheese cloth was removed several times, and the cheeses were ready to leave the press on the sixth morning. Mr. PROCTOR's dairy was furnished with one of Messrs. COCKEY's heating apparatus. This apparatus not only maintains a uniform temperature in the room in which the cheese is ripened, but provides a supply of steam, by which the milk and whey may be kept at any temperature which may be required; the necessity of removing a large quantity of milk or whey to a boiler to be heated, that it may impart the proper temperature to the remainder of the milk or whey in the cheese-tub, is thus done away with. As the steam is quickly generated, careless dairymaids sometimes spoil the cheese in a few minutes by allowing the temperature to rise too high. When the curd is overheated, the cheese made from it is always hard and deficient in flavor.

In using COCKEY's jacketed cheese-tub, care should also be taken to stir up constantly the contents of the tub when steam is admitted into the false bottom, for the purpose of raising the temperature to about 100°, after the curd has been broken up coarsely. If this precaution is neglected, a portion of the curd adheres to the heated bottom, and melts. The melted curd prevents the equal distribution of the heat, and by not amalgamating with the remaining curd produces a cheese which is not uniform in texture, ripens unequally, and is altogether of an inferior quality. When steam is admitted into the jacketed bottom of the tub, the dairymaid should not leave her place for a moment, and constantly keep her hands employed in stirring the contents of the tub with the shovel wire-breaker. This is rather hard work, and therefore much better performed by men than by women, many of whom dislike COCKEY's cheese-tub. Where it is in use there is, indeed, greater risk of the cheese being spoiled than when whey heated in a boiler is added to raise the contents of an ordinary tub to the required temperature. But it is manifestly unjust to condemn a useful apparatus on account of the mischief which may arise from its misuse.

COCKEY's cheese-tub, I have no hesitation in saying, is an excellent apparatus which saves a great deal of labor; but excellent though it may be, I cannot recommend its use to those who cannot place implicit reliance on the care and vigilance of the dairywoman. These women, as a class, are not willing to alter the plan of their operations, and learn the use of a new apparatus, which, if it saves much labor, still requires some special attention—an effort which to some minds seems more troublesome than down-right hard manual labor.

The rennet used in the dairy was made according to the following receipt: Slice the half of a lemon; sprinkle it with about six ounces of salt, then pour upon it one quart of boiling water; cover the vessel to retain the steam. When cold put into the liquid one fresh vell; allow the whole to stand for two days, then strain the liquid through a fine cloth, and the rennet is ready for use. This quantity is deemed sufficient to coagulate six hundred gallons of milk.

Prepared in this mode, and carefully strained off from the sediment which makes its appearance in the course of some days, rennet keeps sweet and efficient for several months.

EXPERIMENTAL CHEESE NO. 1 (WHOLE-MILK CHEESE.)

A cheese was made from one hundred and thirty quarts of evening milk and one hundred and thirty quarts of morning milk as drawn from the cow. A sample of the mixed morning and evening milk, on analysis, gave the following results:

Water,	87.30
Butter,	3.75
*Caseine,	3.31
Milk-sugar and extractive matters,	4.86
Mineral matters (ash),	.78
	100.00
* Containing nitrogen	.53

The whey obtained in this trial was as clear as Rhenish wine, and contained no suspended curd. It furnished the following analytical results:

COMPOSITION OF WHEY OBTAINED IN MAKING CHEESE NO. 1.

Water,	93.25
Butter,	.26
*Albuminous compounds,	.91
†Milk-sugar, lactic acid, &c.,	4.70
Mineral matters (ash),	.88
	100.00
* Containing nitrogen,	.166
† Lactic acid,	.60

This whey, though perfectly clear, like all other samples contained in solution a considerable quantity of a curd-like substance, which is not coagulated by rennet, but separates in flakes like the white of eggs when the liquid is raised to the boiling point. In all probability this curdlike substance is albumen. In the analysis of milk this albuminous compound is given together with caseine; and as it constitutes one-fourth to one-third of the caseine mentioned in the analysis of milk, much less curd is obtained as cheese than would be the case if the total quantity of curdlike substances was coagulated by rennet. I have tried various means of separating this curdlike substance together with the rest of the curd, in the hope of obtaining thereby a larger quantity of cheese from a given number of gallons of milk, but have not succeeded. The only simple way of obtaining this substance is to heat the milk or whey nearly to 212°, a temperature which of course, would altogether spoil the cheese. It has been said that perfectly clear whey possesses little nutritive value, but this is a mistake. Not only does such whey contain nearly the whole of the sugar of milk and bone-producing materials (ash), but also a considerable quantity of albuminous or flesh-producing compounds held in solution, besides some butter, the proportion of which, however, is very small when the operation has been carefully conducted.

On no account, therefore, should the whey be allowed to run to waste. Mixed with a little barley-meal it constitutes the best food that can be given to pigs, for it fattens rapidly, and produces the most delicately-flavored bacon.

In this trial two hundred and sixty quarts of milk produced two hundred and thirty-four quarts of whey.

The cheese was weighed when fresh from the press, and again from time to time, with a view of ascertaining the loss which it sustained in keeping. The loss is considerable, as will be seen by the subjoined weighings:

August 17th (fresh from the press),	61½ lbs.
September 14th	60¼ "
December 14th	57¾ "
February 11th	57¼ "
March 11th	57 "
April 17th	56 "

Total loss in eight months, 5½ lbs., or nine per cent. round numbers.

This cheese was considered quite ripe on the 14th of December, and therefore lost one and three-quarter pounds after it was ready for the market. A portion analysed on the 17th of April, 1861, gave the following results:

Water,	37.85
Butter,	28.91
*Caseine,	25.00
Extractive matters, lactic acid, &c.,	4.91
†Mineral matters (ash),	3.33
	100.00
* Containing nitrogen,	4.00
† Containing common salt,	.52

EXPERIMENTAL CHEESE NO. 2 (PARTIALLY SKIMMED-MILK CHEESE.)

The second cheese was made from one hundred and thirty quarts of skimmed milk and one hundred and thirty quarts of new milk. The morning milk stood thirty-six hours and the evening milk twenty-four hours before being skimmed. The cream removed measured ten pints, and produced nine pounds of butter.

A sample of the mixed skim and new milk from which the cheese No. 2 was made, on analysis gave the following results:

Water,	87.89
Butter,	3.12
*Caseine,	2.94
Milk sugar and extractive matters,	5.29
Mineral matters (ash),	.76
	100.00
*Containing nitrogen,	.47

The whey produced in this experiment measured two hundred and twenty-eight gallons, and was found to have the following composition:

Moisture,	92.85
Butter,	.29
*Albuminous compounds,	.93
Milk sugar, lactic acid, &c.,	5.03
†Mineral matters (ash),	.90
	100.00
* Containing nitrogen,	.168
† Containing lactic acid,	.48

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The cheese No. 2 was made on the 13th of August, 1860, and weighed:

August 21st (fresh from the press),	50¾ lbs.
September 14th,	49¼ "
December 14th,	47 "
March 11th,	46 "
April 18th,	45¼ "
July 30th,	44 "

Total loss in eight months, 6¾ lbs., or thirteen and a-quarter per cent.
Loss when ready for sale, 3¾ lbs., or seven per cent.

Analysed on the 30th of July, 1861, having been kept rather longer than ten months, it had the following composition:

Water,	32.88
Butter,	29.25
*Caseine,	29.87
Extractive matters, lactic acid, &c.,	4.92
†Mineral matters (ash),	3.08
	100.00
* Containing nitrogen,	4.78
† Containing common salt,	.29

Having been kept much longer than the preceding cheese, it contained five per cent. less water and cut rather drier. It will be noticed that this cheese contained very little salt. The dairymaid made a mistake not only in this, but in all the trials, by using an insufficient quantity of salt; not more than about six ounces having been taken for each cheese. The proper quantity of salt is one pound for every fifty pounds of cheese.

EXPERIMENTAL CHEESE NO. 3 (SKIM-MILK CHEESE.)

In this instance two hundred and sixty quarts of new milk were set aside; the moruing milk stood twenty-four hours, and the evening milk thirty-six hours before being skimmed. The milk from which the cream was removed was then made into skimmed-milk cheese; two hundred and sixty quarts of milk gave twenty pints of cream, which according to the preceding trial would have yielded eighteen pounds of butter.

A sample of the skimmed milk from which the Cheese No. 3 was made, on analysis furnished the following results:

Water	89.00
Butter	1.93
*Caseine	3.01
Milk-sugar and extractive matters	5.28
Mineral matters (ash)	.78
	100.00
* Containing nitrogen,	.48

The whey in this experiment measured two hundred and twenty-two quarts, and had the following composition:

Water	93.15
Butter	.14
Albuminous compounds	.91
*Milk-sugar, lactic acid, &c	5.06
Mineral matters	.74
	100.00
* Containing lactic acid	.48

The Cheese No. 3 was made on the 15th of August, and weighed:

August 21st (fresh from the press)	48½	lbs.
September 14th	47	"
December 14th	44	"
February 11th	43½	"
March 11th	43½	"
April 18th	42	"

Total loss in eight months, six and a-half pounds, or thirteen per cent.
Loss when ready for sale, four and a-half pounds, or nine and one-quarter per cent.

A portion of this cheese was analyzed on the 18th of April, 1861, and found to consist in one hundred parts of—

Water	39.43
Butter	27.08
*Caseine	30.37
Extractive matters and lactic acid	.22
†Mineral matters (ash)	2.90
	100.00
* Containing nitrogen	4.86
† Containing common salt	.23

EXPERIMENTAL CHEESE NO. 4 (EXTRA-RICH CHEESE).

The cream from two hundred and sixty quarts of milk was added to two hundred and sixty quarts of new milk and made into cheese. A sample of the mixed cream and new milk from which No. 4 was made contained in one hundred parts:

Water	85.75
Butter	6.11
*Caseine	2.94
Milk-sugar and extractive matters	4.47
Mineral matters (ash)	.73
	100.00
* Containing nitrogen	.47

In this trial two hundred and forty-three quarts of whey were produced. The following is an analysis of the whey obtained in making Cheese No. 4:

Water	92.95
Butter	.65
Albuminous compounds	1 20
*Milk-sugar and lactic acid	4.55
Mineral matters (ash)	.65
	100.00
* Containing lactic acid	.48

In comparison with the whey obtained in making the Cheeses No. 1, 2 and 3, this whey is richer in butter and also in albuminous matter. It was rather milky, and owed its turbid condition to finely-suspended particles of curd and butter.

The Cheese No. 4 was made on the 15th of May, 1860, and weighed:

August 21st (when it left the press)	70¾	lbs.
September 14th	70	"
December 14th	67	"
February 11th	66	"
March 11th	66	"
April 18th	64	"
July 30th	62	"

Total loss in eleven months, eight and three-fourths pounds, or twelve and a-half per cent. in round numbers.

Loss when ready for sale, three and three-fourths pounds, or five per cent.

COMPOSITION OF EXTRA-RICH CHEESE NO. 4 ON JULY 30TH, 1861.

Water	30.53
Butter	41.58
*Caseine	23.38
Extractive matters, lactic acid, &c.	2.45
†Mineral matters (ash)	2.06
	100.00
* Containing nitrogen	3.74
† Containing common salt	.09

It was considered desirable to repeat these trials, and to make four other cheese precisely in the same way in which the preceding four cheeses were made respectively.

CHEESE NO. 5 (WHOLE-MILK CHEESE).

Made from two hundred and sixty quarts of new milk.

COMPOSITION OF THIS MILK (AUGUST 21ST, 1860).

Water	87.00
Butter	3.99
*Caseine	3.44
Milk-sugar, extractive matter, &c.	4.81
Mineral matters (ash)	.76
	100.00
* Containing nitrogen	.55

This milk, it will be seen, differs but slightly in composition from that used on the 11th of August, for making whole-milk cheese.

COMPOSITION OF WHEY FROM CHEESE NO. 5.

Water	92.80
Butter	.59
Albuminous compounds	.91
Milk-sugar, lactic acid, &c.	5.04
Mineral matters (ash)	.66
	100.00

This whey, like that made from Cheese No. 4, was not sufficiently clear, and contained too much fatty matter in a state of mechanical suspension.

The Cheese No. 5 was made on 21st of August, and weighed:

August 27th (fresh from the press)	61½	lbs.
September 14th	60¾	"
December 14th	58¼	"
March 11th	57	"

Total loss in six and a-half months, four and a-half pounds, or seven and one-fourth per cent. Loss when ready for sale, three and one-fourth pounds, or five and one-fourth per cent.

COMPOSITION OF CHEESE NO. 5 ON THE 11TH JULY, 1861.

Water	31.70
Butter	36.18
*Caseine	27.19
Extractive matters, lactic acid, &c.	1.95
†Mineral matters (ash)	2.98
	100.00
* Containing nitrogen	4.35
† Containing common salt	.34

CHEESE NO. 6 (PARTIALLY-SKIMMED-MILK CHEESE).

Made from one hundred and thirty quarts of new milk and one hundred and thirty quarts of skimmed milk.

COMPOSITION OF MILK FROM WHICH CHEESE NO. 6 WAS MADE.

Water	88.50
Butter	2.43
*Caseine	3.25
Milk-sugar, extractive matters, &c.	5.03
Mineral matters (ash)	.79
	100.00
* Containing nitrogen	.52

Ten pints of cream were taken from one hundred and thirty quarts of milk, and produced nine and one-fourth pounds of butter.

COMPOSITION OF WHEY FROM CHEESE NO 6.

Water	93.05
Butter	.40
Albuminous compounds	.95
Milk-sugar, lactic acid, &c.	4 96
Mineral matters (ash)	.64
	100.00

This cheese was made on the 18th of August and weighed :

August 24th	53	lbs.
September 14th	52¼	"
December 14th	49¾	"
February 11th	49	"

Total loss in six months, four pounds, or seven and a-half per cent.
Loss when ready for sale, three and one-fourth pounds, or six per cent.

COMPOSITION OF CHEESE NO. 6, ANALYZED APRIL 22D, 1862.

Water	38.43
Butter	23.28
*Caseine	32.37
Extractive matters, lactic acid, &c.	2.10
†Mineral matters (ash)	3.82
	100.00
* Containing nitrogen	5.18
† Containing salt	.65

CHEESE NO. 7 (SKIMMED-MILK CHEESE).

Made from two hundred and sixty quarts of milk, from which the cream (twenty and one-fourth pints) was taken off.

COMPOSITION OF SKIM-MILK USED IN MAKING THE CHEESE NO. 7.

Water	89.10
Butter	2.31
*Caseine	3.50
Milk-sugar and extractive matters	4.32
Mineral matters (ash)	.77
	100.00
* Containing nitrogen	.56

The whey from this cheese was perfectly clear, and contained hardly any butter, as will be seen by the subjoined analysis :

COMPOSITION OF WHEY FROM CHEESE NO. 7.

Water	93.10
Butter	.14
Albuminous compounds	.76
*Milk-sugar and lactic acid	5.31
Mineral matters (ash)	.69
	100.00
* Containing lactic acid	.46

This cheese was made on the 20th of August, 1860, and weighed:

August 26th	49¾ lbs.
September 14th	49 "
December 14th	47½ "
March 6th	46½ "

Total loss in six months, three and one-fourth pounds, or six and one-half per cent. Loss when ready for sale, two and one-half pounds, or five per cent.

COMPOSITION OF CHEESE NO. 7 (SKIM-MILK CHEESE).

Water	38.39
Butter	23.21
*Caseine	28.37
Extractive matters, lactic acid, &c.	6.80
Mineral matters (ash)	3.23
	100.00
* Containing	4.54

CHEESE NO. 8 (EXTRA RICH CHEESE).

Made from two hundred and sixty quarts of new milk, to which was added the cream (twenty pints) from two hundred and sixty quarts of milk.

COMPOSITION OF THE MILK FROM WHICH THE CHEESE NO. 8 WAS MADE.

Water	86.73
Butter	4.81
*Caseine	2.69
Milk-sugar and extractive matters	5.01
Mineral matters (ash)	.76
	100.00
* Containing nitrogen	.43

COMPOSITION OF THE WHEY FROM CHEESE NO. 8.

Water	92.95
Butter	.42
Albuminous compounds	1.01
Milk-sugar, lactic acid, &c	4.95
Mineral matters (ash)	.67
	100.00

This cheese was made on the 20th of August, 1860, and weighed:

August 26th (fresh from the press)	74¾ lbs.
September 14th	73½ "
December 14th	71 "

Loss from the time it left the press until ready for sale, three and three-fourths pounds, or five per cent.

No analysis was made of this cheese.

These experiments then led to the following results:

	Quarts.			Marketable Cheese. lbs.	Butter. lbs.
1.	520	of milk produced	(whole-milk)	116	..
2.	"	(one-half skimmed) produced		$96\frac{3}{4}$	18
3.	"	(all skimmed) produced		$90\frac{1}{2}$	36
4.	1040	" the cream from one-half being added to the other ... produced	skim cheese	$90\frac{1}{2}$	..
			rich cheese	138	..

The cheeses were sent to Messrs. BRIDGES & Co., extensive cheese factors at Bristol, who considered No. 1 to be worth seventy shillings per hundredweight; No. 2, sixty shillings per hundredweight; No. 3, fifty shillings per hundredweight.

With respect to the extra-rich Cheese No. 4, Messrs. BRIDGES say: "We have examined the cheese marked No. 4; we think it cuts rather richer than that marked No. 1, but it bears no higher value in the market." In my paper on the Composition of Cheese, I pointed out the fact that the market value of cheese does not entirely depend upon the amount of butter which it contains. I am glad to find this opinion confirmed by the testimony of a cheese factor whose practical knowledge is extensive.

Mr. TANNER informs me that he has had a long conversation with Mr. BRIDGES on the subject of cheese-making, and in his letter to me quotes several observations made by him on this occasion, which perfectly accord with remarks made by me in the paper referred to.

Thus Mr. BRIDGES, speaking within certain limits, considers the richness of cheese to depend as much upon the mode of making as upon the quantity of cream in the milk. Too much heat, he says, destroys the cream; meaning, no doubt, that too much heat melts some of the butter, which then passes into the whey. By carelessly manipulating the tender curd, he justly observes, some of the cream may be washed out and passed into the whey. This gentleman is also of opinion that the best Cheddar cheese can be made from good new milk, and therefore considers the addition of cream to milk of questionable service, and certainly an extravagant practice.

The addition of cream to new milk, no doubt, if not absolutely necessary, certainly improves the quality of Stilton cheese, but the market value of Cheddar is not raised materially by such an addition. First-rate cheese-makers, Mr. BRIDGES observes, often take some cream from the milk, and still make a superior quality of cheese (worth more in the market) than less experienced and careless makers produce from unskimmed milk. He looks upon the temperature and careful breaking of the curd as the points upon which the quality of the cheese (Cheddar) mainly depends—apart, of course, from the influence of the natural richness or poverty of the milk.

Having treated of all these points in detail in my paper on the "Composition of Cheese," I need not refer to them in particular. These observations made by Mr. BRIDGES must be satisfactory to dairymen, as affording a practical confirmation of the correctness of opinions which I have already published, as resulting from my own observations and scientific experiments.

The cheeses produced in these trials were not so good as they might have been, nor like those of experienced makers, such as Mr. HARDING of Marksbury, Mr. McADAM of Gorsly Hill, or Mr. CHANDOS POLE of Derby. Anxious not in any way to thwart or disconcert the dairymaid, I thought it wise to let her have entirely her own way. She certainly made two great mistakes. To one I have already alluded; six ounces of salt is not enough for from fifty to sixty pounds of cheese; three-quarters to one pound would have been a better proportion. The second mistake which she made was to raise the temperature to 108° F. On no account should the heat of the cheese-tub be allowed to rise above 100° F. The higher the temperature is raised the more readily the whey passes from the curd, and the less mechanical work is required. The dairywoman may, therefore, be naturally tempted to save herself trouble to the injury of the cheese.

Although I am a great advocate for the Cheddar system of cheese-making, I am bound to say that the comparatively lower temperature which the best Cheshire makers adopt is the main reason of the exceedingly fine aroma which so favorably characterises their produce.

The finest-flavored cheese which I have ever tasted was made at Ridley Hall, near Crewe, Cheshire. I have no hesitation in saying that milk of the same quality as that which there came under the careful management of Mrs. WILLIS, in the hands of the most expert Cheddar maker would not produce a cheese of an equally delicious flavor.

The care, skill, and enormous amount of work and time which the making of the best Cheshire entails, especially when contrasted with the Cheddar system, no doubt are the main causes why so little really first-rate Cheddar cheese is now manufactured. I would strongly recommend those who prefer in the main to follow the Cheshire plan, but find that their cheese is apt to heave and be inferior in quality, to set the milk at a somewhat higher temperature than is their custom; 80° is a very good temperature at the time of applying the rennet. When the curd has been carefully broken up and allowed to settle for about half an hour, the temperature of the cheese-tub may then be raised with advantage to 90° F.

Returning to the Wall's Court cheese trials, it appears, according to preceding data, that one thousand gallons of milk, used according to the four different modes adopted, gave market produce as follows:

No. 1. 1,000 gallons of new milk gave 8 cwt. of whole-milk cheese.

No. 2. 1,000 gallons of milk, partially skimmed, produced 6½ cwts. 16 lbs. of cheese, and 1¼ cwt. of butter.

No. 3. 1,000 gallons of milk, skimmed, produced 6 cwts. 24 lbs. of skim-milk cheese, and 2½ cwts. of butter.

No. 4. 1,000 gallons of milk produced 3 cwts. 12 lbs. of skim-milk cheese, and 4¾ cwts. of extra rich cheese.

Let us now compare the economic results obtained, taking as the basis of our calculation the price actually obtained by the sale of these eight large Cheddar cheeses, and assuming that butter is sold at 1s. per pound.

		£ s. d.	£ s. d.
No. 1.	Produced 8 cwts. of whole milk cheese, worth 70s. per cwt...	....	28 0 0
No. 2.	Cheese, 6 cwts. 2 qrs. 16 lbs. at 60s. per cwt.............	19 18 4	
	Butter, 1¼ cwt., at 1s. per lb............................	7 0 0	
			26 18 4
No. 3.	Cheese, 6 cwts. 24 lbs., at 50s. per cwt..................	15 10 8	
	Butter, 2½ cwts..	14 0 0	
			29 10 8
No. 4.	Made into skim-milk cheese and extra rich cheese, 1,000 gallons of milk produced:		
	Skim-milk cheese, 3 cwts. 12 lbs., at 50s...................	7 15 4	
	Rich cheese, 4 cwts. 3 qrs., at 70s........................	16 12 6	
			24 7 10

Thus in these experiments it will appear that No. 2 gave the best, and No. 4 decidedly the least profitable result. Where a ready sale for butter can be found, I am inclined to think it is more profitable to make skim-milk cheese and butter than to look only to the production of a cheese of a better quality. The Cheddar plan, however, is not so well adapted for the making of skim-milk cheese as the Gloucester system, neither is it desirable to make thick skim-cheeses. A thick skim-milk cheese, when made at the elevated temperature at which Cheddar is usually produced, never ripens properly, and like all skim-milk cheese deteriorates when kept more than two months; whereas a rich Cheddar is gradually improved by keeping for many months.

CHEESE EXPERIMENTS MADE AT MR. HARRISON'S DAIRY, FROCESTER COURT, STONEHOUSE.

Mr. J. F. HARRISON makes excellent uncolored single Gloucester, and follows the ordinary practice in his neighborhood of making cheese twice a day.

The pasture in this district is good, but full of buttercups (*Ranunculus*). The cows kept on this pasture yield milk rich in butter. In making single Gloucester, a portion of the milk from each milking is generally set aside, partially skimmed, and then added to new milk. The rennet is applied at a temperature varying, according to the time of the year, from 75° to 80°. After an hour the curd is carefully cut across with a large-bladed knife, then removed by a skimming dish from the sides and bottom of the tub. The curd is allowed to subside for about a quarter of an hour, after which the clear whey is dipped out with a wooden bowl, care being taken not to press or injure the tender curd. When most of the whey has been removed, the curd is again carefully stirred with a wooden skimming dish, and afterwards with a wire breaker, at first very cautiously and gradually more briskly. After the curd has been thoroughly broken, the whole is left to settle for twenty or twenty-five minutes; the clear whey is next drawn off, and the curd collected into one mass. This is cut into thin slices, which are heaped up and again collected into one mass, and this process of slicing and heaping is repeated several times, as it materially facilitates the separation of the whey and is much preferable to the use of pressure. Many dairymaids, anxious to be rid of this work, put the curd far too soon into the presses; in consequence of which the pores of the outside layers of the cheese are completely closed up, and the whey prevented from escaping. No amount of ordinary pressure removes the whey so perfectly as repeated slicing and careful breaking up.

When sufficiently firm and dry, the curd is placed upon cloth in the vat, and gently pressed under an ordinary cheese-press. When no more whey flows out, it is removed from the press, crumbled coarsely by hand, and then more minutely by the curd-mill. Finally the curd is vatted, and placed at first under a slight pressure, which is gradually increased. The last thing done on the day on which the cheeses are made, is often to rub in some salt. Subseqnently the cheeses are salted in the same way three times, and each time the salt is rubbed in, a clean and dry cloth is placed around the cheeses. In about a week's time the cheeses are ready to be removed to the cheese-room.

The preceding is a short description of the usual plan of making thin Gloucester cheese.

Mr. HARRISON does not color his cheese, and keeps it for about a fortnight in a warm room, and then removes it to a cool, airy shed for three weeks longer before he sends it to market. In both rooms the cheeses are kept on wooden shelves and frequently turned. In winter the first room is heated by a stove.

Mr. HARRISON, who takes great interest in cheese-making, some years ago applied the ordinary centrifugal drying-machine to the purpose of separating whey. A small turbine or water-wheel drives the revolving vessel in which the curd is placed in a cloth. As the vessel attains its velocity, the whey is driven outwards through the perforated surface which encloses it, and escapes. The curd in this case is either not broken at all, unless by accident, or but imperfectly.

Having operated with the drying machine, I am of opinion that instead of beating curd and whey together into the revolving vessel, it would be better and more expeditious to break the curd coarsely, to let it subside for twenty minutes, to dip out as much of the clear whey as possible without disturbing the curd, and then to place it, tied in a cloth, in the revolving vessel.

Mr. HARRISON obligingly placed his dairy at my disposal to try certain experiments, and for his kindness and personal assistance my sincere thanks are due to this gentleman.

It has been stated by many, that in cheesemaking a considerable loss, both in curd and butter, is often incurred by adopting a faulty method, or by careless manipulation. With a view of preventing these alleged losses, Mr. HARRISON was the first to adapt the centrifugal drying-machine to dairy operations. But as his excellent dairymaid prefers to make cheese by hand, the centrifugal machine is not often set in motion at Frocester Court.

I was anxious to ascertain by comparative trials whether the alleged loss in cheesemaking was unavoidable, or whether it could be avoided or diminished by the employment of this centrifugal whey-separating machine. The trials were made at Frocester Court on the 7th of August, 1860.

No. 1.—In the first experiments, eighty gallons of milk were made according to the usual plan into four cheeses, which may be called hand-made cheeses.

No. 2.—In the second trial, eighty gallons of milk were made into four cheeses as before, with this exception—that the whey was separated by the centrifugal machine.

The milk used in both trials had the following composition:

Water,	87.40
Butter,	3.43
*Caseine,	3.12
Milk sugar, extractive matters, &c.,	5.12
Mineral matters (ash),	.93
	100.00
* Containing nitrogen	.50

The whey obtained in each experiment was nearly clear; that produced by the machine being the clearer of the two. On analysis the following results were obtained:

COMPOSITION OF TWO SAMPLES OF WHEY MADE AT FROCESTER COURT, AUG. 7TH, 1860.

	MACHINE-MADE.	HAND-MADE.
Water,	92.75	92.60
Butter,	.39	.55
*Albuminous Compounds,	87	.96
Ash.	.86	.81
Sugar and extractive matters,	5.13	5.08
	100.00	100.00
* Containing nitrogen	.14	.15
Free lactic acid,	.41	.36

We see then that both in respect of the butter and the albuminous compounds left in the whey, the machine has an advantage, though but a slight one; but there is no essential difference between ordinary whey and that produced by the centrifugal machine. Other samples of whey from cheese made by hand have given me quite as little butter as that found in the whey produced by the machine; and every sample of whey which I have yet examined contained from 8-10ths to 1 per cent. of a curd-like albuminous matter which is not coagulated by rennet, and that can only be separated by boiling.

The four cheeses of each trial were carefully marked and weighed at intervals. They were made, it will be remembered, on the 7th of August.

No. I.—The cheeses made by hand weighed:

August 18th,	81½ lbs.
September 3d,	78½ "
September 22d,	75 "

Loss in four weeks, 6½ lbs., or 8 per cent.

II.—The four cheeses made by the machine weighed:

August 18th,	74½ lbs.
September 3d,	70½ "
September 22d,	67 "

Loss in four weeks, 7½ lbs., or 10 per cent.

The cheese was sold at 7*d.* a pound when only five weeks old, and no perceptible difference in the quality of the cheese made by hand and that made by the machine could be noticed. All were equally good and fine-flavored cheeses.

Eighty gallons of milk when made by hand into cheese thus produced seventy-five pounds, and when made by the machlne only sixty-seven pounds of salable cheese. Since the whey from the machine-made cheese was rather the poorer, fully as great a weight of cheese might have been expected when the machine was used as when the ordinary plan of manipulation was adopted. To account for this difference of eight pounds, it may be supposed that the machine-made cheese was drier than the other; but the preceding weighings show that whereas the No. I cheeses lost in four weeks only eight per cent. in weight, the No. II cheeses made by machine lost ten per cent., indicating thereby that the latter were more moist than the former. Direct determinations, indeed, showed that the machine-made cheese contained more water than that made in the ordinary way. In the former I found 37.20 per cent. and in the latter 36.77 per cent. of water; but this difference is not sufficient to account for the results.

The case was puzzling; equal quantities of milk had in each case been carefully measured out; rather less matter had been left in the whey which came from the machine; the cheese differed but little in respect of moisture; but for an accidental observation I should have been completely at a loss to explain the anomaly. I found out by chance that the dairymaid was determined not to be beaten by the machine, and to prove her skill by making a larger quantity by hand than by the machine. The two trials were made in two adjoining rooms, and watching the making of the two sets of cheese from beginning to end, I found the dairymaid in the act of incorporating some cheese-parings from the preceding day's make with the hand-made cheese. Whether these parings were specially reserved for the coming trial or not I cannot say; but I certainly saw her take them from a tolerably large supply which she kept under the cheese-tub.

The examination of the two samples of whey had, however, in my opinion, afforded sufficient evidence of the fact that no matter how cheese is made, a considerable proportion of the nitrogenized compounds of the milk is left in the whey; and that this loss is unavoidable, and not necessarily greater in the ordinary plans of operation than by the use of a machine.

All the experimental cheeses were received by me on the 28th of September, 1860.

One of them which was made by the machine got injured in the transmission from the dairy to Cirencester. It weighed sixteen and a-half pounds. A portion of the cheese was analyzed on the 28th of September, and yielded the following results:

Water,	37.20
Butter,	27.30
*Caseine,	24.50
Extractive matters, lactic acid, &c.,	7.44
†Mineral matters (ash),	3.56
	100.00
* Containing nitrogen,	3.92
† Containing common salt,	.85

The cheeses were kept for a considerable length of time, principally for the purpose of ascertaining the loss in weight which they sustained in keeping.

On the 28th of September the eight cheeses weighed:

MACHINE-MADE. No.	lbs	HAND-MADE. No.	lbs.
1	16½	1	18¾
2	17¼	2	17
3	16¼	3	18¾
4	16½	4	20
Total	66½	Total	74½

On the 9th of November they weighed:

No.	MACHINE-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.	No.	HAND-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.
1	15¾		1	18¼	½
2	16¾		2	16¼	¾
3	15¾	½	3	18¼	½
4 Consumed.			4	19¾	½

Weights on the 19th of January, 1861:

No.	MACHINE-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.	No.	HAND-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.
1	14	2½	1	16¾	2
2	15	2¼	2 Consumed on the 9th Nov.		
3	14¼	2	3	16½	2¼
4 Consumed.			4	18¼	2

Weights on the 12th of February, 1861:

No.	MACHINE-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.	No.	HAND-MADE. lbs.	LOSS SINCE 28th SEPT. lbs.
1	13¾	2¾	1 Consumed.		
2	14¾	2½	2 Consumed.		
3	14	2½	3	16	2¾
4 Consumed.			4	17¾	2½

Accordingly forty-two and a-half pounds of machine-made cheese lost from the time they were ready for sale until the 12th of February—that is, a period of not quite five months—seven and three-quarters pounds, or eighteen per cent.; while thirty-three and three-quarter pounds of the hand-made cheese lost in the same period five and a-quarter pounds, or fifteen and a-half per cent.; thus showing plainly that the hand-made cheeses were rather drier than those made by the machine. These weighings likewise show the economy of selling cheese as soon as possible after it is ready for the market.

One of the cheeses made by hand was analyzed on the 21st of January, 1861, and found to contain in one hundred parts:

Water,	31.96
Butter,	31.37
*Caseine,	29.37
Extractive matters, lactic acid, &c.,	2.85
†Mineral matters (ash),	4.45
	100.00
* Containing nitrogen,	4.70
† Containing common salt,	1.35

During the time of keeping it became, of course, drier and correspondingly richer in butter.

Two skim-cheeses made on the 8th of August, 1860, weighed on the 18th of August, thirty-one and a-half pounds; on the 3d September, thirty pounds; and on the 22d of September, twenty-eight pounds, and were then considered ready for sale. Kept still longer they lost considerably in weight, as will be seen by the following weighings:

WEIGHT OF TWO SKIM CHEESES.

No.	SEPTEMBER 28th. lbs.	NOVEMBER 9th. lbs.	JANUARY 19th, 1861. lbs.	FEBRUARY 12th, 1861. lbs.
1	13	12½	11½	11
2	15	14½	13¼	12¾
Total	28	27	24¾	23¾

Total loss in weight in not quite five months, 4¼ lbs., or 15 per cent.

A portion of one of the skim-cheeses was analyzed on the 19th of February, 1861, with the following results:

Water	27.68
Butter	30.80
*Caseine	35.12
Extractive matters, lactic acid, &c	1.46
†Mineral matters (ash)	4.94
	100.00
* Containing nitrogen	6.62
† Containing common salt	1.27

This cheese was hardly inferior to a good whole-milk cheese, and might readily have been sold as such.

It is a well-ascertained fact that towards the fall of the year cows produce much less but richer milk than in spring and summer. This is strikingly illustrated by the various quantities of cheese which are obtained at different times of the year, from a given quantity of milk, as will be seen by the following results with which Mr. HARRISON kindly supplied me:

In the beginning of August, 160 gallons of milk produced 8 cheeses, weighing on the 22d of September 142 lbs.

On the 19th of October, 110 gallons of milk produced 7 cheeses, weighing on the 31st of December, 108½ lbs.

On the 29th of November, 60 gallons of milk produced 5 cheeses, weighing 70 lbs. on the 13th of February.

On the 29th of November the cows were still out to grass, and had no extra food but hay.

In conclusion I may mention an experiment which Mr. HARDING of Marksbury made at my request, with a view of converting into cheese, if possible, the curd-like substance which is not coagulated by rennet, together with any suspended particles of butter usually occurring in whey.

To this end seventy gallons of whey were heated to the boiling point, and kept for some time at that temperature. The curd-like substance which separated was collected on a cloth, and after the addition of a little salt, placed in the cheese-press. After remaining in it for three days eighteen ounces of whey-cheese were obtained. This cheese had a peculiar granular texture, and even after long keeping did not ripen properly like other cheese. The high temperature at which it was produced evidently prevents the necessary fermentation which curd must undergo before it becomes mellow, and salable as human food.

The small quantity of eighteen ounces from seventy gallons, moreover, appears hardly sufficient to repay for the trouble. On the whole it would appear to be quite as profitable to set the whey for butter, and to give the skimmed whey to the pigs.

As a matter of curiosity I append an analysis of the whey-cheese, which although very rich in fatty matters, had a bad texture and quite an inferior flavor.

COMPOSITION OF WHEY-CHEESE.

Moisture	30.23
Butter	44.27
*Caseine	21.50
Extractive matters, lactic acid, &c.	1.52
†Mineral matters (ash)	2.48
	100.00
* Containing nitrogen	3.44
† Containing common salt	1.83

PRELIMINARY TO CHEESE-MAKING.

Before entering upon the subject of cheese manufacture in detail, I have some few remarks to make on topics omitted in previous pages.

CLEANSING DAIRY UTENSILS.

Before commencing the operation of milking, it is important that the pails and cans be clean and sweet. This is an old story, which every dairyman has probably heard over and over again, and understands perfectly in the abstract. The cleansing of pails and cans usually belongs to the female portion of the household, and some would take it as an offense to be told that their dairy utensils are not kept clean and in order; but it is a fact that many dairywomen, though patterns in neatness generally, do not understand when a milk pail is in proper order to be used. It is a common practice to take wooden pails after milking, clean the outside and rinse them in cold water. The water is turned into the first pail, and a cloth may perhaps be used to brush around the water. Then the contents of the pail are emptied into the second pail, and thus the whole lot is treated. Then the pails are a second time rinsed and turned down to drain and dry, and are pronounced clean and sweet. This is the evening management. In the morning the same operation is performed with hot water, that is, water not so hot but that the hand may be borne in it, without seriously discommoding the operator. To the common observer pails treated in this way may appear perfectly sweet and clean; but to those who understand the nature of milk ferments, these utensils are positively filthy. A close observation about the corners at the bottom, about the ears of the pail, and often upon the sides, will reveal a gum-like substance, which consists of minute particles of milk, adhering to the surface and drying down, having the appearance of discolored white paint. After awhile this gummy substance becomes so thick that it arrests the attention of the dairymaid, and she forthwith scours it off with salt or otherwise, and the pails present a whiter aspect. But of the damage that has been done from day to day to the milk from these germs of ferment, especially if the weather has been warm, she has no idea, and often will not be convinced.

A great deal of trouble with milk at factories and private dairies arises from improperly cleaned pails; for it is surprising how small a quantity of this old decomposed milk will set a large quantity of good milk in a ferment.

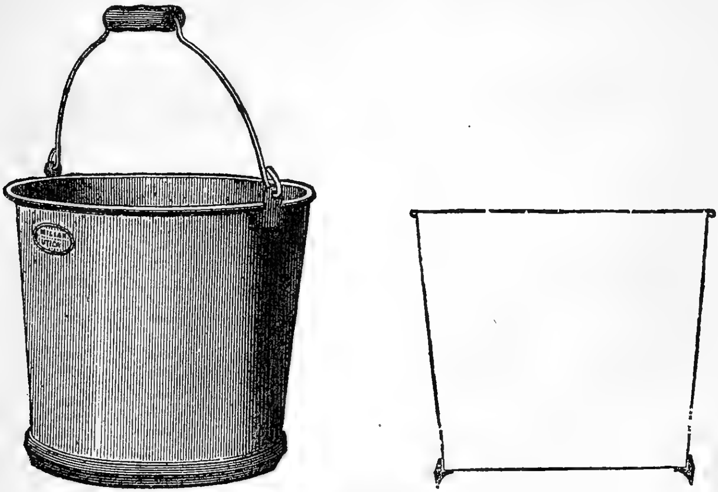


Figure 1.

My own experiments upon this point have been numerous, and with those who have carefully studied the nature of milk the question has never for a moment been disputed. It was on account of the carelessness and negligence in cleansing wooden milk pails, that I long since denounced them as a *nuisance*, and I am glad to say that Dairy Associations in New York, in Ohio, in Canada and the Northwest have sustained this opinion, and resolutions recommending their banishment from the dairy, and the use of tin in their place. We introduce cuts of approved tin milk pails—the Millar pail, that of the Iron Clad Co., and the Ralph pail.

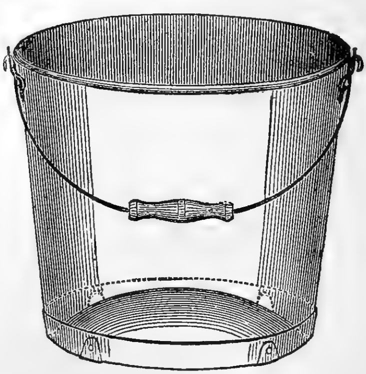


Figure 2.

Millar's tin milk pails (Fig. 1) are made from four cross tin, imported on purpose for them, have but one seam in the body of the pail and are soldered very smoothly. A tinned malleable iron rim or band is soldered firmly to the bottom inclosing it, and is so constructed as to thoroughly protect and support it and to raise it sufficiently to prevent it from resting on the floor and from picking up the dirt; it is also convenient for tipping the pail. The wire in the upper edge of the pail is inclosed by the tin and then soldered so that it cannot rust. The bail is made from the best tinned wire.

The Iron Clad Co. pail is also of heavy tin, substantially made, the bottom being convex to give it strength. It is shown in Fig. 2.

The RALPH pail is of tin, and has a concave bottom. It is made in two styles, the one with a rim on the bottom, and the other as a tin lining to a wooden pail. Figs. 3 and 4 represent the last named style.

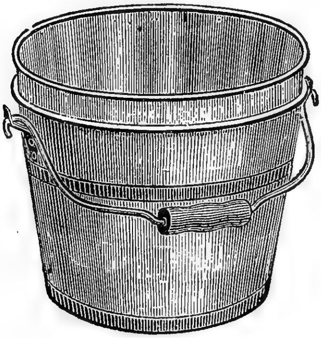


FIGURE 3.

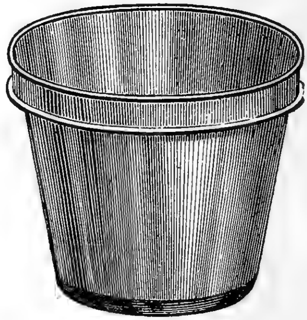


FIGURE 4.

In cleansing dairy utensils, it should be understood that neither cold or warm water is sufficient to destroy the germs of ferment contained in these particles of decomposed milk. To be efficient, the water must be at the boiling point, or 212°. Dr. VOELCKER well remarks, in speaking of this point, that "it is important to ascertain that the water is perfectly boiling; and yet it is strange that few women, comparatively speaking, though they have spent many years in the kitchen, know to a certainty when the kettle is really boiling." "This remark," he adds, "applies to some educated as well as uneducated females. They often mistake the singing voice of the tea kettle, accompanied by a certain amount of vapor, for a sign that water is in a state of ebullition." Now go through the country, and how many dairies will be found where attention is given to this matter of boiling water in cleansing cans and pails? Probably not one in one hundred. It is true when tin is used the difficulty of cleaning is not so great as with wood, since the metal will not absorb liquids; and yet we hear of much complaint from imperfectly cleansed milk pails and cans. At a meeting of the American Dairy Association, Mr. MOON of Herkimer, in discussing the question of floating curds, gave an instance where this trouble was had in one vat of milk at the factory every day for a week. The cause was finally traced to a certain dairy, and an examination of the milk utensils revealed the fact, that under the small piece of tin soldered around the vent hole in the can cover, some milk had leaked through the imperfect solder. Here had lodged small particles of milk which, decomposing or becoming putrid, was the cause of the trouble. The covers were repaired and properly cleaned, and afterwards there were no floating curds. The plan of

CLEANSING AND STEAMING THE CANS with a jet of hot steam, as practiced by the Elgin Condensing Works, is worthy of imitation, and should be adopted by every factory. And I believe that unless farmers take this matter more at heart, and resolve to be more careful with dairy utensils and in the delivery of milk at the factories, the same losses and troubles that have been going on for years past will continue. The question is of vital importance, and cannot be too frequently urged upon the dairy public.

MILKING.

Farmers generally have the impression that when milch cows have wintered well and are fairly out to grass there need be but little care or attention given to the animals, and that then in their herds they have a fountain that is to supply good, pure milk simply by drawing it, not much matter how or when. It is true people understand that when cows are milked with great irregularity, or are subjected to any extraordinary brutal treatment—such as sundry kicks in the udder with a heavy boot, they will yield unprofitable results, since the consequence of such management forces itself almost immediately upon the attention. But it is not those things that come so plainly under the eye of the observer, concerning which I propose to speak. If an angry man kicks his cow in the udder, some of the blood-vessels of the part will probably be ruptured, and the bloody milk which flows from the teats will speak more forcibly than any words of mine; but if he kicks her in the ribs, or mauls her with a milking-stool upon the hips and back, the consequences may not be so immediately apparent, yet that damage is done and that loss will follow, is equally certain. I am speaking of no exceptional cases, but of those that are of common occurrence wherever any considerable herd is kept, and when the eye of the master is not sharp to detect and punish these offenses. The pressing want in the dairy districts to-day is for good, kind, humane laborers, who can be trusted to do the milking in a proper manner. Many of these people do not understand that any particular loss is to follow from a *moderately* brutal and cruel treatment of cattle.

I have always advised dairymen to make a special contract with laborers who are to be employed about the dairy. Let it be understood that the moment a cow is maltreated, *that moment* a settlement is to be made and the party offending to be discharged with a reasonable deduction from his wages. This fairly understood at the time of hiring, together with proper oversight of the animals, and those about the dairy will go far to mitigate a great and growing evil. It is a lamentable fact that there are a large number of ailing milch cows in the dairy districts—cows that are not in vigorous health, that fall off in milk, that have sick turns, now and then, which, if the history of their treatment was known, could all be traced to the causes I have enumerated. A rap upon the spine with the stool has ruined many a valuable beast; a stroke upon the udder has often produced unaccountable cases of garget.

I wish it could be generally and thoroughly understood, that nothing pays better in the dairy than kindness and gentleness to stock. Milch cows should be kept as quiet and comfortable as possible, and no person should be employed in milking that the animals fear. Any undue nervous excitement not only lessens the quantity but depreciates the quality of the milk. Sometimes cows take a dislike to their milker, and in such cases a change should be made, otherwise there is a liability of the cow falling off in her milk. I have seen several cases of this kind, and although such freaks are quite unaccountable, it will always be found better to change the milker if possible, rather than to attempt to conquer this peculiarity. I do not approve the practice, common with some dairymen, of the milkers milking the cows indiscriminately. The hands should each select a certain number of cows and continue to milk them from day to day throughout the season.

The hours of milking should be regular, and each cow should be milked in regular order. The milk should be drawn rapidly and to the last drop, and all loud talking, singing, and wrangling avoided. These are little things in themselves, and may seem to many to be "over nice;" but repeated and well-conducted experiments have convinced me that they are important points to be attended to, and must be observed to obtain the best results. I always insist that the milkers

STUDY THE DISPOSITION OF THE COWS

under their charge, that they become familiar or perfectly acquainted with each animal, patting them, or in other ways making them understand that you are friendly and fond of them. When once their confidence has been obtained in this way they will exhibit affection in return, and will yield in the increased quantity of milk more than enough to pay for the time and trouble given to the purpose indicated. Some cows are extremely nervous and excitable; such require caution and attention in management, otherwise they soon become worthless for the dairy.

IN DRIVING CATTLE FROM THE PASTURE

to the stable they should never be hurried or made to go faster than a walk. Good cows have well-filled udders, which make it painful to move over the ground faster than a walk. Besides, in warm weather, by hurrying the animal there is always danger of over-heating her blood and milk, and thus not only injuring it, but all the other milk with which it comes in contact. Dogs should never be allowed in a dairy. They are the source of infinite mischief. In all my observations I have never yet met with a strictly first-class dairy of cheese, where the cows were dogged from the pasture to the stable.

What I desire to impress upon the mind is, that these truths should be understood not only in the abstract, but that they be carried into practice. Neither good butter nor good cheese can be made from diseased milk; nor can good milk be had from diseased cows.

WETTING THE TEATS WITH MILK.

Some people are in the habit, when first sitting down to milk, of drawing a little milk to wet their hands and the teats of the cow. It is not a cleanly practice and should always be avoided. I have seen milkers with their hands gummed up with filth, and the reeking compound of milk, dirt and manure, oozing out from between the fingers and dropping into the pail, as the result of this bad habit referred to. In some dairies a great deal of milk is tainted in this way, and not unfrequently this taint shows itself in a very marked degree in the butter and cheese manufactured. Many thoughtless persons have the impression that milk in some way purifies itself and that taints imparted in the way I have named cannot be carried into the butter and cheese. Such ideas are very erroneous, and the sooner correct notions are had in regard to the purity and cleanliness of milk for dairy purposes, the sooner shall we arrive at a higher standard of excellence in dairy products, and as a consequence better prices be obtained.

MILK WITH DRY HANDS.

Cows do not milk any easier with wet hands than with dry hands. If the udder or teats are muddy or covered with filth, they should be washed with clean water and wiped dry. Then milk with dry hands and it will soon be found easier and pleasanter, even with those who have been accustomed to wetting the hands and teats while milking. In summer, when cows are running upon clean upland pastures, the udder and teats will generally be clean, except perhaps in wet weather. If there is no occasion to wash the udder and teats, it is always well to brush over the parts with the hands or with a cloth to remove any particles of dust or loose hairs adhering and then set the pail in position and commence to milk with dry hands. Uncleanliness in milking is one of the great faults in the dairies of this country, and it is one of the causes of bad flavor in dairy products. Every dairyman should fully explain this matter to hired help and insist upon cleanly habits in milking. That the fault referred to is a serious one and more general than some would at first imagine, can very easily be demonstrated by visiting any of the factories at the time the milk is being delivered. Let the milk strainers then be closely scrutinized, and they will often be found to present a most disgustingly filthy appearance. If this mass of filth could be shown to some uncleanly milkers, I hardly think they would be willing to taste milk filtered through such material.

EXPERIMENTS IN COAGULATING MILK.

Various attempts have been made from time to time to find a substitute for rennet in cheese-making. Acids have been used for this purpose, and are to some extent employed in Holland at the present time. It is claimed by some that when acids are used for coagulating the milk a larger percentage of curd is obtained, and that the cheese has longer keeping qualities than when rennet is used; but I believe it to be generally conceded that no substance has as yet been found equal to rennet for making a fine, delicate-flavored cheese, such as the markets in England now demand. In regard to the use of acids for coagulating milk we have some interesting experiments made by an English manufacturer, and detailed by him as follows:

He procured four pints of milk of the same cow, having a specific gravity of 10.32; to one, rennet was added in the ordinary manner, to the second, tartaric acid, to the third, acetic acid, and to the fourth, hydro-chloric, or muriatic acid. After the lapse of about half-an-hour the curd had formed in the milk to which the rennet had been added. The curd and the whey exhibited to test paper the slightest possible acid reaction, and both were perfectly sweet to the taste; further, it was observed that the curd was very soft and readily broken up, while the serum or whey was somewhat white and opaque, from the retention of a certain amount of the butter of the milk. For the coagulation of the second pint of milk thirty-seven grains of tartaric acid were required; the coagulation was effected immediately on the addition of the acid; the whey and curd both exhibited to test paper a strong acid reaction and were also perceptibly acid to the taste. The curd in this case was firmer, and the whey clear and transparent, almost like water, showing that the whole of the butter had been precipitated with the curd.

No less than one hundred and forty drops by measure of the acetic acid, of weight or specific gravity, 10.46, were necessary to precipitate the whole of the curd contained in the third pint of milk. The curd and whey presented nearly the same character as in the previous case. Of muriatic acid, of specific gravity, 11.65, seventy-five drops were added before the whole of the curd in the fourth pint of milk was thrown down; the curd and whey were more decidedly acid than in the former cases. In other respects their characters were nearly the same. The whey was carefully separated from the curd in each case, when it was ascertained that those curds which had been formed by the addition of acids were heavier and more bulky than those from the rennet. The curds were then well washed with brine; this occasioned some loss, especially of the rennet curd. The application of the brine was made in order the more completely to separate the whey, rennet and acids employed in the precipitation of the curds. Lastly, the curds were salted and pressed into small cheeses, those made with the acids being the *largest.*

AMOUNT OF ACIDS REQUIRED.

For the coagulation, then, of one gallon of milk, no less than five drachms of tartaric acid, or rather more than two and one-fourth ounces of acetic acid, or one and one-fourth ounces of muriatic acid would be required. The prices of these would be about one-half penny, one penny, and one-half penny, sterling, or very nearly, in American coin, one cent, two cents, and one cent. The cost of these articles, therefore, it is evident, is an important element to be considered. The cheese made with the acids were firmer, sharper to the taste, and were of longer-keeping qualities than the one in the preparation of which rennet was used; but the last was richer and more delicate in flavor.

THE ADVANTAGES OF ACIDS OVER RENNET would seem, from these experiments, to be that the yield of curd is somewhat greater; that their operation is certain, and that the coagulation is effected without loss of time. On the other hand, they are expensive, and the flavor of the cheese is not equal to the standard now set up as *fine* in the English markets; that is, a cheese preserving unimpaired the combined flavor of the caseine and butter of the milk. These experiments may be interesting to cheese manufacturers, and may serve as a basis or guide for future experiments, by those who are looking for a substance different from rennet for coagulating milk in cheese-making. The acid usually employed by the Dutch is muriatic acid. Some of the Dutch cheese is excellent, and is highly relished by those who have acquired a taste for this character of cheese.

RENNETS.

There is a great deal of loose writing and bad advice about rennets. There is a great difference in the strength of rennets, and so there is a great difference in the action of living stomachs for digesting food. Some stomachs are naturally weak, or have less vital energy than others. This is of frequent occurrence in the human family, and is not confined to it alone, but extends to the brute creation. Calves that are delicate eaters, that have weak stomachs and impaired digestion, yield weak rennets. It is the strong, healthy, vigorous calf, and one that has a perfect digestive apparatus, that will give a rennet of great strength. I have made some carefully conducted experiments on this point, which have convinced me that one source, at least, of weak rennets, is due to the cause I have named. There are other causes, as when the stomachs have been improperly saved and prepared. Many salt down the stomachs in a cask or tub. It is a very bad practice, and has been the cause of a great deal of mischief in the dairy. The trouble with salting down rennets and packing a considerable number together is this: If one diseased or bad rennet gets into the cask, it communicates its taint to the whole mass, and the leaven once having been added, develops with wonderful rapidity, so soon as circumstances become favorable,—and these circumstances do become favorable, when it is added to the milk at a temperature as high as 80°.

WHAT CALVES TO TAKE RENNETS FROM.

Rennets should only be saved from healthy calves; from those that have been allowed all the milk they will take for at least four days, and up to within some twelve or fourteen hours of slaughter. A calf that has been starved will be likely to have a diseased and inflamed stomach, and if it is used for cheese-making it will most assuredly impair the flavor of the cheese. A good, healthy stomach having been selected, the contents should be emptied out and all specks wiped off. Then it should either be blown up like a bladder, or slightly salted and stretched on a forked stick, and hung up in a dry atmosphere, only moderately warm.

RENNETS BADLY PREPARED.

Some cheese-makers prepare rennets badly, by soaking in wooden casks or barrels. There are many tons of cheese spoiled in flavor every year simply on this account. It is almost an impossibility to keep a wooden vessel sweet that is used for steeping rennet. I have used the most scrupulous care, over and over again, with wooden vessels, and have never succeeded in keeping them sweet for any considerable length of time. Rennet tubs and rennets are often tainted when the cheese-maker is not aware of the fact. I have frequently been called to examine cheese that was out of flavor, or acting badly, with a view of discovering the difficulty, and have often found the whole tronble to come from a tainted rennet cask. So important do I consider this single point, that it may be laid down as a rule that no first-class, high-flavored cheese can be made, for any considerable length of time, where wooden casks are used for steeping rennets.

THE STEEPING VESSELS

should be of stone ware. They are manufactured now for the purpose, of various sizes—of five, ten, twenty or more gallons. We give illustration of the jar (Fig. 5). Farmers who have been so unfortunate as to have had pork tainted in the barrel, know how difficult it is to cleanse the cask; and many who have attempted it have lost their pork, by packing in a barrel that has once been tainted. Rennets are more liable to taint, while steeping, than salt meats, and common sense should teach us that wooden vessels ought never to be employed for the purpose.

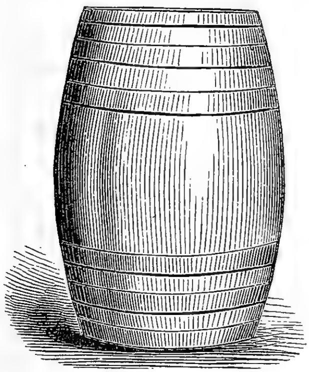


FIGURE 5.

STEEPING IN WHEY.

Rennets are more efficient when steeped in whey; but the whey should be free from taint in the first instance, and then freed from its albuminous matter. Rennet does not act on the albumen of milk, and this nitrogenous constituent passes off in the whey. Albumen coagulates at a high temperature. By heating the whey to boiling, the albuminous matter coagulates, and may be skimmed off. This should be done soon after drawing the whey from the vats, and before it has begun to ferment and putrefy. When whey is used for steeping rennet, before it is freed from albumen, it is often decomposed and putrid, and a very dangerous ferment is therefore added to the milk, which carries a taint to the cheese. Some people save the whey that runs from the press in which to steep rennets. This is a very bad practice. On putting cheese to press, a whitish, milky substance often flows out at the first pressure. This whey is probably highly charged with albumen. The whey having been freed from its albumen, if set aside, makes a very sharp acid, and is altogether the best liquid for steeping rennet that has yet been discovered. It is this purified whey that should be used for developing an acid condition of the curds, when necessary.

After the rennets have been soaked, and rubbed to extract their strength (and this will occupy several days, the rubbing being performed at least three or four times), the liquor should then be strained off into a clean stone cask or rennet jar, and is fit for use. The rennets are then to be put to soak again with whey as at first, and are rubbed from time to time until their strength is exhausted. They may then be taken out, washed in whey, and the liquor added to that in the jar and the rennets thrown away. It is not a good practice to add new rennets to those that have been steeping, and thus keep a batch of rennets in soak during the whole season, as there is more liability of their becoming tainted; and when their strength has once been exhausted they are useless in the rennet jar, and it is better to have them out of it. When sour whey is used for steeping but little salt is needed. The rennets should not be allowed to float on the whey. By using a stone crock cover, they may be kept at the bottom of the whey.

EXAMINE RENNETS DAILY.

I hardly need to add that rennets should be examined daily, while steeping, and the liquor stirred to keep it sweet and free from taint. Nor should the liquor be used from the crock where the rennets are steeping, before being strained through a thin cloth, as small pieces rubbed from the skins get into the milk, and are worked up into the curds.

PREPARING RENNET—ENGLISH METHOD.

I have given what I consider the best method to be adopted by dairymen and at factories for the preparation of rennet for cheese-making. I now give the method recommended in the best dairies of England, and it may be found suggestive in many particulars. It is always an advantage to the cheese that the rennet should be prepared some time before it is wanted for use; and English dairymen recommend that it should be made in February or March, and that as large a quantity be provided as can be conveniently done, consistently with the size of the dairy. They find large olive jars useful for steeping the rennet, some of which will hold thirty gallons. A hole is made at the bottom to draw the rennet, and they think it much better to draw it in this way from the bottom, than to disturb it at the top by dipping out. A wooden tap should be used, as the acidity of the liquid has an injurious effect on a metal one. They have a piece of board with holes perforated in it to put into the jar under the vells or rennets, to prevent their getting to the bottom and obstructing the liquid running out by getting against the taps. The rennet is prepared by first making a brine strong enough to bear an egg. It is then boiled for half an hour, and when quite cold put into the jar. For every two gallons of brine six vells are added, one lemon, sliced, and one ounce of saltpeter. They claim that rennet should always be prepared at least two months before using, and there will then be less cause for the cheese to be affected with undue fermentation, which is injurious to fine flavor.

ASSOCIATED DAIRYING.

The idea of associated dairying, as has been remarked, is claimed to have originated in Europe. The system, it is true, has been practiced to some extent in Switzerland and in France, but it differs materially from that of this country. The European system grew out of a necessity. It was the offspring of poverty rather than of wealth. The peasants of a neighborhood, each having one or two cows, united them in one large herd. They employed a herdsman in common, and sent him with the herd to the mountainous portions of the Alps. Here the herdsman and his assistants take charge of the cattle for a certain number of months, turning the milk into cheese, which, at the end of the season, is divided among the owners of the cows, in proportion to the number furnished by each. Cheese cannot be manufactured to advantage from one or two cows; but under this system the poorest peasant makes the product of his one cow compete successfully in the market with that made from the large herds of the wealthy, since it is similar in shape and quality. In other words, he has a merchantable article, which he could not obtain singly and alone.

Now, the European system accomplished no grand results. It did not spread, or become generally adopted among the nations. It developed no new principle, either in the art of manufacturing the milk or in the economy of labor-saving appliances. It attracted no particular attention, because it developed nothing new. Associated dairying in America may be said to be the first successful movement in this direction. What distinguishes the American system is the constant effort to reduce the whole art and practice of dairying to a science. The buildings, the appliances, the manipulations in the various departments, are matters of study, and of progress and economy. The grand result sought is to make associated capital pay better than non-associated capital. It is a new application of an old principle. It is adapting the rule to farming that has been found successful in commerce and manufactures.

THE POPULAR METHOD OF ORGANIZING FACTORIES,

and one which seems to give good satisfaction, is to make them joint-stock concerns. The ground is selected, and an estimate made of buildings, machinery and fixtures. The whole cost is then divided up into shares of fifty to one hundred dollars each, and the neighboring farmers, or those favorable to the movement, take stock in proportion to the number of cows from which they are to deliver milk. Officers are chosen, and the company managed as a joint-stock company. We give the following forms, as a guide to companies about erecting factories, or for old factories which have been operating without any written form or regulations:

FORM FOR CERTIFICATE OF STOCK.

Capital Stock, $3,000; Shares, $100 each.

CREAM CHEESE DAIRY MANUFACTURING COMPANY.

Organized 1865.

No. 1872. [CUT] ONE SHARE.

It is hereby Certified, That UNITED STATES GRANT *is the proprietor of one share in the Capital Stock of the* CREAM CHEESE DAIRY MANUFACTURING COMPANY, *each share being One Hundred Dollars, transferable only on the books of the Company by the Stockholder, or by an Attorney duly constituted, on the return of this Certificate.*

IN TESTIMONY WHEREOF, *the President and Secretary have hereunto set their hands, at Lenox, this 2d day of February,* 1871.

GENERAL THOMAS, *President.*

JOHN DITTO, *Secretary.*

The following form is printed on back of the certificate:

FOR VALUE RECEIVED,........*hereby sell and transfer to*........................
....*Share of the within mentioned stock, and do hereby countenance and appoint*...........
Attorney to transfer the same on the books of the Company.

WITNESS,......*hand and seal , this*......*day of*................187..

....

RULES FOR ORGANIZING FACTORIES.

WE, the undersigned, hereby agree and unite ourselves into a body or association for the purpose of erecting and building a Cheese Factory, and for the purpose also of running said factory to make cheese from the milk which shall or may be brought in from time to time to said factory by members of the association and other persons, to be made or manufactured into cheese at a certain price for the work and materials expended from time to time, to be fixed by the association.

Said building or manufactory is to be one hundred feet by thirty-four in size, and three stories high, to be built of good and substantial materials, and suitable and convenient in its arrangements for the purpose intended, and is to be located on the land of............ ... .

It shall be known by the name and style of ...., and it is agreed by and between the parties to these presents, that they shall and will at all times during the continuance of such association bear, pay and discharge equally between them, all cost of building said factory, and all rents and other expenses, and for hired help that may be required for the support and management of the said business; and that all gains, profits and increase that shall come, grow or arise from or by means of the said business, shall be divided between them, said association, share and share alike; and all loss that shall happen to them in said joint business, by all commodities, or by bad debts or otherwise, shall be borne and paid equally between them; and there shall be kept just and true books of account and entry of the resolutions and doings of said association, showing the true state of the operations of said association by reason or on account of said business, and all matters and things whatsoever to the said business and management thereof in any wise belonging; which said books shall be used in common between the members of said association, so that either of them may have access thereto without any interruption or hindrance of the other.

And it is hereby further agreed that all questions arising as to the way and manner of conducting said business and as to the person or persons to be employed as help by the association, and all and every matter of interest, of whatever thing or nature, to the association, shall always, in case of dispute, be decided by a majority vote, which shall be entered of record and the time for the continuance of said association or ....of any member thereof, and entry of any new member shall, in case of dispute, be decided in the same way, and recorded.

In witness whereof, the parties to these presents have hereunto set their hands and seals, this........ day of........... ......18.....

ANOTHER FORM FOR ORGANIZING.

ARTICLE I. This Association shall be known as the..........Dairy Manufacturing Company.

ART. II. The business of this association shall be under the direction and control of a Board of three Directors, There shall also be a Secretary and Treasurer; all of which shall hold their respective offices one year, and until others are elected.

ART. III. The annual meeting of this company shall be held on the first Saturday in January of each year, at the cheese house belonging to this company, at two o'clock, P. M., at which time the officers authorized by the second article shall be elected, and any and all business connected with this company shall be lawfully transacted—each share of stock being entitled to one vote.

ART. IV. At said annual meeting said directors shall make a report in writing of the financial condition of the company, showing all moneys received and expended by said directors.

ART. V. The Secretary shall keep a record of all meetings of the company, for the examination of stockholders; also a list of stockholders and of all transfer of stock reported him.

ART. VI. It shall be the duty of the President of the Board of Directors, in connection with the Secretary, to issue certificates of the capital stock of the company to each shareholder—each share to be one hundred dollars; also to issue new certificates in case of transfer, to the party purchasing the same, all of which shall be duly numbered, dated and recorded.

ART. VII. All sale or transfer of the capital stock of this company shall be in writing, and be reported to the Secretary within thirty days after such sale or transfer, or be of no binding form on the company.

ART. VIII. All moneys paid by the Treasurer shall be by the consent of the Directors, and on the written order of the President of such Board of Directors.

ART. IX. Any stockholder refusing or failing to promptly pay any and all assessments made on his stock (not exceeding one hundred dollars on each share) within the time ordered, shall forfeit to the company any and all payments formerly made, but nothing in the article shall release such delinquent stockholder from a suit at law for the recovery of any assessments due and unpaid by him.

ART. X. The Directors shall not incumber or impair otherwise the property of this company.

ART. XI. A special meeting may be held in pursuance of a call of the Directors in writing to be filed with the Secretary, giving at least (7) seven days' notice of the time and place of such meeting; and it shall be the duty of the Secretary, in case of such notice of a special meeting being delivered to him, to post in (3) three public places, and also an the cheese house front door, a written notice of the time and place of such meeting. It shall also be the duty of the Secretary to give notice of the annual meeting of the company, by posting (3) three notices as provided for a special meeting.

ART. XII. The capital stock of this company shall be Three Thousand Dollars, in shares of One Hundred Dollars each.

ART. XIII. The foregoing By-Laws, or any one of them, may be repealed or amended at any annual meeting, by a majority vote of the stock represented, there being not less than sixteen shares represented at such meeting.

CREAM CHEESE DAIRY MANUFACTURING CO.—NOTICE TO PATRONS.

The Directors are happy to announce to the public that they have secured the valuable services of Mr. WM. SHAKSPEARE, and that they will be prepared to commence the manufacture of Cheese on Monday, April 12th, upon the following

TERMS:

1. TWO DOLLARS, TWELVE AND ONE-HALF CENTS PER HUNDRED POUNDS (to be deducted from the receipts at eacn sale), and ONE GOOD RENNET for each four hundred pounds of cheese; which shall include manufacturing, curing, furnishing and ordinary expense, delivering the cheese at the door of the dry house ready for market.

2. The company will not be responsible for any loss by fire, theft, or other similar cause.

3. It is expressly understood that every person sending milk to this Factory will conform to the following

REGULATIONS:

1. All milk to be received for manufacture must be carefully strained and brought to the factory in a tin can without faucet, PURE AND SWEET.

2. Any milk which by reason of negligence, uncleanliness or other cause, is not in suitable condition for use WILL BE REJECTED if discovered before it is let into the vat.

3. If any person shall bring milk which has been skimmed, watered, or otherwise tampered with in a manner forbidden by law, then upon obtaining proof sufficient to convict the offender, the directors will prosecute such person and will not compromise or settle only as he pays the FULL PENALTY OF THE LAW AND ALL DAMAGE ACCRUING FROM HIS OFFENSE,

4. It shall be the duty of the manufacturer, at least once in each week, to carefully test the milk from each and every dairy, and in case he shall find any that has been skimmed or watered or otherwise in violation of law, shall at once report the same to the directors, and to NO OTHER PERSON, and they will then take such measures as they think expedient to obtain conclusive proof against the offender.

5. It is necessary that milk should be delivered at the factory before eight o'clock in the morning of each day, and the manufacturer will not be required to receive it after that time.

6. Each patron may take from the factory his share of whey in proportion each day to the amount of milk delivered the day previous; the quantity to be regulated by the manufacturer.

7. These regulations shall apply to each director in all respects the same as to any other patron.

DAN'L WEBSTER,
HENRY CLAY,
J. C. CALHOUN, } Directors.

CREAM HILL, N. Y., April 10th, 1871.

SELLING THE CHEESE.

Usually a committee or some one person selected from the patrons, is chosen as salesman of the cheese, whose duty it is to make sales at best prices to be had, to arrange dividends and to pay over shares to patrons, deducting of course the price per pound for manufacturing, which is made to cover all, including the per cent. on cost of buildings and fixtures.

CERTIFICATE OF SALE.

The accompanying form should be filled out to be given to each patron at the time of paying over his share of proceeds; a book of printed blanks being provided for the purpose:

FORM OF BLANK.

OLD SALISBURY CHEESE FACTORY, 1871.

Sale No..............No. of Cheese sold,.............Price sold for............Whole amount of Cheese sold...........lbs. Milk...........Comprising Cheese from.......... to..........both days included. Pounds of Milk required for one pound of Cheese.........
DIVIDEND TO..................
Pounds of Milk,.................Pounds of Cheese,.............Amounts due 2 cts. per lb. for making, &c., deducted, $................

........................, Salesman.

PAYING THE MANUFACTURER BY THE POUND.

Sometimes a good cheese-maker is employed as manufacturer and manager, at a certain price per pound of the cheese manufactured. This manager employs his laborers or assistants, and bears all expense of running the factory, taking care of cheese, keeping record of milk delivered daily by different patrons, entering the same on the books of the factory, and upon the pass-books of patrons. Often the Company employ the manufacturer and all hands at fixed salaries. Some prefer one plan and some another. The milk is weighed at the factory when delivered, and as experience has shown that every ten pounds of milk (as an average for the season) should make one pound of cured cheese, firm, solid and in good marketable condition, each farmer thus has a daily record in his pass-book of what his herd is yielding. The manager is employed with the understanding that he is to make a good, fair article, and his product is examined from time to time by committees, by experts, and by patrons as they see fit, and thus bad work is soon detected. If the management is not satisfactory the cheese-maker is discharged, or the causes of the bad work traced out and rectified.

The stock-holders, and those delivering milk may meet from time to time and deliberate as to sales; each one voting according to the number of cows from which he delivers milk, and in this way instructions are issued to the salesman.

FACTORY OWNED AND MANAGED BY ONE PERSON.

Then there is another method of establishing factories. One man or a company erects buildings and bears all expenses of running the factory, charging by the pound of cured cheese for manufacturing. The cheese in this instance, it will be seen, belongs to patrons, who appoint a salesman and control the product precisely as under the other method. We give a form of rules and regulations applicable to such cases; also to cases where the proprietor of a factory purchases the milk of patrons. Of course these rules may be varied to meet the views of persons in different localities.

RULES AND REGULATIONS FOR THE GOVERNMENT OF THE SINCLEARVILLE CHEESE FACTORY.

I. The proprietor of the factory is to make and take care of the cheese, furnish boxes, salt, swathing, coloring matter, box and weigh the cheese, mark the boxes, make out bills, tally out cheese to cheese drawers, keep the books, receive the cheese and tally the same at the point of delivery, receive the money for the cheese and disburse the same among the patrons, for the sum of two cents (.02) per pound; this includes patrons sending milk five months. Patrons sending milk four months and less than five months will be charged two cents and one mill (.021) per pound. Patrons sending milk three months and less than four months will be charged two cents and two mills (.022) per pound. Patrons sending milk less than three months will be charged two cents and three mills (.023) per pound for manufacturing.

II. Each patron sending milk to the factory is to furnish one good calf rennet, in good order, to each cow's milk sent to the factory, or pay the sum of fifteen cents in lieu thereof.

III. Each patron shall have such proportion of the money received for the cheese as his milk bears to the whole quantity furnished by patrons during the time he sends milk to the factory (always subject to part first).

IV. Each patron shall furnish pure, sweet, unskimmed milk, and each one furnishing milk shall strain the same before it is delivered at the factory, and if any is reserved for use, it shall be of an average quality given by his cows.

V. The milk of each patron delivered at the factory shall be properly tested once in each month during the season, and the result shall be publicly stated to those patrons requiring the same.

VI. Any patron that knowingly skims, waters or adulterates his milk in any form, or takes out the strippings, shall forfeit the sum of twenty-five dollars for the first offense, and the sum of fifty dollars for the second offense, and for the third offense he shall forfeit his whole interest in the factory. If his interest does not amount to seventy-five dollars, he shall pay the proprietor enough to make seventy-five dollars. All forfeit money received shall be disbursed among the patrons interested in the same, in proportion to their interest. When such facts come to the knowledge of the proprietor, he shall retain the money received for cheese, and dispose of as aforesaid.

VII. No milk shall be worked into cheese which, in the judgment of the manufacturer, will be a damage to the general interest of the patrons.

VIII. Each patron shall bring his milk as often as the manufacturer shall require, and at or before the time he may require, and all cans must be washed and scalded daily, and kept sweet and clean.

IX. Each patron shall be to his proportion of the expense of getting the cheese to market.

X. There shall be a committee on sale of cheese, said committee to consist of three persons having interest in the cheese. The committee shall be WILLIAM REED, FORDYCE SYLVESTER and JOHN D. BARGER. Said committee shall have power to sell the cheese once in each week, if in their judgment they think best, and shall see that the cheese is delivered according to contract.

XI. That each patron who has a load of cheese at the time of sale shall be notified by committee on sale of cheese, and if such patron fail to appear at the time specified in the notice, he shall pay all extra necessary expenses and damages for the delivery or failure of the same.

XII. There shall be a committee on whey; that committee shall be composed of three patrons, namely, HENRY DUNBAR, THOMAS SPEAR, RUSSELL SEARS.

XIII. Any patron may take his proportion of whey and dispose of the same as he sees fit, providing he notifies the whey committee in writing of the same on or before he sends his milk to the factory, providing he draws his whey from the bottom of the whey vat; otherwise he will have to stand the loss or gain in proportion to his milk sent to the factory. No patron shall take away more than two-thirds as much in bulk of whey as he sends milk to the factory. No patron shall feed whey to cows when milk is sent to the factory.

XIV. The whey committee shall have power to dispose of the balance of the whey to the best general interest and advantage of the patrons, in their judgment.

XV. That the profit or loss on whey shall be divided or assessed on the patrons owning the same, in proportion to the amount of milk sent to the factory.

XVI. The proprietor agrees to make the whey butter, and furnish sufficient to oil the cheese, the balance to be divided—the patrons to have one-third and the proprietor two-thirds of the profits, the proprietor to furnish salt and tubs.

XVII. *Resolved*, That all cheese sold shall be paid for on delivery.

XVIII. The proprietor shall take care of the cheese up to the first of December. If kept later, a fair compensation is to be allowed him.

XIX. Each person furnishing milk to the factory is hereby understood as agreeing to the foregoing rules.

—— ————, *Chairman.*
————————, *Clerk.*
————————, *Proprietor.*

RULES FOR FACTORY WHERE THE PROPRIETOR PURCHASES THE MILK OF PATRONS.

I. ——— ———, Proprietor of the ——— Cheese Factory, agrees as follows: To purchase the milk of the said patrons of the ——— Cheese Factory for the year 1871, and to commence making cheese on or about the first of April, and close on or about the first of November next.

II. For value received, I promise to pay to each patron of the ——— Cheese Factory, for his or her milk, as follows: As much per pound for his or her milk as the milk of any factory they choose nets them after they deduct expenses for making and furnishing and getting the cheese ready for market, and three per cent. more in addition, and take the milk at the factory, the patrons to have no further expense with it.

III. ——— ——— is to pay to each patron his proportion of money as soon as it can be ascertained how much each month's milk is worth.

IV. The patrons are to choose, on or before the first day of June, one of the following factories for a basis to make our estimates on, namely: Charlotte Center, Arkwright Union, Clear Spring, Walnut Creek or Hamlet Factory. The factory chosen shall be by a vote of patrons at a meeting called for that purpose. The meeting is to be called by the proprietor at any time when two or more of the patrons may direct.

V. Each patron may take his proportion of the whey away; that is, two-thirds as much in bulk as he or she sends milk to the factory. If he or she takes their whey away, they will not be entitled to the benefit of the three per cent., but will be entitled to all other benefits that any other patron has.

VI. Each patron sending milk to the factory is to furnish pure, sweet, unskimmed milk, and each one furnishing milk shall strain the same at the time of milking, and if any is reserved for use it shall be of the average quality given by his or her cows.

VII. Any patron that knowingly skims, waters or adulterates his or her milk in any way or form, or takes out the strippings, shall forfeit the entire amount of interest he or she has in the factory at the time of the misdemeanor.

VIII. Each patron sending milk to the factory is to furnish one good calf rennet, in good order, to each cow's milk sent to the factory, or pay the sum of fifteen cents in lieu thereof.

IX. Each person shall bring his or her milk as often as the manufacturer shall require, and at or before the time he may require, and all cans and milk pails must be washed and scalded daily, and be kept sweet and clean.

X. Any patron sending milk to the factory is herely understood as agreeing to the foregoing rules.

——————, *Proprietor.*

It will be observed that, under this system of checks, all men who deliver milk are upon an equal footing, where no advantage can be taken; for the farmer, if he chooses, can weigh his milk at home, and compare it with the figures entered at the factory upon his pass-book. The company is responsible for milk delivered. The account is payable in cheese; this part of the system being somewhat like that in making deposits at bank.

NUMBER OF COWS.

The number of cows varies greatly—from three hundred to fifteen hundred, or even more. Experience shows that a factory with less than three hundred cows will not pay expenses, including interest on capital invested in building, fixtures, &c., unless an extra rate be charged for manufacturing. Extremely large factories, say of fifteen hundred cows, do not give the best returns to farmers. There is usually more waste; the milk coming from a long distance is often in bad condition, and the work at the factory is from time to time slighted. The best results are obtained, both as to quantity and quality of product, when the factory uses the milk of from five hundred to eight hundred cows, and not above one thousand.

FACTORY BUILDINGS.

Improvements are constantly being made in buildings. The early factories were rude and imperfect structures. The late erections are more substantially built, but very plain in style, with no pretensions to architectural beauty. This is a mistake. A competent architect should be employed, who should give designs for a handsome exterior, imposing, graceful and pleasing to the eye. The cost would not be very much more, but the value of such buildings would be greatly enhanced, and could be turned to good account in case they were abandoned for cheese-making. In some establishments the manufacturing department and curing rooms are under one roof; in others these are separated. The system of marketing cheese in America is somewhat different from that in England. The cheese is not held for so great a length of time while curing. We try to send our cheese to market when it is from thirty to sixty days old. There are few curing rooms built with the design of holding cheese for the entire season. Without attempting to originate new plans for model buildings, it will perhaps suffice to present plans of modern factories which are esteemed as among the first class. The Fairfield and the Willow Grove Factory send out cheese favorably known in the English markets. They have for several years received "top prices" from English shippers.

THE FAIRFIELD FACTORY

is located in Herkimer Co., N. Y., eight miles from Little Falls, the largest country cheese market in America. It receives the milk from one thousand cows. The manufacturing department and curing room ("dry house") are under one roof. The establishment is one hundred and forty-eight feet long by thirty-eight feet wide and three stories high. The second and third stories are for curing rooms. The manufacturing room is forty by twenty-eight feet; press room thirty-five by thirty-one feet. The boiler, of five-horse power, stands in a separate room, and cost four hundred and fifty dollars. The manufacturing room is supplied with double vats for cheese-making. These vats are each sixteen feet long, three feet four inches wide, and eighteen inches deep, holding six hundred gallons. I may remark here that vats of this size and proportion are convenient for work, and are usually adopted at the factories. They are double, that is, the inner one of tin, setting in a wooden vat, with spaces between the two at the sides and bottom, where heat is applied—either steam or hot water.

THE WILLOW GROVE FACTORY

is in Oneida County. The dry house sets upon high stone piers, and is one hundred feet by thirty feet, and two stories. The manufacturing department is in a separate building, being thirty by twenty-eight feet, with press room twenty-six by fourteen feet. This factory has capacity for the milk of one thousand cows.

WIGHT'S WHITESBORO FACTORY,

in Oneida Co., N. Y., has also a high reputation in the English markets. It was erected for six hundred cows; dry house one hundred and four by thirty feet; two stories. Directly opposite stands the manufacturing department, which is twenty-six by fifty feet.

THE SANBORN FACTORY.

We give elevation and plan (see Figs. 6 and 7) of a very neat and convenient factory, erected at Sanborn, N. Y. It is thirty-six feet wide by

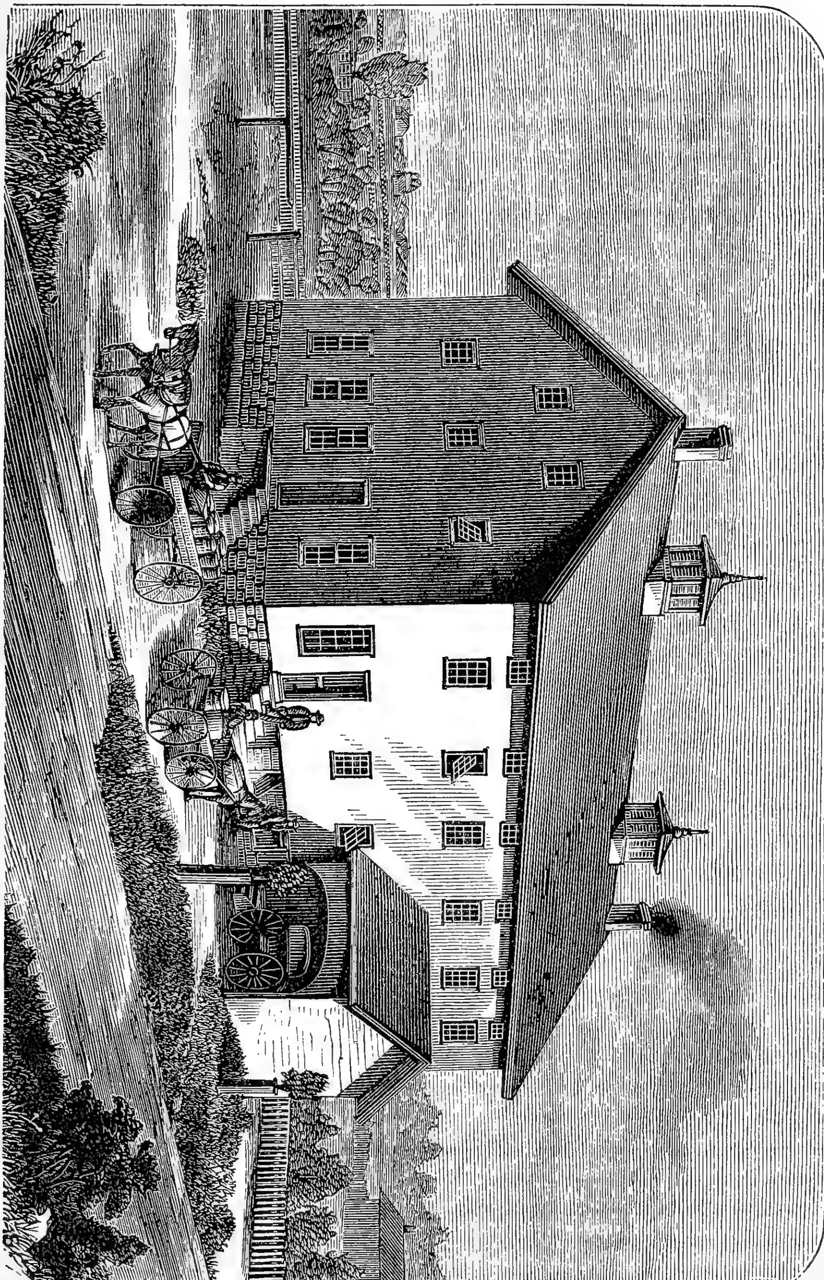


FIG. 6.—THE SANBORN FACTORY—ELEVATION.

seventy-five feet long and three stories high above the basement. The manufacturing department is in the basement, and the curing rooms above. On the first floor above the basement a living-room, bed-room, pantry, &c., are finished off, as apartments for the manufacturer. The building was erected

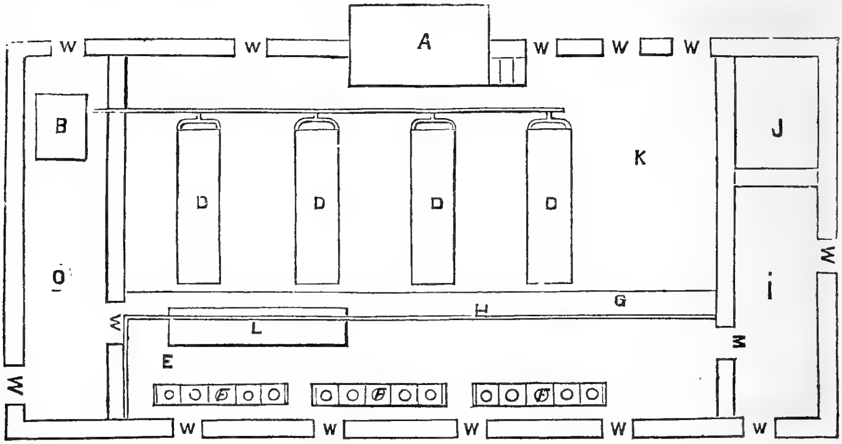


FIGURE 7.—GROUND PLAN.

DESCRIPTION OF GROUND PLAN.—A, Platform for receiving milk, half outside of building, and four feet above basement floor. B, Millar vat and heater. C, Fire room. D, D, D, D, Millar vat, 600 gallons. E, Whey spout, level with basement floor. F, F, F, Fifteen presses. G, Drop below main floor. H, Conduit for slop water; floor descending each way thirty inches from main floor. I, Cellar for family use. J, Cistern. K, Main floor, twenty-two by fifty feet. L, Sinks on castors. M, M, M, Doors. W, W, W, Windows.

by a stock company, at a cost of some $6,000. The subjoined ground plan and description of the manufacturing room (Fig. 7) will be readily understood.

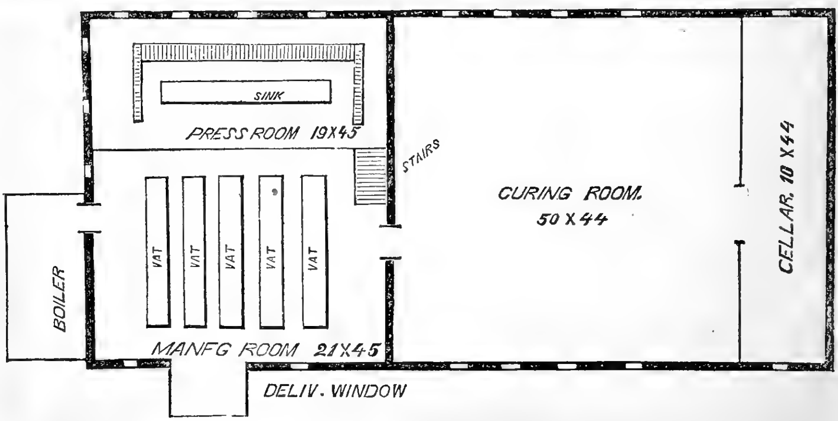


FIGURE 8.—BASEMENT.

A HERKIMER COUNTY FANCY FACTORY.

One of the most convenient of the modern factories is that recently erected at Newville, Herkimer Co., N. Y. The whole establishment is under one roof, the structure being three stories high. The manufactory is in the basement or first story, and the living rooms of manufacturer in the second story, with cellar in basement and chambers in third story. The illustrations (Figs. 8, 9 and 10) show the rooms in the different stories,

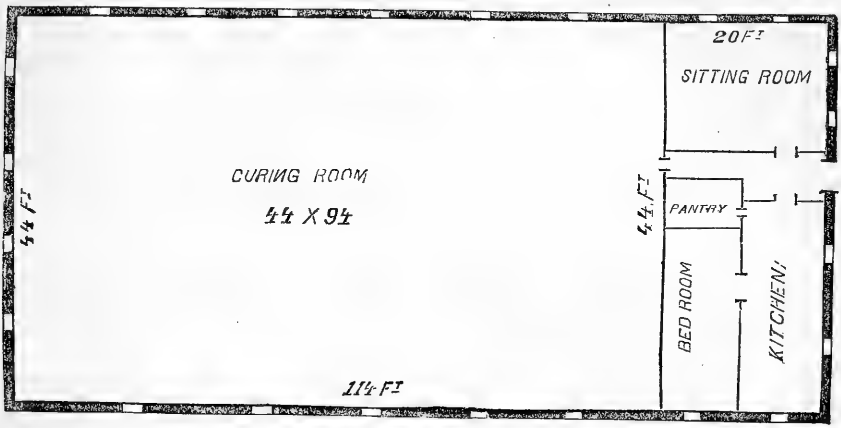


Figure 9. — Second Story.

and the position of apparatus in the basement. These plans, with those previously given, will be useful to those about building factories, or for those who contemplate remodeling old structures, while at the same time they give the reader a clearer idea of the buildings than any written description alone.

THE COST.

The cost of buildings, of course, varies in different localities, and must be

Figure 10. — Third Story.

regulated according to taste in architecture, cost of material, labor, &c., &c. Factories in the State of New York cost from $3,000 to $10,000. The principal cost of machinery will be for steam boiler, milk vats, presses and hoops. Steam boiler, with fixtures, say $500; vats, $100 each; screw presses, $4 each. A factory for six hundred cows may be fitted up in good running order for from $1,200 to $1,500. Vats with heater attached, which will obviate having steam boiler, are sold (six hundred gallon size) for about $200 each. A factory with from six hundred to eight hundred cows will need five hands, and perhaps, when the curing rooms are full, more help. The manufacturer or head manager, if skillful, will command from $800 to $1,000 and board, for the cheese-making season of nine months. The second man, who perhaps has worked at the business a year or more, gets, say from $35 to $50 per month and board, and women from $4 to $5 per week and board. Women not unfrequently take charge of factories as head managers, at salaries sometimes as high as $80 to $100 per month and board. Boys and girls, or young persons of immature age, are not usually employed. The head manufacturer at a factory is expected to "take off his coat," and do a good day's work every day—seeing to the delivery of the milk, working at the curds, the presses, and all the time with a sharp eye to see that all moves on in order and on time. The quantity of milk received must of course depend on a variety of circumstances—goodness of cows, quality of pasturage, the season, and time of commencing and closing operations. The Weeks' Factory, at Verona, Oneida Co., N. Y., in 1867, had an average of six hundred and forty cows; length of season, two hundred and nine days; pounds of milk received, 2,481,615; green cheese made, 261,904 pounds; cured cheese, 250,540 pounds; shrinkage, four and one-third per cent.; pounds of milk to green cheese, nine and forty-eight one hundredths; pounds of milk for cured cheese, nine and ninety-one one hundredths. The gross receipts per cow (average for the season, exclusive of income from butter and cheese made before factory opened and after close) varied from $34 to $78, the former being the poorest dairies and the latter the best. The cheese sales in 1867 were low, the average at the Weeks' Factory being only $14.40 per one hundred pounds. The receipts during other years have been much larger. Some of the factories in Herkimer Co. make an average of five hundred pounds to the cow, which, at present prices (fifteen cents), would give $75. This would be too large an estimate, however, for a novice to base dairy prospects upon.

DISTANCE IN DELIVERING MILK.

The average distance from which milk is brought will not exceed one and a-half miles, and perhaps in the old dairy districts in New York is a little less. Four or five miles may be set down as the maximum, except in rare cases, as at the West, where we have reports of milk being carted eight miles and more; and yet, if cooled at the farm, arriving at the factory in good condition. Such a long distance is regarded as altogether too far to cart milk with profit, especially on our country roads, which, for the most part, are rough during a considerable portion of the year.

COOLING MILK AT THE FARM.

The practice of cooling milk at the farm does not usually obtain among dairymen. Canning milk too warm, and hauling it in this condition to the factory, results in great losses to dairymen. It is now several years since I commenced urging the importance of cooling milk at the farm, and as soon as drawn from the cow, and most especially have I urged this principle since returning from my visit to European dairies. After an extended observation over the dairy districts of Great Britain, and an examination of the best English methods, it was clear that in the matter of cleanliness, care of milk and of stock, management of pasturage, &c., the English were in advance of us; but in machinery and appliances for manufacturing, the Americans were a long way in advance of the English. My report upon English methods, &c., has effected a change in American dairy practice, and it is pleasant to know that the bad practices of our dairymen are being corrected. We are now beginning to cool milk at the farm, and as a consequence the character of American cheese must greatly improve. If milk is exposed to the air and cooled to 60°, when drawn from the cow and before canning, it may then be canned, and will arrive at the factory in good order. It is quite important that milk be freely exposed to the air, while warm from the cow, in order that unpleasant odors may pass off. There are now a number of devices for cooling milk at the farm. The Riggs plan is to conduct the milk in zigzag channels over a tin plate, with cold water underneath. Mr. Bussey of Oneida Co. effects the object by a tin cylinder holding water, and which floats upon the surface of the milk in the can.

Mr. Hawley of Syracuse has a somewhat similar arrangement. Mr. Burnap of Schoharie Co. introduces in the can a long tin tube, filled with water. Others simply pass the milk over a shallow tin vat, with water underneath. Mr. Arnold believes that milk should not only be cooled but deodorized, and he effects this by exposing the milk to a current of air. For this purpose fans are provided, which are to be put in motion by a weight and gearing. The milk falls on a succession of corrugated tin plates, and is thus spread out into a thin sheet, while the fans throw forward and through it a current of air, which carries away offensive odors. The last plate gathers the milk into a stream which falls into the can, and thus both cooling and airing are effected. Recently he has invented a ventilator, to be applied to the carrying can, which is so arranged as to give the milk ventilation while being carried to the factory, and at the same time prevent any escape of milk from slopping over during its transit. Mr. Bussey, in his National Milk Cooler, has an improved strainer, which is so arranged as to aerate the milk as it falls into the can and upon the cooling apparatus. We give illustrations of four forms of coolers (see Figs. 11, 12, 13 and 14), which are to be applied to the carrying can, are quite inexpensive, and very convenient of application.

Fig. 11 shows an improved strainer-pail, applied to the BUSSEY Cooler, which operates in exposing the milk to the atmosphere, for the purpose of deodorizing it. At Fig. 12 is shown BURNAP's Can and Cooler.

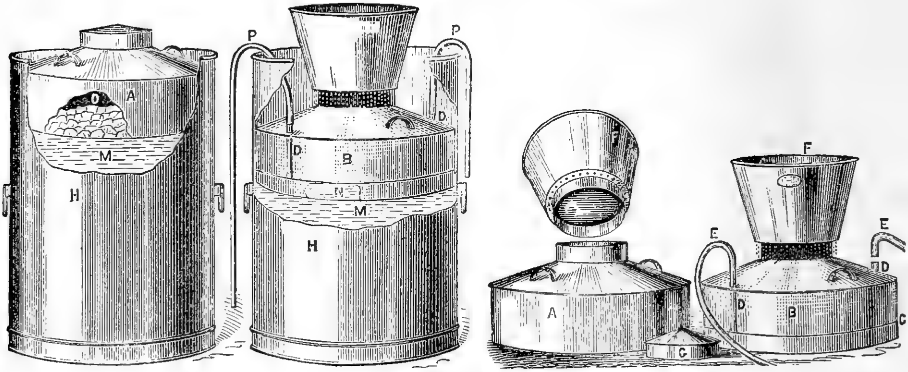


FIGURE 11.

A, Cooler. F, Strainer pail. D and E, Syphon pipe. G, Cover. H, Milk can. M, Milk. O, Ice in the cooler. N, Cold water in cooler.

The principle of the HAWLEY Cooler (Fig. 13) is based upon strict philosophical laws—*the cooling of fluids from the top.* Fig. 1 represents the cooler as placed within the can. The cooler is a hollow chamber, which floats upon the milk, and will therefore operate whether there is much or little milk in the can. Water is introduced into this float at the rubber spout, B, (Fig. 2,) through funnel attached, and is forced out at C when more water is poured in. The points marked D represent passages through the cooler which bring the milk in direct contact with the air. By the handle, if desired, the cooler can read ily be plunged into the milk occasionally, thus thoroughly agitating the entire mass.

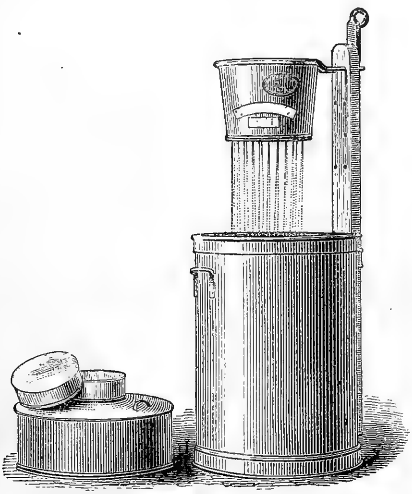


FIGURE 11.—IMPROVED.

NORTHROP's Automatic Agitating Cooler (Fig. 14) consists of an upright tube, two or three inches in diameter, having a funnel top, in the center of which is a pivot, supporting the tube in an upright position; the tube resting on a pivot at the bottom of the can. At the lower end of the tube, two or more agitating and cooling tubes are attached, opening into the upright tube; within the upright tube is an inner tube extending nearly to the bottom of the upright tube, its upper end being connected, just above the top of the can, with one or more discharging arms, which are attached to the upright tube, and which extend out and turn downwards over the top edge

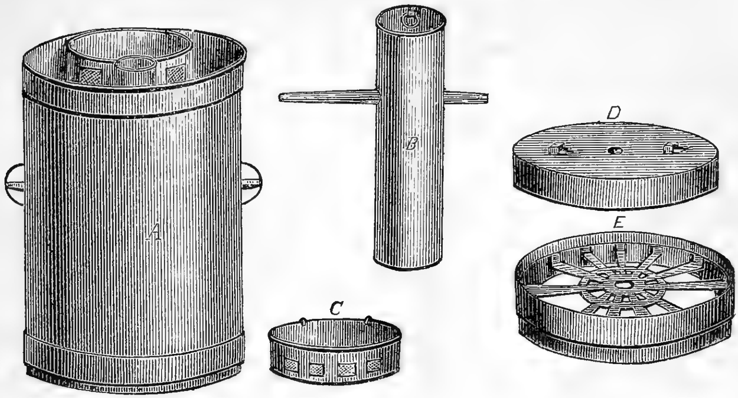


FIGURE 12.

A, Can. B, Cooler. C, Strainer. D, Can cooler. E, Can bottom.

of the can, having their issues adjacent to the side of the can. In operation, the cooling liquid (cold water) enters the funnel at the top of the upright tube through a faucet, from a tank, or spring, or penstock, and passes down the upright tube to the agitating tubes, through these to the bottom of the upright tube, thence upward through the inner tube to the discharging arms, out of these arms (the issues of which are turned in opposite directions) against the outside of the can, the reaction of the streams of water causing the whole to revolve, thus distributing the water evenly all over the outside of the can, and cooling and stirring the milk on the inside of the can.

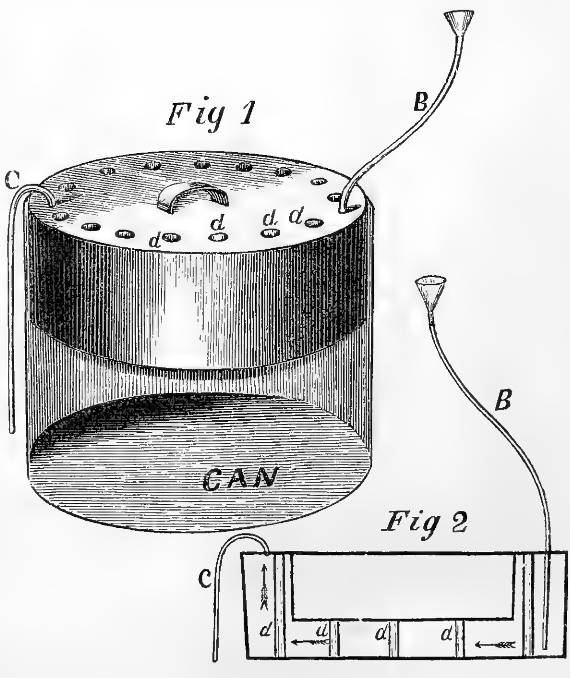


FIGURE 13.

The can should be provided with a woolen cloth or jacket (tied on), for the purpose of absorbing the water, thereby inclosing the can in a cold armor, the intensity of which is increased by the rapid evaporation from the woolen jacket. The illustration (Fig. 15) shows the manner in which the frame is arranged for supporting the water tank. The machine is quite simple in its arrangement, easily cleaned, and as an agitator and cooler combined, is one of the best we have seen.

FACTORY CHARGE FOR MAKING CHEESE.

The usual charge in large factories for making the cheese is seventy-five cents per one hundred pounds cured cheese. This includes care of cheese until sold. If the factory is small, one cent per pound is charged. A large number of factories charge two cents per pound, and furnish everything required — bandage, annatto, rennet, salt, and the boxes in which the cheese is placed for shipping. Hauling cheese to railroad depot is done by patrons.

THE WHEY.

The whey is usually fed to hogs, sometimes at the factory and sometimes at the farm. Ample pens and yards in the former case are provided by factories. Each farmer delivering milk is allowed one hog at the factory for every five cows. He can

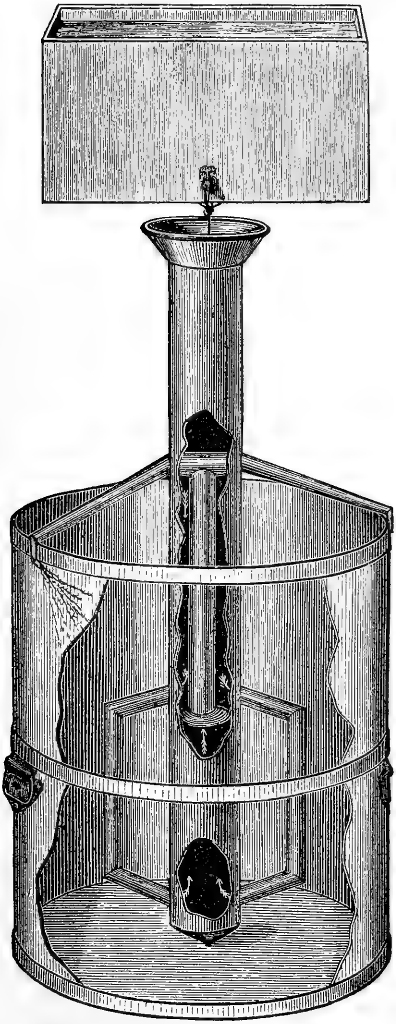


FIGURE 14.

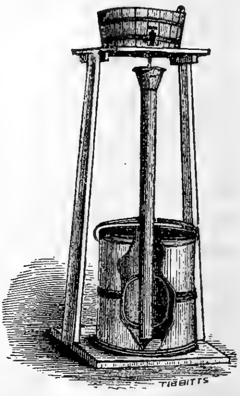


FIGURE 15.

have a pen where he can keep his hogs separate, or turn them in the yard with the others. The whey runs to large reservoirs near the pens, and when the hogs are to be fed, a faucet is opened which lets the whey into the troughs. The difficulty of keeping the factory premises free from foul odors is so great that the practice of feeding hogs in connection with the factory is being abandoned. I should always advise this course, but if it is resolved upon to have swine kept at the factory, the pens should be located a long distance from the milk and cheese departments, so that there be no possibility of the air becoming tainted about the premises. It is altogether better, however, that the whey be carted home by farmers on the return trip of delivering milk at the factory. At some factories the whey is considered a perquisite of the manufacturer or stockholders of the factory, who extract the butter from it, purchasing hogs, and feeding them on the refuse whey. We shall describe the recent processes of making marketable butter from whey when we come to treat of butter manufacture.

BRANCH FACTORIES.

It often happens that farms and herds are so located in respect to the factory that long distances over rough and hilly roads have to be traveled by patrons, making the delivery of milk difficult and expensive. In such cases the plan of branch factories has been found convenient and practical in their working. In this plan a large central building is provided, where the cheese is stored, and small, cheap structures are erected at different points over the country, simply for the manufacture of cheese which is carried to the central building to be stored and cured. One of the largest central establishments on the branch factory system is located at Ingersoll, Canada (Fig. 16). This factory is noted for having made a cheese weighing some seven thousand pounds, the largest cheese that has ever been manufactured. It was six feet ten inches in diameter, three feet in hight, and twenty-one feet in circumference. To make it, thirty-five tons of milk were required, or one milking of seven thousand cows. It was bandaged with wire cloth, and its shape was in every respect perfect.

To transport this immense cheese (Fig. 18) to the railroads from place to place, a very heavy wagon was specially manufactured for it. Then the hoop in which it was pressed was placed upon the mammoth, and the ends inclosed with heavy plank above and below, held in place by rods of iron firmly secured with nuts. It is not very probable that an attempt will very soon, if ever, be made "in the cheese line" to "outdo" this Canadian mammoth, and as a matter of history connected with large cheeses, we give an illustration of the monster as it appeared at the New York State Fair at Saratoga, and in the streets of London and other cities of England, on its way to the place of exhibition.

In making very large cheeses, unless due caution be taken, there will be difficulty in expelling the whey, and if the whey is not properly expelled under the press, or otherwise, the cheese will be sure to turn off bad flavor. Several very large cheeses have been spoiled by not attending to this

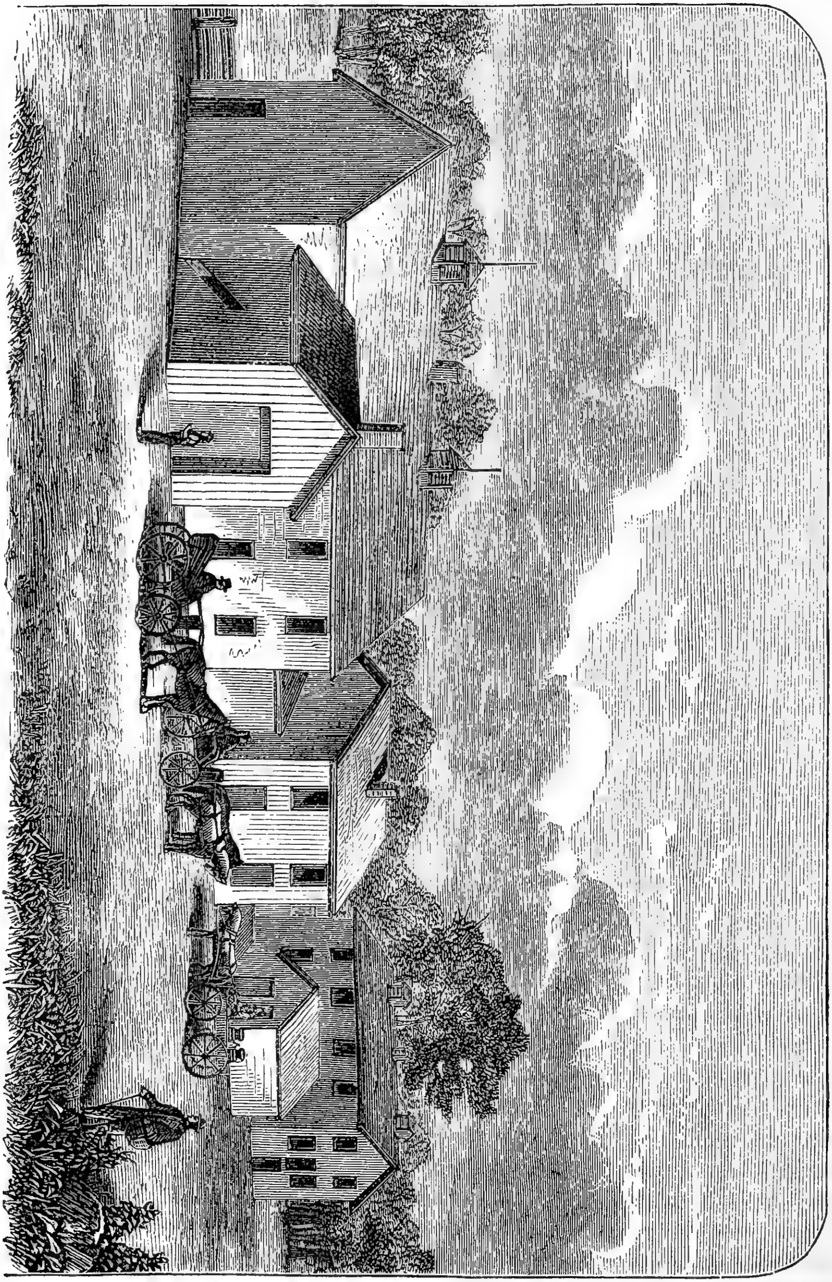


FIG 16.-INGERSOLL FACTORY.

particular. The method adopted at the Ingersoll factory, and one which proved to be successful, was to divide the curds into small parcels—say from fifty to seventy pounds—and press thoroughly in hoops. Then after the whey had been expelled, the cheeses were broken up and passed through a curd-mill, and after being thoroughly mingled together were placed in the large hoop, where the curd assumed the proper shape under a powerful pressure.

Mr. LEMUEL BROWN, who first suggested this plan and put it in successful operation, thus describes the advantages of the system. He says:—"In regard to the question of branch cheese factories, I will state that, for the last four years, I have been in business which led me from one factory to another, through the principal dairy region of this State. In taking this broad view of the factory system, I have seen certain objections, which, if

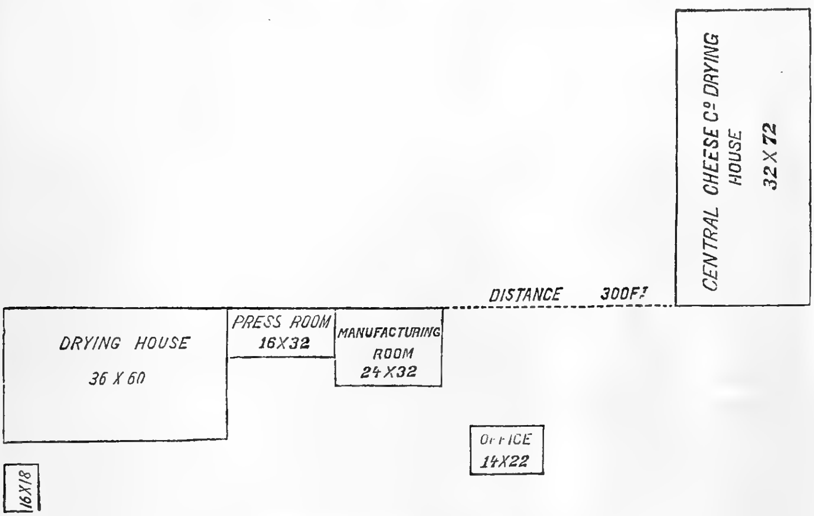


FIG 17.—GROUND PLAN OF INGERSOLL FACTORY.

carried out, would soon cripple it in its infancy. The first and greatest objection is the expense and trouble of carrying milk long distances. I therefore introduced and put into practical operation, two years ago, and to a greater extent one year ago, the plan of working the milk at different points, and drawing the cheese together instead of drawing the milk. For this purpose I erected cheap buildings, some eighteen by twenty-four feet, furnishing them with all the apparatus and conveniences of a nice factory, with ranges to hold ten or fifteen cheeses, or a load, which were boxed and drawn to the dry-house. I prepared the rennet, annatto and bandages at the dry-house, sending the required amount to the branches when the team went after the cheese. I have closely followed up the experiment for the last two seasons, and found the plan to work admirably, even beyond my expectations. The advantages are greater and the objections less than I expected. The first advantage is, that it gets a large amount of cheese together by drawing the milk but a short distance; and there is not only a saving in distance, but, as there are but few teams to deliver at one of these branches, the patron can drive up and unload at almost any moment, thus saving much time from the disadvantage of waiting his turn at a large factory. Another advantage is that as the milk is drawn but a short distance, it is delivered earlier in the day and in better condition—two considerations which will be appreciated by all practical cheese-makers. In many instances, when milk comes in a bad condition, had it been delivered an hour or an hour and a-half sooner, it would have caused no difficulty in its manufacture. As it will be admitted by all that the quality of the milk has much to do in determining the character of the cheese, these facts will argue a superior dairy in favor of the branch system, to say nothing of the increased amount of the product.

"The third advantage is the facility with which the patron can obtain his share of the whey, having to draw it but a short distance on his return home from carrying his milk. In brief, the branch system secures to the farmer all the advantages of a large factory in his own neighborhood.

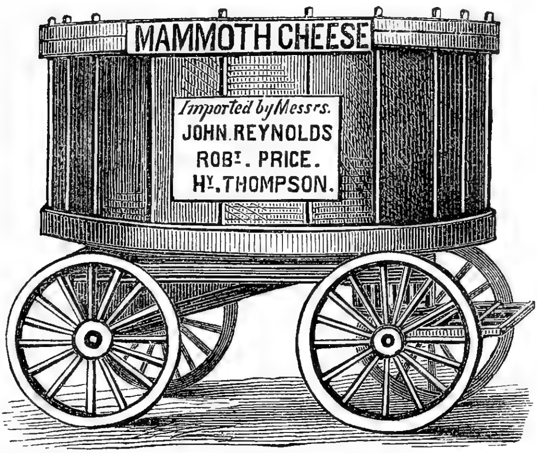


FIG. 18.

"By giving the farmers these advantages and conveniences, I think the permanency of the factory system will be established; but as I am led to believe that the day of drawing milk long distances is nearly over, it is my opinion that, unless the branch system is adopted, the large factories will break up into smaller ones, which will fail to be sufficiently profitable to stimulate individual enterprise. They will then be built by a few farmers in convenient localities, and managed to save expense, much like the old private dairies. As they have learned something from the present factory system, they will undoubtedly make better cheese than of old; but there will be an end to all that progress in cheese manufacture, which has within the last few years, given American cheese the first place in the world's market. Indeed, the quality of American cheese will be generally lowered; for, while few excel or equal the present standard, many will fall below it, from lack of that interest which is felt by the individual who makes cheese-making not only his business, but his study.

"As to the manufacture of cheese in branch factories, they can be so placed as to get the milk from two to three hundred cows into a single vat, which can be worked by one hand without any additional help. I hired a hand the past season, who ran a branch with two hundred and thirty-six cows, without receiving the least assistance from any source.

"As the help has but one vat to watch, the work can always be done in season. Not so in the large factory, with a conbination of vats; for in case two or more vats need dipping at the same time, which is often the case, one of them is obliged to wait, to its injury.

"These considerations argue two points against large factories, and in favor of the branch system:

"1. The milk will be delivered at the branch earlier and in better condition.

"2. The work can always be done at the branch in the proper time.

"One objection brought against this system by many is, that there will be as many kinds of cheese as there are places of manufacture. My experience does not sustain this objection. Distance has nothing to do with the result. If the same rennet and annatto are used, and the same rules are observed in the process of manufacture, what difference can it make whether the vats are two feet or two miles apart? The conditions being the same, I see no reason why the result would not be the same. Facts and observations show that it is. During the past season I visited a large number of factories, and nowhere did I find a more uniform lot of cheese than was produced under the branch system.

"As regards the amount of help, I think a dairy of one thousand cows could be manufactured nearly as cheaply at four branches, with two hundred and fifty cows each, as if the milk were all delivered in one place. I am now speaking simply of making. The additional expense and trouble would be in drawing the cheese together. Still this is less than the extra expense and trouble of drawing the milk long distances. There is not only more weight, but the milk has to be delivered in season, whatever may be the weather, while the cheese can be left over in case of bad weather or hurry.

"When the milk is all drawn to one large establishment, the entire care is commonly thrown upon one person, the rest feeling little or no responsibility, and not working with the interest required in the successful performance of such delicate business. But when the milk is worked by the branch system, the care is divided, and not only a feeling of responsibility, but a spirit of rivalry is awakened. Consequently, the labor is more carefully and thoroughly performed.

"Another objection raised against the branch system is, that it will require all experienced hands. But, as the milk comes in better season and condition, and there is only one vat to watch, with the rennet and annatto prepared and furnished ready for use, it will readily be seen that, with frequent visits from the overseer, it will not require as much experience and skill as it would to manage a large factory. I have found no trouble with hands of little experience. In one case I hired a hand who was totally unacquainted with cheese-making, and he ran a branch through the season with the best of success. There is an effort among the hands to excel each other, and should any of them have bad luck, as each branch has its own mark, the superintendent will readily detect it, when a visit to the branch will enable him to soon put everything right.

"Farmers at a distance would generally choose to pay for drawing their milk, rather than to draw it themselves. But if a branch were erected in their neighborhood, the general opinion is that each would rather draw his own milk than to be obliged to get it ready for the milk-wagon at just such a minute every night and morning. Admitting this to be so, the branch system would save to many the sum paid for drawing their milk to a large factory—it, on an average, costing $2.50 per cow. Allowing it to cost twenty-five cents per hundred pounds more to work up milk under this plan; then, as a cow will make four hundred pounds, which would make the additional expense one dollar per cow, the saving to the farmer would be one dollar and a-half on each cow—which, with other advantages mentioned, would throw the argument in favor of the branch system.

"In conclusion, I will say to those who are about to build, unless you adopt the branch system, do not build too large. I have been on the road for the last three months, and have exchanged views on this point with a large number of manufacturers. It is the prevailing opinion that the day of drawing milk long distances is rapidly coming to a close. From a mile and a-half to two miles is as far as it will be found feasible to draw it. This, as a general thing, will get together the milk of from two to three hundred cows."

CHEESE-MAKING MACHINERY.

In cheese factory machinery, the first thing naturally to be considered is the heater and vat. There are a great variety of heaters—the steam boiler, boiler and engine, tanks for hot water, cheese vats with heater underneath, &c., &c. There are so many kinds of apparatus, some of which are not now to be recommended, that I shall only name those of recent invention, or those which have been generally approved. The engine and boiler has been in use, more or less, from the first introduction of factory cheese-making. Some old cheese-makers are very much prejudiced in favor of steam in cheese factories, and where an engine can be utilized to do other work besides supplying heat to the vats, this form of heater is very desirable. Among the new things recently brought out is

CLARK'S SECTIONAL BOILER AND STEAM GENERATOR,

an illustration of which (Fig. 19) we give in this connection. It is constructed of a series of sections of solid, heavy cast iron cylindrical hollow rings, with lathe-turned faces, bolted together vertically, one upon another, with water passages or openings communicating through the series, and made water and steam tight by thin rubber packing around each opening. The lower sections, forming the ash pit and combustion chamber, are plain hollow cylinders; the others are constructed with corrugated and chambered projections inside for water, and for increasing the heating surfaces exposed to the fire. The number of sections may be indefinitely increased to utilize all the available heat from the fire. The small vertical spaces between the corrugations form the smoke and heating flues, while the larger central space is lined with heavy sheet iron, and forms the coal magazine, thus making at once a perpetual base-burner and self-feeding machine of the most approved shape known. The magazine is filled through a door and shute in the dome-shaped smoke top, and holds sufficient supply for its full capacity for about

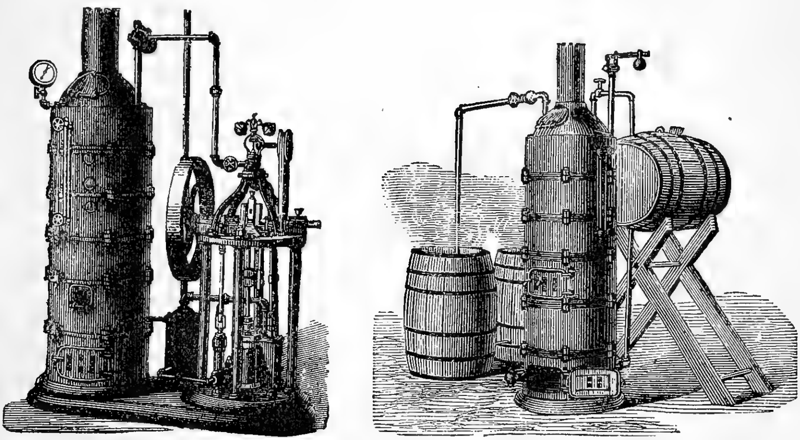


FIGURE 19.

eight hours, or for simply heating and cooking purposes for sixteen to twenty-four hours. For wood fuel, an additional plain section, with feeding door in the combustion chamber, is used. They are recommended as entirely safe from explosions, and cannot be ruptured with a pressure of two hundred pounds or less to the square inch, and all are practically tested under that force at the manufactory. See view of sections (Fig. 20). They remain entirely free from incrustations or scale from hard or lime water, as the feed water enters just below the grate, and as the temperature gradually reaches to about 190° F. (which is far below boiling point), the lime is precipitated to the mud ring around the ash pit, where it remains undisturbed mud until blown off at the waste cock, or removed at convenience; as this deposition occurs before the lime and muddy water reaches the corrugated and chambered sections, they consequently do not become clogged or choked by lime or mud. They can be readily taken all apart for handling, transportation, re-packing or other purposes, and put together again by two men, in less than two hours' time.

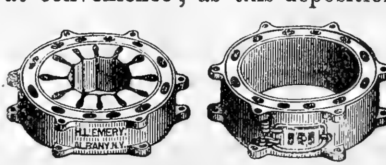


FIGURE 20.

Mr. HORACE L. EMERY of Albany, who has had considerable experience with engines and boilers, and whose opinion I have asked concerning the merits of this invention, writes me as follows:—"It is my belief that, as a steam generator—for safety, economy in space occupied, fuel and attention, and, I believe, durability, and most of all, efficiency—it has no superior, whether for heating, cooking or power purposes. When to it is applied the non-conductor covering of plastic felting, called Salamander Felting, from our neighboring city, Troy, I think it the safest from fire and frost of all

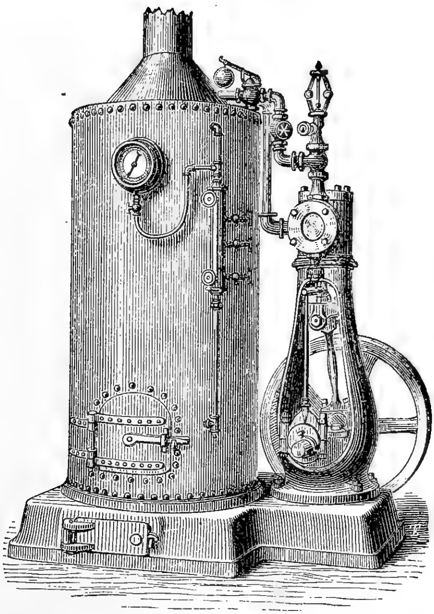


FIGURE 21.

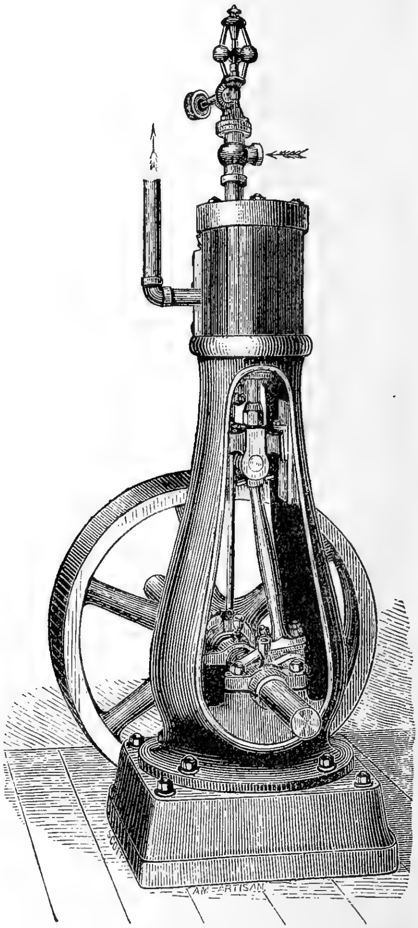


FIGURE 22.

inventions. I am putting the machine you saw into my house, in place of the portable hot-air furnace, which last is now worn or burned out beyond repairs, having been in the place twelve to fifteen years, and, as arranged, is as good a pattern as any in use in Albany; still I prefer to use steam, for the reasons that it is perfectly controllable in temperature, under different pressures, while its fire is controllable by its diaphragm automatic damper, below the grate. I shall use four hundred feet of one-inch caliber iron pipe in my heating air chamber, through which the air circulation passes, precisely as with the hot-air furnace, and use all the air-pipes and registers, precisely as they are and have been for the hot-air furnace, making no change. The hot or pipe chamber will be made of wood, and lined with a thick coating of the non-conductor felting, for economy in cost, safety, and to prevent absorption or radiation of heat. To this I have also attached a positive automatic water feed, so that while the heating air for the house does not consume or waste any water, still by drawing hot water through the house, on all four floors, as well as for washing purposes, &c., &c., the self-feed supply will maintain the water flow to its line all the time. I am operating it now, all mounted, at our works, and am pleased with its performance. For cheese dairies I am confident it is preferable to anything I have seen. I think the No. 3 size would prove more desirable, as its capacity is double; while for a given amount of work with the No. 2, it is quite as economical in its fuel item."

VERTICAL ENGINE AND BOILER.

Mr. EMERY sends me the following brief description of the vertical engine and boiler (see Figs. 21 and 22), which are adapted to factory use: "The boilers are of the upright tubular style, with internal fire box, are made of the best material and workmanship, and are all tested to one hundred and fifty pounds pressure per inch. The heating surface and area of grate are in excess of the quantities usually allowed for the same power, and it is therefore unnecessary to purchase a greater rated power than that required for actual use; while in cases of emergency these boilers can be depended upon for much more than their rated power. The engine is not fastened to or upon the boiler, and is, therefore, not affected by the expansion, nor are the bearings over-heated by conduction, or the ascending heat from the boiler. The fly-wheel, being at the base, secures steadiness under the high speed which is necessary for economy of fuel. Being attached to one base, the combined engine and boiler is easily transported, occupies little space, and may be very readily mounted upon wheels, rendering it peculiarly adapted for agricultural purposes."

ANOTHER NEW BOILER AND ENGINE.

Messrs. JONES and FAULKNER of Utica, N. Y., have also within the past year 1870 brought out a boiler and engine, which appears to be well adapted to cheese factories. We give (Fig. 23) an illustration of the boiler, &c., as applied to the common factory vat.

AUTOMATIC HEATER AND CHEESE VAT.

Of the recent inventions in this class of heaters, that of Messrs. WHITMAN and BURRELL of Little Falls, N. Y, deserves attention. It is very much liked by those who have given it a trial, and is meeting with success. The subjoined cut (Fig. 24) and description will explain its operation.

The heater consists of a metallic vat or pan, Y, for holding water, with a series of flues, C C, running through it, carrying the smoke and heated air from the chamber, B, at the back end of the fire box, into the chamber, G, at the foot of the smoke pipe H. The chamber, G, is directly over the front of the fire box, J, and is connected with it only as the common termination of the flues, C. The bottom is of iron, and being directly over the fire the heat

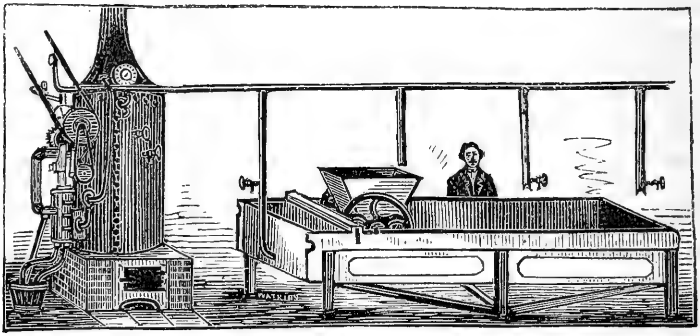


FIGURE 23.

rarefies the smoke and air in the chamber, and increases the draft through the smoke pipes. In front of the chamber, G, are slides on doors, I, which admit of cleaning the smoke flues, C C. The pan, Y, is supported over the fire box, Z, by parallel metallic pipes, which receive a supply of water from the fountain or spring through the pipe, E, and discharge it through the pipe into the

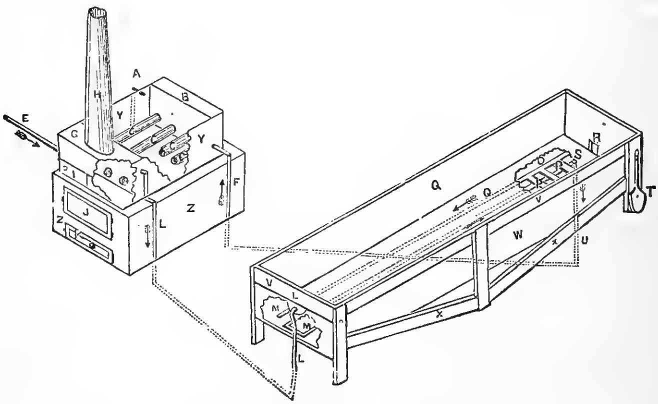


FIGURE 24.

pan at, A, in a partly heated state (not hot enough to precipitate lime, but about milk warm); and as, generally, water is running through the pipe, no sediment can lodge in it. When very hot water is used the pipes are dispensed with, as they are not important. The supply pipe, when it empties into the pan, is furnished with a T, at A, having the end entering the pan, Y, an inch or more lower than the other end, thus making a self-regulating supply to the pan, which, so long as the water is permitted to run, is always evenly full, for as soon as the water in the pan becomes as high as the outer end of the T, the water will waste instead of running into the pan. Hot water runs from the pan, Y, through the pipe, L, into the base of the milk vat, and is conducted by a set of pipes through the water, under the milk. The heated water under the tin milk vat, as it grows cooler, is returned through the pipe, U, F, to be re-heated in the pan, Y. A constant circulation may be thus kept up, through both heater and milk vat, on any number of vats. The outlet from the pan, Y, into the pipe, L, is on a level with a point to which the water is to be raised about the milk vat, while the inlet to the pan, Y, through pipe, U, F, is on a level with the bottom of the milk vats. The supply of water and circulation is regulated by faucets. The size of heater is three and a-half feet by five and a-half feet. There are five flues, C C, each three and a-half inches in diameter. The pan is made from very thick heavy English galvanized wrought iron, No. 17.

Advantages.—1st. By means of the return smoke flues, C C, the heat is all utilized, thus saving one-half the fuel, while the very large heating surface (more than twice the bottom of the pan) makes the water boiling hot surprisingly quick. 2d. The "draft" to the fire, in the fire box, is increased very much by re-heating the smoke after it reaches the chamber, G. 3d. The saving of water as set forth. 4th. Its durability—made of extra heavy galvanized wrought iron, it will last a long time, and is easily repaired by any tinsmith if it gets out of order. 5th. Hot water is coming to be regarded by many manufacturers as the best heating agent that can be used in making cheese. 6th. This apparatus can be furnished cheaply, and as the price of a milk vat is also $100, the heater with, say two six hundred gallon milk vats, costs but $300; and with three milk vats, $400.

THE CHEESE VAT OR MILK VAT.

consists of a water-tight metallic reservoir or pan, A, sustained at the top by the wooden rim, V, and set just within a wooden vat, W, also water tight. The metallic vat is supported at the bottom by wooden strips, P, running transversely, which are retained in place by longitudinal strips, O. Hot water is supplied from the heater and, after entering the outer or wooden vat, W, at M, it is divided into two streams, which, after traversing the whole length of the vat through the pipes, M, are discharged into the wooden vat near its place of entrance. The water circulates freely around the metallic pan, and may be kept in constant circulation between the milk vat and heater through the outlet, S, which connect with the heater by the pipe, U, F; or the water may be withdrawn entirely from the milk vat by a waste pipe at the end of the vat. The discharge of the curd and whey into the cheese sink through the opening, R, may be facilitated by tipping down the cheese vat by turning over the lever, T, thus shortening two legs and rocking the vat upon two middle legs.

Advantages.—1st. The metallic vat is made of five cross tin, large sheets, so there are but three seams in bottom and two seams in sides, thus making it much more durable and easier to clean, as there are but few seams. 2d. The bottom of the wooden vat is made of but two plank, the same being of best clear pine lumber, each two inches thick, twenty-two inches wide, and fifteen feet long; five heavy bolts, with nuts on ends of same, running through the legs across the bottom and ends of vat, so that if the vats shrink or swell it can be regulated easily. 3d. The discharge curd and whey gate, R, is five inches by six inches; and when the "drop floor" is put in factories it is of great use in drawing off the curd into the sink. Vat, with dip connections, $100; vat, with discharge curd gate, $110.

OLD STYLE "SELF-HEATERS."

Of the heaters directly beneath the cheese-vat, sometimes called "self-heaters," the ROE vat and heater, the O Neil vat and heater, and the COOPER vat and heater, are all similar in principle and all resemble each other. They were at one time quite popular among farm dairies at the West, and have been applied to factory vats for some years. We give a cut of an apparatus of this description, manufactured at Watertown, N. Y.

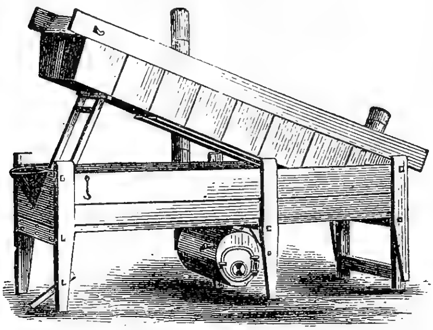


FIGURE 25.

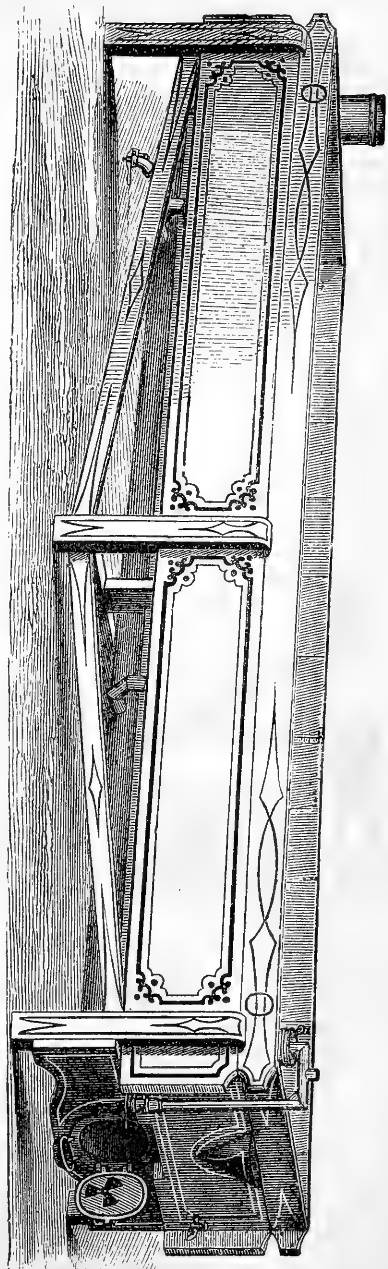
The illustration (Fig. 25), shows the inner or tin vat raised. Beneath the wooden vat is the double iron cylinder, the space between the two parts being for water and the fire-box in the center. It will be readily understood from the figure representing it.

ANOTHER FORM OF HEATER UNDER THE VAT.

The Oneida vat and heater (Fig. 26), invented by WM. RALPH of Utica, has long been in use, and has always held a prominent position among this class of apparatus, on account of its economy in the use of fuel and its even distribution of heat.

Figure 26 shows a very correct representation of the external appearance of an apparatus that is quite extensively in use in cheese-factories and dairies throughout the country. It consists of an inner vat of heavy tin plate, with a frame of wood about the top, and is furnished with a graduated scale attached to the side, for ascertaining the amount of milk that may be contained, which may also be a guide for determining the proper amount of rennet and salt. The tin vat sets inside of an outer vat of wood, usually lined with galvanized sheet-iron or copper. Between these vats, at the sides, ends and bottom, is a space for water for cooling the milk, which is run in through a funnel or hopper at one end, and discharged through gates or faucets at the opposite end. Water is also used to communicate heat to the inner vat, and is heated by a fire made in the heater, which is a copper cylinder of the length of the vat, situated in a recess underneath the vat, the recess being something more than a half cylinder in form, with its opening communicating with the water chamber between the vats; the water flows around the heater and through the opening at its top, the entire length of the vat. The heater and recess is equal to about one-third the width of the outer vat. Over the heater, in the water space between the vats, is placed a platform of thin boards, movable, but held in place by suitable fastenings, upon the upper and under side of which are cleats for the support of the inner vat, between which the water flows from the heater, first around the sides and ends, then under the bottom of the inner vat, thence through pipes to the bottom of the heater. This platform or diaphragm is technically called the "equalizer," the office of which is to prevent the currents of warm water from striking the bottom of the inner vat till after they have been in contact with the sides and ends, and given off a portion of their heat, causing an even warming of the milk and cooking of the curd, with a comparatively small amount of agitation.

FIGURE 26.



At one end of the heating cylinder is a fire-door, damper and hearth. At the other end is attached the smoke-pipe; a whey strainer, siphon, or whey gate and heat stopper complete the arrangement.

The construction and operation of the vat, and direction of the currents of water in heating, will be readily understood by the diagram shown in figure 27 of a cross section of the same: A, is the inner vat; B, outer vat; C, heating cylinder; D, case or jacket forming the recess in which the heater is situated; E, the equalizer; F, F, are pipes for returning water to the heater after having given off its heat. The arrows indicate the course of the currents of water from the heater to the tin vat, and their return through the pipes F, F, to the water.

It will be seen that as the recess containing the heater is opened at the top the whole length of the vat, there is entire freedom of circulation of the warm water,—a space of one and a-half inches at the sides and ends of the equalizer being left clear for the purpose—the water is put in motion and conveys the heat to the inner vat as fast as it receives the same; as a consequence, the water is but a few degrees higher in temperature at the time being than the milk or curds in the vat; it is claimed, therefore, that by the application and retention of so low a temperature, a larger proportionate amount of cheese from a given amount of milk may be obtained than where a higher heat is brought in contact with the milk vat; that all the butter in the milk is retained in the cheese, and that the apparatus requires a comparatively small amount of labor or fuel; heats with uniformity; never forms hard water scale on the heater; is simple and safe, and being complete in itself, involves no expense in setting up.

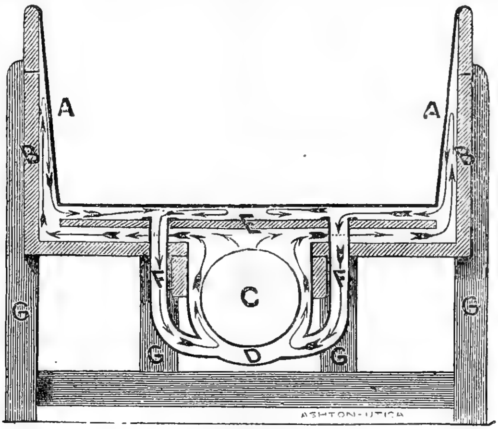


FIGURE 27.

MILLAR'S CIRCULATING COIL HEATER AND CHEESE VAT.

This is another form of heater economical of fuel, the general appearance of which, with its connections, is represented at Figure 28. It is constructed on the circulating principle, by means of which very little water is required to be heated besides that contained in the vats themselves. It has been thoroughly tested for four or five seasons, and is now in use in a large number of cheese factories. A representation of the heater and water tank fitted to accompany it as shown at Figure 29.

The heater is constructed separately from the vat, and consists of wrought-iron pipes, screwed together in such a manner as to form a fire chamber, and present a large amount of heating surface directly exposed to the action of the fire. This coil of pipes is inclosed in brick-work, which prevents loss of heat. A pan or tank, rests on the top of this brick-work, and is connected to the coil in such a manner as to form a perfect circulation; so that when this tank is filled with water and a fire started, the water is warmed very rapidly. A flue is formed underneath the bottom of this tank so that it receives the heat from the fire after it has passed the coil. Figure 30 shows a view of the arrangement of the heating pipes of the vat. The coil is also connected with the vat and forms with that a perfect circulation. The upper pipe, the one that supplies the heat to the vat, branches off, and two smaller pipes are connected to it, and these extend through the space between the tin and wooden vats, and are perforated so as to distribute the heat equally. The lower pipe, the one that supplies the coil with water from the vat, is attached directly to the bottom of the wooden vat. Proper stop-cocks are attached, so that the heat from the coil can be turned on or shut off from either the tank or vat at pleasure. A safety pipe is attached to the cold water, or lower pipe of the coil, which allows the water and steam to escape into the tank, to prevent all danger of exploding, in case all the stop-cocks should be negligently closed at once.

A most convenient and simple arrangement for tipping the vat is attached, by means of which it can be tipped or righted again very easily, and without requiring any great outlay of strength.

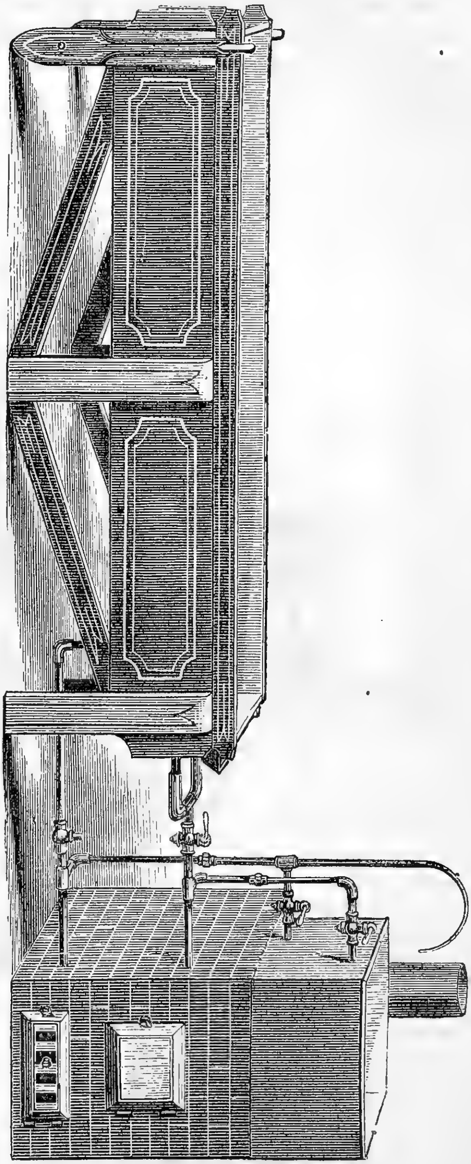


FIGURE 28.

THE OPERATION OF THE APPARATUS.

The tank is filled with water, a fire started in the chamber formed by the coil of pipes, and the water in the tank is first warmed; the stop-cocks that connect it to the coil being open, while those to the vat are closed, thus forming a circulation with the tank only. After this water is warm, and when the milk has been placed in the tin vat, the stop-cock to the vat is opened, and the warm water immediately passes from the tank, filling the space between the tin and wooden vats. When filled, the stop-cocks to the tank are closed, leaving the coil in connection with the vat only. The heat-

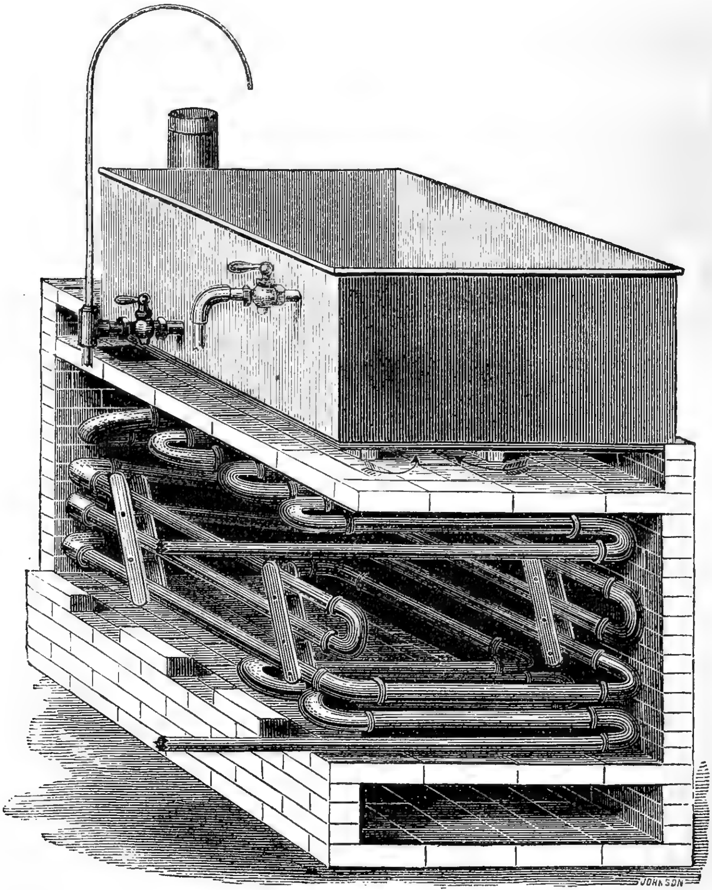


FIGURE 29.

ing of the vat then immediately commences. The water passes from the vat, through the lower pipe, and circulates slowly through the coil, becoming gradually heated, returns to the vat through the perforated pipes, and by them the heat is most evenly distributed. The same circuit is continued until the proper temperature is reached, when the stop-cock to the vat should be closed. This at once cuts off the circulation, and prevents a further rise in temperature. When the heat is shut off from the vat, the stop-cocks to the tank should be at once opened, and the tank, having been refilled with cold water, receives the heat from the coil until the vat is ready to be warmed again, as it also receives the heat from the fire after it has passed the coil, by means of the flue underneath it. A supply of hot water is constantly on hand for any purpose, without using extra fuel.

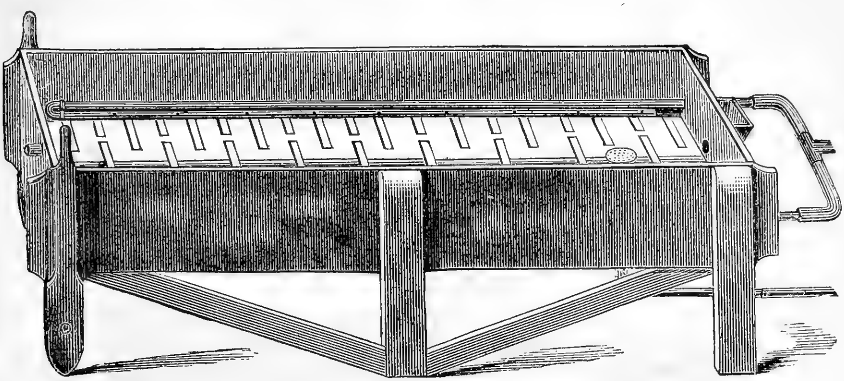


FIGURE 30.

POSITIONS OF HEATER AND VATS.

This apparatus is convenient to arrange for factory purposes. The heater can be placed in almost any position to suit the room. This will be readily understood from the plans at Fig. 31. Plan 1st shows vats connected to a right-hand heater; Plan 2d shows vats connected to a left-hand heater; and

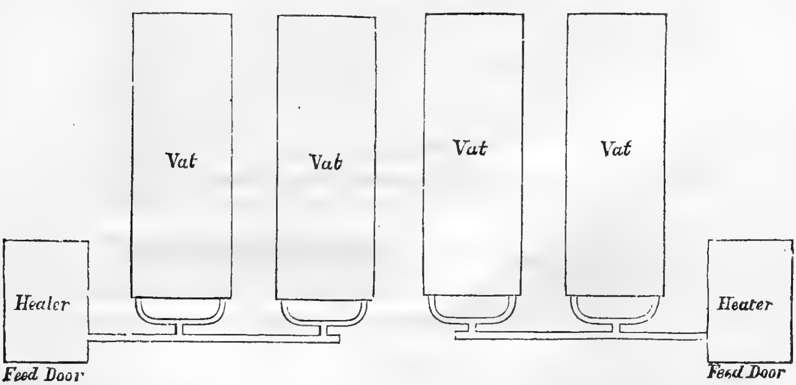


FIGURE 31.—PLAN 1. FIGURE 31.—PLAN 2.

Plan 3d shows vats connected to a heater placed in front of them, which can be either right or left. The feed-door can be placed at either end of heater.

Many other advantages are claimed for this apparatus besides those previously mentioned, but the following is the most important, viz., the manner of applying the heat. The heating pipes, or those that distribute the hot water in the vat, enter and extend through the vat, on each side of the tin milk holder, thus diffusing the heated water equally along the sides of it. The lower or cold water pipe is attached to the bottom of the vat, and as through this pipe the water is continually passing out to the coil, the warmer water is gradually drawn under the tin vat; thus the bottom is at no time but a little warmer than the milk or curd inside, while the majority of the heat is transmitted through the sides of the tin vat. This is at all times a great desideratum, but especially in the operation of "cooking the curd," as the curd, after it is cut, settles to the bottom. In this apparatus the majority of the heat is imparted to the curd by means of the whey, which receives its heat from the sides of the vat; at the same time sufficient heat is imparted to the curd that lays on the bottom to keep it of an equal temperature with the rest.

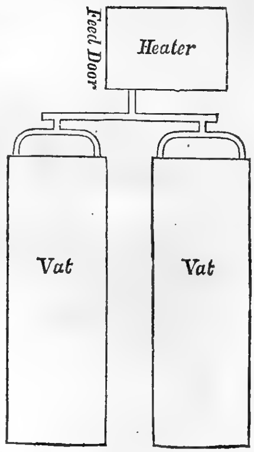


FIGURE 31.—PLAN 3.

These heaters (Fig. 32) are made in a portable form; they are constructed on the same principle as the stationary apparatus, except that they are portable; their position can be changed at any time. The heater is inclosed in a cast-iron stove, instead of brick work. In the two smallest sizes this stove is lined with fire brick, to prevent loss of heat by radiation into the room.

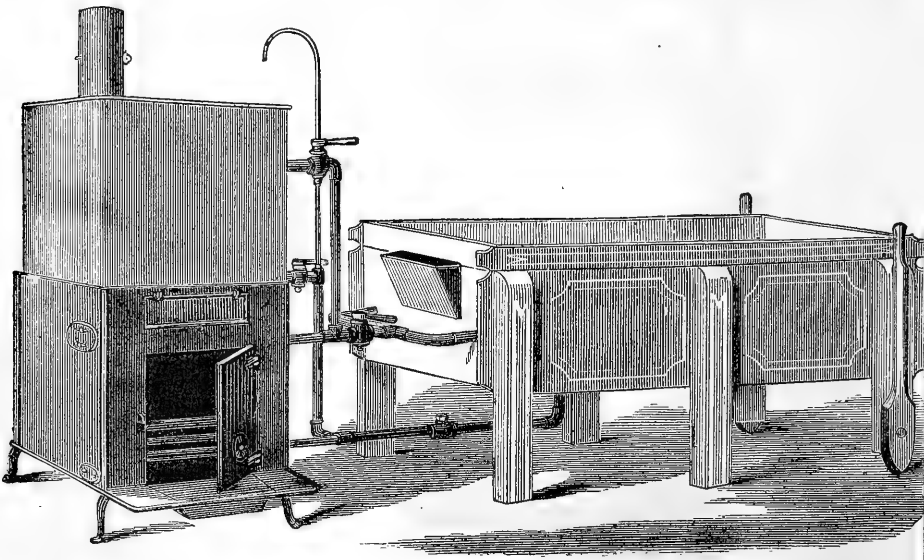
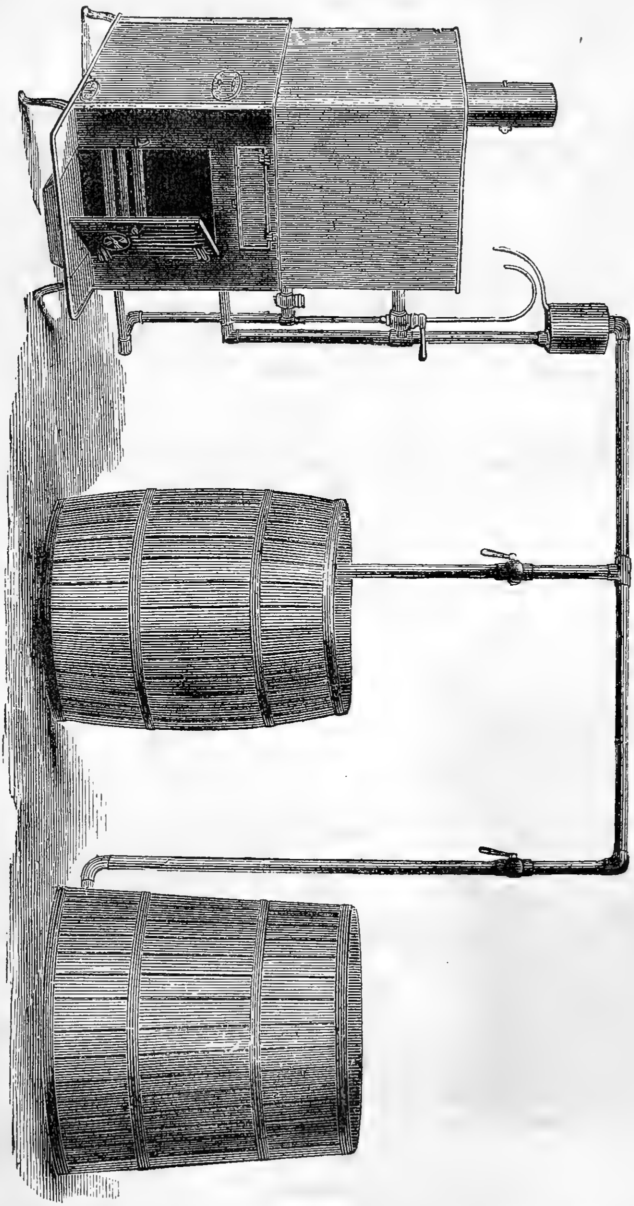


FIGURE 32.

The two largest sizes have a lining of common brick work, laid up on the the inside of the castings, for the same purpose. They require but a small amount of fuel, burn either wood or soft coal, and can be used for many other purposes besides cheese-making. They are especially useful for steaming and cooking feed for stock. When arranged for this purpose, the general

FIGURE 33.



construction of the heater is the same. The only difference is that a check-valve (see Fig. 33) is substituted for the lower stop-cock to the tank, and the pipe furnishing the hot water or steam, instead of extending out horizontally, is carried up perpendicularly, and a steam separator is attached, to which the steam pipes are connected. The principle of its operation is this: When the stop-cock in the upper pipe is open, the water in the tank circu-

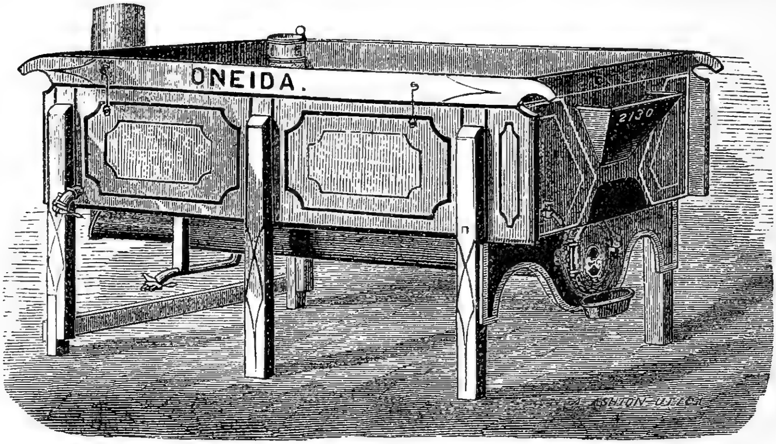


FIGURE 34.

lates through the coil, and is heated in the same manner as in the cheese vat heaters; but when steam is desired this stop-cock is closed, the return of the water to the tank is thus cut off, and it remains in the heater until steam is

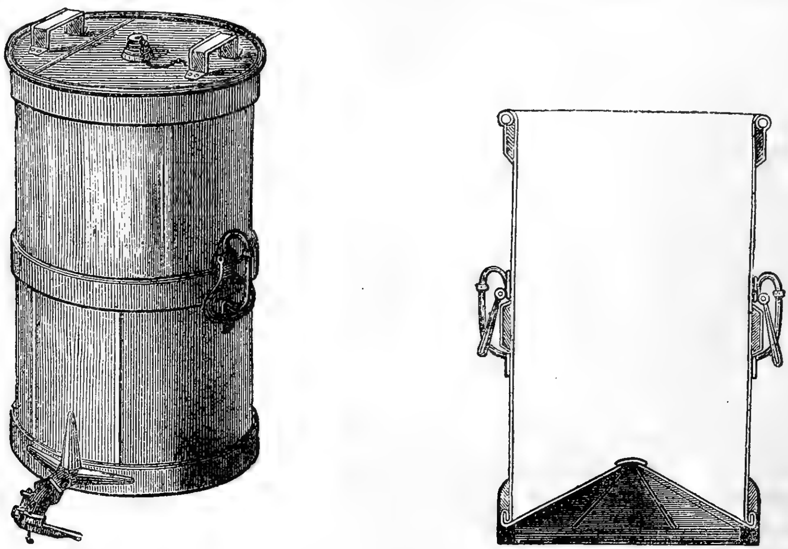


FIGURE 35.

generated, when the mixed steam and water are driven up into the separator; the water, being separated, runs back into the tank, and the steam passes off through the pipes to the desired points. This will continue as long as the stop-cock is open. During this operation, the coil is fed with water from the tank, through the lower pipe.

We give also in this connection an illustration of the vat and heater for farm dairies, called the Oneida Farm Vat (see Fig. 34.)

FACTORY MILK CANS.

These cans are constructed with a conical bottom (Fig. 35), which renders them very durable and strong, and does not add anything to the ordinary weight of the can. A solid tinned or galvanized iron band, with a projecting lip for the support of the can, encloses this bottom, attached by soldering. This renders it durable. We also give a cut of the Iron Clad milk can, (Fig. 36), which is stoutly made.

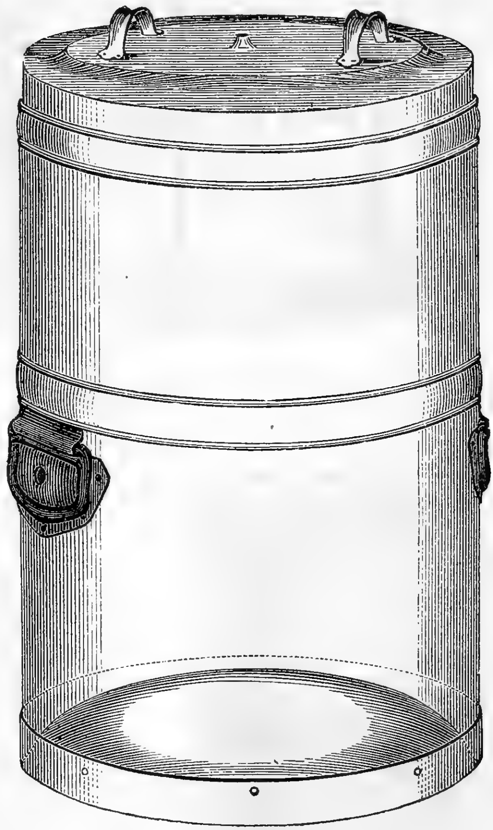


Figure 36.

MILK CAN HANDLES.

These handles (Figs. 37 and 38) are made especially for combining a convenient handle for carrying or lifting a cheese factory carrying can, with another for the purpose of dumping or tipping it when a crane is used. They are made so as to embrace or inclose the band, which is usually placed near the center of the can, thus attaching them to the strongest and stiffest part of the can. The new pattern (Fig. 37) is adapted to either the ordinary hooks, or the straight or squarely bent hooks or tongs used in some localities, which require a hole or socket to fit them. The old pattern (Fig. 38) is only adapted to the ordinary lifting hooks. Another form of can handle is shown at Fig. 39. It consists of a broad, malleable iron plate fitted to the curvature of the side of the can, for riveting thereto; having a flanged socket and knob, also a hinged handle for lifting by hand; which handle, when not in use, drops to the side of the can. This arrangement is adapted for hoisting and tipping the can, to empty from the top, to any and every device used for the purpose; whether hinged bail with hooks to fit the socket, common hook or simple ring, fitting the outside of the barrel, neither of which can slip or unhook, and either of which will allow a complete revolution of the can. The plate tends to strengthen and protect the can while being hoisted. The projection of the socket and knob being but three-quarters of an inch outside of the handle, it is not liable to be broken or to jam surrounding cans while

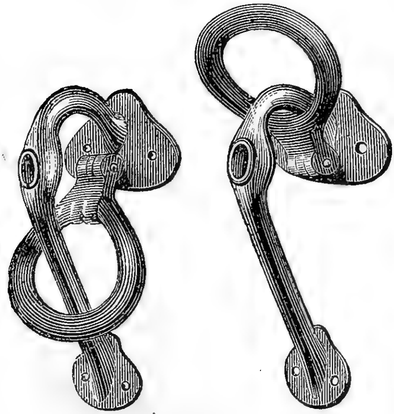


Figure 37.

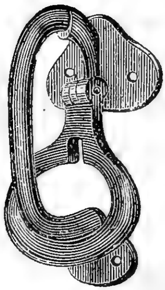


Figure 38.

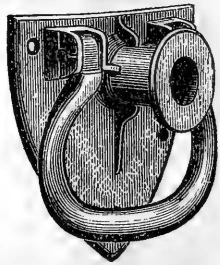


Figure 39.

being carried. The handles represented at Figs. 40 and 41 are designed to be used on the Iron Clad can (Fig. 36).

FACTORY WEIGHING CAN.

The cut (Fig. 42) represents a tin weighing can for receiving the milk as it is brought to the factory. This can stands on the scales, and each patron's

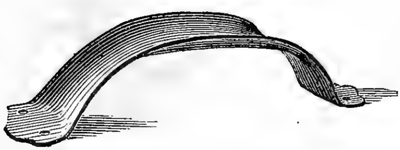


Figure 40—Cover Handle.

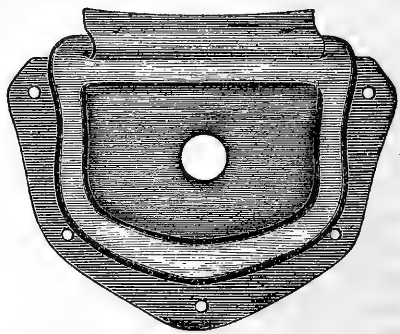


Figure 41—Side Handle.

milk is emptied into it, weighed, and then allowed to run to the vats. The bottom is made to incline to the faucet or gate, which is extra large, generally about three inches in diameter, so that it is emptied very rapidly. A conductor head (shown in Fig. 43) is placed in front of the faucet to prevent the milk from spattering and to conduct it to the vats. The tube or pipe on the end can be extended to any required length, though if more than three or four feet long, it should be an open trough. Fig. 44 shows an extra strong, large, weigh-can gate, having guides to steady and regulate the handle.

CHEESE PRESSES.

One of the most convenient presses for farm dairies is the Oyston's Herkimer County Press, illustrated in Fig. 45.

Description.—Between the upper beams of the stout wooden frame two sectors, E E, are hung by wrought iron journals in iron boxes inserted in the beams. One of these sectors is geared on the inside and the other on the outside. They are operated by a pinion, the shaft of which passes through

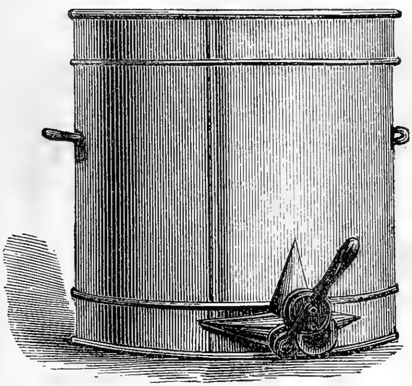


Figure 42.

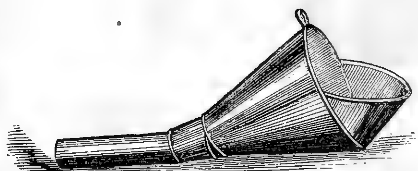


Figure 43.

the front beam, and on which the ratchet wheel, F, is fastened. Next to the ratchet the end of the lever, G, plays loosely, and then the crank is secured with a pin, which also keeps the lever in its place. The pitmen, or toggle levers, D D, are four in number; their upper ends are secured on wrought-iron journals, cast solid in the sectors, and their bottom ends are pivoted to the follower, and work in iron boxes. The follower, A, slides up and down between the posts, and is kept perfectly steady. To operate the press the lever, G, is raised and a dog at the back of the lever, which plays on a strong pivot, is hooked on to a pin in the beam and holds the lever up. The dog, H, is then turned back so that its other end shall take into the ratchet below the center; the sectors, follower, &c., are then run up with the crank and held up by the dog, H; the cheese is then put in, the dog, H, turned to the position as now represented; the lever is then raised, which unhooks the lever dog and allows it to take into the rachet. Then press the lever down, or hang a weight and leave it as you please. The follower and sectors are represented about half way down; the journals on which the strain comes move but one-quarter of a revolution as at each operation of pressing, which consumes little power and produces little wear, while the pinion makes over three revolutions, which gives the end of the lever a traverse of over eighty-six feet.

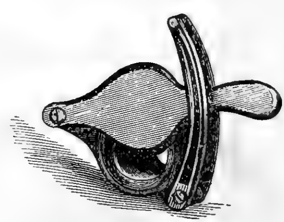


Figure 44.

FACTORY PRESSES.

The presses at the factories (Fig. 46) are generally quite similar in construction, and, except the iron screw and its fittings, are usually made upon the spot by some carpenter. These presses are not patented, and are so

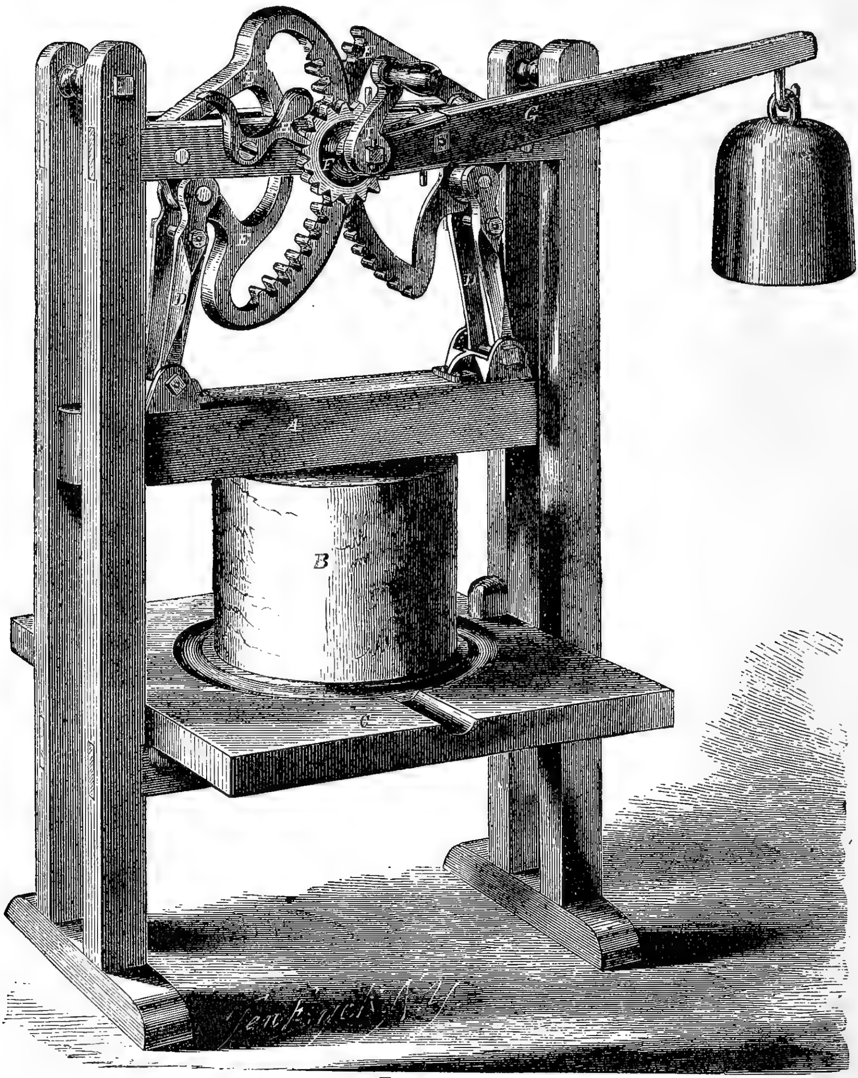


FIGURE 45.

simple in construction that any one handy with tools can do the wood work for less money than their cost of transportation over long distances. The wooden frames should be made of well seasoned timber, and the parts of sufficient size to be strong, so as not to spring or warp. The sills for holding the hoops are about fifteen inches wide and four inches thick, and the beams ten inches by six inches thick. The posts are of the same thickness, and of the width of the sill at the bottom, slanting to the width of the beam at the top. The posts should be about four feet ten inches long. The sill and beam are let into the posts say about a half to three-quarters of an inch. The sills stand about two feet from the floor, and the beams are about two feet five inches above the sills. The posts are set about two feet apart, which gives a space of two feet by two feet five inches for the hoop. Iron rods with nut and screw for the ends are used for holding the wood work firmly in place, and six or eight frames or presses may be connected together. Fig. 46 gives their general appearance.

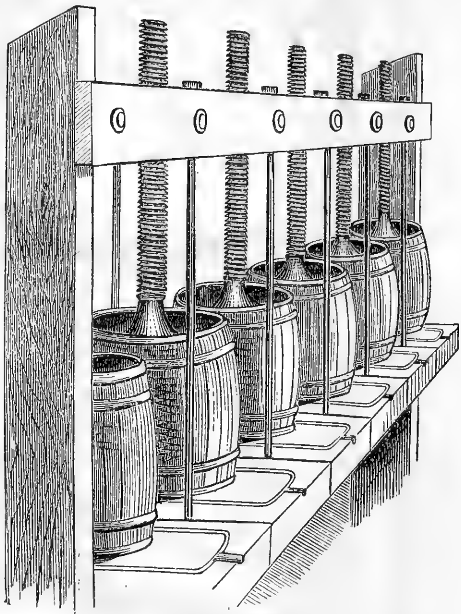


FIGURE 46.

CHEESE PRESS SCREWS.

While for private dairies lever presses are still used to some extent, the screw presses have been universally adopted by cheese factorymen. The screws are usually placed in benches of six or eight. These benches, as we have remarked, are made very strong, from heavy timber, with bolts, to hold them from spreading, between each screw. The ordinary screw has two holes drilled in its hub, and is turned by means of a round iron bar. Ratchet screws are much more convenient, but, as usually made, are very objectionable, on account of their complication, thereby allowing the collection of whey and dirt, causing them to rust and smell badly; they are also constantly getting out of order. The illustrations (Figs. 47 and 48) show an improved Ratchet Cheese Press Screw, which is said to entirely overcome these objections. The screw is thus constructed: A toothed or ratchet wheel is firmly attached to the screw, leaving about an inch space between the top of the flange and the lower side of the wheel. A lever, to which is attached the pawl of the ratchet, is made to fit in this space, thus when attached completing the ratchet. But as this lever can be readily removed from or attached to the screw, by merely pressing back the pawl, one lever can be made to answer for all screws in a factory. It will thus be seen that this arrangement combines all the advantages of the ordinary ratchet screw, with the simplicity, strength and cleanliness of the common plain screw. The pawl attached to the lever is made wide enough to turn the ratchet wheel, when placed either side up; thus it can be readily adjusted to either raise or lower the screw. The screw, when relieved of pressure, can be

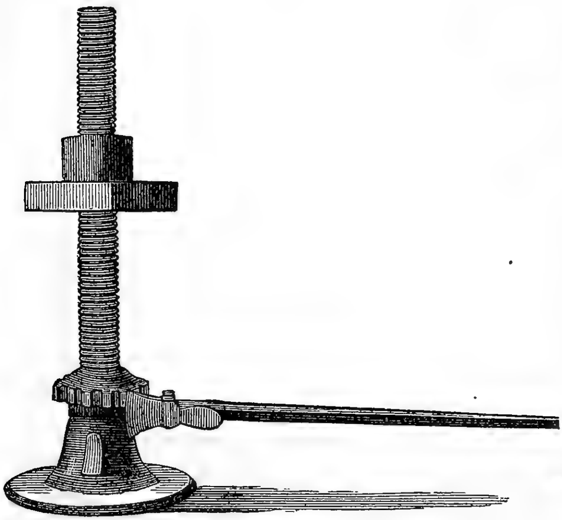


FIGURE 47.

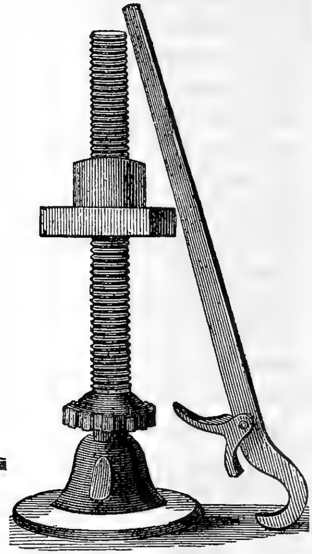


FIGURE 48.

rapidly raised or lowered, by means of a malleable iron handle, made expressly for this purpose (see Fig. 49). The flange of this screw is made very heavy and strong, and has an extra deep socket, in which the lower end

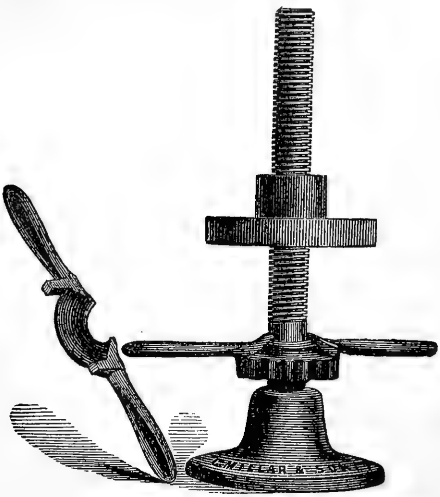


FIGURE 49.

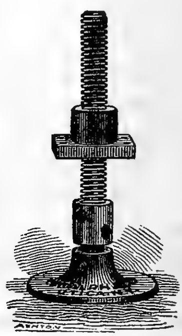


FIGURE 50.

of the screw is carefully fitted, so that the flange cannot tip in the least, but will press the cheese true and even. Both the handle and lever of these screws are galvanized, which is quite important, as the salt and acid in the curd and whey will rust them badly. If the common screws are used, the iron bars for running them should always be galvanized, for the same reasons.

Another pattern of these screws (shown at Fig. 50) is simple in construction, consisting of a screw of refined wrought iron, attached to and turning in a heavy cast base, also a heavy cast nut through which the screw works, for fastening into the beam of the press. The screws are turned by means of a wrought iron bar inserted into holes in the collar of the screw. They are usually of two sizes—one and three-fourths inches and one and a-half inches in diameter. The one and three-fourths inch screw is in extreme length twenty inches; has thirteen inches length of screw thread; four holes in collar for inserting a seven-eighths inch bar, and a base nine inches in diameter. The one and a-half inch screw is in entire length eighteen inches; length of screw thread, eleven and a-half inches; four holes in collar for three-fourths inch bar, and eight inch diameter of base. The grade and pitch of screw are calculated for the most rapid motion compatible with strength, great power and ease of working.

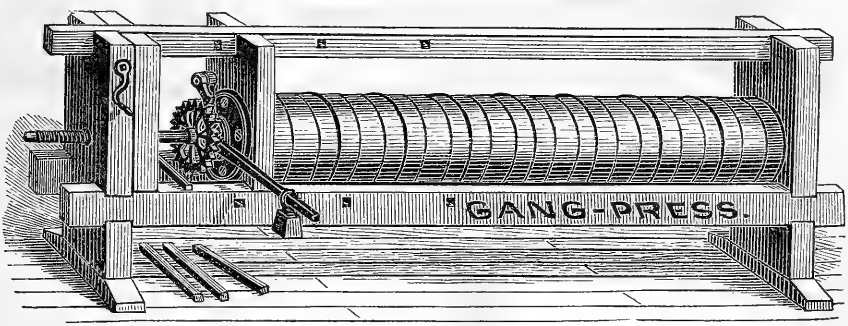


Figure 51.

FRAZER'S GANG CHEESE PRESS.

This press is constructed horizontally, and presses any given number of cheese, with a single ratchet screw set in movable head-blocks, so as to repeat when run out its length. The cheeses are placed upon their edges in metallic hoops, made in sections, with heads or covers of the same material, not liable to shrink or swell, forming a complete box, the sections sliding together as the pressing is performed, finishing the cheese at one operation. The advantages claimed for it are: 1st. It saves the labor of one man, where a large number of cheese are made. 2d. It takes up less than one-half the room of the old presses. 3d. The hoops are so constructed that the *air* and *whey* escape as soon as pressure is applied. This is an advantage not appreciated heretofore. 4th. The hoops also make a perfectly smooth, rounding edge. 5th. The cheese are pressed in bandage at once—no turning in press, nor particle of trimming. This alone saves much labor. 6th It will press any number of cheese as perfectly as one. 7th. It presses perfectly even, and cannot do otherwise, if the press and hoops are made true. 8th. The pressing is so gradual, on a large number of cheese, that there is no curd forced off with the whey, as is the case with the single cheese press. 9th. The pressing is uniform; as one is pressed against the other, therefore

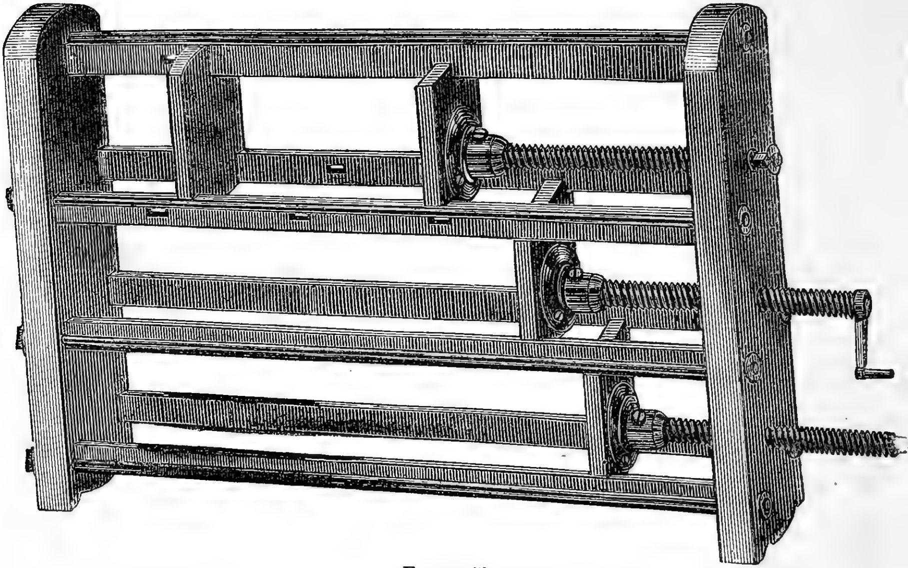


FIGURE 52.

all must be pressed exactly alike. 10th. A weight is attached to the lever to continue pressing, or indicate when manipulation is necessary. 11th. When the screw is reversed sufficiently to relieve one cheese, they will all come out, saving much labor running screws up and down, as in the ordinary press. 12th. The hoops are made in sections for bandaging and contracting, dispensing with all followers and bottom boards. Figs. 51 and 52 illustrate these presses.

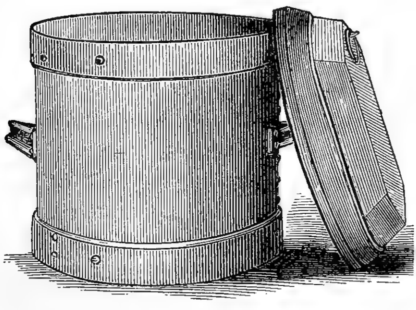


FIGURE 53.

CHEESE PRESS HOOPS.

The hoops for pressing cheese were formerly, and are still, to a large extent, made from wood, but the last few seasons galvanized iron hoops (see Fig. 53) have been introduced to a great extent, and are better on many accounts. They do not shrink or swell, absorb no whey, and the cheese slips out more readily.

RUBBER PRESS RINGS.

A source of considerable trouble and annoyance to cheese-makers is the shrinking and swelling of the cheese followers; if they fit loosely, the curd will press up, thereby making it necessary to trim it off, thus causing a waste of cheese. Figs. 54 and 55 illustrate an invention designed to overcome this difficulty. Fig. 54 shows a cheese hoop cut in two perpendicularly. A, represents the cheese hoop; B, the follower; C, the cheese; E and F, rubber washers or rings. One of these rubber rings (Fig. 55) is placed on the inside of the cheese hoop, resting on the press board below the curd or cheese. The other is placed above the cheese, directly under the follower.

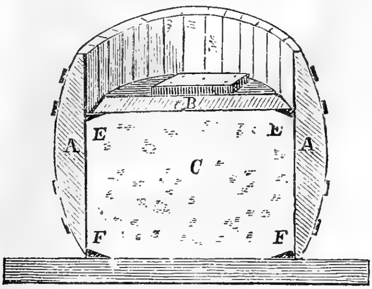


FIGURE 54.

FIGURE 55.

As soon as the pressure is applied, it causes the rubber rings to expand and fit tight to the hoops, preventing the curd from pressing either up around the follower or out underneath the bottom of the hoop. By using these rubber rings, the followers may fit the hoops very loosely. They are very valuable in using for the second pressing after the bandage has been put on; the rings then prevent the bandage bursting at the edge, which has always been a great annoyance, as it allows the flies to get in, producing skippers in a place whence they can scarcely ever be gotten out.

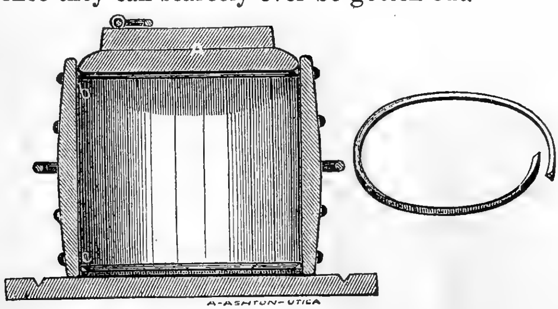


FIGURE 56.

HOOPS AND WOODEN PRESS RINGS.

Hoops and wooden press rings are usually made of staves and hard wood (see Fig. 56) doubled together and banded with riveted or welded bands. Hoops of heavy sheet iron, galvanized, with a welded band at top and bottom, are now generally preferred. The illustration (Fig. 56) is a perpendicular section of a wood hoop and press rings, showing the position of the rings in pressing, also a ring separate. The hoop is shown resting upon the press board, in which are seen the channels for conducting off the whey. A is the follower, with its edge slightly beveled, corresponding with one side of the upper or triangular ring, *b*. The lower ring, *c*, is in its section a right-angled triangle, and is seen in its place at the bottom of the hoop, though by some this ring is not considered necessary. D is the upper ring shown out of the hoop. These rings are made of hard and tough wood by machinery, which

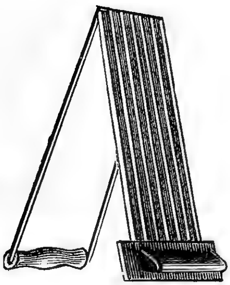


FIGURE 57.

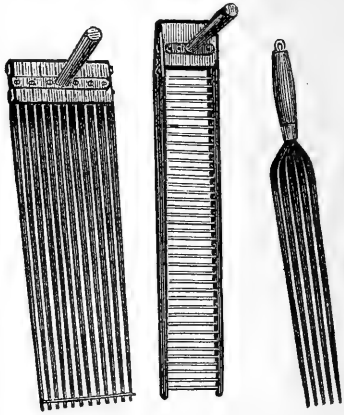


FIGURE 58.

smoothly rives them into a three-cornered shape and forms them into circles, so as to tightly fit the inner surface of the hoop, with ends butted together. The manner of using is: first place the hoop on the press board, insert the lower ring, press it down till it is flat upon the board, put in the curd, insert

FIGURE 59.

FIGURE 60.

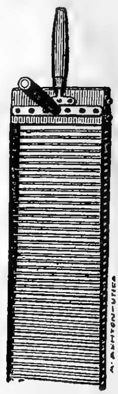


FIGURE 61.

the upper ring just below the top of the hoop, put on the follower, and it is ready for the press. On removing the cheese from the hoop the rings slip out with it. After bandaging put in the cheese and the upper ring, forcing it down to the cheese, insert the follower and apply the pressure. By this means nothing but the whey can pass the rings, the corners of the cheese are left perfect, and the edge of the bandage is firmly impressed; no press cloth is required, though some prefer a small round cloth for top and bottom.

CAST-STEEL DAIRY KNIVES FOR CUTTING UP THE CURD are differently arranged and mounted. They are of two kinds, the perpendicular and the horizontal (Figs. 57 and 58). The perpendicular is designed to pass through the vat, cutting up the curd into columns. Then the horizontal, passing through, cuts the columns into cubes. These knives are manufactured of sixteen, eighteen and twenty inch lengths, and from four to thirty blades each—to cut perpendicularly. The blades are now tin plated. From four to fifteen blades, the blades are half an inch apart; the twenty-blade knives are three-eighths of an inch, and the thirty-blade knives quarter of an inch apart. The four to six blades inclusive have handles on top of head, as in illustration Fig. 59. The seven to thirteen blades have handle on side of head as in Fig. 60. The twenty and thirty blades have handles on both side and top of head, as shown on the horizontal cutting knife in the illustration. The thirty-blade perpendicular knife is intended for use where cheese is made

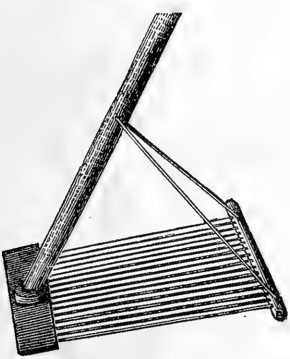


FIGURE 62.

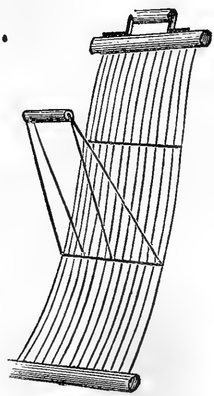


FIGURE 63.

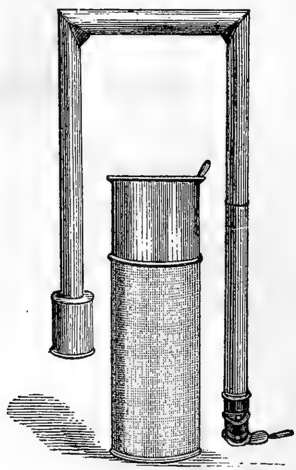


FIGURE 64.

in the "coarse curd process," and is passed through the curd but once, cutting it into slices. The other perpendicular knives are passed through the curd both length and crosswise. The horizontal knives (Fig. 61) are eighteen and twenty inches long; four, six and eight inches wide; with blades half an inch apart. This knife is not intended to take the place of the perpendicular knife, but to be used in connection with it. After cutting the curd length and crosswise, this knife cuts the columns into cubes. For dairy use, four to seven blades, perpendicular, and four inch horizontal; for cheese factory, eleven and thirteen blades perpendicular, and eight inch horizontal.

The rake agitator (Figure 62) is used for the purpose of agitating the curd while cooking, is very convenient and will save much labor. This is made of wood and tinned wire. The illustration (Fig. 63) gives another form of the agitator. Whey strainer and siphon (Figure 64), for the purpose of drawing off the whey. The lower part of the strainer is made of perforated tin. The syphon has a faucet attached to one end, with a valve at the other, so constructed that when filled with whey they will prevent it from escaping. It can then be carried to the vat in which the strainer is placed, the valve end of the syphon is inserted in the strainer, the faucet end hanging over the trough for conducting off the whey. The whey immediately commences to run through the syphon on opening the faucets.

CURD-MILLS, DAIRY-DIPPERS, ETC.

Curd Mills are now coming into general use in many sections of the country. Figure 65 represents the McAdam Mill; it is constructed from iron, with the exception of the frame and hopper, which is wood; it is geared up so as to run rapidly, and has a heavy balance-wheel to make it run easily. They are invaluable where the Cheddar system is adopted, and will be found a valuable article, particularly in hot weather when the milk is often not in the very best condition. At such times it has the effect of improving the quality of the curd by finely dividing, cooling and exposing it to the air; equalizing its character and insuring more perfect salting.

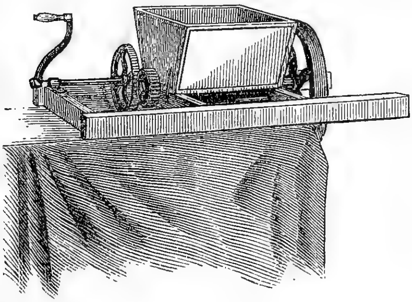


Figure 65.

We give an illustration in Figure 66 of Ralph's American Curd Mill. Referring to the illustration it will be seen that the mill is fitted for lying upon the top of the cheese-vat or sink, and may be moved at pleasure or permanently secured at one place. It consists of a wood frame, upon which is secured a metallic rack with curved ribs; in this rack lie the picking cylinder or cylinders which are of tinned iron; each cylinder having two rows of teeth set spirally, which teeth by the revolving of the cylinders, gradually enter between the curved ribs of the rack, carrying before them the picked curd into the receptacle below.

The peculiarity of this machine is in the metallic cylinders, and the action of the teeth through the ribs of the curved rack, by means of which the curd is not only easily and rapidly picked up, but being *gradually* passed through the ribs, is not mashed, nor the butter separated from it.

The cut represents a double cylinder or factory size, the cylinders being geared together. The dairy size has a single cylinder; they are worked by hand with a crank, also arranged for power, being furnished with a balance-wheel to carry a belt.

Dairy dippers (Figure 67) should be made from IXXXX tin, and hold from three to four quarts, the seams should be well filled with solder, and they should be made plain and smooth. Figure 68 is a flat-sided pail made for the purpose of dipping out the curd from the vat; it should be made from heavy tin, with bail, and a handle in the back. A curd-scoop (Figure 69) should accompany it, which is made from tin, somewhat in the shape of an ordinary dust-pan, but made heavier and more carefully soldered. The curd sink should be mounted on castors, so as to be readily moved in any direction; these castors (Figure 70) should be made very heavy and substantial, with a

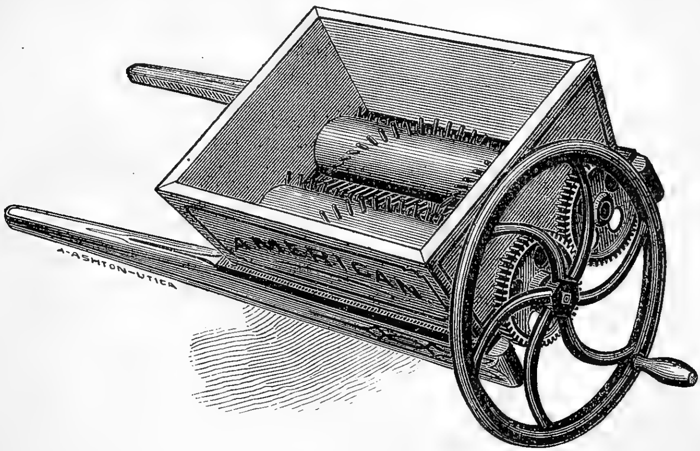


FIGURE 66.

projecting lip to take the weight off from the screws that fasten it to the legs of the sink. The wheel shank is so secured in the socket, that while it allows the wheel to revolve freely, it cannot slip out of place. The castors are secured to the legs by wood screws; the bottom of the legs of the sink resting upon projecting lips made to receive them. Four constitute a set.

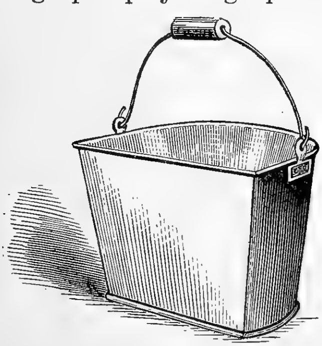


FIGURE 67.

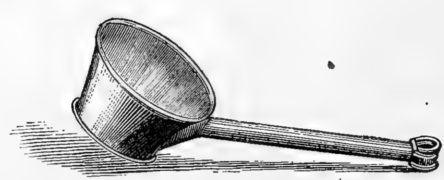


FIGURE 68.

Rubber mops (Figure 71), a most desirable article for cleaning a wet floor, will save their cost in brooms several times during a season. No cheese factory will be without then when once tried.

Dairy thermometers (Figure 72) should be made with a heavy brass back, and a small loose tin collar to slip over the bulb to protect it; the handiest size is the ten-inch. The most approved patterns are now plated with nickel.

SCALES.

Good scales are an important feature in cheese factory fixtures. We give in Figs. 73, 74, 75, 76 and 77 different forms of the HOWE scales. These

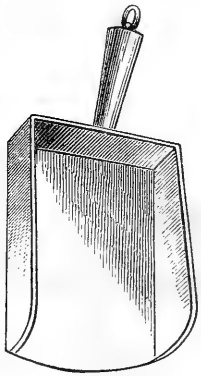


FIGURE 69.

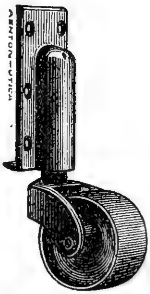


FIGURE 70.

FIGURE 71.

scales are accurate and reliable. By introducing chilled iron balls between the platform, and by making all the bearings *self-adjusting*, they take nearly all the wear from the pivots, upon the sharpness of which the accuracy and durability of all scales very largely depend. Fig. 74 represents a platform scale on wheels. This, or the one shown in Fig. 73, is the kind wanted by every cheese factory for weighing the milk when it is taken in. About six hundred pound scales are the most desirable. Either of the scales shown in Figs. 75 and 76 are very convenient for weighing salt, &c., in cheese making, but the best to purchase in most cases is the Improved Union Scales (Fig. 77), as they not only answer for weighing small things, but have a convenient platform for weighing cheese or any heavy article. The JONES Scales are very similar in construction to the above, and are good, reliable scales. We give in Fig. 78 a cut of the JONES Stock Scales, which are found useful in weighing very heavy weights.

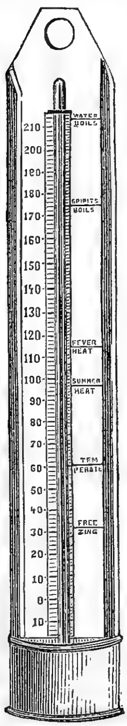


FIGURE 72.

THE RECTANGULAR CHEESE.

Cheese has been made from time to time in a variety of shapes. In England and America the cylindrical form has always been most popular. Other shapes, such as the "pine-apple," the "cannon ball," the "Limberger" or brick shape, and the "French cakes," have been, each and all, of limited demand. Some of these shapes, such as the "pine-apple," have been made and are still made in small quantities in this country, and as a fancy article they sell at comparatively high prices. The "cannon ball" was at one time made in certain districts of New York to supply the

Navy. The "Edam" of Holland is round like a ball, and on account of its small size finds ready sale in England, where it is in favor among the lower classes, the farm laborers, and those who desire a low priced cheese, and cannot afford to indulge in the better sorts. The Limberger is only suited to German tastes. It is rank in taste and smell, and comparatively few Englishmen or Americans have learned to like it. It is manufactured to some extent in this country to supply our German population, but is not exported. The

FIGURE 73.

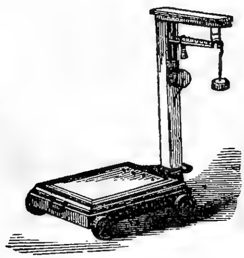


FIGURE 74.

FIGURE 75.

French cakes have not been made in America. A good deal has been said at one time and another about changing the cylindrical or common shape of our cheese to a square or oblong form. And the reasons urged for this change are that the present shapes entail a heavy expense in boxing, while they cannot be cut in small pieces to advantage. A wedge of cheese, it is contended, must always leave more waste, when it is divided up for the table, than the same weight in a square form, and as small cubical blocks are more pleasing to the eye than irregular pieces cut from a wedge, this alone is good reason why a square or cubical-shaped cheese should be made. But as the

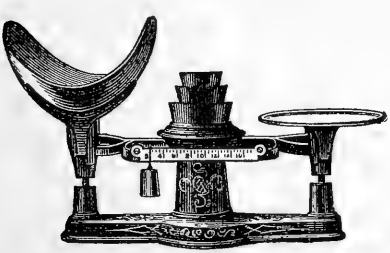


FIGURE 76.

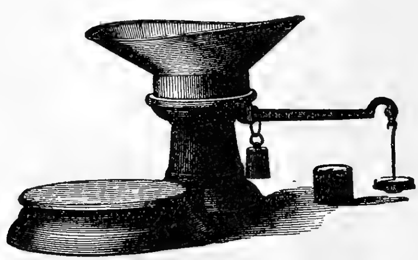


FIGURE 77.

material for making cylindrical boxes is growing scarce and expensive, a cheese of another form is required to meet this difficulty. Square boxes are not only more economical in cost of material and in the labor of making, but as they can be packed closer, there would be a gain over round boxes in the matter of freight when sending to market. These are the arguments that have been urged by the advocates of this radical change in cheese manufacture. On the other hand, serious objections have been suggested against the proposed change. In the first place a reputation has been established in the markets for cheese of a particular shape, and it is a question whether the prejudices of consumers for these shapes could be readily overcome. It was thought, too, by many, that by making cheese in a square form the corners and edges would be more liable to break in handling, and finally, that there would be difficulty in securing the bandage, and thus the matter has rested until quite recently.

The first practical experiments in the way of making square-shaped cheeses, we believe, are due to Mr. HOLDRIDGE of Otsego county, N. Y. He has been for several years developing his system of cheese manufacture, but his plans were not fully matured until last year, when his new style of cheese was put upon the markets. We have seen several letters written by dealers who have handled the "Holdridge cheese," in which its shape and quality are highly commended, and from which it appears that sales have been readily made at good figures. As the plan adopted by Mr. HOLDRIDGE is original, and may be somewhat new to the dairy public, I shall briefly allude to some of its leading features. In the first place the curds are pressed in a square box, arranged with follower, &c., on the plan of the common hoop. The cubical block of curd is then removed from the frame and cut with a fine saw into blocks of the desired size. For these blocks Mr. HOLDRIDGE adopts an oblong form, the ends being square. A strip of bandage cloth, just wide enough to wrap around these blocks, (a small piece having previously been adjusted on the ends), is wet in water. The dampness causes it to adhere to the cheese. The blocks of curd are then simply laid upon the cloth and rolled over until the sides are covered, when the ends are lapped down, and this completes the process of bandaging. The bandaged blocks are then laid in the hoop in the same order in which they were cut, the courses being separated by thin boards, and when in place form a cubical mass. Then the follower is adjusted and pressure applied in the same way as for ordinary cheese. This process fastens the bandage securely, and after being properly pressed the frame is taken off, the blocks separated and put upon the shelves. While curing, these blocks of cheese are turned from day to day, but only a quarter revolution at a time. Mr. HOLDRIDGE claims that the escape of the whey by evaporation is greatly facilitated by the form of the cheese, inasmuch as the whey percolates towards the bottom, and the turning being only a quarter revolution, or at right angles, it constantly tends toward the outside, while in the ordinary form of cheese the turning from one side to the other has a tendency to keep the whey in the center of the cheese. In the block-shaped cheese, therefore, the

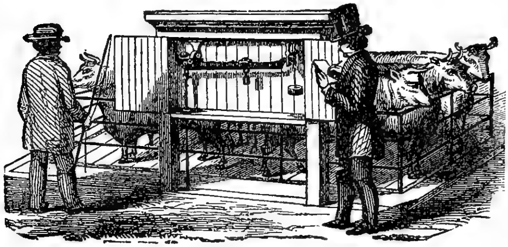


FIGURE 78.

whey is so far dissipated that decomposition is less liable to take place, and further, that the cheese can be preserved without the greasing process commonly employed. He claims also that for the retail trade the block cheese is of great advantage, since the dealer can weigh the whole cheese and cut by measure the exact weight desired. And again, for family use they are superior, since by turning the bandage back from the end a thin slice may be cut off for the table, the bandage replaced and the cheese set on end, thereby excluding the freshly cut surface from the air, preventing drying and the attack of flies.

In the manufacture of small cheeses it will be observed the plan proposed must be a great saving in presses and hoops, while the ease and rapidity of adjusting the bandage is a matter of some consideration. I have examined the Holdridge rectangular appliances for pressing with considerable care. The whole is very simple, easily operated, and not liable to get out of order. The plan, if successfully adopted, must save a large amount of labor at cheese factories, since one curb and one press is sufficient for a large quantity of curd. Then the cheese can be made of any desired weight without going to the extra expense of procuring hoops and presses and screws to meet the emergency. For making small sized cheeses, say from ten to thirty pounds, it would seem to be admirably adapted. Small sized cheeses are very much needed in the home trade, and are not supplied in sufficient quantity for the reason that manufacturers have not been willing to take the extra expense of labor and appliances for their production. Under the rectangular plan most of the objections to making a small sized cheese are obviated. We see no reason why the rectangular cheese cannot be made of equal quality with other shapes. Indeed, we have tested numerous samples made at different seasons of the year, and have found them excellent. The small expense in boxing this style of cheese alone commends it to favorable consideration. But of course the prejudice for round shapes among certain consumers may interfere for a time with the general introduction of rectangular cheese. Still from the success already obtained for this plan, and the favor with which the cheese has been received in the home and foreign markets, there is reason to believe that the oblong shapes are destined to work a revolution in the old styles of cheese. We hear of a number of factories this year, 1871, entering upon their manufacture, and by the end of the season enough cheeses will have been made to fully test the feeling of different markets in regard to the new shapes.

We give a cut (Fig. 79) representing the curb and press, and the manner in which the cheese is placed for pressure. A represents cheese with bandage. B, composite mold. C, square curb or hoop. D and E, mortised slips for connecting the hoops. Mr. Holdridge, the inventor, gives the following statement as regards the comparative cost of making rectangular cheese and round cheese, together with the directions for pressing, bandaging and boxing, which will be useful to those proposing to adopt this style of manufacture:

Saving in Boxes, Down Weights and Handling.—Comparative cost of manufacture, boxing, &c., of one hundred pounds of cheese made into ten pound rectangular cheese, or made into fifty pound round cheese:—Ten

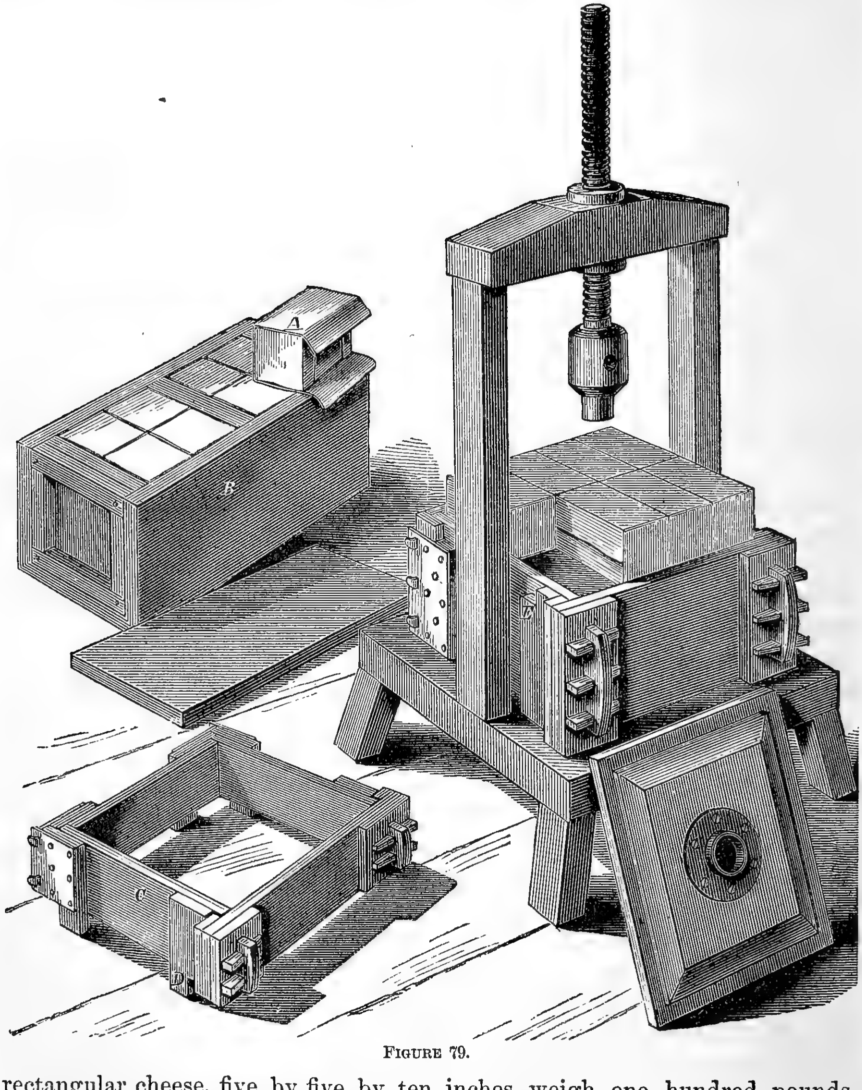


FIGURE 79.

rectangular cheese, five by five by ten inches, weigh one hundred pounds. Two round cheese, fifteen inches in diameter and eight inches high, weigh one hundred pounds. Bandage for round cheese, three-quarters wide, say one yard, costs six cents; to box two such cheese, forty-four cents. Total cost for one hundred pounds, fifty cents. Bandage for ten rectangular cheese, as above, three yards, three-quarters wide, cost eighteen cents; boxes for one hundred pounds, thirty cents. Total cost per one hundred pounds, forty-eight cents; a saving of two cents per one hundred pounds.

Comparing ten pound rectangular with fifty pound round cheese:—These small cheeses are packed eighteen (one hundred and eighty pounds) in a case. The same amount of cheese in fifty pound round cheese would require three down weights or more—a loss of two weights, not less than one pound of cheese as compared with the small cheese—worth sixteen cents. A saving of about nine cents per one hundred pounds, which, added to the two cents saved as above, makes not less than eleven cents per one hundred pounds saved thus far in favor of rectangular small cheese. This saving greatly increases as the size of the round cheese compared with the rectangular diminishes.

Compare twenty-five pounds rectangular with the same size round cheese: Round cheese of this weight are about thirteen inches in diameter and six inches high. Rectangular cheese, same weight, are seven by seven by fourteen inches. The bandage for round cheese, per one hundred pounds, costs seven cents; four boxes at sixteen cents, sixty-four cents. Total for one hundred pounds, seventy-one cents. Rectangular cheese:—Bandage, twelve cents; boxes, twenty-five cents. Total per one hundred pounds, thirty-seven cents; saved, thirty-four cents. To this should be added seven down weights saved, (three and a-half pounds of cheese), to case of eight cheeses, per one hundred pounds, twenty-eight cents. Total saved per one hundred pounds, sixty-two cents. In comparing fifty pound round cheese with rectangular cheese eight by eight by sixteen inches, weighing same, the saving per one hundred pounds is thirty cents. The above figures do not include the saving in screws, hoops and frames, nor in labor required to take care of them.

Saving in Hoops, Screws, &c.—To manufacture the milk from five hundred cows requires hoops, screws and appurtenances to take care of at least one thousand pounds of curd. To manufacture this into fifty pound round cheese would require twenty hoops, screws, frames, &c., and would cost not less than $15 per set; total, $300. To manufacture the same curd into rectangular cheese, twenty-five pounds each, would, if pressed into eight cheeses, two hundred pounds in a curb, require but five curbs, which, with screws and frames, would not cost over $150. A net saving of fifty per cent. To make the same amount of curd into ten pound rectangular cheese would require, if pressed in curbs thirty by thirty inches, two cheese in thickness, three curbs and fixtures, and would not cost over $100.

Saving in Boxes.—We box eight cheese, thirty-pound size, in one case —two hundred and forty pounds—and the box will cost not over sixty cents, and can be furnished for less, as they can be made of pieces of boards and refuse lumber. We box the ten-pound size, eighteen in a case—one hundred and eighty pounds—and boxes cost each sixty cents. By comparing these figures with the cost of boxes for round cheese, per one hundred pounds, the saving in expense is readily seen. We can use the same screws and frames as used with hoops. The common round hoops cost about $5 each, and press from twenty-five to fifty pounds of curd. Our curbs cost from $15 to $20 each, and press from two hundred to four hundred pounds, or more. Curbs without sections cost twenty per cent. less. The expense of these can be lessened by using one or more locked or hinged curbs, with boxes dove-tailed or screwed together for first pressing the curd. And when several locked curbs are used they do not all require sections. Much less room for presses is required and the drying room can be much smaller for these cheeses than for round ones, as they occupy less space on the table or shelves, and the shelves can be placed one above the other. The rooms can be better ventilated, as the cheese are bandaged all over and will not crack. By using our style of press or curb, cheese can be pressed as long as desired, as each day's cheese can be put under one press.

The Press Cloths.—Two press cloths are used with each curb. A square one, a little larger than the curb, and a long one, of sufficient length to reach around inside of the curb, and wide enough to protect the sides of the curb. Place the square press cloth upon the press board and put the curb upon it. Put in the long press cloth around the inside of the curb, and let it lap about an inch upon the bottom towards the center of the curb. If this cloth be not wide enough to cover the top of the cheese, a small square cloth should be used. Put in curd enough to make the cake of required thickness. Put in the follower and press the curd till next morning, or till sufficiently formed to cut. Having removed the screw, lift up one side of the curb and pull the bottom press cloth back half way, then lift up the other side and remove the cloth. Take out the pins and loosen and remove the curb and side and top press cloths, and the cake is ready to cut. Cut the cake by measure into desired sizes.

To Bandage the Cheese.—Cut the bandage into strips, one inch wider than the length of the cheese, and of sufficient length to reach around the cheese and lap about an inch. Also cut square pieces one inch larger than the end of the cheese. Place the pieces of bandage in a vessel of water, and put on the bandage wet. Place the end pieces on first, lapping over the ends one-half an inch all around. The side piece is put on as follows: Place one end of the bandage near the middle of the uppermost side of the cheese, spread it smoothly and turn the cheese from the person, and the bandage can be put on very smooth. Smooth over the corners and ends, and replace the cheese into the curb for second pressing. Where quantities of this cheese are made, we use a common table having on the under side a trough of water, and the bandage is cut into long strips of proper width and placed in the water in rolls on spools, and through slots in the table is drawn up as required, and cut off as each cheese is bandaged. This is a very simple and cheap arrangement, and will greatly assist in preparing and putting on the bandage. The bandaged cheese having been piled upon the press board, the curb is locked around it. Between each layer of cheese place an inch board same size as the follower. Nothing but the bandage is placed between the cheeses in the same layer. Apply the screw and press as long as desired. When the cheeses are first put upon the shelves or tables, place them close together for a few days, to prevent drying too fast, and after that keep them about an inch apart—to be governed by the weather and how fast they are desired to dry. The cheese should be rubbed and turned a quarter revolution daily, and kept nice and clean.

Boxes.—We box these cheese as follows: Ten-pound cheese, eighteen cheeses in a case. Twenty to thirty-pound cheese, eight cheeses in a case. The boxes are made of one-half inch stuff for the sides, and inch stuff for the ends and middle partition. The end pieces are set in a little from the ends of the sides, and a small cleat nailed around the outside of the heads, as shown in the engraving, makes them very firm. The middle piece is same size and shape as the heads. A cleat is put around the boxes outside at the ends and middle to keep them from being packed too closely together. This cleat should be of one-half inch stuff, and about an inch wide. (This cleat does not show in engraving.) The lumber should all be planed, it looks so much better; and if the cover is fastened on with screws, it will be an advantage, as shippers and others can inspect the cheese without injury to the box, and where the market is not too far off the empty boxes can be returned. A thin piece of veneer or board, of same size as side of cheese, should be put between each cheese in the box, as a scale board, and the boxes should always lie so that the cheese stand on end. It pays well to make a neat looking package. Butter dairymen understand this, and know that the price of their butter is seriously affected by the appearance of the package. We know from experience that good, neat looking boxes for our cheeses are a profitable investment.

THE CHEESE RACK AND SETTER,

were considered indispensable in the curing rooms of the early factories, but the necessity now for their use is not so great. Indeed, with the medium-sized cheese now generally made, many prefer the simple table on which to place the cheese while curing, as it is easier cleaned and affords more room. The cheese rack consists of scantling (four by five inches) with the corners beveled or cut so as to be five-sided; these are framed the proper distance at the ends and set on legs of the desired hight, forming a skeleton table. Or, instead of legs, arms may be framed into the posts which support the floors of the curing room, and upon these arms the scantling are placed to form the rack. Then round covers of inch hemlock or pine, bound with stout elm rims, three or four inches wide, set upon the racks and hold the cheese. When the cheese is to be turned, a spare cover is placed on top, and the cheese and covers turned over; the cover now on top is removed, rubbed with a cloth, and is ready to be applied to the next cheese. The rims of the covers protect the edges of the cheese in the process of turning; and a part of the cheese swinging down in the open space between the timbers, and the rims resting on the beveled sides, renders the operation not only easy, but insures safety to the cheese. A large cheese can be turned with as much ease on a properly constructed rack as the loosening of the cheese on the table preparatory to being turned. Large cheeses are difficult to handle on a table, and are liable to have their edges broken or in other ways marred in turning. The illustration (Fig. 80) gives an idea of the manner of constructing the rack.

CONVENIENT APPLIANCES.

In the construction and fitting up of factories, it is very important to have every department as conveniently arranged as possible. Attention should be given to have every appliance for saving labor and facilitating all the various operations. Good factory hands are comparatively scarce, and command large wages. By having conveniently arranged buildings and handy implements, the labor of one or two persons may be saved, and this is an

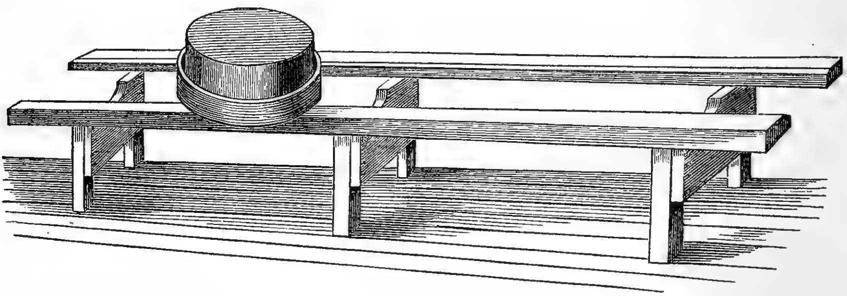


FIGURE 80.

important item. In a recent visit to Chautauqua County, I found some things adopted at the Sinclairville Factory, by which the operations were very expeditiously conducted. The Sinclairville Factory is one of the largest in the State of New York, receiving the milk of fifteen hundred cows and upward. Where such a large quantity of milk is received at one place, it is evident more than ordinary attention must be given to have the various parts of the factory and its appliances so as to be convenient, for if otherwise there would be great liability of neglect from time to time, which would result in damaging the product

THE MAIN BUILDING

is one hundred and twenty feet by fifty feet, three stories high, and this structure is wholly employed as a dry house or cheese curing department. The two lines of posts running through the central part of the building, in the several stories, to support the frame, are also made of use in holding the arms on which the tables or shelves rest, one above the other, thereby giving the building capacity for storing a large number of cheeses. Some idea of its capacity will be had from the fact that at one time nine thousand cheeses (fifteen-inch size) were stored upon the shelves.

THE MANUFACTURING DEPARTMENT

is in a wing extending in a line with the main building, one hundred and thirty feet long by thirty-two feet broad, and one story high. From the main building to the end of the wing the floor has one foot fall. The floor also descends from either side toward the center, where there is a narrow ditch for conducting off the whey and slops. The vats are upon one side and the presses upon the other side, opposite. The space from the vats to the side of the building occupied by the presses is eleven feet, which gives ample room for the sink, provided with large casters, to move up and down between the vats and presses as desired, while sufficient room is given on either side of the sink for the hands to work in, stirring the curds, &c., &c.

THE SINK

is three feet two inches wide by thirteen feet four inches in length. The bottom is made dishing, and is of matched pine, except in the center, where there is a narrow strip of perforated tin, through which the whey escapes to a movable trough, which is a little wider than the tin, and fits up close to the bottom of the sink, so that all the whey dripping from the curds is caught. At the upper end of the manufacturing department, and adjoining the dry-house, a space thirty feet long is devoted to

A DRESSING ROOM.

There are tables along the side of this department, where the cheese, when taken from the press, are received and dressed preparatory to going forward into the dry-house. At the lower end of the manufactory there is an open shed or covered drive-way, where the teams deliver milk. Upon one side stand the platform scales, three and a-half feet higher than the floor of the drive-way. The usual weighing can and its accompanying tin milk conductor are not used at this factory. Instead, there is a truck running on rails along the heads of vats. This truck has a platform about the same hight from the floor as that upon which the scales rest. When the milk teams come in, the cans are moved directly from the wagon to the scales, and after being weighed go upon the truck, which is then moved along to the head of the vat and dumped. One edge of the platform on the truck is cut down lower than the others, and has a notch to receive the bottom of the can on this side, so as to facilitate dumping, and also to prevent the can from slipping while being dumped. The platform scales being about the same hight as the milk wagons, there is no difficulty in rolling the can upon the scales, and from the scales to the dumping truck. Each patron's can is weighed and marked, so that the weight of milk is rapidly obtained. There is no bother with cranes, no weighing can to be kept clean, no milk conductor to look after, while the operation of weighing and delivering the milk to the vats, Mr. BURNHAM, the proprietor, says, can be done quite as rapidly and safely as by the usual method, and with no more labor. On the other hand, a very large amount of work in cleaning weighing can and milk conductors is obviated during the season, while at the same time there is less liability of sour milk, &c., arising from neglect on the part of factory hands to keep these utensils in proper order. The arrangement seemed to be convenient, as it certainly was ingenious, and being so different from the usual plan of delivering milk, may prove suggestive to those persons who are about to build cheese factories.

THE CURD FILLER.

Another handy device in use at this factory is that for filling the hoops with curd. A tin form (see Fig. 81) just large enough to slip down inside the hoop is used. It is a little longer than the hoop, and is surmounted by a flaring top, and when in place, has the appearance of a common tin pan sitting upon the hoop (see Fig. 82).

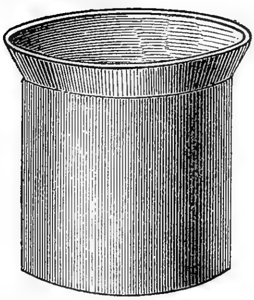


FIGURE 81.

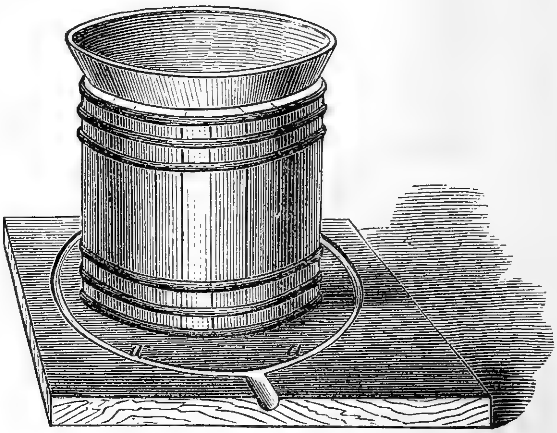


FIGURE 82.

Now, when the hoop is to be filled with curd, the lower or smaller end of this tin form receives a circular piece of cotton cloth just large enough to cover the bottom and come up over the edges of the tin outside—say about an inch. The cloth having been dampened and spread over the tin, is pushed into the hoop. It covers the bottom of the hoop, and the edges, of course, are held between the hoop and the tin, about an inch high all around the hoop. The curd is now placed in the hoop, and when full the tin form drawn out, which leaves the bottom cloth with edges turned up between the curd and hoop, preventing the escape of the curd during pressure. A circular cap of cloth is put on the top when the follower is adjusted and the cheese goes to press. By this device the use of large pressing-cloths is avoided, while a nice surface is secured to the cheese, making a considerable saving, not only in expense for cloth, but in labor of washing, &c.

THE BANDAGING MACHINE.

This is another convenient arrangement by which a cheese can be very expeditiously bandaged. It consists simply of a circular-topped stool (see Figure 83) for placing the cheese upon as it comes from the press. The top of the stool is about the same diameter as that of the cheese to be bandaged. A strip of tin is bent into a circle, so that it may be made to inclose the cheese. The ends are not joined together (see Figure 84), so that it may be contracted or expanded. It is provided with handles.

Now, when the cheese is to be bandaged, it is placed upon the stool, the circular tin contracted so as to readily receive the bandage, when it is allowed to expand, and is then forced down over the cheese and over the stool, or so far as is necessary to make a lap of bandage for the under side of the cheese.

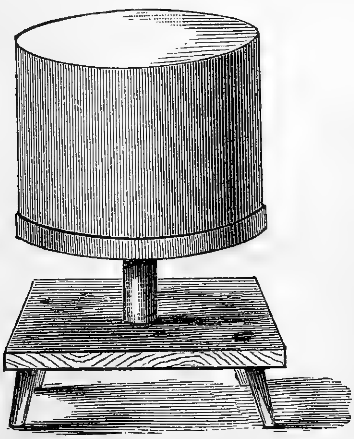


FIGURE 83.

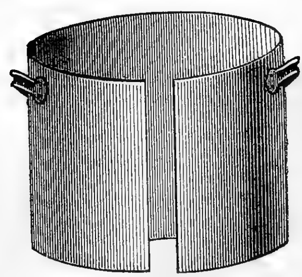


FIGURE 84.

Then the tin is withdrawn, leaving the bandage nicely in place. The work is very rapidly effected, without trouble or tearing the bandage; and a closer and better fit may be made than where the bandage is drawn on by hand, as in the old way.

THE MILK TESTER.

In testing of milk, from time to time, the common lactometer, or set of glass tubes graduated, is used. But instead of marking the name of the patron back of each tube to designate it, as is usual at many factories, figures (see Figure 85) are used, which refer to corresponding names kept in a private book. Thus the tests may be conducted without arousing suspicion or causing unpleasant feeling among the patrons on account of subjecting the milk to a test. This plan seems to be altogether preferable to the use of names directly on the apparatus, since all unpleasant remarks concerning certain specimens of milk by those going through the factory are avoided, as the names corresponding with the numbers are known only to the factory manager, and can be kept secret by him. We give an illustration herewith of the glass tubes set in a frame, and each with its appropriate number on the board at the back part of the frame.

THE "YOUNG AMERICAN" CHEESE.

Small cheeses of the "Young America" style have been manufactured at this factory, and sales for such have averaged considerably more than for large cheese. These cheeses are pressed in hoops seven inches in diameter, and the cheeses made from six to seven inches high. Several are pressed together under one screw—in some cases as many as sixteen. They are set together, the followers adjusted, and a thick, wide plank put upon the blocking, so that the whole may be pressed evenly and alike. In boxing these cheeses for market, twenty-one and a-half inch boxes are used, and seven cheeses put in a box. One cheese stands in the center of the box, and the others are arranged about it, and they thus fill the box, so that they may be safely sent to market, without moving about or marring. We were much pleased with several other features at this factory, but which we have no space now to describe.

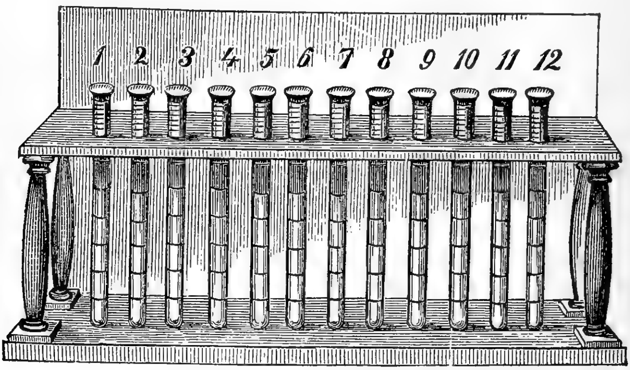


FIGURE 85.

ON FACTORY BUILDINGS AND FIXTURES.

The following from the pen of Dr. L. L. WIGHT, who has had large experience in the management of factories, will appropriately close this branch of our work:

"The first thing to be considered in selecting a site for building, after having secured a sufficient number of cows, is a plentiful supply of cold, running water. The quantity should not be less than sufficient to fill a two-inch pipe, for the milk of every five hundred cows. The temperature of this water should not rise above sixty degrees in the warmest weather of summer. Instead of erecting the buildings over some low, marshy, swampy ground, where water, slop and whey will settle and stagnate and infect the superincumbent air, as is too often the case, by all means select some dry, hard, airy location, a little descending to the rear, and with a continuous descent from the building, to insure the escape of all decomposing liquids to a safe distance. The size of the main building should be thirty-two feet wide, two stories high, of eight feet each in the clear, and the length will depend upon the amount of milk anticipated. A building seventy-five feet long will accommodate the milk from five or six hundred cows. Let the piers be made very substantial, extending to a depth beyond the possibility of frost, and not be over about ten feet apart in either direction. The main timbers, being ten by twelve inches square, support three by ten inch joists, not set in gains but resting on the cross-sills. The joists must be sound and set not over sixteen inches apart, being well bridged. The flooring of the manufactory, made of well-matched, sound yellow pine-plank, inclines three inches from the front, to a substantial box-drain made in the floor, four feet from the rear. The floor also inclines slightly from the rear to said drain. The drain drops from each end of the manufactory to the center, where it enters another box which conveys all slop, whey, etc., to a safe distance from the building. The entire outside is covered with well-seasoned, matched, sound pine-siding. The entire sides and ends of the manufacturing part, inside, are ceiled with pine. The ceiling is well plastered. The curing-rooms have floors laid with good, sound, seasoned spruce flooring. The sides are double-plastered, so as to make two fixed air spaces. The ceilings are also all well plastered. There need be no posts to support the floor. The second floor is supported by iron rods suspended from bridges in the attic. The entire building is well lighted by double-sash windows, which are supplied with good rotary outside blinds. Thorough ventilation of the curing-room is secured by the building being elevated so far above the ground as to admit of an abundance of air; and the insertion of large registers in each bent, under every counter in the first and second floors, and by good ventilators through the attic floor and roof. By careful attention to these registers, and keeping the blinds closed in hot and sunny days, the temperature can usually be kept at a sufficiently low degree, even in the warmest weather. An ice chamber in the attic, so arranged as to register the cold, moist air into the curing-rooms below, would likely at times be beneficial. The curing-rooms are supplied with counters twenty-four inches high and three feet wide; each table being made of two seventeen-inch wide pine plank, with a two inch space between them. Matched boards under cheese are objectionable, from the greater difficulty of cleansing and the danger of skippers infesting the cracks. It is better to have the counters two feet distant from each other for the convenience of the laborers, cheese-buyers and visitors. The manufacturing-room will be separated from the curing-room below by a tight double partition, with a large sliding door in the center, between the two lines of presses. The length of the manufacturing and pressing-room, in a building of the size above mentioned, would be thirty-five or forty feet. The boiler-room, and wood or coal-room will be erected at the end and adjoining the manufactory, having easy entrance thereto. A building about thirteen feet square should be attached to the front of the manufactory, containing a drive-way and a receiving-platform. The platform will be closed toward the drive-way, except a slide window to receive the milk through, and be open toward the vats. The center of this building will correspond to the center of the vats, so that the receiving-can may stand equi-distant from each outside vat. The ground of the drive-way is four and one-half feet below the top of the weighing-can. The receiving-platform is about one foot higher than the top of the milk-vats. This building is supplied with means to hoist the cans of milk, either by a crane-derrick, or, what is preferable, a hoisting wheel. Permit no faucets in the transporting cans, as they cause the milk to taint when not cleansed thoroughly, and are liable to be neglected. The wooden vats being about fifteen feet in length, it gives three feet between the receiving-platform and the end of the vats; two feet between the vats and the curd-sink; two feet between the curd-sink and the presses, and two feet between the presses and the rear of the building. The vats are separated two feet from each other, and three feet from the end of the building. The wooden vats almost invariably leak, and I think it would be better to have them lined with sheet-lead. The tin vats should be made of the largest sheets of tin, of the best quality, and be soldered together very smoothly. The wooden vat should rest upon a frame-work extending the one-half length of the vat, and not coming to the edge or upper end within four inches. The wooden vats should not be incumbered with legs extending to the floor, to be in the way of the feet. The most convenient way of raising and lowering the foot of the vat is by means of a standard, spring and catch, attached to the floor and the lower end of the vat. The space between the last vat and the curing-room will accommodate two tiers of presses, and give sufficient room for storing salt, for rennet and annatto jars, for hanging siphons, conductors, pails and knives; for washing-sink, hot and cold water barrels, etc. Supply each milk vat with a water pipe of at least three-quarters of an inch bore. The water, after having circulated around and cooled the milk, will be conducted to a water-wheel and furnish the power to move the milk agitator, of which AUSTIN's patent is recommended. If the factory is to receive the milk of five hundred cows or over, get a steam engine of not less than two horse-power, the boiler being not less than a six horse-power. It requires the expenditure of a large quantity of steam to warm the milk, and you want to be sure of it just when you need it; and the engine will enable you to pump water into the boiler, to grind your curds, to churn, if you wish, to saw your wood, or perform what other service soever you may desire. If you have a less number of cows than above indicated, a patent heater manufactured by CHARLES MILLAR & Son of Utica, will heat the milk gradually and very perfectly, and gives general satisfaction. If you do not grind your curds you will need two curd-sinks, so as to give greater facility for cooling the curds before putting to press. Your milk conductors will be large, stout, and open at the top to insure easy cleansing. Procure a good curd-mill to be used at least in hot weather. You want one gang knife of thirty blades, with one-fourth inch spaces, and one horizontal curd knife. If you use a steam boiler use the steam dry, after the method patented by Mr. Schermerhorn. Altogether the best method of warming the curing-room is by steam from the boiler. This gives a more equable temperature, and a moister, purer atmosphere. The next best mode of heating is by a furnace, well supplied with water for evaporation. Wood or coal stoves do not sufficiently equalize the temperature. Having an ice chamber in the attic, you can perform the double operation of cooling and moistening the rooms at any time. Curd-rakes, to keep the curd from packing, are nearly as indispensable as curd-knives. The patent horizontal press, pressing a number of cheeses at once, with one screw, will come into general use when the patentee has learned to obviate the difficulty of making an indentation or crease in each cheese, which harms their appearance, and supplies an excellent place for the generation of skippers in fly time. The followers must fit the hoops very nearly, or if not, the use of the rubber ring is necessitated. The use of this will hinder the curd from passing up between the hoop and the follower. In very hot weather, however, the acid in the whey soon decomposes the rubber and necessitates new purchases. No press cloths are needed. The rings and staples in the followers you buy are worthless, and should be replaced by your blacksmith, before attempting to use them. Turning covers are not wanted, even if the patentee will pay you for using them. Fairbanks' scales are the most reliable and give the best satisfaction. In weighing cheese for market, use a suitable sized counter-scale, which you can slip along readily on the counter, as you weigh each cheese, before being boxed. Give good up-weight in this manner, and there need be no trouble of having short weights returned upon you. Fine cap cloths give the smoothest rind. A convenient door will be made in each end of the second story, and in the end of the curing-room below, through which the cheeses may pass to the wagons on shipping. The boxes may very readily be slid from the second story to the wagons on properly constructed skids."

CHEESE MANUFACTURE.

THE ENGLISH STANDARD AS TO THE FLAVOR OF CHEESE.

MILK varies in character from various causes, but chiefly in the butter and milk-sugar, the caseine showing but slight variations. Now the great art sought by the cheese dairymen is in extracting two of the above constituents of the milk—caseine and butter—and combining them with the water in such proportions as to make a palatable article to suit a certain arbitrary taste. I say arbitrary, because taste is educated, and different nations have different standards as to what is palatable.

When I was in Switzerland I saw gentlemen, apparently of the highest respectability, eating cheese of a most intensely disagreeable odor. They ate this cheese with a relish, and pronounced it excellent, while, to my taste, it had all the peculiarities of badly tainted food, the very odor of which was nauseating. Some of the Germans also like a strong and rancid cheese.

The English taste, both for butter and cheese, has changed materially during the last half century. What is now required in cheese is a mild, clean flavor, with a certain mellowness of texture, readily dissolving under the tongue, and leaving a nutty, new milk taste in the mouth. The English demand a cheese of solid texture—that is, free from porosity—because a porous cheese usually indicates an imperfect separation of the whey, or undue fermentation. Such cheese often has a sweetish taste, which is owing to the excess of the sugar of milk in the whey, and they invariably turn with a bad flavor. The market value of cheese does not depend entirely on the amount of butter which it contains. In an address before the American Dairymen's Association a few years ago, I broached and discussed this point. It was new doctrine, which the dairy public, and especially dealers, were not then prepared to admit.

The experiments at factories, since that time, have proved the assumption, and shown that cheese made from milk partially skimmed was not even suspected by the dealer at home, and was pronounced first quality in the English market. The fact has also been established by Dr. VOELCKER, in the analyses of different samples of cheese; the common or ordinary American, he finds richer in butter than the best English Cheddar, which is the highest grade of cheese known to English taste. It may not be out of place, in this connection, to give Dr. VOELCKER's language. He says:—"One of the chief tests of the skill of the dairymaid is the production of a rich tasting and looking, fine flavored and mellow cheese, from milk not particularly rich in cream. That this can be done, is abundantly proved by the practice of good makers. One of the finest Cheddars I ever examined was made by Mr. JOSEPH HARDING of Marksbury, Somersetshire, and analyzed by me when six months old. Like all good cheese, it of course contained a large amount of butter, though, as I found by experiment, not nearly so large an amount as its appearance, rich taste, and fine, mature condition seemed to imply. Though only six months old, it had a much more mature appearance than a Cheddar cheese which was at least eleven months old when analyzed, and, thanks to Mr. HARDING's skill and experience, had a far much fatter and more mellow appearance and richer taste, than a specimen which actually contained two and a-half per cent. more butter." "In the opinion of good judges," he goes on to remark "this Cheddar cheese, notwithstanding the larger amount of butter and smaller amount of water it contained, was worth a penny a pound *less* than the specimen made by Mr. HARDING."

MELLOW APPEARANCE.

"The peculiar mellow appearance of good cheese, though due to some extent to the butter it contains, depends, in a higher degree, upon a gradual transformation, which caseine or curd undergoes in ripening. Now, if this ripening process is badly conducted, or the original character of the curd is such that it adapts itself but slowly to the transformation, the cheese, when sold, will be comparatively tough, and appear less rich in butter than it really is, while in a well made and properly kept cheese, this series of changes will be rapidly and thoroughly effected."

PROPER RIPENING.

"Proper ripening, then, imparts to cheese a rich appearance, and unites with the butter in giving it that most desirable property of melting in the mouth. On examining some cheeses deficient in this melting property, and accordingly pronounced by practical judges defective in butter, I nevertheless found in them a very high percentage of that substance, clear proof that the mellow and rich taste is not owing entirely, or indeed is chiefly due, to the fatty matter which it contains."

I do not introduce this topic for the purpose of advising manufacturers to skim the milk for cheese-making, but rather as a suggestion that no effort should be spared in acquiring that skill in manufacturing which is able to bring about desirable results, and to show that, even with the best material, a cheese unskillfully made may be tough, poor and unpalatable.

THE PROPORTION OF MOISTURE IN CHEESE.

Now, it may not be uninteresting to know what are the component parts of what is considered the highest grade of cheese in the English market, such as we are attempting to furnish. It at least gives us some general idea of the proportion of water, caseine and butter which has effected the highest results.

The analysis of Mr. HARDING's cheese gives the following in the one hundred parts:

Water	33.92
Butter	33.15
Caseine	28.12
Milk sugar, lactic acid and extractive matter	00.96
Mineral matter	3.85
Total	100.00

The 28.12 parts of caseine contain 21.50 parts of nitrogen, and of the 3.85 parts mineral matter, 1.15 was common salt. It will be seen, then, that good cheese, properly cured, has about thirty-four per cent. of water, and less than one per cent. of milk-sugar, lactic acid, &c.

From the analyses which I have seen of different samples of the best English and American cheese, when ripe, it appears that the proportion of water should not be above thirty-four per cent. Any considerable increase above this almost invariably indicates bad flavor. There is no doubt, a due proportion of the water in cheese imparts to it a smooth and apparently rich texture, and it is to this point manufacturers should direct their attention. When too much water is taken out of the curd, we have a dry, stiff cheese, the transformation of the caseine or curd being imperfect, and the cheese appears less rich than it really is. Any system of cheese-making, then, by which we may be able to judge the most accurately as to the amount of water to be retained in the curds, will be the most successful, other things being equal.

SALTY TASTE.

In regard to the saline taste sometimes complained of in old cheese, otherwise rich and good, Dr. VOELCKER attributes it to ammoniacal salts, developed during the ripening process. He says:—"During the ripening of the cheese, a portion of the caseine or curd suffers decomposition, and is partially changed into ammonia; the latter, however, does not escape, but combines with several fatty acids, formed in the course of time from the butter. Peculiar ammoniacal salts are thus produced, and these, like most other salts of ammonia, have a pungent, saline taste. The longer cheese is kept within reasonable limits, the riper it gets, and as it ripens, the proportion of ammoniacal salts, with this pungent, saline taste, increases. It can be readily shown that old cheese contains a good deal of ammonia, in the shape of ammoniacal salts. All that is necessary is to pound a piece with quick lime, when, on the addition of a little water, a strong smell of spirits of hartshorn will be developed. In well kept, sound old cheese, the ammonia is not free, but exists in the form of salts, whose base is ammonia, in combination with butyric, caprinic, caprylic and other acids, generated under favorable circumstances by the fats of which butter consists. Ripe cheese, even if very old, but sound, instead of containing free ammonia, always exhibits a decidedly acid reaction, when tested with blue litmus paper. Rotten cheese, on the other hand, is generally alkaline in its reaction, and contains free ammonia."

KEEPING QUALITIES.

I have alluded to some of the characteristics demanded in them, to suit the English taste. There is another requisite, which trade and our own interest imperatively demand: it is the production of cheese that is slow of decay—that will sustain its good qualities a long time; one that can be kept, either at home upon the factory shelves, or in the hands of purchasers, without fear of deterioration or loss. English shippers and dealers have always complained of the early decay of American cheese, and the fear of loss from this source has had great influence upon the market. When considerable stocks have been accumulated, the dealer has been over-anxious to get rid of them, and has pushed them, at low prices, upon the market, on the assumption that the loss from deterioration, by holding, would more than cover any prospective advance in price. Factories, too, have often pushed forward their goods on this account. It is true there has been great improvement, during the last few years, in the keeping qualities of our cheese, but there is room for more improvement, and no factory should make a pound of cheese that cannot be kept, without deterioration, at least several months. It would seem to be evident that the exceedingly fine aroma which obtains in the best samples of Stilton, Cheddar and Cheshire cheese, is secured, at least in part, by manufacturing perfectly pure milk, in good condition, at low temperature.

THE CHIEF CHARACTERISTICS OF STILTON

are a peculiar delicacy of flavor, a delicious mellowness, and a great aptness to acquire a species of artificial decay, without which, to the somewhat vitiated taste of the lovers of Stilton cheese, as now eaten, it is not considered of prime account. To be in good order, according to the present standard, it must be decayed, blue and moist. Considerable quantities of Stilton, however, are sold in London free from mold, and good samples have a peculiarly delicate flavor and delicious mellowness, preserving these qualities for one or two years. Now the Stilton is set at a low temperature—about 78°—and after coagulation is perfected it is cut in blocks, and a short time afterwards it is lifted out carefully into a willow basket to drain, and then put into a small hoop and turned frequently, receiving no pressure except from its own weight.

I do not propose to go into details of Stilton manufacture in this place since it is not adapted to our factory system: but I introduce the main feature to show in part the philosophy of cheese-making. Here, in this most delicious of all cheeses, in which there is an extra amount of cream, a very low temperature is employed, with scarcely any manipulation. The manipulations are not hastened, but the cheese is left, so to speak, to do its own work. The Stilton cheeses are thick but small, only weighing from six to eight pounds. Of course we could not make our large cheese in this way, as the whey would not readily separate and pass off. But it is a remarkable fact that these cheeses are capable of retaining a delicate flavor for a long time. In all the finest English cheeses coming under my observation the temperature for setting the milk ranged at about 78° to 82°, never above 84°. It is undoubtedly a fact that if coagulation takes place when the milk is too warm it becomes too adhesive, and the oily parts of the milk, being kept in solution, escape with the whey.

THE AMERICAN AND CHEDDAR PROCESSES COMPARED.

The American process of manufacturing cheese as now commonly practiced, differs but little from the improved Cheddar process of England. The night's and morning's mess of milk mingled together are taken to make the cheese. One great feature in the Cheddar process is to understand pretty accurately the condition of the milk in regard to its approximate acidity at the time of commencing the operation of manufacturing. They prefer therefore to have the milk in a condition to use sour whey at the time of adding the rennet. When a large number of persons are delivering milk as at our factories, it is impossible to judge so well how far the milk has progressed toward sensible acidity, as in a single dairy where the milk is under the eye of the manufacturer from first to last.

In the Cheddar practice the milk is set at a temperature of about 79° to 82°, receiving sour whey with the rennet according to the condition of the milk. A quantity of rennet is added sufficient to coagulate the mass in from forty to sixty minutes. When firm enough to break, the curd is cut across in checks. After it has stood from fifteen to twenty minutes for the whey to form, and the curd to acquire a firm consistency, the Cheddar dairymen commence breaking with a shovel breaker, which is similar in construction to our factory agitator. The curd is handled very carefully until the whole is minutely broken, and they insist that this part of the process shall be done without any additional heat. After breaking, heat is applied, and the temperature gradually raised to 98° or 100°, according to circumstances of weather, etc., the mass meanwhile being carefully stirred. It is then left at rest and only occasionally stirred, until a scarcely perceptible change toward acidity is indicated in the whey; the whey is then immediately drawn and the curd heaped up in the vat to drain and develop the required acidity gradually. It remains in this condition for half an hour or more, the whey meanwhile flowing slowly from the heap, when it is taken out and placed in the sink or cooler. It is then split by the hand into thin flakes and spread out to cool. The curd at this stage has a distinctly acid smell, and is slightly sour to the taste.

It is left here to cool for fifteen minutes, when it is turned over and left for the same length of time, or until it has the peculiar mellow or flakey feel desired. It is then gathered up and put to press for ten minutes, when it is taken out, ground in the curd-mill and salted at the rate of two pounds of salt to one hundred and twelve pounds of curd. It then goes to press and is kept under pressure two or three days. The curd when it goes to press has a temperature of 60° to 65°, and when in the sink it is preferred not to go below this point. A proper temperature is retained in the curd during the various parts of the process, during cool weather by throwing over it a thick cloth. Much of our factory cheese has been injured by being put to press at too high a temperature. The thermometer should always be used to determine the condition of the curd when put to press; and there is no doubt but that the Cheddar dairymen have hit upon the proper temperature.

Mr. HARDING, the great exponent of this system in England, told me he had made a great many experiments in this direction, and that a higher temperature than 75° when put to press was almost always attended with loss of flavor, undue fermentation, and, as a consequence, greater or less porosity. He claimed that the curd could not be properly broken at 90° or above, and that a better separation of the whey and condition of the curd was effected by breaking at 75° to 80°.

What we are to learn by the Cheddar process, is not so much following out blindly all details, but seizing upon a few leading principles of the process and adapting them to our use. These principles may be briefly summed up as follows: 1st. Studying the condition of the milk. 2d. Setting at a temperature from 78° to 82°. 3d. Drawing the whey early. 4th. Exposing the curd longer to the atmosphere and allowing it to perfect its acidity after the whey is drawn. 5th. Putting in press before salting at a temperature of 60° to 70°. 6th. Grinding in a curd-mill and then salting. These last two items are important, because you cannot regulate the salt accurately by guess, and can only get the right proportion by uniformity in the condition of the curd. The application of salt, too, at a higher temperature than 75° is claimed to be prejudicial.

I am firmly of the opinion, not only from my observations abroad, but from my own experiments, that the exposure of the curd in small particles to the air is beneficial, and helps to secure a good flavor and mellowness of texture. When curds are exposed to the atmosphere the external parts become rapidly oxydized, which is seen by their heightened color.

FLOATING CURDS.

One of the troubles which cheese-makers have to contend with is a floating curd. It means tainted milk, putrefaction, fermentation, a most disagreeable customer, and one which no manufacturer cares to meet. There are various ways of treating floating curds, but the main points to be observed are, drawing the whey early, developing an acid, exposure of the curd to the atmosphere a long time, and grinding in a curd-mill. One experienced cheese-maker writes me as follows:

"One morning in July last I noticed a peculiar odor in the milk which was delivered at the factory. I pronounced it tainted. The weather was warm and the milk from some of the dairies was quite near enough sour, being so far advanced as to require rather rapid handling, faster than would be profitable with milk in the proper condition. I exposed it to the air by stirring it and dipping it, until ready to add the coloring and rennet, which was done at a heat of 82°.

"The curd did not seem to act right while cooking; it would not *come down* so as to present to the maker that feeling and appearance which indicate a good cheese. The curd came to the surface of the whey while it was cooking. The odor was so disagreeable that one of our hands could not bear to work over it. One individual who was present insisted that the curd was sour and the whey sweet. I could not see it so. I held it in the whey as long as I thought advisable, which I assure you was not any longer than was necessary to cook it fairly; for I did not think the whey was improving it any. The heat must have been nearly to 100°, when I ran it into the curd sink, for I had been keeping up the heat hoping to cook it sufficiently. We stirred it a long while in the sink, opening the windows and doors of the work-room, in order to give it all the air possible. I salted it in the proportion of three pounds of salt to one thousand pounds of milk, and put it to press. After pressing for perhaps an hour, turned and bandaged them, then pressed again, until the next morning, when they were placed upon the shelves in the drying-room.

"I saw by the next day that they were inclined to give me trouble. They commenced rising *en masse*, like a loaf of bread. They did not leak whey, but there seemed to be a sort of internal working, and when pressed upon with the hand would emit a hissing sort of noise. I determined to experiment. I cut one into slices and ground it up in the curd-mill. The odor that had been present in the vat had not all left. I warmed a pailful of whey of the day before to 100° and poured it upon the curd. I kept the whey upon the curd but a short time, just long enough to warm it, say five minutes. I then added as much salt as I thought the whey had taken out, then pressed, turned and bandaged as before. When placed upon the shelf the next day it felt firm and had every appearance of lying quiet. I treated the other three in the same manner and with a similar result. We kept those cheeses until about forty days' old. They never raised in the least again. I called the attention of several buyers and professed judges of cheese to them, and they, without an exception, pronounced them 'all right.' They were firm, never showing a pore when tried; still, they were not over hard. The odor had so much left them that our buyers were unable to detect it. Perhaps upon other occasions the same process may not prove as satisfactory as upon this. Be that as it may, I feel confident that I saved four cheeses, which promised to be a total loss."

He adds, "That when the cheeses were cut open for grinding, they were very porous, presenting the appearance of a loaf of bread, which if possible, had been over-risen."

MR. IRONS' PROCESS.

Mr. Irons, a young Englishman, whom Mr. Harding of England sent to me in the spring of 1868, and who has been managing some factories at the West since that time, says he has tried various modes of treating floating curds, and finds by the following process that he is able to make from such curds a cheese of good texture and taste.

When the appearance of the whey shows numerous air bubbles floating in, or forming by the slightest agitation of the finger, and also a kind of greasy feeling of the curd, all of which are indications of an unusual fermentation, proceed with the process as at other times, only working a little slower. The temperature should not be raised above 100°. If you are in the habit of making coarse curds, then on this occasion they should be worked a little finer with the agitator. When the mass has been raised to the desired temperature the stirring should be continued for about half an hour. Then leave it to rest for a short time, or with only an occasional stirring. When you see the curds beginning to float upon the whey let them all come up, and then immediately draw the whey. The whey having been removed pack the curd in large heaps at the bottom of the vat, with a space down the middle for the whey to drain off, and which should be removed as fast as it gathers. When the curd has lain in this shape for about fifteen minutes, or until strong enough to bear turning, the heaps should be turned bottom side up, and, if possible, without breaking the curd.

Now, let it lie, till the acid is properly developed, which will be indicated by the odor when opening one of the heaps in the center, and it will have a kind of flaky appearance, or as some have it, a kind of grain. Then break the heaps into three or four pieces, and spread over the bottom of the vat to cool gradually. When the pieces have laid thus for about fifteen or twenty minutes take them out of the vat, put them in the sink and break them into small pieces, and stir so as to cool. When the temperature has been reduced to about 70° to 75°, grind in a curd-mill and salt at the rate of two and a-half pounds salt to one thousand (1,000) pounds of milk. It would be better to put the mass to press for about ten minutes before grinding, but when there is a large mass of curd, and time is wanting, the course above may be adopted.

Mr. Irons says he has under this treatment of floating curds, made them into good cheese, so good, indeed, that experienced cheese-dealers have not objected to their flavor, or even suspected that there had been any trouble with the curds more than ordinarily. The cheese, he adds, is of very solid texture, and no difficulty is had in curing, except the liability to check a little if care is not taken.

Mr. Moon, manager of the North Fairfield Factory, gives the following as his method of treating tainted milk and floating curds :—First, thorough stirring and cooling of the milk at night. In the morning do not begin to heat the milk until ready to heat rapidly, and then heat as quickly as possible, stirring the milk the while. Add an extra amount of rennet that the coagulation may be quite firm, cut and manipulate with unusual caution; keep the whey drawn off as close as possible; heat gradually but continually until the temperature of about 98° is attained, then, when sufficiently cooked, dip to the sink and wait for the developement of the lactic acid, in more than the usual quantity; salt and allow to stand exposed to the air from one to three hours, according as the milk was bad or *very* bad.

"Frequently," he says, "the acid will be developed enough when dipped to the sink; in that case salt as soon as drained; stir the curd before and after salting, in order that it may not pack in the sink. Having been exposed to the air for the proper length of time, put to press; in the morning remove the hoop, and perforate the cheese in several places with a small wire, in order to allow any gas to escape that may have been generated in the cheese during the night. Put to press again, and if possible, allow to press twenty-four hours longer, remove to the dry-house and treat like other cheese."

Mr. ALEXANDER MCADAM, of the Smith Creek Factory, N. Y., who has been very successful as a manufacturer of "fancy cheese," and whose cheese is well-known in the markets on account of its superior quality, writes me in a recent letter as follows:

CAUSE OF FLOATING CURDS.

"The immediate cause of floating curds is the presence in each particle or cube of an extraordinary number of the spores of a species of fungus, which generate a gas in the middle of each cube of curd at the time when the curd is in the whey at a temperature of from 80° to 96°, when each cube of curd is expanded by this gas so much as to become lighter than its bulk of whey —there occurs a floating curd.

"The reason why those spores are in so great abundance at times as to cause floating curds are two, viz.: First, diseased or fevered state of the cow before the milk is drawn from her. Second, improper handling of the milk *after* being drawn from the cow. In regard to the first reason, there are a great many cows slightly diseased or fevered, a few of the causes of which, are cows drinking stagnant, putrid or filthy water; the eating of vegetation growing on ground saturated with such water; cows inhaling the odor arising from rapidly decomposing matter; cows in heat, or having been driven rapidly from the pasture; or any state of the cow which causes the milk to be at a higher temperature than blood heat (98°) when drawn from her, which in a great many instances is the case, and it has been known to be as high as 105° when milked. Such milk, when it has been coagulated and heated, is almost certain to produce floating curds.

"In the second place, when the milk has been improperly handled after being drawn from the cow. This is the case when any filth, cow manure, or other impurity drops into the milk during milking, or in its transit from the farm to the cheese factory, and which can never afterwards be wholly removed from it by passing it even through the finest strainer; or when the milk has come into contact with any utensils or strainers which have not been thoroughly cleansed; or when the milk has not been thoroughly ventilated before being shut up in almost air-tight vessels. These are some of the most frequent causes of floating curds.

PREVENTION OF FLOATING CURDS.

"To prevent floating curds, the milk intended to be manufactured into cheese ought to be milked from cows that have access at all times to pure running water, and have no access at all to stagnant, filthy water, as cows will often prefer such filthy water to clean water (for reasons unknown). Every one of the cows of a dairy ought to be in perfect health, as one diseased cow's milk will taint the milk from the whole dairy. Dairy cows ought not to have access to weeds of any description, and ought to have plenty of shade trees in their pasture in warm weather, and when driven to and from their pastures they ought not to be urged faster than a slow walk, and before being milked they ought to be allowed to stand one hour in cool, airy stables at a distance from manure heaps or any decomposing matter.

"After standing an hour the cows ought to be milked with the most scrupulous cleanliness, and the milk strained. It must then be immediately ventilated by exposure to the atmosphere to allow the animal odor to escape, and cooled. But cooling without ventilation is almost useless, or as some assert, *worse* than useless. The milk being cooled and ventilated, it can then be moved to the factory, and will arrive there in good condition. All the utensils with which the milk comes in contact ought to be thoroughly cleaned with warm water, soap and a brush, and afterwards scalded with *boiling* water or steam. All these particulars being attended to there will be no danger of floating curds.

THE REMEDY FOR FLOATING CURDS.

"When the milk which has to be manufactured into cheese emits the offensive odors which usually come from tainted milk, it is reasonably certain the curd after coagulation will either float or require the same treatment as if it did float. In such a case enough of rennet must be added so as to cause coagulation in thirty minutes or less. Then, after the curd is sufficiently cut, the mass of curd and whey must be heated quickly to a temperature of 96°, and so allowed to remain until acid is slightly perceptible to the smell or taste, the whey must then be separated from the curd, and the curd allowed to take on considerable more acid. The exact pitch to which the acid should be raised at this time can only be learned by experience; when this has been attained the curd should be then ground and salted according to the Cheddar process, which is becoming too common to need explanation. After the curd is salted it should be thoroughly ventilated by repeated stirring and turning over before being put to press. The amount of salt to be used should be the same as when the curd is perfect. The reason that more rennet is required for floating curd is because such curd has to be made sooner than usual, and would take longer to cure if only the same amount of rennet was used. And the reason it is heated quickly is to induce the acid to develop sooner.

"A strictly fine-flavored or good-keeping cheese can not be made from floating curds, but still when properly handled a very fair, merchantable article can be obtained, the only fault being insipidity and lack of the fine nutty aroma so highly prized by the dealers in and consumers of all kinds of high-priced cheese. The reason that this aroma is lost in floating curds is because so much acid has to be introduced into the curd to kill the taint or bad smell. Now, this acid also destroys the finest of the aroma, which is the most volatile and easily destroyed in either butter or cheese."

TREATMENT OF FLOATING CURDS.

In the treatment of floating curds, a mill for grinding the curds renders very important aid. By grinding, the particles of curd are more minutely broken than it is easy to do by hand, and the breaking liberates not only the gases, but, by a free exposure of the particles to the air, the offensive odor passes off, and fermentation is checked. In some cases, even after the cheeses have been removed from the press to the curing room, and then begun to huff and behave badly, by cutting them up and passing through a curd mill, warming with whey at a temperature of 98°, and then draining, salting and pressing, no further trouble has been given, the cheese turning out of fair quality. As more or less trouble is had every year from tainted milk and floating curds, suggestions as to their management will be of important aid to the cheese manufacturer.

MANUFACTURING FROM SMALL QUANTITIES OF MILK.

Where only one vat is used, I should always prefer the portable vat, with heater attached. It is quite as convenient, and much less expensive, not only in the original outlay, but in the cost of running, than the steam boiler and vat separated, like those in use in many of the New York factories. In a small factory, where there is no probability of running more than two vats, and where part of the time only *one* is used, I should still prefer the "portable" or "self-heater," as less expensive, while, as to the management of heat, some of these self-heating vats are as perfect as anything yet brought out. So far as the manufacture of cheese is concerned there is nothing better than to heat with hot water, if the arrangements are such as to be convenient, and the heat under control. The advantages of a steam boiler are, that the boiler is in a separate room by itself, and all litter, dirt, smoke, &c., are confined to that apartment, and do not get "mixed up" in the milk room, while the heat is applied simply by turning a faucet in the conducting pipe. Then, again, the heat can be turned off in a moment. On these accounts many old factorymen prefer steam boilers to the "self-heaters." The Ralph, the Millar and the Burrell heaters are good, so far as their arrangements for heating and manufacturing are concerned. They take but very little fuel.

SOUR WHEY.

The use of sour whey in cheese-making must be regulated according to the condition of the milk. If the milk has made progress toward acidity, so that it will be properly developed at the close of the process of cheese-making, the sour whey is not needed. But in cool weather, when the milk has been brought down to a low temperature, an acid condition of the curds is not easily developed, at least during the ordinary time for conducting the process of cheese-making. Sour whey, under such circumstances, is often used with great advantage. In the spring of the year, when the cows are "between hay and grass," it is sometimes quite difficult for the cheese-maker to turn off a nice quality of cheese. The curds are often run up too sweet, and the consequence is a soft, spongy product, containing a superabundance of whey which has not been properly separated, and could not be expelled while the cheese was in press. This could have been remedied by a proper application of sour whey.

At cheese factories there is not usually that necessity for using sour whey as at farm dairies, because the milk, from cartage and other causes, has generally progressed further toward acidity, when cheese-making commences, than it would had the milk been kept and made up at the farm dairy. But, though the necessity for using sour whey may not be so great at the factory as at the farm, there are times when it can be employed in factory manufacture to very great advantage.

At the farm dairy, when the night's milk has been cooled down to 45°, we should say that the sour whey could be used; for, if all utensils have been kept scrupulously clean, the milk will be very sweet, and will not readily develop the desired change in proper time, or during the time usually employed in the process of manufacture into cheese, unless so treated. Sour whey cannot be used at random, but in the hands of skillful cheese-makers it produces the very best results.

COOLING THE MORNING'S MESS OF MILK AT FARM DAIRIES.

As to the question of removing the animal heat from the morning's milk for farm dairies, when the night's milk has been cooled, as described above, it is not usually considered important to do so. If the morning's milk is to be carted to the factory, there is no question but it should be thoroughly cooled before putting in the cans, or as soon as may be after being drawn from the cow. And I have no doubt, for private dairies, the milk for cheese-making, both morning and evening mess, is improved by being divested of animal heat. In the private dairy, however, it must be observed, the quantity of milk to be handled is comparatively small. The morning's milk is added by degrees, or only as fast as drawn from the cow, and is at least partly cooled by coming in contact with the night's milk. And, again, the vat being open so as to allow free exposure to the air, while the process of cheese-making is commenced at once, all would seem to indicate that a special cooling of the morning's milk might, perhaps, be dispensed with. If, however, convenient apparatus be had for cooling the morning's milk as soon as drawn from the cow, so that it could be readily done, without loss of time or causing much trouble, I should do so, since I am of the opinion a more delicately flavored cheese would result from cooling and aerating both the night's and morning's mess of milk. But without apparatus or conveniences, it would not, perhaps, be advisable to spend much time and trouble in attempting to cool the morning's milk for farm dairies.

COLORING CHEESE.

An attempt has been made, from time to time, to induce factories to abandon the use of coloring matter in cheese. The fact that annatto (the only coloring matter that should ever be used for this purpose) adds nothing to the flavor or nutrition of cheese, would seem to favor the discontinuance of a practice which is troublesome, attended with expense, and sometimes injurious on account of the adulterations of annatto with red lead and other poisonous compounds. Pure annatto is a harmless vegetable substance, prepared from the seeds of a tree (*Bixa orellana*), and when used in the ordinary way for coloring cheese is in no way injurious. Its employment for this purpose comes down to us from the mother country. I do not know when or by whom the practice was first inaugurated, but it is of ancient date, and its object must have been to deceive consumers, by giving them the idea that the cheese was made from a very rich quality of milk. And that impression now generally prevails among the uninitiated. So much has the imagination to do in controlling human action, that I have seen poor, skim-milk cheese highly colored, preferred and purchased instead of a rich, nice-flavored, pale cheese, both standing on the counter, and offered at the same price. Color, therefore, has an important influence with some people, and it is useless for the dairyman to "run his head" against this prejudice, unless he chooses to have his pockets depleted by lower sales.

It is true, in some of the English markets, like Manchester, for instance, pale cheese is in favor, and finds a better price than the colored article; but the London trade insists upon color, and as it is willing to pay for it, American dairymen must for the present submit. Some people think that, by abandoning the use of annatto, we can correct the English prejudice for colored cheese, and thereby benefit all parties. It would be an absurd and futile effort on our part, and would simply give the English dairymen additional advantage in their own markets; for you cannot force people to purchase what they do not want, however excellent your argument may be against their prejudices.

METHOD OF PREPARING BASKET ANNATTO FOR USE.

Some of the methods employed by old and experienced dairymen for preparing annatto for coloring cheese are as follows:

First Recipe.—Dissolve six pounds concentrated potash and one pound saltpeter in five gallons of warm water; then add thirty gallons cold water, put in as much choice annatto as the liquid will dissolve, heat gently to a boil; put into a cask, and store in a cool place.

Second Recipe.—Dissolve four pounds potash in one-half barrel of water; put in as much pure annatto as the liquid will cut. The mixture need not be boiled.

Third Recipe.—Take four pounds of best annatto, two pounds concentrated potash, five ounces saltpeter, one and a-half pounds sal-soda, and five gallons boiling water. Put the ingredients into a tub, and pour on the boiling water.

The annatto should be inclosed in a cloth, and, as it dissolves, squeeze it through the cloth into the liquid. About two ounces of this mixture is sufficient for one hundred pounds of curd in summer.

RECIPE FOR PREPARING ANNATTO USED AT BROCKETT'S BRIDGE FACTORY.

To eight pounds crude annatto, add three pounds BABBITT's concentrated potash; place in a cask, pour on boiling water, and stir frequently until all is dissolved. Water is then added to make it sufficiently diluted, so that a pint of the liquid will color four thousand pounds of milk. In coloring cheese, the best way is to fix upon the desired shade by trial (marking the quantity of liquid used), and after that is known the same proportion will give color that is uniform.

ANNATTOINE.

Preparations of liquid annatto have been made and sold from time to time, some of which, like the NICHOLS & ENGLISH preparation, have acquired a high reputation. The foreign liquid annattoes, however, are expensive, and their high cost has operated very much against their use among the factories. Recently a new preparation of annatto has been brought out by G. DE CORDOVA, under the name of annattoine, or dry extract of annatto. The coloring material, which lies wholly on the surface of the seeds, is separated and prepared by CORDOVA by an improvement on the LA BLOND and VAUQUELIN theories. The latter asserts that boiling injures the color, and as this has been clearly proven, CORDOVA reduces the precipitation to powder instead of boiling to a paste. In the spring of 1870 I made tests with the annattoine in coloring both butter and cheese, and found that it gave a clear and beautiful shade, equal to any preparation that I had seen, but on dissolving or cutting the annattoine in the usual manner I found the liquor on standing was inclined to form a coagulum. Soon after this time Mr. D. H. BURRELL of Little Falls entered upon a series of experiments for the purpose of overcoming this difficulty. In this he has been entirely successful, and we now have a perfect coloring material, free from any injurious adulterations, and a preparation which has given satisfaction to both factories and shippers. Indeed, some of the latter have expressed the opinion that cheese colored with this preparation retains flavor better and for longer periods than cheese colored with the common basket annatto. The annattoine is largely coming into use among the factories, and is superseding all other preparations. Prof. CALDWELL, who has made an analysis of the annattoine, certifies as to its purity or freedom from deleterious adulterations, and we are therefore enabled to obtain a reliable coloring material at moderate cost.

Mr. BURRELL's recipe for cutting the annattoine is as follows:—Put two pounds of annattoine in four gallons of clear, cold water, and let it stand in this state one day, stirring thoroughly, meantime, so as to perfectly dissolve the annattoine. Then put two pounds strongest potash, and one pound sal-soda (carbonate of soda) in three gallons of cold water. When this is perfectly dissolved and settled, pour off the clear liquor, and mix the two preparations together. Let this compound stand two or three days, until the annattoine is cut or dissolved perfectly by the potash, stirring occasionally meantime. Use about a teacupful for a thousand pounds of milk. Do not mix with the rennet, but put it in a little milk and then mix in the mass of milk in the vats by stirring it in thoroughly, just before the rennet is used. If in a day or two after the preparation is made the annattoine does not seem to be perfectly cut, so that specks can be seen, it is certain that the potash was not strong enough. Adding more of a stronger solution of the potash will remedy the trouble. When annattoine is used for coloring butter a portion of the prepared liquor is added to the cream at the commencement of churning. It gives a very rich color, and may be used in winter-made butter, often with advantage.

CUTTING THE CURDS.

The steel curd-knife now in general use was invented some dozen years ago or thereabouts, by a Herkimer county dairyman. The old-fashioned curd-knife was of wood, a single blade, and a rude affair. The curds were cut into large blocks, and all the subsequent breaking was done with the hands. This necessitated a good deal of labor, and unless the curds were very carefully handled, there was a considerable loss of cheese. The first improvement in this class of implements originated also in Herkimer, and consisted of a triangular iron frame, strung with brass wire. It was made of different sizes to correspond with the cheese-tub, half its diameter in length, so that going round with the breaker in the operation, no section of the curds would be broken twice. This was a great improvement over the wooden knife and hand breaking; but after a while it was found objectionable, as the tender curds were torn and mashed by the frame of the breaker, and by the points where the wires crossed each other in forming the checks.

The next improvement was a breaker of tin, formed into checks, so as to cut the curd into long square strips as the instrument was pushed down to the bottom of the vat. I made some experiments with the tin and wire breakers at an early day, and found there was a saving in product by using the tin. When the gang of steel knives was invented for cutting the curds into perpendicular columns, further experiments were made, and a decided advantage in product was found to result from the use of sharp, cutting blades over the tin cutter, which did not divide the curd as smoothly as the polished steel blades. These experiments, extended over a considerable period and conducted with care, convinced me that the first breaking of the tender curds should be done with sharp cutting blades; since not one cheese-maker in a hundred will use sufficient care in breaking with the hands to avoid the loss that can be saved by the use of the steel knives, to say nothing of the labor and time gained by the knives over hand breaking. If it be admitted that these sharp, polished steel blades are better for breaking the curds in their tender state than the hands, or indeed than any device that tears the mass into particles, that bruises them or presses out the oily portion, then the whole of the breaking should be done with knives.

The use of horizontal knives is only of recent introduction among the factories of New York. The perpendicular blades referred to above left the curds in cubical columns, which were to be in some way broken up, and it was done either by the hands, by an agitator, or by other imperfect means. Some of the best English cheese-makers use what is called the shovel-breaker for working or breaking the curds after the first cutting. It is of heavy wire, something in general form like a shovel, and attached to a long handle. They claim that in using this the curd splits apart in grains naturally, and hence the shovel breaker, skillfully used, is the best implement for the purpose that has yet been invented. As, until quite recently, they knew nothing of the operations of the American knives, and as their product from a given quantity of milk is less than that turned off by skillful American manufacturers, it is evident they are not competent, at present, to pass upon the merits of this improved American implement.

In the best English methods of cheese-making, as well as in the best American processes, it is deemed important that the breaking should be done when the curds are young and before additional heat is applied. All cheese-makers agree that any rough handling of curds at this early stage must be attended with loss. But if we can have an implement or implements that will pass through the curds perpendicularly and horizontally, separating the mass into parts of the desired size, and doing the work without any undue agitation or bruising of the mass, a great desideratum, it would seem, is reached. The perpendicular and horizontal curd-knives when used in connection with each other do this most effectually. The horizontal knives cut the long, perpendicular blocks of curd into small pieces of uniform size, leaving the mass completely broken up.

I experimented with the horizontal knives long before they were brought out or used in the dairies of New York. The knives were made expressly for my experiments by Mr. Oysten of Little Falls, who had proposed at the time to take out a patent upon them. He did not do so, and the principle suggested itself to others, and is now adopted at factories.

In a recent conversation with Mr. Davis, who owns and operates a factory in Herkimer, N. Y., he stated that he found from experiments that a considerable gain was effected in the quantity of cheese by the use of the horizontal knives, and that by their use also the quality of his cheese was greatly improved. Mr. Davis is a manufacturer of experience, and his cheese has a high reputation for excellence, bringing a high price in the markets. Others make similar statements.

From what has been said it will be seen that in factories of any considerable size, the horizontal knives, in connection with the others, save during the season a large amount of labor, while the work is better performed than by operating on the old plan, as every portion of the mass is divided in pieces of uniform size. The object of cutting or breaking the curds is to favor the expulsion of whey; hence, when the mass is broken up into pieces all of the same size, the progress and condition of the curds from time to time are more uniform in all their parts; and this is an important point which many cheese-makers overlook in their operations. The principle to be observed is to treat every portion of the curd alike, so far as possible, in all its manipulations, and then we get a product upon which fermentation during the curing process will go on evenly, and good flavor is more readily secured, than when the particles of the curd are unlike, or not in the same condition.

USE OF HEAT IN CHEESE MAKING.

The term "cooking the curd" in cheese making is a misnomer. It conveys to the mind a wrong impression and leads many astray. To make cheese properly, neither the milk nor the curds should be "cooked." The more you approximate to the cooking process the more you injure the cheese. Animal bodies are not cooked at a temperature of blood heat. As a rule in cheese making, no part of the process requires a temperature above blood heat. One hundred degrees is the maximum temperature that can be employed with safety. This is two degrees above blood heat, and is admissible only when heat is liable to pass off rapidly, and for the purpose of holding the mass at 98°. Heat is constantly passing off from the whey and curds, and the loss is more rapid when the temperature of the surrounding atmosphere is low. It is more rapid when a small quantity of milk is used than when a large quantity is collected together, hence we sometimes employ a temperature one or two degrees above blood heat in the process of solidifying the curds, in order to meet this loss of heat. It is a well recognized fact in cheese making that fine quality and delicate flavor cannot be secured when high heat is used in manipulating the curds. The best cheese are made at low temperatures, and when dairymen fancy the curd must be cooked to preserve it, they have an erroneous idea of the true principles of cheese making.

The manufacture of cheese is in part a chemical process. We have a material composed of various constituents, and the art is to separate these constituents, selecting those required to form cheese and expelling the others. Milk as it comes from the cow is properly prepared for food. It needs no further cooking to be assimilated, and what the cheese maker wants is to extract the caseine and butter, getting rid of the water and reducing the mass to a solid. The butter is not improved by cooking, neither is the caseine, and hence, as we find in practice, the best cheese is made when neither the milk nor the curds have been subjected to so high a heat as would cook them. After the curds are broken up we use heat for the purpose of expelling the whey. A change is constantly going on. The heat assists in developing an acid, which causes the curds to contract, expelling the whey. The process of separating the whey should be slow, and the whey should flow away gradually, otherwise there is a loss of oily particles. The butter is contained in the shells of caseine and is not acted upon by rennet. If the contraction of the caseine is rapid, the oily globules are forced out with the whey, instead of being retained and amalgamated with the mass, and you have a tough, leathery cheese. Milk which is exposed to the atmosphere and warmth begins to put on an acid condition as soon as drawn from the cow. In cheese making we want to carry this acid just far enough to expel the surplus whey, retaining the butter and a certain amount of moisture. If we stop short of the required point, too much whey will be retained and cannot be pressed out.

When the cheese is put upon the shelf this pent up whey decomposes, becomes acid, and parts from the caseine, and we have a leaky cheese. If the cheese is kept in a warm place and the whey is soon expelled, the cheese, though defective in flavor, may pass as second rate; but if the whey cannot find an exit, it soon becomes sour and putrid, and the cheese, in consequence, is positively bad. On the other hand, when the acid is carried too far, the curds part with too much moisture and we have a hard, dry cheese. What is understood, then, by the term "cooking the curd," is the application of a gentle heat for the purpose of developing a certain degree of acidity, that the whey may properly part from the solids, a sufficient amount being retained to carry on the process of fermentation when the cheese goes into the curing-room. It is very difficult to carry this acid to the proper point while the whey is in the vat. It is preferable, therefore, to draw the whey as soon as acidity becomes perceptible to the taste or smell, and allow a further development in the curds after the whey is drawn.

A good many cheese makers who get the idea that curds must be cooked like a piece of meat, often spoil their cheese by applying heat too rapidly and running the mass up at too high a temperature. They do not seem to understand the leading principle of this part of the process, which is a slow development of acid in the curds. Instead of heating gradually and watching for this development, they push the heat, thinking they can effect their object in cooking; the consequence is, an inferior product, destitute of that quality and flavor that the market now demands.

VIEWS OF MR. FISH ON HEAT IN CHEESE MAKING.

In discussing the question of heat in cheese making, Mr. A. L. FISH of Herkimer, N. Y., well known as a distinguished practical cheese manufacturer, as well as one of the early writers on dairy farming, has recently presented the following as his matured views on the subject of heat, and they deserve attention. He says:—"In contemplating the agency of heat in making and curing cheese, we are led to consider that cheese has a physical constitution, like other bodies, subject to growth and decay, that require a list of substances, in their formation, which is assimilated by special agencies and brought to an equipoise; in other words, brought into such a condition that opposing forces balance each other equally. Such a condition we denominate the constitution of animate and inanimate bodies. The condition or power to hold an equipoise or equilibrium of opposing forces, determines the liability to slow or more speedy decay and dissolution. I have hinted the capacity of heat to prevent and destroy consolidation; also, its indispensable agency in inducing relation and union of extraneous matter in forming solids. Its most judicious appliance in cheese making, where it is required to serve a double purpose, is the question to be discussed. First, what is a proper temperature to apply to the fluid mass (milk), in bringing it to condition most favorable for the aid and action of rennet in separating and dispelling such a portion of fluid parts as desirable, and no more, and why? My answer is, not exceeding 98°, because that is the point nature has fixed to sustain the most healthy and active condition in the animal organism. Hence, a higher temperature weakens the action of the rennet in bringing the mass to a unity. Any excess of heat applied to a part unfits it for a union with other parts. Solids are formed by cohesive attraction, which draws particles of matter of a sameness together. Any agency or condition that makes these unlike, prevents a perfect union. In cheese, it is manifest in swelling after being pressed, or by a rough, sticky, or crackly surface, and a lack of close adhesiveness of the meat of the cheese, which indicate that the agencies used in forming its constitution have not been equipoised in the process of manufacture. Such a condition involves the question, which of the agencies used is in fault?

INJUDICIOUS USE OF HEAT.

"Some will say weak rennet, premature acidity, putrefactive fermentation from some unknown cause, &c.; but few seem to appreciate that an injudicious use of heat may be a fruitful cause, while a proper use might be a preventive. I trust all practical cheese makers will agree with us in the assertion that curd having been exposed to 140° heat, and mixed with other curd not exposed to over 100°, will not make a good cheese; if so, does it not follow logically, that any portion of the milk or curd exposed to that degree of high heat, will not unite harmoniously with other portions exposed to much less heat? If such a varied condition is admitted to be wrong, the next question is, do we practice it, and if so, what is a remedy? From my observations in the usual mode of managing heat in milk and curd, and curing-rooms, I am convinced that sufficient care is not taken to suppress the action of heat when less is needed; hence a large proportion of the imperfections of our factory cheese is traceable to an injudicious management of heat. In explanation, I will address myself to the patrons of cheese factories first, because with them lies the first practical remedy, as they have the ability to suppress the action of heat upon the milk before it reaches the factorymen, by stirring and cooling it immediately after it is drawn from the cows, which should always be done to guard against the tendency of heat to induce acidity and putrescence. If the habit of thus cooling the milk to a low temperature was universal among dairymen, it would result in a profit that is now lost to all interested. The advantages would be more pounds and better quality of cheese from a given amount of milk, because the manufacturer would not be compelled to use means to hasten the separation of fluid portions of milk from the caseine too rapidly, which is always wasteful.

BEST MODE OF APPLYING HEAT.

"In considering the best mode of applying heat to the mass of milk or curd, I shall not favor or discard any patent or fixture now used for that purpose, but will lay down as a practical rule (and would invite the attention of skilled mechanics to it) that an apparatus or fixture by which heat is imparted or conveyed to the mass, the mildest and most uniformly to every part, and having otherwise the most perfect control of heat, is to be preferred, because a uniform low temperature conveyed to every part and particle of the mass, is the principle relied on to preserve a perfect affinity or sameness of condition. To insure the most perfect cheese, the less antagonism induced in the process of manufacture the more perfect cheese will be attained. Conveying heat by any means into a thin sheet or volume of water contained between the outer and inner vat I consider injudicious, because there is not water enough to soften the heat before it comes in contact with the inner vat containing the milk or curd. I am not able to understand how a large vat of milk or curd can be heated by discharging steam or boiling water into a thin sheet of water between vats without some portions of it coming in contact with a surface heated to a point that will melt the buttery globules and otherwise unfit it to harmonize with other portions not so exposed. I have frequently examined the heated surface of inner vats, and found it so heated as to burn my flesh, and an oily substance floating on the whey, and clots of curd resting on the overheated surface melted together, and I did not wonder that cheese made with such practice got out of flavor and became unsalable.

GUARD AGAINST OVERHEATING.

"As a guard against thus overheating I would suggest a widening and enlargement of the heating medium between the vats, so that the heat conveyed through it will be softened and equalized before coming in contact with the inner vat. It should be held in view by the vat builder, that the wider the space between the points of discharging heat, and the vat containing the milk or curd to be hot, the softer and more uniform will be the effect of heat, and the less liability to a deranged constitution in the cheese. When heat and rennet in their joint action are supposed to have dispelled a desired portion of the fluid of milk, it is essential to arrest uniformly their further progress through the whole mass to preserve an affinity of the parts to be pressed into cheese. This should not be done too suddenly before adding salt, as a sudden chill of the curd would cause it to reject the effect of salt to properly season the curd, which, while warm, has a tendency to expel animal odors if thoroughly stirred in cooling. After being salted warm, and packed, and covered to steep for ten minutes, then if well stirred, and cooled to 80° before putting it in press hoops, the action of the heat and rennet are so checked as to give the new agent (salt) control of opposing forces in the process of curing. The cooler the curing-room is kept, the less salt is required to preserve cheese from taint, and the less salt used the earlier the maturity of cheese. The proper construction of the curing-room is essential to a proper control of heat in process of curing.

DANGER OF HIGH HEAT.

"The danger of high heat is not past till cheese is ripened for market. A perfectly made cheese is often spoiled by too much and uneven heat in curing. A steady, even temperature should be kept, not exceeding 70°, with free ventilation at bottom and top of the room, so arranged that the outer air may be let in at pleasure at the bottom or near the floor below the cheese and pass out through draft tubes at the top of the room through the center, which should be made to be closed when a draft is not needed to carry off surplus heat or dampness in the room, or for changing the air.

HEAT IN CURING-ROOMS.

"Curing-rooms built tight with six inches space for air between inner and outer ceiling, with tubes six inches square passing through to the open air at the outer end, made to close at pleasure at the inside to reject too much air, placed once in ten feet on all sides of the room near the floor, with draft tubes twelve inches square once in ten feet through the center of the top of the room, will afford a sufficient circulation of air at all times in the largest sized rooms; the air chamber at the side and over the top of the room protects it from sudden effects of external heat. The upper floor or ceiling should be covered with sawdust or fine shavings, to prevent concentration of heat from above. No more windows should be used than are needed to give sufficient light, as they are seldom if ever needed for air. With such ventilation and construction of the curing-room, as described, I have found no difficulty in keeping any desired temperature down to 70°. If a succession of extreme heat is raising the temperature above a desired point, it may be checked by closing the ventilating tubes when the air without is warmer than desired, and placing ice in the room on a drainer over a tub or box to catch the water as the ice dissolves."

DR. WIGHT'S VIEWS.

In a recent discussion before the National Dairymen's Club, Dr. Wight, of the Whitesboro Factory, said:—"If the milk tends to acidity, less heat and more rennet should be used; if the milk should be tainted the converse would be the treatment, viz., more heat and less rennet. I have observed that the slight difference of not more than two degrees in warming the curd will at times make one or two cents per pound difference in the price of the cheese when sold, all other conditions being apparently the same. I have also noticed that when green cheese is exposed to too low a temperature in the early stages of curing, it invariably injures the texture, flavor and general quality of the product during all the future stages of curing. In fact, I firmly believe that if the milk should constantly be kept at a proper temperature, and the curing-rooms be kept at a temperature neither too low nor too high—all of which is barely and simply a work of art entirely under our own control—I firmly believe, I say, that these conditions being constantly and rigidly observed, we may readily save all that depreciation in the quality and price of cheese which now invariably takes place during the heat of summer; losing to the dairyman seldom less than three, and frequently five and six cents per pound. With the temperature of our milk and our manufactories kept at a sufficiently low degree during the months of June, July and August, we may preserve the cheese made during these months for the fall trade, and thus realize an equal, if not a higher price for them than we now do for our best fall cheese.

WARMING CURING-ROOMS BY STEAM.

"I will close with a few suggestions about the best mode of preserving the most equable and proper temperatures in our curing-houses. Thorough ventilation being premised, I would warm the rooms by steam pipes and cool them by the admission of cold air from an ice-house, keeping the temperature as near 70° as may be, equable throughout the building, and a little moist rather than too dry. By strict attention to these few things much improvement may be made in the quality and profits of our products."

Mr. Alexander McAdam, the very successful manufacturer of the Smith Creek Factory, said, "In making cheese now (very early in spring) we are making from milk three messes of which are skimmed and one new. When skimmed the milk is placed in a warm place where the temperature is adapted for the cream rising. Set at eighty, and coagulated sufficient to cut in thirty minutes, it commences to thicken in fifteen minutes. He used extra rennet for skim-milk cheese. He heated it slowly to eighty-eight. Sometimes in cold weather the milk is very sweet and it may lie five or six hours in the whey. He meant to keep the temperature about eighty-eight.

TEMPERATURE WHEN ONE MESS IS SKIMMED.

"When the weather becomes warmer he will use the milk with one mess skimmed, and then the temperature would be at eighty-two and heat up to ninety-two and keep to this temperature. This milk would require thirty-five minutes to coagulate. He was accustomed to have coagulation occur sooner than some factories, as some let it run an hour or even an hour and ten minutes. By scalding as low as eighty-eight, the curd keeps soft and the acid is developed before the curd becomes solid. He used more rennet, less salt and less heat when making skim-milk cheese than without skimming the milk. The salt is applied upon the slightest appearance of the acid. He used it at the rate of one and one-half pounds of salt to the thousand pounds of milk. The appearance of the cheese after coming from the press must be the guide to the temperature and according to the appearance of the cheese is determined the place upon the shelves. The curd should be put to press as soon as convenient after grinding, and before it gets too cool to face good.

MANAGEMENT WHEN FAILING TO FACE.

"If it failed to face, he used hot water and hot cloths under the follower and hot water upon the press board. If too much rennet was used the curd would be rather slimy and it would not unite as well, but if the rennet was sweet the taste would not be affected. He thought if too much rennet was used some of the excess would be held at least mechanically in the curd and would appear in the color.

TEMPERATURE FOR WHOLE MILK.

"He used with all new milk in spring manufacture a temperature of eighty-two, and heat to ninety-four, and in curing he would not use over sixty-five in the dry-house—such a handling would produce a fine-flavored cheese. The action of heat facilitates the action of the rennet. He would use more heat after applying the rennet. As a general thing he did not think two or three degrees in temperature would make a great difference in the price of the cheese when made. He thought time would modify the slight excess of temperature. He would heat whole milk up to ninety-six in the summer time."

ADVANTAGES OF A CELLAR UNDER CHEESE FACTORIES.

Mr. McAdam spoke of a cheese factory which had a good cellar under it. He said "In the summer time this cellar could be used with great advantage as a curing-room. And in the spring and fall the cellar could be used for a making-room, and the curing done above.

HOW IS THE RIPENING OF CHEESE AFFECTED BY THE MODE OF MANUFACTURE?

"This subject is quite important, as it is often necessary to manufacture cheese that will ripen very quickly. When the market is declining, to have as many of them as possible fit for sale, and consequently bring a higher price, is the great desideratum. On the contrary, when the cheese-market is advancing it is often advisable to make cheese that will take a much longer time in curing, so that in holding for higher prices there will be less danger of deterioration in the quality of the cheese by their becoming off in flavor. Now, in the ripening or curing of cheese, I regard the action of the rennet as the element that does the whole business; and, therefore, in making cheese that are to cure quickly, we have only to place the rennet in the most favorable circumstances for promoting its growth all through the process of manufacture, and to cure slowly, the opposite. Now, what are the most favorable circumstances for promoting the growth of the spores of the rennet?

"First, is the presence of the greatest quantity of butter in the milk to be manufactured into cheese. Second, a larger amount of rennet added to such milk. Third, by using a lower temperature in cooking or scalding the curd. Fourth, the absence or a minimum amount of acid in the curd, when the salt is added; and, Fifth, a less quantity of salt added to the curd; also by keeping the cheese in the curing-room at a higher temperature. Cheese made from tainted milk will naturally cure more quickly than if the milk was good. An exactly opposite process will check the growth of the spores of the rennet in the milk, curd and cheese, and cause the cheese to cure more slowly. Heat hastens the development of the acid more rapidly than the development of the rennet spores, and though heat hastens both developments, the acid is generated faster relatively. Cheese cured quickly ought to go into immediate consumption, as if kept, especially in warm weather, they deteriorate in quality very rapidly. And I think that the complaints of the English shippers about the defects in the color and flavor of American cheese, when held over winter, are mainly owing to the fact that these cheese have been cured too quickly to hold long."

These views above, from some of our most successful cheese-makers, and very recently expressed (1871), are worthy of attention.

SALTING THE CURDS.

The leading object of using salt in the curds is to arrest putrefactive fermentation, and hold the cheese in a condition to make a suitable article of food. Different nations, it is true, differ in their tastes. Some of the people on the continent of Europe have so educated their taste as to prefer cheese that is more or less tainted, but the English race, as a rule, demand a clean, well-flavored article. As we are manufacturing mostly for English and American markets, my remarks must refer particularly to the great bulk of goods made to suit, what may be denominated as the English taste. The Swiss, the Limberger, and other characters of cheese are now made to some extent in this country, but the quantity is so small when compared with the great mass of our product, that American dairymen do not generally understand what the peculiar flavor is which is esteemed in the cheeses referred to.

Salt is a very important agent in modifying the taste of cheese, and on the manner in which it is used, will depend in a great measure the character and reputation of the dairy in market. In the application of salt there can be but little doubt, that fine, clean flavor can be best secured in the cheese by salting when the curds are comparatively cool. Some manufacturers have the impression that salt is more efficient, and is more evenly distributed when the curds are quite warm. I believe it is a well-established rule among meat packers, that meats are secured in the best condition when salt is applied after the meat has cooled off. At any rate in cheese manufacture a fine, delicate flavor is only obtained when salt is applied to the curds at a low temperature. This rule is strictly observed in the celebrated dairies of England, whether it be Cheshire or Cheddar. Among the best Cheshire dairies, the heat at no time during the process of manufacture is allowed to run above 78° or 80°, and in applying salt, as a rule 75° should be regarded as the maximum temperature of the curds.

In addition to the liability of affecting injuriously the flavor of cheese, by applying salt while the curds are too warm, the salt has another effect. Its action is to harden the parts of the curd with which it comes in contact, surrounding them with a tough pellicle or coat of caseine, and thus preventing a free flow of whey. The whey should be thoroughly expelled before salting, for in no other way can the quantity of salt be regulated with certainty. If there is much whey in the curds at the time of salting, it will be no easy matter to guess at the quantity of salt that will pass off in the whey, and hence, when this kind of guess work is relied on by the manufacturers, the cheese will not be of uniform character. When too small a quantity of salt is used, the cheese ripens with great rapidity, and must be eaten when comparatively young, for it will soon get out of flavor. On the other hand, too much salt delays the ripening process; the cheese is long in coming to maturity, and is likely to be hard and stiff. It will be seen, therefore, that the quantity of salt to be used should be pretty accurately determined, according to the character of cheese we design to make. If we want cheese to ripen in thirty days from the tub or vat, and go into market early and be consumed, the quantity of salt must be regulated for that object; while cheese of long-keeping qualities, maturing slowly, and requiring a higher per centage of salt, must needs have the quantity also regulated with precision. When the curds are drained, and subjected to pressure for a short time in the hoop, and then broken up by passing through a curd mill, and then salted as in the Cheddar process, the proportion of salt can be regulated with great nicety. But in all cases, before salting, it is well to have the curds as dry as they can be conveniently made.

Another office of salt is to check the acidity of the curds. When the acid has been fully developed, and the process carried far enough, the application checks its further progress, and thus, in the manipulation, is made to serve a very important purpose in the hands of a skillful manufacturer. I can only announce some of the principles to be observed in the use of salt for cheese-making. What I particularly wish to impress is, that it cannot be employed at random, and that the making of fine cheese depends, in a good degree, upon the time, manner and quantity in which the manufacturer employs this agent for his work. The quantity of salt used by manufacturers varies according to the character of cheese to be made at different seasons of the year, from two and one-fourth to three pounds of salt to one hundred pounds of green cheese. In spring, when it is desired to have the cheese ripen quickly, as low a proportion as two to two and one-fourth pounds are used. In hot weather, two and a-half to two and seven-tenths pounds, for one hundred pounds green cheese are employed by the best manufacturers, and sometimes three pounds are used, and these proportions refer to curds that are not pressed before salting, and consequently are not thoroughly drained of whey. The rule among the best Cheddar dairymen of England is one pound of salt for fifty-six pounds of curd; the salt applied after the curds have been pressed for ten minutes in the hoop, and then ground in a curd mill, the temperature of the curds being from 60° to 65°. The English Cheddars are longer in coming to maturity than the usual style of American manufacture. It will be seen, also, that in the English process, the curds are made dryer at the time of salting, than generally obtains in American manufacture, and that in consequence a less amount of salt is required, or is used, than at the American factories.

THE KIND OF SALT TO BE USED.

Much has been said and written about salt for dairy purposes; the subject is by no means exhausted; it at least demands discussion and agitation, so long as dairy products continue to be injured and spoiled by the use of an impure article. Many people imagine that all salt in the market is pure; that if its appearance to the eye is clean, it contains no ingredients deleterious to butter and cheese, and that all the difference between a common article and the higher grades consists in pulverizing and putting up in neater packages. One can meet scores of men who will insist there is no other difference than that we have named, and that they do not propose to throw away money on a high-priced article. They prefer to prepare their own salt, crushing the lumps, if necessary, and chuckling over the superior sagacity they have to those who are throwing away their money on a high-priced article. Somehow it generally turns out that these very wise and saving persons have a low grade product of butter and cheese, and in consequence make sales considerably below those obtained for a first-class article.

I have sustained losses, both in butter and cheese, on account of using poor salt, and I have no confidence in the common barrel salt constantly to be met with in the market. Some of it may be good, and most of it may possibly do for the ordinary purposes for which it was intended, but the risk never should be taken of using it in butter and cheese. The dealers and experts in butter have for years cautioned the butter-makers to use nothing but the best Ashton or Liverpool salt. Chlorides of calcium and magnesium are the substances in salt which affect the taste and injure the quality of butter, however carefully otherwise it may be made.

Solar salt, produced by evaporating the brines, and which is largely used by packers, though it may not contain any deleterious substance that would affect meats, is very likely to contain a sufficient per centage of the chlorides to injure the taste of butter. To the cultivated taste of an experienced butter buyer, the least trace of the chlorides existing in the salt used betrays its presence. The Ashton is a very good salt, but is expensive. All the salt sold under the name or brand of Ashton is not genuine. Cheese and butter-makers should purchase their salt only of reliable dealers—men who know where they obtain their goods, and can vouch for their quality.

Somewhat recently the Onondaga Salt Works, at Syracuse, N. Y., have been manufacturing a superior dairy salt. Prof. Goessman, a distinguished chemist, was employed for some years at the Works, to superintend the manufacture of salt, with a view of freeing it from deleterious substances, and it is by his process that the brand known as "factory filled" or dairy salt is now manufactured. From numerous chemical analyses, it exhibits greater purity than the Ashton and other foreign brands, and its use among our best dairymen, for some years, has proved its perfect adaptation to the dairy.

At the New York State Fair, in 1867, there was a large exhibition of butter from different parts of the State, and among the packages were a number of samples, half of which had been salted with Onondaga and half with Ashton salt. The Committee, composed of experts, pronounced, in twenty-five cases, the butter cured with factory filled salt, made at the New York Mills, Syracuse, to be the best, as compared with its alternate package, cured in the same dairy with Ashton. Prof. S. W. Johnson of the Sheffield Scientific School, Yale College, has stated that the purest salt made in this or any other country that he is acquainted with, came from Syracuse, where the ingenious processes of Dr. Goessman were then employed, and that such factory filled salt must take rank second to none, as regards purity and freedom from any deleterious ingredients, especially the chlorides of calcium and magnesium. Gov. Alvord of Syracuse stated, at a meeting of the American Dairymen's Association, that the Onondaga Salt Company were prepared to guarantee their factory filled salt, and to pay for every pound of butter or cheese that was injured by the use of such salt; but the salt must come from the accredited agents of the Company, as certain dealers had been known to put up other salt in packages, using the factory filled brand.

I have referred to these facts, because I know the genuine article to be good; and as it is furnished much cheaper than the foreign or imported salt, it is of interest for dairymen to know it.

TO DISTINGUISH GOOD SALT.

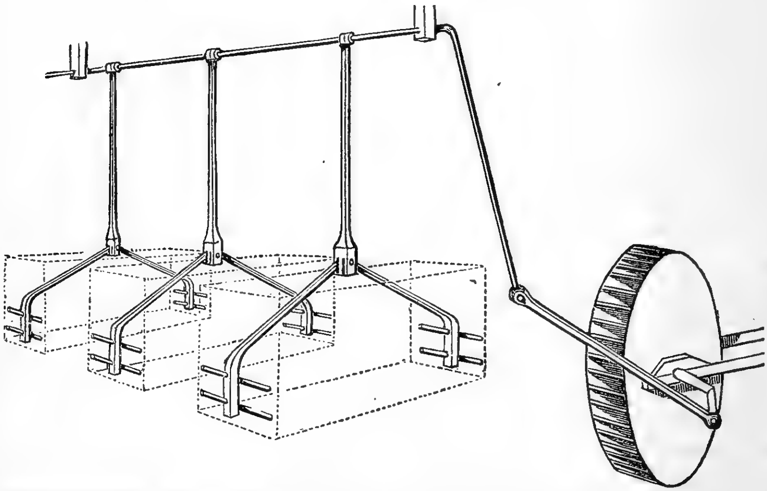
A satisfactory evidence of pure salt is its dryness, as the chlorides cause salt to absorb and retain moisture. In order that dairymen may be enabled to judge somewhat of the character of good dairy salt, from its appearance in addition to its dryness, I give the following from Prof. Charles H. Porter:—"A chalky or very fine grained or pulverulent salt is not the best for dairy purposes, and would at once be rejected, I believe, by experienced dairymen. A good dairy salt, ought, I imagine, besides being of proper chemical composition, to be of moderately fine grain, crystalline and transparent, and, when seen in a mass, of a pure white color; it ought to be free from odor, and possess that sharp, pungent taste characteristic of pure salt."

STIRRING THE MILK DURING THE NIGHT.

One of the mechanical devices brought to the notice of cheese-manufacturers, during the past few years, is the milk agitator. They commenced to be used in 1867, but since that time their use has become quite general, and our best factories in New York consider them of great utility. They are without doubt one of the useful improvements for cheese factories in this age of fertile invention. There are two or three kinds, but all work nearly upon the same principle, or accomplish the same object, that is, stirring the milk in the vats during the night, and are operated by the waste water from the vats. Before these appliances came in use, it was necessary for cheese-makers to stir the night's milk in the vats until it was reduced to a temperature of 60°. In hot weather the constant flow of water under the milk, or between the vats, was not sufficient to preserve it in good order, and this stirring had to be continued, from time to time, until a late hour of the night. It is evident if machinery can be introduced for this purpose, a great saving of labor is secured.

There is another object gained by stirring the milk at intervals during the night: the cream is prevented from rising, which is of great importance where butter is not made at the factory, as it is very difficult to get the cream which has once risen back again into the milk for cheese-making without loss; and again, the particles of milk being moved so as to be exposed to the atmosphere, it keeps in better order. The apparatus is quite simple, and consists merely of a wooden float, attached to an arm, which is carried back and forward, at intervals, across the vat, and operated by a water wheel or water box, which is kept moving by the waste water from the vats. Doubtless much benefit is often gained by this movement of the milk, especially when not in perfect condition, as the particles are being constantly exposed to the atmosphere, and improved by allowing bad odors to pass off.

During the summer of 1867 one of the best cheese manufacturers of Oneida wrote to me as follows:—"Believing, as I do, that the agitator deserves more extensive notice, and more general introduction into cheese factories than it has yet received, I desire to add my testimony respecting its merits and benefits. Some weeks since I consented to have the agitator introduced into the four vats of my factory, on trial; I am so far pleased with it, that I have come to the conclusion that it is a necessary appurtenance to my factory. It is not claimed for it, I believe, that a larger yield of cheese can be obtained by its use, though I am of opinion that a slight increase in quantity and quality will result, when the agitator is judiciously used; this will especially be the case in the cold part of the season: it certainly is a perfect preventive of the raising of any cream, and that this is an important advantage no one will deny. I find, also, that the milk in the vats, in the morning, has an incomparably sweeter, cleaner, fresher taste and smell than ever before; and this, notwithstanding the fact that my spring affords an abundance of excellent water, and the temperature of the milk in the morning, before the agitator was put in, had always been



AUSTIN'S AGITATOR, SHOWING WATER WHEEL AND MANNER OF APPLYING RAKES TO THE VATS.

from 54° to 58°. The necessity of stirring milk until ten, eleven and even twelve o'clock at night, as is the case in very many factories, is entirely obviated. If there were no other advantage arising, resulting from its use, this alone should be sufficient argument in its favor. Factory hands work hard, and if the night's labor can be dispensed with, it should be done. Of course, further experience and fuller acquaintance with its operations and effects may modify and radically change my views in relation to it. After the testimony of such experienced and successful cheese-makers as Col. MILLER and others, who used it last year, I hardly look for such a result. At present I heartily commend its use, only suggesting that, in my judgment, the motion of the frame and rakes should be slow—not over two or three strokes per minute." The experience of the past three years has confirmed these views as to the utility of this appliance.

USE OF ICE IN COOLING AND PRESERVING MILK.

The use of ice in cooling and preserving milk for cheese manufacture is practiced to a large extent. It is applied in various ways; sometimes by adding it in messes to the milk in the vats, or by placing it in large tin coolers, which are then immersed in the milk, and in various other ways, to suit the convenience of those who have the care of the dairy. Recently coolers have been invented, to be used for cooling milk with ice at the farm; but it may be well to caution those who employ ice for this purpose, that it should not be used in direct contact with the milk, or in any way in which the milk may come in contact with an ice-cold surface.

An impression prevails with many that no injury can result to milk from the use of ice, no matter in what way it may be employed. Ice, if judiciously used in connection with the dairy, is convenient and useful in hot weather, and especially so when the supply of water is limited, or its temperature is so high that the milk cannot be cooled down properly by it alone. But because the direct application of an ice cold surface does not do the milk any apparent injury for the moment, it must not be inferred that it has no remote influence upon the product of butter and cheese which may be manufactured out of such milk. All animal bodies, though they may be kept fresh and sweet for a long time when laid upon ice in an ice box, yet when exposed to the air and warmth rapidly decompose and become stale. When milk has been cooled by coming in contact with ice and then manufactured into cheese, the injury does not immediately show itself; but it has been observed that the cheese ripens rapidly, decays early, and will not keep in flavor like that which is made of milk, none of the particles of which have come in contact with a surface of lower temperature than 50°.

The butter makers of Orange county, N. Y., who have experimented largely with milk, are extremely cautious in the use of ice in connection with butter manufacture. It is sometimes necessary to use it during hot weather while churning, by breaking it up fine and applying it to the cream in the churn; but when ice has been employed in this way, the butter will not keep; though for present use the butter may be regarded as of prime quality. In 1868, during the month of July, we had extremely warm weather, and ice was used in the New York factories quite freely—often injudiciously. From an account of the cheese made that year, given by the English shipper, Mr. WEBB, it appears there was not a single factory sending cheese abroad that had it arrive and retain a good, clean flavor. He says:—"The English dealer and the English consumer alike began to get a surfeit of that strong flavored, loosely made, bad-keeping quality, which was the universal characteristic of the July make of cheese. This inferior quality," he remarks, "was doubtless largely owing to the intensely hot weather then prevailing. But whatever the cause, your very serious attention should be directed to the discovery of a remedy—for not a single dairy, as far as my personal experience and pretty full inquiries extended, not one single dairy stood the test of that most trying month. Even those dairies that for a series of years have been always and uniformly excellent, did not hold their own last July; but proved in the matter of flavor and keeping qualities to be no better than the great majority of your State factories."

Now how far the injudicious use of ice may have added to the trouble I am unable to say; but I have no doubt that some share at least may be justly laid to that source. I have personal knowledge of some factories where large quantities of ice are used to cool the milk by applying it directly to the milk in the vats, and the milk is apparently in good order, and yet great complaint is made of the cheese manufactured as soon "off flavor," while it must be observed that the best flavored goods are not made at those factories which use the ice in this way; but where there is an abundance of pure, cold water—cold water and an agitator which stirs the milk during the night, worked by the waste water from the vats, give practically the best results. As this question of ice is somewhat new to the dairy public, and has not been very closely investigated by cheese manufacturers, it will be sufficient to call attention to the matter, with the suggestion to avoid as far as possible the use of ice, or an ice cold surface in direct contact with the milk.

DRAWING OFF THE CURDS.

Where large quantities of milk are delivered at one point to be manufactured into cheese, it is important to have every convenience, so that it may be handled easily and expeditiously. Without convenient appliances the cheese factory system would be a failure. It would be very difficult, and perhaps impossible, to make the fine character of cheese now demanded in the leading markets of the world by massing the milk in large quantities, and using old appliances in operation before the factory system was inaugurated. It is to the perfection of cheese factory machinery and the mechanical devices for manipulating milk in proper time that the manufacturer, in a great measure, owes his success. It is true, intelligence and skill, with habits of close observation, are necessary in cheese manufacture, and no amount of mechanical contrivance can be substituted for them. But as many of the operations in cheese making admit of no delay, but require immediate and rapid action, the appliances must be suited to the work, or the most skillful operator will be liable to fail in securing the best results. What seems to be a most fortunate thing for American cheese dairying is, that whenever any essential point or principle is discovered in manufacture, the inventors immediately step in with devices or contrivances for easily securing the object desired. I could mention several of these which are unknown among the best Cheddar cheese makers of England, and which doubtless would not yet have been invented here had we remained under the old system of farm dairies.

THE SHUTE.

Among the somewhat recent improvements in cheese factory arrangements is the *Shute*. This invention originated in Herkimer county, and is now being adopted by all the new or improved modled factories. The shute is now introduced among those factories in New York which produce cheese that sells for extreme or "top prices." I do not presume to say that the shute is the only or chief cause of the high reputation which these factories enjoy, and yet I have no doubt it has contributed somewhat in effecting this reputation. Indeed, in some instances at least, the manufacturers are from factories where the shute is not employed, and only in taking charge of the shute factories have their reputations reached the enviable position they now enjoy. The shute is an arrangement in the vats, whereby all the curds in the vats may be thrown upon the sink in a moment. In this arrangement the floor of the manufacturing room at one end of the vats is sunk some four feet below the part upon which the vats stand. Here is placed the sink upon rails, and in some instances immediately back of it the presses. The ends of the vats come out nearly to the fall in the floor, and in the end of each vat there is a large circular opening secured with an iron door, water-tight, which is opened for the discharge of the curds. When a vat is to be emptied the sink is rolled along opposite the vat, the vat canted down, the tin conductor placed under the orifice or point of discharge in the vat, and the iron door removed. In this manner the vat is rapidly emptied of its contents, and the curds at once spread out upon the sink to cool. Old cheese makers will readily understand the advantage of this arrangement. When the acid is properly developed it should be immediately checked. With large masses of curd, and under the old arrangement, it was very difficult to time operations to meet this condition. To dip the curd out with pails often required so much time that, do the best you could, the acid would often be carried too far before the work was accomplished. As the temperature of the atmosphere varies from day to day, and the condition of the milk is also different, it was exceedingly difficult to calculate the changes that would occur in a few minutes. It will be seen, then, how great the advantage is when the manufacturer can empty his vat at once. Sometimes acidity goes on gradually for a time, and then all at once is developed much more rapidly than was anticipated. With the shute you are master of the situation; you have the whole matter under control; you manipulate your forces to produce an exact result; you march to the very threshold of danger, but do not step over the line; you have control of the shute, and at the word of command you feel that you can count upon accomplishing the object desired. The shute is, without doubt, of considerable assistance in securing the make of nice, marketable goods, and its adoption can be recommended on this account, in addition to the labor it saves over the old plan of dipping.

PROCESS FOR MAKING EXTRA FINE CHEESE.

We have now discussed at length some of the leading points in cheese manufacture, and I here give some of the most recent views and practice of manufacturers who have been successful in making a high-priced cheese, and in this connection the following paper of Mr. A. McAdam, read at the Dairymen's Convention of 1871, so fully explains in regular order and in detail the method of cheese making at the Smith Creek factory, that it will be useful. I may remark in passing that the cheese made at the Smith Creek factory in 1869 and 1870 was regarded by dealers and shippers as a fancy article, and it sold at the Little Falls, N. Y., market uniformly at the highest price paid for best factories. Mr. McAdam says:—"I will give a description of the process as I practice it, and state some of the reasons why I practice it. As you are probably all aware, the milk that is delivered at cheese factories is not always in the same state, sometimes being tainted or partially putrid, sometimes sour, or nearly so, and sometimes it is, what it always ought to be, perfect. I propose to describe the process, first, when the milk is right and good; second, when it is partially sour, and third, when tainted. The evening's milk, when delivered at the factory, ought to be cooled so as to reach a temperature of 58° to 62° in the morning. When the morning's milk is added, it is heated to 80°, then enough rennet is added to coagulate the mass in as nearly forty minutes' time as possible. When the curd has attained sufficient consistency, it is cut four times—twice with the horizontal curd knife, and twice with the perpendicular one, with a short interval between each cutting. The curd is then gently manipulated and heated to 96°, care being taken to prevent the curd from packing on the bottom of the vat; the time required for heating being from an hour to an hour and a-half. The stirring is continued for ten or fifteen minutes after this heat has been attained, and the curd is then allowed to pack on the bottom of the vat, where it lies undisturbed until the separation of the whey from the curd becomes necessary. Up to this stage the process is almost identical with that practiced in manufacturing cheese in the usual manner.

"In the manufacture of American cheese (I will so designate the method usually practiced, to distinguish it from the process, which I will term *Cheddar*), it is of the utmost importance to determine the precise time at which to separate the whey from the curd, and it is also an operation requiring the greatest amount of skill and experience, as well as the exercise of the nicest sense of taste and smell. But in the manufacture of Cheddar cheese it is not of the same vital importance, as the whey can be separated from the curd from half an hour to an hour and a-half before acidity is developed so as to be perceptible; and, on the other hand, the whey can be left on the curd till the acid is distinctly developed, without materially affecting the quality of the product. As the acid or souring generally makes its appearance about noon, in summer, the Cheddar system gives factory hands more time for dinner, and consequently they can masticate their food, instead of having to bolt it, as has to be done in many cases. When the whey is drawn off, and the vat tipped down on one end, the curd is then heaped on each side of the vat, leaving a space in the middle to allow the remainder of the whey to pass off. I may here state that when the "shute," or flood gate, is not used, there ought to be, in the Cheddar system, a faucet in the vat, to allow the whey to pass off as it drains from the curd. After the curd has laid in a heap on the bottom of the vat for fifteen or twenty minutes, and the original particles of curd have become amalgamated into a solid mass, it is then cut into convenient pieces with a knife, and turned over, and so left until the curd has become sour enough for grinding and salting, which is determined by the taste of the whey that drains from the curd. This whey should now have a sharp, sour milk taste, which can be understood by any intelligent cheese maker, after a few days' experience. The curd is then torn by hand into strips of two or three pounds weight, and allowed to cool for a short time, in order to allow the butter in it to become solid enough so as not to escape during the operation of grinding. The curd is then ground into pieces, averaging about the size of hickory nuts. Five hundred pounds of curd can be ground by hand, with McAdam's curd mill, in from five to fifteen minutes, according to the toughness of the curd and muscle of the operator. The salt is then immediately added and mixed thoroughly, at the rate of from one and a-half to two and a quarter pounds per one thousand pounds of milk, according to circumstances. The curd is then ready to be put into the hoops for pressing.

"2d. Mode of procedure when the milk we have to handle is (from whatever cause) sour, or partially so; and such cases are liable to happen in any factory, however well regulated. You are all aware that when milk is partially sour, it will coagulate in the same time as sweet milk with the addition of considerably less rennet. But to such milk I usually add more rennet, instead of less, so as to have the coagulation occur very quickly. As soon as the rennet has completed its office, I commence cutting and working the curd much more rapidly than usual. In such cases I use very little heat in scalding—seldom heating over 86° or 90°, according to the severity of the case. Indeed, in some instances, when the milk is *very* sour, I do not think that it is advisable to heat the curd at all after coagulation. I reason in this way: just as good cheese can be made without scalding at all, as with it; the reason that we scald the curd (if heating to a temperature of 98° can be called scalding), is to develop the acid sooner, and if, when the curd is inclined to develop acid sooner than usual, we heat it to a temperature of 96° to 98°, we hasten the action of the acid, which is the very thing we are trying to avoid. In other words, when the acid in the curd is developing too fast of its own accord, we develop it still faster by means of heat, and thus aggravate the evil. After this curd is cut up, the whey must be removed from it as fast as it makes its appearance, and as soon as practicable the vat must be tipped down and the curd thrown to the upper end of the vat. The curd at this stage is very sloppy, as it contains considerable whey. One person should now cut it into small pieces with a knife, and another be employed in turning the pieces over and piling them up in heaps, so as to liberate the whey, which passes off in a continuous stream. When the curd has assumed a proper consistency it must be ground and salted; the quantity of salt used must be according to the amount of whey contained in the curd, which is generally, in such cases, considerably more than usual. In extreme cases, the whole process, from the adding of the rennet to the mixing in of the salt, can be performed in less than an hour.

"To explain why more rennet is needed when the milk is partially sour, I will refer to the address delivered by Professor Caldwell last year, before this Convention, and also to the able and highly useful paper read by L. B. Arnold, Esq., on 'Rennet, its Nature and Use,' before the same Convention. These gentlemen demonstrated to us very clearly that the acting principle of rennet consists of minute globules, or spores, which feed upon nitrogenous substances, and when placed in such, at a favorable temperature, multiply very rapidly. Now a quantity of rennet, containing a vast number of these spores, placed in a vat of milk which is highly nitrogenous, at a temperature of 80°, which is favorable to their growth, will multiply in a short time to such an extent as to cause its coagulation. And their action by no means stops here. They have still a very important mission to perform, viz., that of curing or ripening the cheese. And if the presence of these spores in the cheese, cures or ripens it, an excess of them will ripen the cheese more quickly, and *vice versa.* Now we all know that a sour cheese, or a cheese which contains an excess of sour milk spores (Arthrococci), takes a much longer time to ripen than a sweet cheese, and *vice versa.* Therefore, to have a cheese cured in a given time, the spores of the Micrococci and of the Arthrococci, must be contained in it in relative quantities. So, when we have a vat of sour milk to handle, where the Arthrococci are in abundance, we must add more rennet to counterbalance their action on the nitrogenous ingredients of the milk, and thereby cause the cheese to ripen much quicker than if less rennet had been added. I have found by experiment, during the past summer, that cheese made from sour milk in the above manner will cure as fast as other cheese, but they will require more annatto to make them of the same color, these sour milk spores appearing to have a destructive effect upon annatto. I have likewise noticed that such cheese will have more tendency to mold, but the flavor will not be objectionable.

"3. When the milk is tainted, or has an excess of putrefactive spores. This tainted milk occurs, in some localities, in hot weather, no matter what care is taken in cleaning the utensils with which it comes in contact, and I think that the milk is damaged in most cases before it is drawn from the cow. But of course it can be greatly aggravated by being brought into contact with unclean milk pails, strainers, cans, &c., which have not been properly cleansed, and therefore contain numbers of those putrefactive spores clinging to their seams and crevices, and which spring into new life and activity on being brought into contact with the warm milk. During the past season, from the middle of June to the middle of September, in a factory of over nine hundred cows, I did not have a vat of milk which was not tainted, most of it very badly, and over one-third of it so much that the curd floated. The cheese made from this milk sold for the highest price in the Little Falls market. In handling such milk I prefer to have the temperature of the evening's mess about 68° or 70° in the morning before the morning's milk is added, for two reasons. First, it has been shown that the putrefactive spores are in great abundance in such tainted milk; by leaving the evening's milk through the night at a higher temperature, we promote the growth of the Arthrococci, or sour milk spores, and these check the growth of the Micrococci, and counterbalance their action to a certain degree. Second, when the milk is left through the night at a higher temperature, a great number of the putrefactive spores pass off in the form of gas, especially where the milk agitator is used. This we know by the foul odor it emits when warm, but when the milk is cooled to a low temperature, this gas is not so volatile, and does not escape so readily, as we can perceive by its emitting little or no smell. But the cooling of the milk does not kill the Micrococci; it only partially prevents their escape, and though at the same time cooling the milk, also retards their growth as well as their escape; it also retards the growth of the sour milk spores, and these are much more efficient agents for the prevention of putrefaction than cooling is. Therefore, I maintain that the less tainted or putrid milk is cooled, so as not to be absolutely sour in the morning, the better the product obtained will be, if the milk be properly handled. I know that some cheese-makers prefer cooling such milk to as low a temperature as possible, and add sour whey with the rennet in the morning, and have very good success, but I prefer the former method, as by it the formation of the putrefactive spores is checked at a much earlier stage of the proceedings. With this difference of cooling the milk, my process is the same with tainted milk as with good milk, until the separation of the whey from the curd. When tainted we allow the whey to remain on the curd until acid is slightly perceptible, whether the curd floats or not. The whey is then drawn off and the curd handled as before. If the curd is badly tainted, while lying in a mass at the bottom of the vat, it will swell up to twice its original size, like dough under the action of the yeast, and when broken emits a very offensive odor. The exact degree of acidity to be allowed to develop at this point is the most important, as well as the most difficult thing to determine in the whole management of floating curds, as the odor and taste of both the curd and the whey that drains from it very much resemble acid, and are in a great many instances mistaken for it. The acid ought to be developed just enough to kill the taint, and no more, and the result, notwithstanding the assertions of some to the contrary, will be a fine cheese. After the requisite amount of acid has been determined upon, and the curd ground and salted (using the same amount of salt as when not tainted), the curd must be cooled and ventilated as much as possible before being put to press.

"I do not pretend to say that cheese can be made from tainted milk and floating curds, possessing quite as much of the fine, nutty aroma as from curds properly handled which are not tainted at all. But I do assert that I have seen cheese made from floating curds, in several factories during the past summer, that were perfectly close, rich and meaty, having no objectionable flavor, and which not one expert in ten would object to.

"One other fact I wish to mention: It requires more milk when tainted, to make a pound of cheese, than when it is not. One reason for this is, that more acid must be present in such cases, and, of course, the more acid the less cheese. In the Smith Creek Factory, last summer, it took two pounds more milk to make a pound of cheese in July than it did in April.

"I have endeavored to tell you how I practice grinding curds. I will now try to tell you why I practice it. In the first place, I think that it requires less milk to make a pound of cheese; in the second place, it does not tax the judgment of the cheese-maker so much, or require so much skill and attention; and, in the third place, I think that cheese made by the Cheddar process will be closer, and at the same time appear more rich and buttery, and will cure faster. It takes less milk to make a pound of cheese because the whey is drawn from the curd before the acid is perceptible, while in the American system, the whey has to be left on the curd from ten to sixty minutes after acid is detected, in order to insure a good, solid cheese, and you all know that sour whey will eat or digest grease from any substance containing it, with which it comes in contact. The longer the curd is exposed to this acidity in the whey the slimier the whey becomes, on account of the grease it has taken from the curd, and, in fact, some cheese-makers determine when the curd is ready to dip into the sink by the sliminess or sudsing of the whey. The quantity of butter which passes off unseen in the American system is certainly more than is contained in the small quantity of *white* whey which comes from the cheese when pressing in the Cheddar system.

"During the past season, notwithstanding the general complaint that the milk did not yield well, and the fact that over half of the cheese made at Smith Creek Factory was from tainted milk, we used only 9 9-10ths pounds of milk for one pound of cured cheese. And the reason why the Cheddar cheese will appear more rich and buttery, with the same solidity, is that when the whey is drawn from the curd before the acid is detected, the action of the sour milk spores is retarded, and the rennet, at work in the mass of warm curd, is allowed full play. And, as the rennet cures the cheese, it will therefore cure sooner, and, curing sooner, will be richer and more buttery at the same age."

HERKIMER COUNTY "FANCY FACTORY CHEESE."

As the manner of making a high-priced cheese is always of interest to manufacturers, I give some of the leading features at a few fancy factories where "gilt-edged" cheese is made. The processes are those adopted in 1870. At the North Fairfield Factory, the temperature of milk in the morning is 56°. The night's milk is cooled by passing a stream of water between the vats and underneath the milk vat. Rennet is added for coagulating when the milk has been raised to a temperature of 84°. After coagulation is perfected the curds are cut first with the horizontal curd-knife, which leaves the mass in thin sheets. Then follow with the perpendicular knife, cutting lengthwise of the vat. Let the curds now stand ten minutes, or until the whey forms; when the curds are cut with the perpendicular knife across the vat.

The breaking having been perfected, heat is begun to be gradually applied and is continued until the mass reaches a temperature of 98°, the time occupied being one and a-half hours or thereabouts. It is regarded of great importance to heat slowly, and care is taken that the increase in temperature in all parts of the heating process is regular and gradual. Sour whey is not usually employed, as it is preferred that the acid be developed in heating. The curds are taken out of the vat into the sink at 90°—the acid having been developed—and they are left exposed in the sink to cool. If acid has by chance been carried too far in the vat, cold water is conducted between the vats, under the curds to cool them rapidly. It is preferred, however, to cool the curds by exposing them to the air, as they are spread out in the sink.

When the curds have been cooled down to a temperature of from 75° to 80°, and also are thoroughly drained of whey; they are salted in summer at the rate of 2 9-10ths pounds of salt to one hundred pounds of green cheese, and for September about a tenth of a pound less salt. If the milk in hot weather is not all right, or if tainted, particular attention is given to have the curds exposed a long time to the atmosphere. The temperature of the curing-room is kept at 70°, or as near that point as possible.

In May the average quantity of milk for a pound of cured cheese was 9 37-100ths pounds; in June, 9 3-10ths pounds, and in July 9 7-10ths pounds. The cheese on hand at the time of my visit, were meaty, solid and of uniform fine flavor. The factory is convenient in its arrangements, but the building is very plain and cheap in appearance.

The factory of the Norway Association receives the milk from four hundred cows, and careful attention is given among patrons to deliver clean, sweet milk. An agitator is kept moving in the night's milk, and the temperature of the water is reduced with ice, so that the night's milk will stand in the morning at a temperature of 60°. Mr. James, the manufacturer, sets the milk for coagulation at 84°, and during the process of scalding 98° is the highest temperature employed. The best factory filled salt is used in spring at the rate of two and a-half pounds to one hundred of curd; in summer the salt is three pounds, and in fall two and seven-tenths pounds.

As at other factories where high-priced cheese is made, the heating process is very slow and gradual, requiring from one and a-quarter to one and a-half hours. Great attention is paid to the development of the acid, and Mr. James attributes his success to the faculty of distinguishing the proper condition of the curds in this respect, and to their exposure to the atmosphere in the sink until properly matured. Of course these peculiar conditions of the curds cannot be described in words, but must be learned by experience.

Mr. JAMES says he likes to develop the acid "sharp" through June, July and August, but in fall not so much. As soon as it can be detected in the vats, the whey is immediately withdrawn, and as I have before remarked, the appliance of the shute is here of service in taking immediate advantage for regulating this condition of the curds.

The cheese at this factory are pressed in fourteen and a-half inch hoops, weigh about sixty pounds each. They are slightly colored. At the time of my visit fifteen cheeses were being made daily. The highest receipts of milk during the season were ten thousand pounds, which made eighteen and a-half cheeses daily.

THE "COARSE CURDS" PROCESS

is followed at the Cold Creek Factory, and whatever difference of opinion there may be as to the merits of this process, it is just to say that the cheese shows it to be a success. I saw the Cold Creek brand in England in 1866, and heard dealers express their opinion that it was among the best of the American factories. Since that time, if measured by the test of prices at home, the process, at least in Mr. HOPSON'S hands, must be considered a success. What is claimed in the coarse curds process, is the production of cheese, solid yet mellow in texture, having a sweet, nutty or new milk flavor, or as the trade expresses it, "clean flavored;" and finally, a better retention of the butteraneous matter of the milk, than in the ordinary course of manufacture.

The theory of the coarse curds is, that the less the cutting or agitation of the curds while in a soft state the more butter you retain, hence the curds are cut or broken no more than is absolutely necessary, while the stirring is of the gentlest kind, and just sufficient to keep the mass from clinging together. Mr. HOPSON sets the milk for coagulation at 80°, using a sufficient quantity of rennet to thoroughly coagulate the mass fit for the knife in an hour. Then he commences cutting with a gang of steel blades, lengthwise of the vat, going through once.

The mass is now left at rest from ten to twenty minutes, until the whey begins to rise. Then a four-bladed knife (with blades three-fourths of an inch apart) is used for the cross-cutting. It is set at an angle of 45° with the bottom of the vat, and run through the mass crosswise of the vat. Then if there is likely to be no immediate change in the whey, the mass is left at rest for ten or fifteen minutes, and the knife used again across the vat, the operator standing on the side opposite to where he stood for the previous cutting. Inexperienced cheese-makers, or those who do not understand the philosophy of cheese-making, advise that all the cutting be done as quickly as possible, and if an instrument could be made for the purpose, would prefer that all the cutting should be done instantaneously. This is evidently injudicious, as the whey forms slowly, and a complete division of curds at once in their tender condition cannot be effected without liberating the oily particles, and thus causing waste. Such cutting is admissible only when acidity is progressing rapidly, and all parts of the process require to be hastened.

In the coarse curd process, the cutting having been performed as just described, it completes what is understood by "breaking"—for no other division or breaking up of the particles is deemed necessary. Heat is now begun to be applied very slowly, and the mass is stirred in the gentlest manner possible, and no more than to prevent the curds from running or clinging together. Great attention is paid to careful handling in this part of the process, in order that none of the buttery particles be pressed out, the theory being to let the curds do their own work as far as possible. The time of heating up is usually about an hour or an hour and a-quarter, the mass being raised to 100°. After heating, the curds are only stirred occasionally to prevent matting, and the mass remains in the vats till the acid is properly developed. Mr. Hopson depends for the most part upon the sense of smell in determining the degree of acidity required, and with long practice and good judgment in this respect, he is able to time operations so as to manage his curds with great uniformity. The curds are now thrown into the sink to be exposed to the atmosphere, where they are stirred, and when properly cooled down and the acidity carried to the exact point desired, salt is applied.

THE SALTING

during the summer is at the rate of three and a-half pounds salt to one hundred pounds curd, and it is thoroughly and evenly incorporated with the curds. In spring and up to the 10th of May three and a-quarter pounds salt is the rate. No sour whey is used except that employed for soaking the rennets. The curds when ready to salt, appear to be in particles about the size of chestnuts. They have a very nice look and feel, being what cheese-makers term "lively."

Although this is an old factory the buildings are in good repair, clean and sweet, with neat surroundings. The size of the dairy-house is thirty by one hundred feet, and the manufactory, which is a separate structure, thirty-six by thirty-six feet. Milk is delivered from five hundred and fifty cows. Ordinarily the cheese is pressed in fifteen and a-half inch hoops, and will weigh sixty-five pounds each. The factory is supplied with an abundance of pure spring water of a temperature of about 52°. In summer a stream of water is kept flowing under the night's milk in the vats, and the milk is stirred also during the night with Austin's agitator.

On the 8th of September, 1869, Mr. Hopson had an order for one hundred large cheeses, eighty colored and twenty white. The order was completed on the 12th of October. These cheeses weighed three hundred and thirty pounds each, and a handsomer lot could not well be got together. I tested a large number of cheeses in the curing-room, and found them uniformly very meaty, and of clean and delicate flavor. Something of their character may be indicated from the fact that twenty-two cents per pound was offered by a purchaser in our presence for the lot of large cheese, the highest market rates at Little Falls at that time being nineteen cents.

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About two miles east of Salisbury Center is another "fancy factory," the "Herkimer County," or "AVERY & IVES"—giving the name of the proprietors. This is an old factory, and the manufacturer, Mr. E. B. FAIRCHILD, has been here seven years. Mr. FAIRCHILD is, without doubt, one of the best cheese manufacturers in the State. His cheese stands high among the "fancies." He follows the coarse curds process, though not precisely in the steps of Mr. HOPSON. His cheese is very solid, meaty and fine-flavored. An old cheese-dealer and noted expert remarked to me, on the day of my visit, that probably nothing finer could be found in the State than the lot of cheese then on the shelves at the AVERY & IVES factory.

The factory takes the milk of six hundred cows, and the receipts on October 23d were five thousand pounds, and made into nine cheeses, which weighed sixty-five pounds each; in shape, Cheddars, being pressed in fourteen and a-half inch hoops. The establishment is in two buildings, the making department being thirty by thirty feet, and the dry house one hundred by thirty-six feet, two stories high. The milk is set at 80°, the highest heat in scalding 100°. The curds are cut coarse, somewhat similar to Mr. HOPSON's at Cold Creek, and the time of heating and extreme care in handling the curds are also similar; but the salting is not so high, the rate in summer being three pounds, and in fall two and eight-tenths pounds salt to one hundred pounds curd.

Mr. FAIRCHILD thinks the fine texture of his cheese results in a great measure from having the milk in perfect condition at the commencement of operations and then employing heat slowly, manipulating the curds in the gentlest manner, and finally, accuracy in developing the degree of acidity. During cool weather in the fall, sour whey is added with the rennet to the milk, at the rate of two pails whey for four hundred gallons of milk. He thinks coarse curds make a more meaty cheese and produce a larger quantity of cheese from a given quantity of milk than fine curds. Acid is developed in the vat with the whey rather than in the sink, and from long practice and close watching, he is able to detect the changes from time to time very accurately. The practice at other factories might be given, but these described will suffice, it is believed, for all practical purposes.

MAKING CHEESE FROM A SMALL NUMBER OF COWS.

If there happen to be three or four neighbors similarly situated, that is, each having but two or three cows, it will be a good plan for all to join together, delivering a certain quantity of milk daily at some central neighbor's house, where the cheese is to be made. There will be no very great trouble in this, and by assisting each other, all may be supplied. As the labor in manufacture will be no more for ten pails of milk than for four, and as the cheese can then be made up at once, it will be advisable to associate together whenever practicable.

Ten pails of milk will make say twenty-five gallons, and the twenty-five gallons will give a cheese of twenty pounds, and perhaps a trifle over. If the milk is worked in the manner I have described, the curds may be pressed in a hoop eleven inches in diameter and about the same hight. Small cheeses of this kind need not be bandaged. After coming from the hoop, they should be oiled over with a little fresh butter to prevent the rind from checking, and may be placed upon the shelf. They will need turning every day, giving the surface a smart rubbing with the hand, which will prevent the cheese flies from securing a safe deposit of their eggs. If the rind of the cheese gets dry, it will be well to oil again with fresh butter. If properly cared for the cheese will begin to be mellow in four or five weeks, and will be eatable, though age will improve it, and when six months old it should be of delicious flavor and quality if well made.

DOUBLE CURDS.

But if the quantity of milk is too small to make a curd for one pressing, then resort may be had to what is termed double curds. These are managed after the following manner: The milk is treated precisely as if there was sufficient for a cheese. After the curds have been drained and slightly salted and are ready for the hoop, they are set aside in a cool place in the cellar until next day. Then, after the next curds are ready, the previous day's curds are treated with warm whey, so that they may be broken up, when they are drained and the two days' curds are thoroughly mingled together and salted. They are then put to press, and will unite together the same as if they had been a " one day's cheese."

I have seen some most excellent cheese made in this way, cheese as fine in flavor and quality as one could wish to see. Sometimes curds are kept in this way three days, or more, until a sufficient quantity has accumulated to make a cheese of the desired size. In this way cheese can be made when only one cow is kept.

GRAFTING THE CURDS.

There is another way of managing the curds, called grafting. As soon as the curds are ready they are put to press. The next day the hoop is taken off and a thin scale taken from the top of the cheese with a sharp knife, and the fresh surface made rough with a fork. The top rind and the upper edges being pared off the parings are broken up and warmed by the addition of whey. They are then mingled with the new curds and placed in the hoop on top of the previous day's cheese and put to press. The two days' curds will adhere, and in this way small quantities of milk may be utilized in cheese-making. Grafted cheese should always be bandaged, for unless the whey is very thoroughly drained from the curds, the two sections or grafts sometimes will not adhere so firmly as the parts where they are not joined. It is a good plan in grafting cheese, after paring off the rind as I have described, to cut across the cheese two or three times, taking out a small triangular strip. Some people after paring the rind and cutting across as above, make the upper surface also rough by scraping with the point of a knife or fork. This is done for the purpose of giving the new curds a stronger hold on those of the previous day.

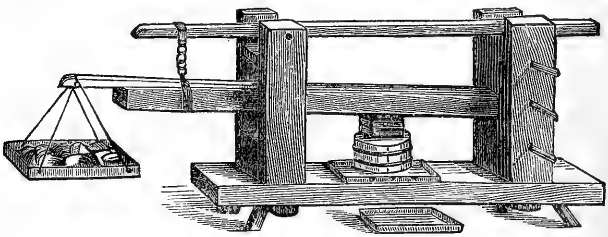
MAKING CHEESE WITHOUT PROPER APPARATUS AND FIXTURES.

Sometimes the farmer who keeps only a few cows to supply his family with milk and butter, would like also to make a few cheeses for family use; he does not care to make cheese to sell, and therefore hardly feels able to purchase cheese apparatus and fit up a dairy-house after the most approved models; this he thinks would cost more than to purchase his supply of cheese in the market. But it often happens that where this state of things exists, the money cannot be spared for buying cheese, and so this luxury is dispensed with at the family table.

Let us see now, how cheaply we can arrange for a primitive dairy. If nothing better is at hand, a common wash-tub, clean and sweet, will answer the purpose for setting the milk and working the curds. A hoop must be had from the cooper. Let it be ten inches in diameter, top and bottom, by twelve inches high, and fitted with a follower.

A PRIMITIVE PRESS.

A very good press may be made in a few hours from a twelve-foot plank, and a few pieces of scantling. About a foot from either end of the plank



THE OLD-FASHIONED LOG CHEESE PRESS.

set up two short pieces of scantling four and a-half inches apart. Fasten them firmly to the plank with bolts or pins. The lever may be a joist, four by four, or four by six, and fourteen feet long. One end is secured by a pin passing through the uprights at one end of the plank, and it is to move freely up and down between the uprights at the other end. A weight hung at one end of the lever and you have a press that will do good service.

The weights at the end of the long lever are a stone or two from the field. There may be another lever arranged for raising the long lever or press-beam, without removing the weights, which are stationary. We give an illustration of an old-fashioned log press.

The hoop is placed near the stationary end of the press-beam, and blocks put upon the follower, the press-beam let down upon them, and in this way the cheese is pressed. A long, thin wooden knife will do for cutting the curds. A gallon of good milk (wine measure) will make nearly a pound of cheese.

THE PROCESS.

Your milk having been placed in the tub, and the number of gallons known, a portion may be taken out and heated in pans over a common stove. The pan holding the milk should be set in another pan holding water or over a kettle containing water, so as not to scorch or burn the milk in the pan. Heat the milk and pour into the tub, till the mass indicates a temperature of 85°. Then add a quantity of rennet (which has been previously prepared by steeping the dry skins or rennet in water), sufficient to coagulate the milk, say in forty or fifty minutes. Now put your finger into the curd, raise it slowly, and if it readily splits apart the mass is ready to cut into blocks with the curd knife. After cutting into checks two inches square, let it remain at rest ten to fifteen minutes for the whey to form. Then carefully break with the hands by lifting up the curds very gently, and when the mass has been gone over, let it rest for ten or fifteen minutes for the curd to subside.

Now dip off a portion of the whey into the pans, and heat on the stove in the same manner that the milk was warmed. In the meantime continue breaking, by gently lifting the curd, until the particles of curd are about the size of small chestnuts or large beans. Then pour in the warm whey and continue heating and adding the warm whey until the mass indicates a temperature of 98°. Do not be in a hurry, but take things leisurely, continuing the breaking or stirring the curds while heat is being applied. It may now be left at rest for half an hour and then stirred, so that the particles may not pack or adhere together in the tub, and this treatment continued until the curd has a firm consistency. Take up a handful and press it together in the hand, and if on opening the hand it readily falls to pieces, it is about ready for draining. Throw a cloth strainer over the tub and dip off the whey down to the curd. Then put the strainer on a willow clothes basket and dip the curd into it to drain. It may now be broken up with the hands, and when pretty dry may be salted in the basket or returned to the tub for salting. Salt at the rate of four to four and a-half ounces of salt to ten pounds curd; mix it thoroughly and put to press. After remaining from two to four hours in press, turn and put to press again, leaving it under pressure till next morning, when it may be removed to the shelf. Very small cheeses need not be bandaged. They should be rubbed over with a little fresh butter, melted and applied warm, or with oil made from the cream that rises from the whey. They should be turned and rubbed daily until well ripened.

THE CHEESE FLY.

Most dairymen understand pretty well the habits of the cheese fly; many, however, do not understand how to provide against its depredations. Some people profess to be fond of a skippery cheese, and regard it as an index of what the English understand as a "cheese full of meat"—that is, rich in butter. And it must be confessed that the cheese fly has a great partiality for the best goods in the curing house. They do not so readily attack your "white oak" and skim milk varieties, hence the notion that cheese infested with the fly is rich in butter is not far out of the way.

The primary cause of skippery cheese, of course, is want of care. Cheese in hot weather should be closely examined every day; they require to be turned once a day to facilitate the curing process; the bandages and sides are to be rubbed at the time of turning, in order to brush off or destroy any nits of the fly which may happen to be deposited about the cheese. If there are cracks in the rind, or if the edges of the bandage do not fit snugly, they should at once be attended to, since it is at these points that the fly is most likely to make a safe deposit of its eggs.

FILLING UP THE CRACKS.

The cracks and checks in the cheese should be filled up with particles of cheese that have been crushed under a knife to make them mellow and plastic. When once filled, a strip of thin, tough paper, oiled and laid over the repaired surface will serve as a further protection of the parts. The cheese in the checks soon hardens and forms a new rind. Deep and bad looking checks may be repaired in this way, so as to form a smooth surface, scarcely to be distinguished from the sound parts of the cheese. It is a great mistake to send cheese that have deep checks or broken rinds to market; for in addition to their liability to be attacked by the fly, they have the appearance of being imperfect, and are justly regarded with suspicion.

CURING-ROOM NOT TO BE DARK.

Some dairymen think that a darkened curing-room is best for cheese, and at the same time is the best protection against the fly; I think this is a mistake; cheese cures with the best flavor when it is exposed to light, and besides, it can be examined more minutely from time to time and freed from any depredation of the skipper. August and September are generally the worst months in the year to protect cheese against the attacks of the fly. Some years the trouble is greater than others, and various means have been resorted to for the purpose of avoiding the pest, such as rubbing the cheese over with a mixture of oil and cayenne pepper, &c. These things generally do not amount to much, and are not to be recommended; the best protection is cleanliness, sharp eyes and a good care of the cheese. Whenever a lodgement of skippers has been made they must at once be removed; sometimes it will be necessary to cut into the cheese and remove the nest with a knife, but if the colony is young and small in numbers, a thick oiled paper, plastered over the affected part so as to exclude the air, will bring the pests to the surface, when they may be removed; the oiled paper should again be returned to its place and the skippers removed from time to time till all are destroyed.

WASHING THE TABLES AND RANGES.

If skippers begin to trouble the cheese, the best course to be adopted is to commence at once and wash the ranges, or tables on which the cheese are placed, with hot whey; this will remove all accumulation of grease or nits about the ranges, giving a clean surface, which does not attract the flies. If the cheese also is washed in the hot whey and rubbed with a dry cloth, the labor of expelling the trouble from the curing-rooms will be greatly facilitated. Keep the curing-room clean and sweet; see that the cheeses have a smooth rind, that the bandages are smoothly laid at the edges; turn and rub the cheese daily, and there need be no trouble from the cheese fly.

PAINTED CHEESE.

There are several kinds of foreign fancy cheeses that are peculiar in having their sides painted with a dark brown or red color. The double Gloucester or North Wilts, the small loaf and truckle shapes, and the Edams, are of this character. In the old process of curing the double Gloucester the cheese is rubbed with finely powdered salt, and this is thought to make the cheese more smooth and solid than when the salting process is performed in the curd. After the cheese has been in the curing-room and turned every day for a month or so, it is cleaned of all scurf and rubbed with a woolen cloth, dipped in a paint made of Indian red, or Spanish brown and small beer. After the paint is dry the cheese is rubbed once a week with a cloth. The Edam or Dutch cheese is colored on the outside, when ready for market, with what is called tournesal, the juice of a plant (*Croton tinctorium*) which grows wild in France. Rags are saturated in this juice and then exposed to the vapor arising from lime mixed with urine, which gives them a violet color. The cheeses are rubbed over with these tournesal rags, which gives them the peculiar glowing red with which they appear in market.

A friend, who makes small fancy cheeses in imitation of English, and which sell for a high price, makes a paint for coloring the rinds of the cheese of the following:—Sharp, sour whey, salt, venetian red and burnt umber. The venetian red and umber are added to the whey, so as to make a mixture of the consistency of paint and of the shade desired, and when the cheeses are ready for market the rinds are painted over and allowed to dry. He says that this mixture holds its place and color on the cheese without flaking off, and is altogether better than the English mixture made of beer and Indian red. No bandage is used upon cheese treated with this coloring matter.

USE OF SALTPETER.

The use of saltpeter in cheese manufacture has been long employed in some of the dairy districts of England. It is claimed by those who use saltpeter for this purpose that it helps preserve the flavor of cheese, improving also the keeping qualities of the goods. I am unable to say how this may be, never having made any direct experiments in my own dairy as a test. Saltpeter is used extensively in curing meats, and most people understand something of its effects when employed for this purpose. I do not understand that saltpeter has ever been used to any great extent in American cheese manufacture, but I am informed by an old and distinguished cheese factory manager at Oneida that it has been used at his factory with the best results. The manner of preparing it for use is as follows:—Take from three to three and a-half pounds saltpeter and reduce it to a powder. This will be sufficient for one barrel of salt, best factory filled. Now spread the salt on a clean floor and sprinkle over with the powder as evenly as possible, and mix thoroughly by shoveling it over. It may then be repacked in the barrel and it is fit for use. When the curds are to be salted use the usual quantity by weight of the compound as you would of salt, if that alone was to be employed. I have seen small quantities of saltpeter added to salt for preserving butter with good results, and it is possible that saltpeter used for preserving cheese in the way described may be of some advantage.

BAD FLAVOR.

It is very difficult to point out the cause of bad flavor in cheese without seeing the cheese and knowing all the details in manufacture, together with the condition of pastures, care of stock, water, &c. There are a great many things that affect flavor in cheese, and of all the months in the year June and July are the most trying to the cheese-maker. Much of the July cheese is often out of flavor, and manufacturers are often at a loss to account for it. Cheese that is well made will take on a taint and get out of flavor by being kept in a badly ventilated and ill-contrived curing-room. Cheese in curing needs air and a uniform temperature not higher than 75°. Some cheese-rooms are excessively warm and close in hot weather, and the fermenting or curing powers are carried on too rapidly.

Scurfy cheese show that there has been fault in manufacture. If it proceeds from whey oozing out, forming a kind of gummy, sticky substance on the sides, the curds have not been properly matured in the vat. The cheese when taken from the press to the table ought not to leak whey. Sometimes a mold or scurf forms on cheese from damp weather, when the cheese is not properly rubbed daily. The scurf should be removed and the cheese "slicked up" before sending to market.

POISON CHEESE.

During a visit to St. Lawrence county a prominent cheese dealer of that county called my attention to a case of cheese poisoning which had come under his observation:—A lot of cheese had been purchased from a dairyman of that county by the dealer referred to, and having been shipped by him and placed upon the market, a complaint was instituted that the cheese proved to be poisonous. No deaths, it is true, came from eating the cheese, but the persons who ate of it were taken suddenly ill with pains and cramps and excessive vomiting, showing evident indications that they had been poisoned.

It was an easy matter of course to trace the source of this illness to the cheese of a particular dairy, and immediately a thorough investigation was inaugurated to discover the origin of the trouble. On an examination of the dairy where the cheese was made nothing unusual was found in the manner of manufacture, or in the appliances used in cheese making. The cheese had been made in the ordinary tin vat, and all the processes of manufacture were similar to those in common practice in the country. Due regard had been exercised as to cleanliness; no known poisons had been employed about the premises, and it had become evident to the parties investigating that the poison, if any, in the cheese, must have come from the salt, the annatto, or in some way of which the cheese maker or his family were not cognizant, or indeed to be blamed.

Samples of the cheese were also forwarded to Prof. Jackson of Boston for analysis; and having been submitted to a rigid examination by this eminent chemist, the opinion was further confirmed that the dairyman was blameless in the matter. Dr. Jackson states in regard to the analysis of this cheese as follows:—"Each and all of the samples were entirely free from any tone poisons. There are no metal or mineral poisons of the kind present, nor any alkaloids or deleterious vegetable principles. But there is a small proportion of offensive putrefying animal matter which has been separated here that does not belong to good cheese. It is impossible to give this impurity any correct name, and it is only an opinion of mine that it comes from the rennet used. It is not poisonous, although it occasions vomiting in dogs and cats, and small portions of it may be taken into the human stomach without effect."

The facts elicited in this analysis of Dr. Jackson correspond in some respects with those discovered a few years since by Dr. Voelcker, and from which it would appear that cheese, as well as other kinds of animal food, under certain conditions of decay, generates a peculiar organic poison; but what the composition of this virulent poison is the chemists are as yet unable to determine. Dr. Voelcker stated to me that instances had come under his observation where this poison in cheese had become dissipated as the cheese passed into a further state of fermentation and decomposition, and that the cheese could then be safely eaten, producing no injurious or unpleasant effects. In his report upon this subject to the Royal Agricultural Society, a case is mentioned somewhat similar to that referred to in St. Lawrence county, and as it details more fully the nature of this peculiar poison than the statement of Dr. Jackson, it will be of interest perhaps to present it in this connection.

Without going into a history of the particular dairy or the various cases of poisoning, it will be sufficient to say that quite a number of people were taken ill after partaking of the cheese, and that samples of the cheese causing the illness were forwarded to Dr. Voelcker for examination. This cheese, he says, presented nothing in appearance which could be regarded as an indication of its spoiled condition or unwholesome quality. The taste was sharp, peculiar and quite different from the rich and pungent taste of well-ripened old cheese; but it was not sufficiently characteristic of its unquestionably poisonous properties. He says:—"Having analyzed at different times cheese which produced bad effects when taken in any quantity, I cautioned my assistants not to take too much of it, and invited them to taste the cheese sent. Certain chemicals, which are sometimes put into cheese, can to a certain extent be recognized by the peculiar taste which they impart. I tasted it myself, and although I took a piece only the size of a hazel nut, I felt its effects four hours after having tasted it. Both my assistants, who had taken no more at the most than a quarter of an ounce each, five hours afterward were violently attacked with vomiting and pain in the bowels; one of them was ill all night, and scarcely able to follow his usual work next day. Both complained of a nasty mercurial taste, which seemed to remain with them for many hours after partaking of the cheese.

"On a former occasion I found sulphate of zinc or white vitriol in a cheese which caused sickness, and in another instance I detected in cheese sulphate of copper. My attention, therefore, naturally was directed to search for metallic poisons; but though carefully operating on large quantities, I failed to detect even traces of zinc, copper, mercury, antimony, arsenic, or any of the metallic poisons which might possibly have imparted injurious properties to the cheese. Having failed to detect any mineral poison I next directed my attention to the examination of the organic constituents: the quantitative general analysis gave the following results:

Water	37.88
Organic constituents	58.04
Mineral	4.08
Total	100.00
Containing salt	1.33

"The proportion of water in this cheese was rather large, considering that it must have been cut for some time, and have lost water by evaporation. On further examining it I found it remarkably sour, and had no difficulty in detecting an unusually large quantity of fatty acids, which if not poisonous themselves are the vehicle conveying the peculiar organic poison which appears to be generated sometimes in cheese undergoing a peculiar kind of fermentation.

"Probably the poison generated in this modified decay of cheese is identical with the so-called sausage poison, which is sometimes found in German sausages, especially those made of coagulated blood. A similar poison appears to be generated sometimes in pickled salmon, smoked sprats, pork, tainted veal, bacon and hams. Bacon and hams when not properly cured, and fat meat, kept in a damp, badly-ventilated cellar, are very apt to become more or less injurious to health, and even *butter after it has turned rancid;* and similar organic matters are liberated in it, which exist in this cheese in a free state, acts as a poison in most cases. Singularly enough, some people are not affected by these subtle organic poisons.

"The poison of cheese was known in Germany as long ago as 1820, and probably even earlier. A great deal has been written on the subject, but we are yet as far as ever from knowing the composition of this virulent poison."

Dr. Voelcker further states that cases of poisoning by cheese, in which no mineral poison can be detected, occur much more frequently than is generally supposed. And it appears that cheese kept in *damp*, *badly-ventilated places*, or where too much whey is left, or indeed, all the circumstances which tend to produce a too acid curd, and to generate fatty acids are apt to produce this peculiar poison.

Dr. Voelcker regrets that we have no means of detecting this invidious poison, which, in a great many cases, has produced fatal results; and he remarks that, what is indeed strange, poisonous cheese of this character when kept until it becomes quite decayed loses its poisonous properties and becomes harmless.

Poisonous cheese always exhibits a strong acid reaction when tested with litmus paper. A slight acid reaction marks all fresh cheese, but while the outside of good old cheese is ammoniacal, the outside of cheese in which this poison occurs is *acid.*

SCHWEITZER KASE.

The large element of foreign population now among us, and more especially that from the German States, has introduced a demand for certain articles which a few years ago were almost unknown in many parts of the country. It is but natural that foreign tastes should thus creep in upon us by degrees, and become more or less adopted by our native population. The Schweitzer Kase and Limberger cheese, a few years ago were imported, and perhaps are to some extent at the present time, but their manufacture now having been established in this country, there is no necessity for such importation. Such cheese can be made here of equal quality with the imported article, and can be afforded also at less cost.

I have frequently had occasion to compare our Schweitzer Kase, or Swiss cheese with the foreign article, and in the presence of good judges, who pronounced the American quite equal in quality and peculiar flavor to the foreign manufacture. Swiss cheese when eaten before it has acquired that strong, rank flavor which is deemed essential, or at least seems to suit the taste of a majority of foreigners, is very palatable, and many Americans who have been accustomed to eat of it, grow fond of it, and prefer it to our best grades of Cheddars.

A few years since I visited a factory in Oneida Co., erected for the purpose of making Swiss cheese, and where a very superior article was produced. The manager here was a Swiss cheese-maker, and the arrangements and machinery of the establishment were after the most approved Swiss pattern. In the proper curing of Swiss cheese a room in which a low, even temperature can be secured is requisite, hence a cellar basement of stone is deemed important for a good curing-room. The factory referred to was erected for manufacturing milk from about two hundred cows. The building is about eighty-four feet long by thirty-four feet broad, and is placed upon a side-hill so as to have a stone basement or cellar, some eight feet high and extending under the entire upper structure, which is of wood.

The cheeses are pressed in two sizes—the one thirty-two inches, and the other twenty-eight inches in diameter, but both are uniformly but five and a-half inches thick. The larger-sized cheese will weigh when cured somewhere near a hundred pounds, and the curing process will require at least three months.

The milk is made up fresh from the cow, that is, the morning's and evening's mess separately. As soon as the morning's milk is received it is turned into a large copper kettle, hanging upon a crane which swings over the fire in a broad, old-fashioned fire-place. When the temperature of the milk indicates 81° the rennet is added. After the milk has coagulated a circular wire-breaker attached to a long handle is introduced, the curd broken up, and the whole mass stirred with the breaker. The kettle is now swung over the fire and the stirring kept up until the mass indicates a temperature of 120° to 125°, when it is moved back on the crane from the fire into the room, and the stirring continued for half an hour longer, or until the curd is sufficiently cooked. This is indicated by its firm and elastic condition, similar to curd properly "cooked" in ordinary cheese-making.

A cloth strainer is now introduced under the curd, the ends of the cloth brought together, when the mass is lifted out of the kettle, leaving the whey behind. It is then immediately put to press and remains in press about two hours, when it is taken out of press and plunged in cold water. Here it remains for two hours or more, or until thoroughly cooled, when it is returned again to the press, where it remains four or five hours.

In pressing, light, adjustable hoops, made of thin strips of elm wood, are used. They are arranged with cords upon the ends, so that the size of the hoop may be contracted or expanded at pleasure. On removing the cheese from the press to the curing-room, these hoops are kept upon the cheese, and serve in lieu of bandages.

No salt is used in the curd at the time of making as is usual in other styles of cheese, but the salt is applied in the curing-room; here dry salt in small quantities is daily sprinkled over the cheese during the space of three months, and after that they are treated with salt every other day. Every two or three days during the curing process the cheeses are washed with brine, which serves to remove any mold that may be inclined to form or adhere to the rinds.

These are briefly the main features in the process. The cheese, while curing, appears to be more elastic, and will not readily break and fall to pieces as that made in the ordinary way. When well made they are mellow and rich, and of a sweet, delicate flavor if eaten before they acquire age. They are quite porous, which is esteemed a mark of good quality. After getting age they are apt to take on a peculiar rank flavor, which nevertheless is regarded as delicious by those who have acquired a taste for it.

Good Swiss cheese usually brings an advanced price over the best grades of factory cheese as usually manufactured, which, I suppose, is on account of the small quantity made, and the supply being kept within the demand.

PINE-APPLE CHEESE.

So far as the manipulation of milk, and the treatment of curds are concerned, the making of pine-apple cheese does not differ materially from that of cheese commonly made at factories. The diamond-like impressions on the rind, by which it is made to resemble somewhat, the scales on the pine-apple fruit, are produced by the meshes of the net in which the cheese is sustained to cure. The main features in the manufacture consist of the molds and nets which give the desired shape and appearance to this style of cheese.

The molds are capable of holding from six to ten pounds of curd. The mold is formed of four scantling, four or five inches square, by scooping out one corner of each in the right shape, and placing them together. The timbers are long enough to allow a neck six or seven inches long, and three or more in diameter, to be grooved from the same corners, and when they are put together the curd is put into the mold through this neck, the neck also being filled with curd pressed in. The separate pieces of timber are bolted firmly together two and two, thus leaving it in two parts. These two parts are held firmly together by a hoop of strap iron tightened by wedges. When the cheese is to be taken out, the wedges are loosened, the hoop slipped off and the mold taken apart. The pressure is applied by any press, provided with a follower that will fit the neck, into which it is forced, and the whey escapes at the joining of the molds, which open a little by the pressure. The cheese-cloth is used the same as in the common hoop, though it should be pressed hard for a while to obliterate the impressions of the folds in the cloth. The follower should be a little concave at the bottom and force the curd down to a level with the curd in the mold. The whey should be entirely removed, and the cheese rendered as compact as possible.

To effect this a follower sharpened in the form of a bodkin at the lower end, long enough to reach near the bottom of the mold, should be forced into the cheese immediately after the curd has been somewhat compacted by the follower, and the orifice filled up with new curd, if there is not enough already in the mold to fill it.

After it has remained in press a sufficient length of time it is removed, and a net is placed upon it similar to a cabbage net, knit with meshes half to three-fourths of an inch square, when they are suspended by the tightening cord to hooks driven into the wall or other place for the purpose. When thoroughly dried they should be smeared with sweet whey butter. After hanging long enough to get their shape confirmed, the net is removed and they are set upon the large end upon trenchers until perfectly cured. During the whole process of curing they are to be rubbed as often as necessary to give them a fair skin and keep away insects.

The molds are sometimes made of blocks of oak timber, about twenty inches long and ten inches square. They are sawed lengthwise through the middle, and each half is carved or worked out in the shape of a pine-apple, one-half in each part. Then a groove is cut about two and a-half inches in diameter, for passing the curd into the mold.

Some manufacturers, after taking the cheese from the press, trim them, and then put on the nets, hanging the cheese for a short time in water of 120°. This is to soften the rind, that they may the better receive the impression of the net, which is done by taking them from the water while enveloped in the nets, placing them in a frame and straining the nets tightly over them by means of screws. They are then hung up as before described, to harden, and finally, are set on shelves having suitable hollows or concavities for the cheese to rest upon. The nets are made from flax twine, and will last several years.

The labor and trouble of making pine-apple cheese is so much, that a large price must be obtained in order to make its manufacture a paying business.

STILTON CHEESE.

Cheese of this character at present is of no commercial importance to American dairymen. Still it is possible small quantities may in time be made for home consumption. Stilton is made from the morning's mess of milk, to which has been added the cream of the night's milk, in proportion of a quart of cream for every ten quarts of milk. The milk and cream having been nicely mingled together, is set for coagulation in a small tub in which there has been previously arranged a linen strainer. The mass is set in the ordinary way with rennet, and when coagulation is perfected the curd is cut across in large checks, and without further breaking, is lifted gently into a willow basket for the whey to escape. No heat, except the natural heat as it comes from the cow, is used during the process. After the whey has separated from the curd in the basket, as described above, the curd is carefully placed in a hoop, and is then turned every three hours, say four or five times during the day. No pressure is applied except its own weight, and it remains in the hoop without cloth or bandage, being turned from day to day, as before described, until sufficiently consolidated to hold together, when it is taken out, and a bandage pinned about it, and then it goes upon the shelf to cure. The hoop is seven inches in diameter and eight inches high; it is pierced with holes, and it has two little followers fitting above and below the cheese, each pierced with holes for the escape of the whey. Two "setters" or covers with rims are also provided and pierced with holes, so that in turning the cheese all that is needed is to change ends without taking the cheese from the hoop. No salt is used in the curds—its application being from the outside after the cheese is taken from the hoop. The cheese is kept at a temperature of about 70° for some time, and then is placed in a warm room for the development of the blue mold, which is considered of prime importance.

IMPROVING HARD, DRY CHEESE.

When a cheese which has been much salted and kept very dry, is washed several times in soft water, and then laid in a cloth moistened with wine or vinegar, it gradually loses its saltness, and from being hard and dry, becomes soft and mellow, provided it be rich cheese. This simple method of improving cheese is worth knowing. It is generally practiced in Switzerland, where cheeses are kept stored for many years, and if they were not very salt and dry they would soon be the prey of worms and mites. A dry Stilton cheese may thus be much improved.

COTTAGE, OR DUTCH CHEESE.

Cottage cheese is in some sections called Dutch cheese or curds. It is the curd of sour milk drained from the whey, pressed into balls or molded in small fancy shapes, and eaten when fresh, or soon after it is made. Some people are very fond of Dutch cheese or curds, and the process of manufacture is so simple and so well known, that we suppose every "good housewife" is well posted in regard to its making.

The milk is allowed to sour and become loppered or thick, when it is gently heated, which facilitates the separation of the whey. The curds are then gathered up, salted, or otherwise, to suit the taste, and pressed in small molds, or formed with the hand into suitable shape, when it is ready for the table and may be used immediately. In cool weather, when milk does not readily thicken, the sour milk may be put in a suitable vessel set in hot water over the range. The milk is then stirred for a few minutes, when the whey will begin to separate, and it is removed, and another batch may be treated in the same manner.

In summer some use large cans, having a spiggot near the bottom; the sour milk is placed in these cans, and allowed to stand in the sun to thicken. The heat of the sun will be sufficient to separate the whey, which may then be drawn off through the spiggot. The curds are then removed to a sink having a slatted bottom, over which a strainer cloth is placed. The curds thrown upon this strainer cloth are soon drained of the whey, when it is ready to be pressed into balls with the hand, or molded into forms.

Sometimes this kind of cheese is potted and left to decompose, and when it has acquired a strong, villainous smell, it is regarded as most delicious by those who have acquired a taste for eating it in this state. In some markets, cottage or Dutch cheese finds a ready sale, and quite a profit is made by certain butter-makers, in turning their sour milk into this product.

POPULAR WEIGHTS, BOXING FOR MARKET, ETC., ETC.

I have referred, in another place, to the Cheddar shapes as the most popular for export. Cheese weighing from forty to sixty-five pounds are on the whole the sizes most commonly made at the factories. For home consumption the growing feeling is for smaller cheeses than those above-named. A cheese of thirty pounds weight is a very desirable size for our home trade.

It is true the cost of manufacture may be greater, and the shrinkage is more, still the consumer can afford to pay a better price for small-sized cheeses, because of their convenience and less waste from decay and drying, incident to large cheese, which must remain a longer time on hand before being consumed.

In boxing cheese, whether for export or the home trade, the greatest care should be taken to have the packages well made, and with an extra band on the lower edge. Cheese should never be sent to market until they have properly ripened, and then they should be placed in boxes that fit—boxes that slip down easily over the cheese, but not so large as to allow "shaking," or a movement from one side to the other in the box, nor in so small a package as to prevent their being readily removed from the package without breaking it. Good, substantial scale-boards should be placed on both sides of the cheese, and no other material is so well adapted to the purpose where cheese is to be exported, or is to remain some time in the package during its transit to market. For short distances heavy straw paper may be used, but care should be taken not to pack with newspaper, as the moisture from the cheese will reduce it to a pulp, giving the cheese a very bad appearance on removal from the box.

When the cheese is in place the sides of the package should come up just even with the top surface of the cheese. If it is below this surface the cheese will be liable to be broken and marred about the edges. If the rim of the box be a little higher than the cheese, it should be trimmed down after the cheese is in the box with a sharp drawing-knife, and then covers that fit closely should be adjusted. Sometimes the boxes are very imperfectly made, with loose-fitting covers that are liable to fall off in rolling the cheese from the scales, or in moving from place to place. In such cases the covers are sometimes tacked in place with nails, but when nails are used, care should be taken that they do not reach through the wood and into the cheese.

The boxes should be neatly branded with the name of the factory, or if from farm dairies with the name of the dairyman, and for this purpose stencil plates are most convenient, while the lettering makes a neater appearance than when the names are burned on with branding-irons.

BUTTER MANUFACTURE.

The question of butter-making has now become one of great importance. In my tour through Great Britain I took some pains to examine this subject, and compare butter-making abroad with our new system as inaugurated in Orange County, N. Y. The system has proved a great success, is being rapidly introduced in new districts, and has attracted attention not only in this country, but in Europe.

There is no people, perhaps, on the face of the earth more fastidious about their food than the better classes in London. Possessed of immense wealth, they pay liberally for extra qualities of food, particularly the products of the dairy. Good butter they *will* have at any cost. Their finest grades come from the continent—Normandy, Holstein and the Channel Islands. It is worth from one hundred and twenty to one hundred and forty shillings per hundred weight, or say about thirty cents gold per pound, wholesale, while Canadian, the only butter imported from America, sells for fifty-four to ninety shillings per hundred weight, and Irish extra, from one hundred and eight to one hundred and twelve shillings per hundred weight.

Their best butter formerly came from Ireland, but the complaint now is, that Irish butter is too salt, and lacks the delicate flavor and aroma of that which comes from the continent. Irish butter is usually packed in stout oak firkins, securely headed. Normandy and Holstein butter is in small packages, flaring at the top, resembling the Orange County tub. It is excellent in flavor and texture, very slightly salted, and of a rich golden color.

In England I saw butter made for the Queen's table, at the Royal Dairy, near Windsor Castle. The milk is set in porcelain pans, resting on marble tables. The walls, the ceiling and the floor of the milk room are of china, and the arrangements for ventilation are the best that can be devised. Fountains of water are constantly playing on all sides of the room, which helps to maintain an even temperature. The churn is of tin and the butter is worked with two thin wooden paddles. The whole establishment, from the milk-room to the stables, is the most perfect specimen of neatness that can be imagined. I need not say that the butter is excellent.

Cream of average richness, according to the analysis of Dr. VOELCKER, contains in one hundred parts:

Water,	64.80
Butter (pure fatty matters),	25.40
Caseine and milk sugar,	7.61
Mineral matters (ash),	2.19
	100.00

He says, that on an average one quart of good cream yields from thirteen to fifteen ounces commercial butter. Occasionally cream is very rich; thus Mr. HORSEFALL states that a quart of cream in his dairy yielded one pound of butter when the cows were out to grass, and no less than twenty-two to twenty-four ounces when the cows were fed in the barn with rape cake and other substances rich in oil.

The first portions of cream which rise are always thin, but rich in fat, a fact that is explained by the circumstance that during milking and the subsequent agitation to which milk is exposed, a portion of the milk globules get broken; in consequence of which their light fatty contents, liberated from the denser caseine shells, rise to the surface with greater facility, and then occupy less room than the unbroken milk globules, which, on account of their specific gravity, are more sluggish in rising. Generally speaking, cream yields more butter when its bulk in proportion to that of the milk from which it is taken is small, and *vice versa*.

The leading principles to be observed in butter-making, are cleanliness and temperature. Experience has shown that a temperature of about 60° and not higher than 65°, is most conducive to the rising of the cream globules, and the more uniformly the temperature can be kept at 60° through winter and summer, the more readily the cream will be thrown up, while the milk will be kept sweet, provided the dairy is dry and properly ventilated. On no account should the temperature fall below 55°.

In cooling milk for butter-making this point is important. It must not be imagined that the lower the temperature is allowed to sink, the more cream will rise, for we must bear in mind that with the reduction of the temperature, the specific gravity of the liquid is greater, and the rising of the cream or milk globules checked accordingly. Every precaution as to habits of cleanliness and the keeping from the milk and cream any article, plant, or impurity, which can by any possibility communicate a taint should be rigidly adopted. The pails and strainer should be washed (*scalded* with boiling water) and well rinsed in cold water, and then suffered to dry in the open air. Every article connected with the dairy should be treated in a similar manner, as there is nothing so prejudicial to new milk as being mixed with ever so small a quantity of that which has become sour, and nothing so difficult to eradicate as the traces left in any vessel of that which has become stale and decomposed.

SPOILING IN THE CHURN.

Perfectly good cream is often spoiled in the churn, when the dairymaid has been negligent in properly cleansing it. When the wood once absorbs this milk taint it is very difficult to eradicate it by subsequent cleansing.

MANNER OF CHURNING.

During the process of churning a certain uniformity of temperature must be observed, or the butter will be soft and spongy instead of being firm and compact. The agitation also of the cream should be regular—neither too quick nor too slow. If the agitation is too quick the butter will make and unmake itself before the churner is aware of it, as too rapid motion induces fermentation, which, when it has reached a certain point is entirely destructive of anything like the possibility of making even moderately good or well tasted butter. If, on the other hand, the motion be too slow, the agitators in the churn fail to produce the desired separation of the component parts of the cream; and the consequence is, that after a good deal of time spent in lazy action, the churner is just as far from his butter as he was at the beginning of his labors. The best temperature for the cream in churning is from 55° to 60°.

EXPERIMENTS IN TEMPERATURE.

Some years ago a series of carefully conducted experiments were made in Scotland to determine the temperature at which butter can be best and easiest obtained from the cream. The following table exhibits the mean temperature of the cream used in each experiment:

1st experiment, cream stood at	57°
2d " " "	60°
3d " " "	62°
4th " " "	66°
5th " " "	70°

The butter produced in the first experiment was of the very best quality, rich, firm and well tasted. That produced in the second experiment was not perceptibly inferior to the first. That produced in the third experiment was more soft and spongy, and that produced in the fourth and fifth experiments, decidedly inferior in every respect to any of the former specimens.

From these experiments it appears that cream should not be kept at a high temperature in the process of churning, and the experimenters conclude that the best temperature to commence the operation of churning is about 55°, and at no time in the operation ought it to exceed 65°; while on the contrary, if at any time the cream should be under 50°, the labor will be much increased without any proportionate advantage being obtained.

CHARACTER OF GOOD BUTTER.

Mr. Stevens well remarks that when butter is properly churned both as to time and temperature, it becomes firm with very little working, and is tenacious, but its most desirable state is that of waxy, when it is easily molded into any shape, and may be drawn out a considerable length without breaking. It is only in this state that butter possesses that rich, nutty flavor and smell which impart so high a degree of pleasure in eating it, and which enhance its value manifold. It is not always necessary to taste butter in judging of it; the smooth, unctuous feel in rubbing a little between the finger and thumb, expresses at once its richness of quality; the nutty smell indicates a similar taste, and the bright, glistening cream-colored surface shows its high state of cleanliness.

FREEING FROM BUTTERMILK, ETC.

When butter forms the churning should cease, and the mass be taken out and cleansed from any buttermilk which may still be incorporated with it. The best test that this has been satisfactorily performed is the fresh water running from the butter as pure and bright as when poured over it. It should be recollected that the less butter is handled the better. Warm hands, however clean, are apt to impart a taint; and the difficulty of keeping them so perfectly clean as is absolutely necessary, appears to be almost insurmountable. The ladle and butter-worker, therefore, should be used in all the necessary manipulations.

THE MODERN METHOD OF MANAGING MILK

for butter-making is to have a spring house for setting the milk; churning the cream rather than the whole milk. It is true there are those who contend that a fine quality of butter can be made by churning the "whole milk;" but such butter is apt to have more of the caseine or cheesy particles of the milk in its composition, than when the cream alone is churned; and this caseine will injure its keeping qualities.

It has been contended, too, that when the whole milk is churned more butter is obtained than by setting the milk and churning the cream. If the butter contains a considerable portion of the caseine of the milk, this would readily explain the reason for the extra quantity claimed. But, however this may be, those who make "fancy butter," and have had long experience in the art, prefer to make their butter by churning the cream, and it is the course I should recommend.

MILK-ROOM FOR FARM DAIRIES.

For farm dairies the Crozier milk cellar would seem to be a very good model, as the building can be erected at moderate expense. A committee of the American Institute Farmers' club, consisting of Mr. J. B. Lyman and Col. F. D. Curtis, visited this establishment, and their report upon it is as follows:—"The walls are thirty-six by eighteen feet, and it is divided into ice-house, milk-room and butter-kitchen. Two tubes or conductors go down from the upper part of the ice-house. They are made of boards eight inches wide and an inch thick, with many holes bored in them. The holes allow the cold air to enter from the ice, and it pours in a stream from the mouth of the tube into the milk-room. The temperature of the air as it comes out at the mouth of the tubes is about 35°. As the milk-room has thick walls and the windows are high this flood of air at 35° is able to lower the mercury to 62°, and even lower, in July. Sometimes he closes one tube to keep the room from growing too cold. The draught is the strongest in the hottest weather. In spring and fall there is little current, and in winter, when the fire in the stove is constantly burning, the draught would be the other way. But then the mouths of the ice-tubes are closed. By this arrangement the desired temperature is secured the season through, and there is no difference between the June butter and the January butter. He makes June butter the year round. He gets ten cents per pound over the highest market price. Making, say, two hundred pounds a week, his gain is $20 a week by having the best arrangement for butter-making. Thus his milk-house pays for itself every nine months, to say nothing of the greatly increased facilities for doing work afforded by a pump, churn and stove so convenient. He consumes about a ton of anthracite in the four coldest months, and a slight allowance is to be made for wood used in summer to heat water for washing and scalding."

THE BEST TEMPERATURE FOR SETTING MILK

to get the cream is about 60° to 62°. The range of temperature should run no higher than 65°. The butter-makers of Orange Co., N. Y., are of the opinion that the best quality of butter is made from cream that has been obtained at a temperature a little below 60°. Cream can be obtained in a short time, and in large quantity by raising the milk to a temperature near boiling and then setting aside to cool; but such cream has more of the caseine or cheesy particles of the milk mingled with it than milk set without the application of artificial heat, and the butter will be injured in its keeping qualities.

COLOR AND TEXTURE.

In butter-making it is important to have the butter come of a good color and of a texture that is hard and has a waxy consistency, and that will retain that peculiar aroma which imparts so much pleasure in eating it.

THE MODERN MILK PAN.

When it is not convenient to have a spring-house, the best arrangement with which I am acquainted for setting the milk is the JENNINGS pan. It is of tin and sets upon a shallow wooden vat, which is to be filled with water from the well or pen stock, as the case may be, and thus the milk is rapidly divested of its animal heat, and a pretty even temperature maintained while the cream is rising. These pans are of different sizes to accommodate different sized dairies, and each one is intended to accommodate the entire mess of milk from the herd at one milking. Four pans are all that are needed for a dairy, or at least with that number of pans the milk may be kept until thirty-six hours old before skimming. After the pans have been once filled the milk that has stood the longest is skimmed and drawn off, and is then ready for the next milking. The age of the milk in the different pans from day to day will be more readily seen by the following diagram:

New Milk.	Milk 12 hours old.	Milk 24 hours old.	Milk 36 hours old.
Pan.	Pan.	Pan.	Pan.

Where a stream of cold water can be kept constantly flowing under the pans, expensive milk-cellars can be dispensed with, and very good results obtained in properly constructed rooms that are kept well ventilated. In the Jennings pan the milk is set from three to four inches deep and there is an arrangement of pipes for drawing off either the milk or water with convenience. These pans are provided with gauze net-work covers to be used as occasion requires for keeping out dust or flies. The general form of these pans is represented in the subjoined illustration (Figure 1).

The Jewett pan is of very similar construction to the one just named, except that the water underneath the milk is conducted in channels instead of being spread out in a thin sheet as in the Jennings invention.

Mr. Jewett describes his apparatus as follows:—The illustration (see

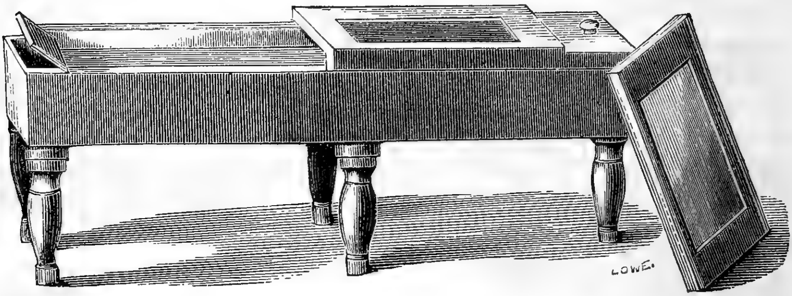


Figure 1.

figure 2) represents a full set of pans, arranged with fixtures necessary for using them, for butter factories, or dairies large or small, by making them of any size required; for factories, as wide as can be conveniently skimmed from the center, and long enough to obtain the required surface, it being perfectly practical to make them large enough for one hundred and fifty cows; for more cows additional sets may be added. The way to use them is, put one milking of the entire dairy into one pan, adjusting the faucet on the supply pipe so as to use just water enough to extract the animal heat from the milk, and keep it at the desired temperature while the cream is rising—from 60° to 62°; at the time the fourth is wanted for use the first will be ready to skim; then stop the water from running into the pan, and open the faucet near the bottom of the pan, that a sufficient quantity of water may run out, while the milk is skimmed and run off to enable the milk-maid to clean the pan. The bottom of the pans being protected from the warm atmosphere in the room by the tables on which they set, the inside bottom being covered with milk, the means of cooling is hidden, yet it is done by keeping the milk cool in a warm, dry room without cooling or dampening the room, which is to be desired by butter-makers, thus reversing the process of carrying the milk to a cool place, where the benefits to be derived are so intermingled with deleterious influences that it is a good illustration of the saying, you must take the bitter with the sweet. This way of handling the milk in my pans, besides reducing the labor more than one-half, enhances the net proceeds of the dairy, both in quantity and quality of the butter, fully twenty per cent. With a book of instructions any good tin-smith can make and set them up.

As given in the engraving, one of the series of pans, A A, is represented as broken away to show the internal arrangement. These pans are provided

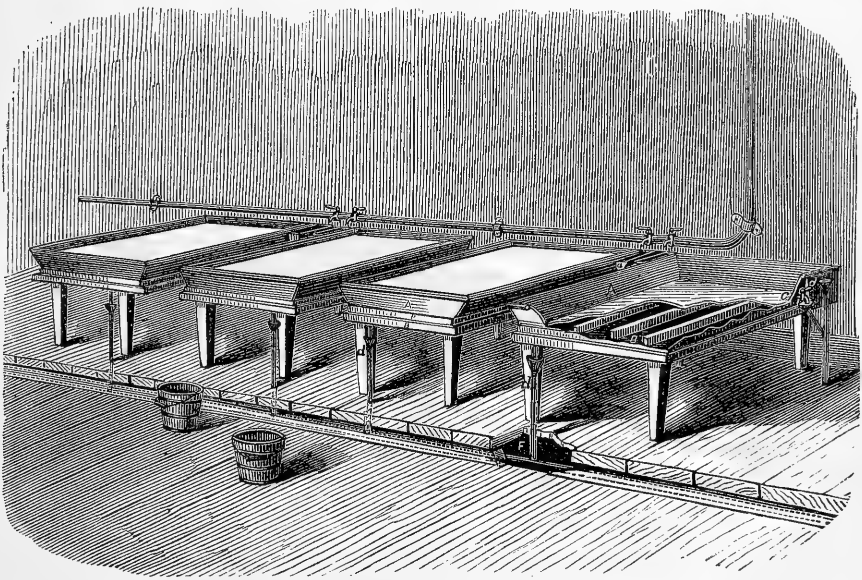


Figure 2.

with a space, B, between their top and bottom walls. Within this space are a number of compartments, communicating with each other at alternate ends, in such a manner as to form one continuous channel, zigzag in its course, having an inlet at *a*, through which warm or cold water, as needed, is received; such water, after flowing through the tortuous channel formed by the partitions, being discharged at the outlet, *b*. At *b* is shown the opening through which the overflow of water is discharged; the object being to keep the channel in the bottom of the pan quite filled while the water is flowing through it. At *c* is shown a faucet through which all the water in the channel can be drawn off.

These pans can be made to serve the double purpose of milk-coolers or cream-raisers, the milk being kept at any temperature desired by raising or lowering the temperature of the water flowing through the passages in the bottom of the pan. When the cream has raised and has been skimmed, the milk is then run off through the pipe, *d*, which communicates with the main discharge-pipe, F, which may be placed under the floor or not, as circumstances will permit; or, if desired, the milk can be conveyed in movable horizontal pipes from the pans into an adjoining room on the same floor. The pipe seen attached to the side of the room and above the rows of pans is the source of supply from which water is conducted to the base of the pans. For cooling, the water is received from a spring or reservoir; but for warming, from boilers or other appropriate apparatus.

THE CREAM THAT FIRST RISES

is the best; and to make choice butter, the cream should always be taken from the milk before it becomes old and sour. The greater the decomposition of the milk the more will the cream be affected, and as a consequence, the more difficult will it be to obtain from it a nice quality of butter.

KEEPING QUALITIES.

Butter, to be good, must have some keeping qualities, for it cannot be consumed from day to day as it is made. Well made butter, if properly cared for, should retain its flavor and sweetness for months; but we cannot expect to obtain such butter from cream that has been badly managed.

STRAINING THE CREAM.

Cream should have a uniform consistency, when it goes to the churn. If portions of it are thick and mingled with hard, dry particles or "cream-skins," the butter will contain "white caps," or be flecked throughout, giving it not only a bad appearance, but injuring its quality. When cream is set in shallow pans in the old way, the butter is very liable to be thus affected. The cream strainer here is of very great advantage, as it reduces the cream to a like consistency in all its parts, breaking down the "skins" and preparing the cream, so that in churning, the butter will come evenly. BAKER'S Excelsior Cream Strainer, illustrations of which we give in figures 3 and 4, is the best that we have seen for the purpose, and gives valuable aid in the butter dairy. Cream that has been raised in a temperature of 60° to 62°, should be churned at about the same temperature. Butter-makers do not like to have the cream churned at a temperature above 64°, as it injures the butter. If the temperature fall below 55°, the labor of churning, as has been remarked, will be prolonged. I do not believe in great haste in churning, or the shortest time that cream can be turned into butter.

CHURNING TOO QUICK.

One often hears of churns in which it is claimed the butter will come in "three minutes." It is possible that good butter may be got from the cream in that time, but I have yet to be convinced that it can be done. That cream *can* be churned into butter in three minutes I am aware, and although the butter may be tolerable for present use, I have never been able to get a good keepable article when the churning was done in so short a space of time. The butter globules are inclosed or surrounded by thin pellicles of caseine. In churning, these are broken and separated from the oily particles. If the churning is done rapidly the separation is imperfect, and hence we get an article of butter in which there is too large a proportion of the shells of caseine. It is the caseine and nitrogenized constituent of milk that is liable to decomposition and which injures the flavor of butter.

COMPOSITION OF BUTTER—INFLUENCE OF CASEINE SHELLS.

The philosophy or manner in which caseine injures the flavor of butter has been well explained by VOELCKER. He says:—"Butter consists mainly of a mixture of several fats, among which palmitin, a solid crystalizable substance, is the most important. Palmitin, with a little stearine, constitutes about sixty-eight per cent. of pure butter. Mixed with these solid fats are

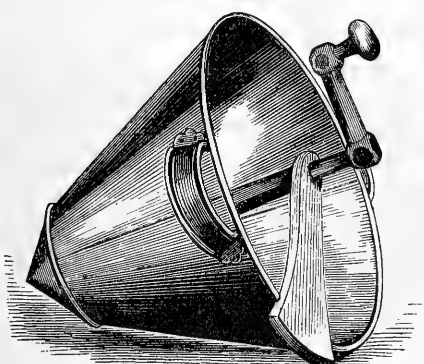


FIGURE 3.

FIGURE 4.

about two per cent. of odoriferous oils. The peculiar flavor and odor of butter are owing to the presence of this small proportion of these peculiar oils, viz., butyrine, caproin and caprylin. In butter, as it comes upon our table, we find besides these fatty matters about sixteen or eighteen per cent. of water; one to two per cent. of salt; and variable small quantities of fragments of caseine shells. The more perfectly the latter are removed by kneading under water, the better butter keeps; for caseine on exposure to the air in a moist state, especially in warm weather, becomes rapidly changed into a ferment, which, acting on the last-named volatile fatty matters of butter, resolves them into glycerine and butyric acid, $C_8\ H_8\ O_4$; caproic acid, $C_{12}\ H_{12}\ O_4$; and caprylic acid $C_{16}\ H_{16}\ O_4$. The occurrence of these volatile uncombined fatty acids in rancid butter, not only spoils flavor, but renders it more or less unwholesome." If all the shells of caseine could be separated from the butter, it could be preserved readily without salt. Pure fat or oil is very easily kept sweet. In some countries butter is melted and the impurities taken out by "trying" it like lard. Of course butter treated in this way loses its aroma and texture, but I mention the fact for the purpose of showing the principle to be observed in obtaining butter of good keeping quality. In churning, I do not care to have butter come sooner than from half to three-quarters of an hour. The butter-makers of Orange Co., say that the churning process should occupy from forty-five minutes to one hour. Their opinions are worthy of consideration, because they make an article that is unrivaled in the market, and from long and varied experience they ought to be able to settle this point definitely. No one should attempt to make butter without

USING A GOOD THERMOMETER,

especially in preparing the cream for churning. Old and experienced butter-makers may guess at temperature pretty accurately, but the temperature of the surrounding atmosphere varies so much from day to day, that no one can be sure of being right, without an accurate instrument for determining the degree of heat required in the cream to produce the best results.

MANAGEMENT FOR MAKING PHILADELPHIA BUTTER.

In the management for the noted "Philadelphia butter," the spring-house is of stone, about eighteen feet wide and twenty-four feet long. Its foundation is deeply set in a hill-side, its floor being about four feet below the surface of the ground on the lower side. The floor of the spring-house is of oak, laid on sand or gravel. The water is allowed to spread over this floor to the depth of three or four inches, and the overflow passes to a tank outside the building. Raised platforms or walks are arranged on the floor of the spring-house for the purpose of moving about the room in handling the milk, etc. The walls of the room are about ten feet high, arranged at the top with windows, covered with wire gauze so as to give ventilation. Deep pans, of small diameter, and well painted on the outside are used. They are provided with bails, so as to be convenient in handling. The milk is strained into these vessels to the depth of about three inches, and they are set directly upon the oak floor, the water surrounding them to the depth of the milk, maintaining a temperature of about 58°.

The milk sets here about twenty-four hours, when the cream is removed and placed in deep vessels holding from ten to twelve gallons. As the temperature of the room does not at any time rise above 58° or 59°, the cream is kept at this temperature until it goes to the churn. In some establishments there is a place in the spring-house, where the depth of water is eight or ten inches, for the especial purpose of placing the pails of cream, and where they are kept until the cream acquires a slightly acid taste, when it is ready for churning. The essential feature in the management of milk, is to keep the milk and cream near a temperature of 60°. And when a uniform temperature of this kind is preserved, the largest quantity of the best quality of butter will be secured. The churning is usually performed twice a week, though in some dairies which manufacture the "Philadelphia butter," the cream is churned but once a week. In removing the cream from the milk the Orange Co. plan is to use a funnel-shaped cup, with a long handle, dipping off the cream until the blue milk makes its appearance. In the Pennsylvania plan the skimming is done with a concave tin scoop, perforated with small holes. The churning is usually done by horse-power at the large establishments, and the temperature of the cream when the churns are set in motion, is about 62°, and just before the butter comes, cold milk or a pail of cold water is thrown into the churn.

The churn is of barrel shape, revolving on a journal at each head. The churning occupies nearly an hour, and after the buttermilk is drawn off cold water is added and a few turns given to the churn, and the water is then drawn off. This is repeated until the water as it is drawn off is nearly free from milkiness. The butter is worked with butter-workers, a dampened cloth meanwhile being pressed upon it to absorb the moisture and free it of traces of butter-milk. The cloth is frequently dipped in cold spring-water and wrung dry during the process of wiping the butter. It is next salted at the rate of an ounce of salt to three pounds of butter, thoroughly and evenly incorporated by means of the butter-worker. It is then removed to a table where it is weighed out and put up into pound prints. After this it goes into large tin trays, and is set in the water to harden, remaining until next morning, when it is wrapped in damp cloths and placed upon shelves, one above another, in the tin-lined cedar-tubs, with ice in the compartments, and then goes immediately to market. Matting is drawn over the tub and it is surrounded again with oil cloth so as to keep out the hot air and dust, and the butter arrives in market in prime condition, commanding not unfrequently from seventy-five cents to one dollar per pound.

PHILADELPHIA BUTTER PAIL.

The following cuts (Figures 5, 6 and 7), illustrate the butter pail and manner of packing for market. Figure 5 shows the general form of the tub,

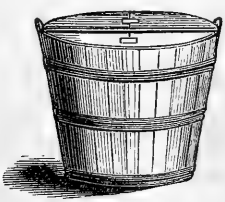


FIGURE 5.

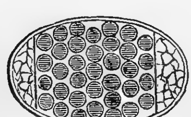


FIGURE 6.

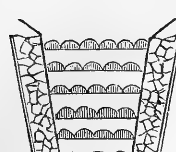


FIGURE 7.

the top or cover opening in halves. Figure 6 is a cross section showing the shelf with the butter prints arranged in place with sections of ice at the ends. Figure 7 is a perpendicular section, showing the ice chamber and ice at the sides, and the shelves of butter one above the other in the center. Ice is

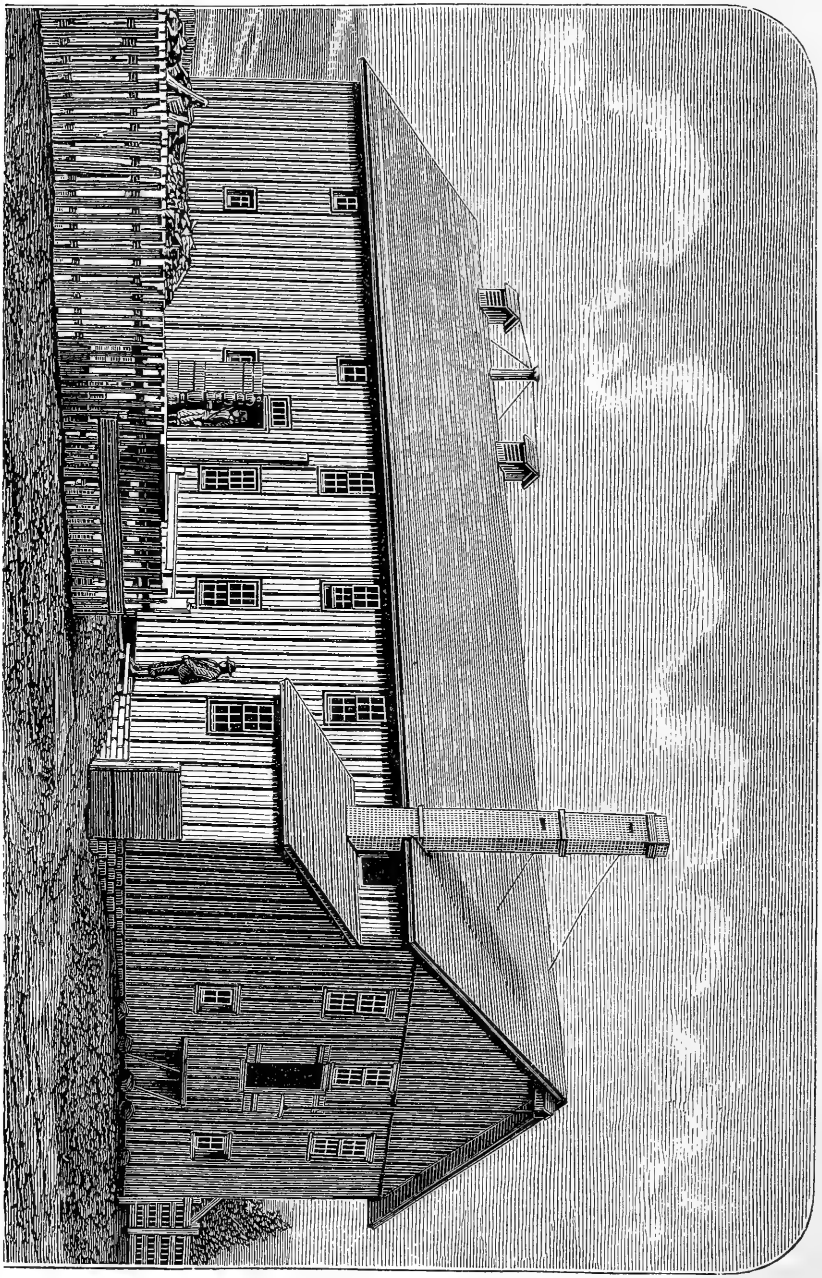


FIGURE 8.—BUTTER FACTORY—ELEVATION.

sometimes broken up and added to reduce the temperature, but the Orange Co. dairymen think a too free use of ice is apt to injure the keeping qualities of the butter.

THE AMERICAN SYSTEM OF BUTTER-MAKING

rests mainly upon six great principles :—1st. Securing rich, clean, healthy milk; milk obtained, if possible, on rich, old pastures, free from weeds. 2d. Setting the milk in an untainted, well-ventilated atmosphere, and keeping it at an even temperature while the cream is rising. 3d. Proper management in churning. 4th. Washing out or otherwise thoroughly expelling the butter-milk, and working so as not to injure the grain. 5th. Thorough and even incorporation of pure salt, and packing in oaken tubs, tight, clean and well made. 6th. Cleanliness in all the operations is of important necessity, while judgment and experience in churning the cream and making the butter must, of course, be had.

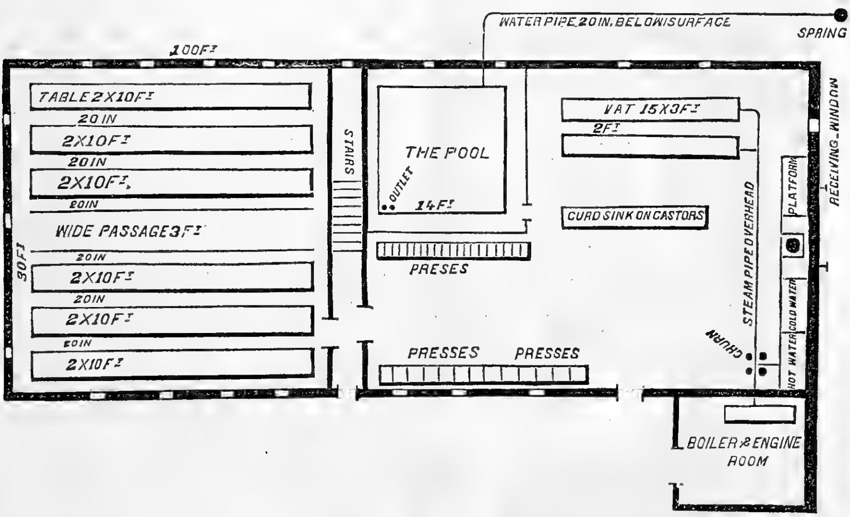


FIGURE 9. GROUND PLAN.—BUTTER FACTORY.

What really distinguishes the American system is the manner of setting the milk so as to secure an even temperature, and applying to butter-making the principles of association, so that the highest skill in manufacturing may be obtained; in other words, the inauguration of butter factories.

In previous pages of this volume cuts illustrating the ground plans of the early butter factories have been given. We introduce here the subjoined cuts (Figures 8 and 9) showing elevation and ground plan of G. B. WEEKS' new butter factory. Referring to the ground plan (Figure 9), it will be seen that in the arrangement the factory is quite as well adapted to cheese-making alone as to butter and skim-cheese manufacture. The advantage of such an arrangement is, that the factory may be turned at once to the making of whole-milk cheese or to butter and skim-cheese, as one or the other system may happen to be most profitable. The ground plan explains itself and needs no description. The upper story of the factory is for a cheese-curing room, and may be divided off for other purposes as well, if desired. The factory is regarded by many as one of the most convenient in its arrangement of any of the modern built establishments.

THE WATER POOLS.

In the butter factories the milk-room is constructed so that good ventilation is secured. It is provided with vats or tanks for holding water. These should be sunk in the earth in order to secure a lower or more even temperature of water as well as for convenience in handling the milk. The pools are about six feet wide, and from twelve to twenty-four feet long, arranged for a depth of eighteen inches of water. There should be a constant flow of water in and out of the vats or pools, so as to secure a uniform temperature of the milk after it has been divested of its animal heat. The milk is set in pails, eight inches in diameter by twenty inches in length (see Figure 10), each holding fifteen quarts of milk. As fast as the milk is delivered, the pails are filled to the depth of from sixteen to seventeen inches, and plunged in the water, care being taken that the water comes up even with or a little above the milk in the pails. The temperature of the water should be from 48° to 56°. A pool holding two thousand quarts of milk should have a sufficient flow of water to divest the milk of its animal heat in less than an hour. Good, pure milk should keep sweet thirty-six hours when thus put in the vats, even in the hottest weather. When milk is kept thirty-six hours in the water nearly all the cream will rise. The Orange Co. dairymen claim that it all rises in twenty-four hours. They say, too, that they get as much cream, by setting in pails on the above plan, as they can by setting the milk shallow in pans, and the cream is of better quality, because a smaller surface being exposed to the air, there is not that liability for the cream to get dry, which has a tendency to fleck the butter and injure its quality.

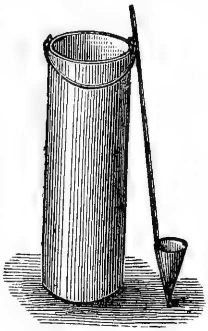


FIGURE 10.

REGULATING TEMPERATURE.

One of the troubles of butter-making on the old system is in regulating the temperature of the milk-room, and in knowing when to skim the cream. It requires close watching. In our variable climate it is almost impossible to keep the milk at an uniform temperature when set in pans in the ordinary way. By the new system we always have an uniform temperature without trouble, and therefore have perfect control of the milk. Again, in the new system, the shells of caseine, inclosing the butter globules, are not so liable to decompose and injure the flavor of the butter, for it is this caseineous matter that spoils the butter, and even under the best management it cannot all be taken out; but by exposing only a small surface to the air we effect an important gain.

PATENT CHURNS.

The Orange Co. butter-makers have tried a great many patent churns, and they find none they like so well as the old barrel dash-churn. At the butter factories they use the barrel and a-half size, and about fifty quarts of sweet cream are put into each churn; the cream is diluted with water, by adding cold water in summer and warm in winter, at the rate of sixteen to thirty quarts to each churning.

THE TEMPERATURE OF THE CREAM IN SUMMER,

when the churns are started is a little below 60°, but in cold weather they are started at 64°. In warm weather ice is sometimes broken up to put in the churn to reduce the temperature to 56°, but it is deemed better to churn without ice if the cream does not go above 64° in the process of churning, as butter made with ice is more sensitive to heat. It requires from forty-five to sixty minutes to churn, when the butter should come solid and of a rich yellow color; it is then taken from the churn, and thoroughly washed in cold spring water. In this process the ladle is used, and three times pouring on water is generally all that is required. It is then salted at the rate of from sixteen to eighteen ounces of salt to twenty-two pounds of butter; for butter intended for keeping through the winter a little more. The butter, after having been salted and worked over, is allowed to stand till evening, and is then worked a second time and packed. A butter-worker, consisting of a lever, fastened to an inclined table, is used for working the butter. Sometimes in hot weather, after salting, it is taken to the spring and immersed in water, when it it taken out, worked over, and packed in sixty pound pails.

WHITE OAK FIRKINS

are used for packing, and the greatest attention is given to have them strongly hooped and perfectly tight, so as not to allow the least leakage. They are thoroughly washed in cold water before using, then in hot water, and again in cold water. After being filled with butter, they are headed up and a strong brine poured in at the top to fill all the intervening spaces. Another advantage resulting from this butter factory system is, that the skimmed milk is turned into skim-cheese. The butter factories, so far as introduced, if managed by competent persons, have proved a success, and have revolutionized the dairy product of the neighborhood.

THEY EFFECTUALLY DO AWAY WITH GREASE

and put upon the market a high-flavored, high priced article. Wherever butter factories are established, consumers go into ecstacies over their introduction. "We now know," they say, "where we can always lay hands on a prime article, and we do not mind the cost for a rare delicacy."

LOSING THE AROMA.

It is sometimes contended that the practice of washing the butter detracts from its fine aroma. Doubtless this is so when the washing is excessive. It is difficult and laborious to expel the butter milk simply by working or kneading. Washing in water seems to be indispensable in removing more perfectly the caseinous particles and securing butter that will keep.

BUTTER CELLARS.

The Orange Co. factories are provided with butter cellars, cool, well ventilated and perfectly free from all taints of decaying substances. It is needless to say that these are indispensable to the butter-maker. To private or family dairies, where butter alone is produced, the system is well adapted. The appliances are not expensive, and compared with the great advantages over old methods cannot be over-estimated.

SKIMMED-CHEESE MANUFACTURE.

In making skimmed-milk cheese, we do not advise that all the cream that will rise be taken from the milk. It is important in the realization of good profits to have a skim cheese of fair quality that will meet with ready sale at a fair price. If all the cream that can be obtained from the milk be removed and the milk then turned into cheese, it will lack quality, and the loss in price will be much more than the value of a little cream which should go with the skimmed milk for the purpose of improving the quality of the cheese, and rendering it more palatable.

If the milk is set in cans plunged in spring water, on the Orange county system, the morning's mess may stand for cream say twenty-four hours, or until next morning; and the night's milk twelve hours. The two messes of milk may then be skimmed, and the milk mingled together, placed in the vat for cheese-making. The manufacture of skim-cheese does not differ materially from that of whole milk cheese. The milk in the vat being raised to a temperature of 82°, a sufficient quantity of rennet is added to perfect coagulation in about fifty minutes or an hour. Then the mass is cut with a steel-bladed curd-knife, the process of breaking effected as with whole milk cheese. The curd now having been allowed to subside, a gentle heat is begun to be applied, and the mass is very gradually raised to a temperature of 96°, the curds meanwhile being stirred, so as to keep from packing or clinging together. The curds are retained in the whey until properly matured, or as dairymen usually express it, "scalded," when the whey is drawn, the curds removed to the sink, and manipulated as with whole milk curds, and then salted at the rate of three pounds salt to one hundred of curd. Skimmed-cheese is usually made in small, flat shapes, somewhat similar to the single Gloucester of English manufacture. They may be pressed in smaller hoops if desired, but very thick shapes should be avoided, as they do not cure so evenly and are more liable to get out of flavor. The most difficult part in manufacture is to know when the curds are properly matured or scalded. This is only to be learned by practice, or by handling the curds.

In making skim-cheese it is important that a good, salable article be produced. When milk is set in pans for butter making, about twenty pounds of milk on an average will produce one pound of butter. In the skim-cheese and butter manufacture, about twenty-eight or thirty pounds of milk on an average are taken to make one pound of butter and two pounds of skim-cheese; thus a basis is given in which to estimate the result of operations.

In regard to the quantity of milk taken to make a pound of butter, I have named twenty pounds as an average, that quantity having been reported from the dairy practice of Hon. ZADOCK PRATT of Green Co., N. Y. In his report, going over several years, we find that during some seasons a much larger quantity of milk was required to make a pound of butter. As milk varies very much in character from a variety of causes, it must be evident that no exact standard can be given to apply in all cases. These figures must therefore, refer only to milk of average good quality.

MILK FOR SKIM-CHEESE MAKING

must not be allowed to sour. It must be kept sweet, and this is easily done with the proper appliances. If the cream is churned sweet, and the buttermilk has not changed, it may be added to the skimmed milk, and thus employed for cheese-making.

BUTTERMILK

can hardly be regarded as of equal average value to the milk with which it is mixed for cheese-making. The value of buttermilk for cheese-making varies greatly from a variety of circumstances. Some specimens may be quite rich and others exceedingly poor. In a specimen of cream examined by BERZELIUS, the butter milk in one hundred parts was composed of cheesy matter, 3.5; whey matter, 92.0. Cream varies very much in composition, according to the circumstances under which it is produced. Cream of average quality contains about twenty-five per cent. of butter. The analysis of two samples of cream gave the following:

	No. 1.	No. 2.
Water,	74.46	61.67
Butter (pure fatty matter),	18.18	33.43
Caseine,	2.69	2.62
Milk sugar,	4.08	1.56
Mineral matter,	0.59	0.72
	100.00	100.00

If it were possible to take all the butter from the cream by churning we should have in the buttermilk of the above samples a trifle over two and a-half pounds of cheesy matter out of a hundred pounds of cream. Or, if we take out the butter, letting the balance represent the butter milk, the first sample would give a little over two and a-half pounds of cheesy material from nearly eighty-nine pounds of buttermilk, and in the second sample about the same amount of cheesy matter from sixty-six and a-half pounds of buttermilk. But in churning the cream a portion of the butter remains in the buttermilk, so it would be no easy matter to say how much cheese one hundred pounds of buttermilk would yield. Milk, in the fall of the year, is quite rich in butter, and even when the night's milk is skimmed and added to the whole milk of the morning, the mixture will probably yield a pound of cheese from nine pounds of milk.

CHURNING THE CREAM OR THE MILK.

It is claimed, as has been remarked, and with some reason, that churning the whole milk makes more butter than to set the milk and churn the cream. In setting the milk there is always a small portion of cream remaining in the milk after skimming; and again, in churning whole milk there are more shells of caseine mixed with the butter. This cheesy matter increases the weight but diminishes the quality of the butter. The shells of caseine also give a whitish appearance to the butter, injuring its color. I do not say but that very good butter may be made from churning whole milk, but it is more difficult than to make from the cream; and hence, for a choice article, of fine color, full of aroma and of long keeping qualities, I should advise setting the milk and churning the cream. A temperature of about 65°, or a little above, is said to be the best for churning whole milk if sweet, but the usual temperature employed is from 60° to 65°.

THE DUTCH PROCESS.

The process of making butter by churning the milk and cream together is practiced to some extent in Holland. In the Dutch process the milk is put into deep jars in a cool place, each meal or portion milked at one time being kept separate. As soon as there is the least appearance of acidity, the whole is placed in an upright churn to be churned. When the butter begins to form in small kernels the contents of the churn are emptied in a sieve that lets the butter milk pass through; the butter is then formed into a mass.

THE SCOTCH METHOD.

In some of the dairy districts of Scotland the process is somewhat similar. The milk when it is drawn from the cow is placed from six to twelve hours in a cooler. When completely cooled the whole meal is emptied into a large wooden tub or vat. If the vat is sufficiently capacious and a second meal of milk has become cold, before the first exhibits any acidity, the two may be mixed together. A lid or cover is then put over the vat, which is allowed to stand undisturbed until the milk has soured and become loppered or coagulated. When it has arrived at this state it is fit to be churned. It is put in the churn and agitated a few minutes merely to break the coagulum of the milk. The mass is then brought to a temperature of 70° and churned. In some sections the milk is churned sweet, either a few hours after milking, or the night's and morning's mess of milk mingled together, and churned in the afternoon. It is more work to churn the milk than the cream.

TURNING THE MILK TO MOST PROFIT.

When it is desired to turn milk to most account or profit, it should be set for cream, and this being removed while sweet, the skim-milk may be made into skim-cheese. Small skim-cheeses well made, meet with ready sale at a fair price. The whey resulting from the manufacture of the skim-cheese, when mixed with meal, is turned to good account as a feed for hogs, and in this way nothing is wasted.

COLORING BUTTER.

One of the market requisites in butter is that it be of a rich yellow or golden color. The fact that grass butter always has a rich shade without resorting to artificial coloring, is sufficient reason on the part of consumers for suspecting that white butter must be of inferior quality. Late fall or spring butter made from the milk of cows fed upon hay, is generally deficient in color, and unless some artificial means be employed to give it the desired shade, it will not command a price in market equal to butter of the same texture and quality that has been colored.

Pure annatto when properly prepared is very successfully used for imparting a good color to fall and winter butter. Annatto, of course, adds nothing to the flavor or quality of butter, but as the pure article when thus employed is quite harmless, there can be no serious objection to its use. In coloring butter with annatto it is important that a prime article be used, and to have it prepared so that it shall be free from sediment. Nicholl's English liquid annatto is a very good article for this purpose, but the annattoine, or dry extract of annatto, prepared as for cheese-making, after D. H. Burrell's receipt, which has been given on a previous page, is the best material for coloring butter artificially that I have seen.

It gives a rich shade of color, is quite free from sediment, and from any deleterious adulteration. Doubtless the best way of coloring butter late in fall and spring, is to feed the cows upon early cut hay, nicely cured, with the addition of a daily mess of carrots, oat and corn meal, etc., as no artificial coloring will then be required, while the flavor and quality of the butter approximates more nearly to that made when the cows are at pasture. But as the kind of hay I have named may not be at hand, something, of course, must be done to take away that tallowy look which winter and spring butter is apt to have.

COLORING WITH CARROTS.

I have seen a rich yellow color imparted to butter by coloring with carrots. The carrots should be thoroughly cleaned, then with a knife scrape off the yellow exterior only, and soak it in boiling milk for ten or fifteen minutes. It is then strained through a fine cloth, and the liquid added to the cream before churning. It not only gives a nice color, but some think it imparts a sweetness of flavor to the butter, somewhat resembling that obtained when the cows are feeding upon grass. When carrots are used for the purpose indicated, the outer or yellow portion of the root only is employed. I have heard it suggested that butter colored in this way (with carrots), is injured somewhat in its keeping qualities, but in my own experience I have not found this to be the case. In the use of annatto it is understood, of course, that the coloring is to be added to the cream before churning.

In the American Agricultural Annual for 1868, Prof. S. W. JOHNSON of Sheffield Scientific School, Yale College, has an interesting article wherein the philosophy of butter making is discussed. We make the following extracts. He says:

"AVERAGE COMPOSITION OF THE PRODUCTS OBTAINED FROM MILK IN MAKING BUTTER.

"In making butter, one hundred parts of milk yield on the average, in round numbers, the following proportions of cream, butter, etc., provided the cream rises in a cool apartment, so that no sensible evaporation of water takes place:

Butter milk,..	6.0		
Butter,..	4.0		Calculated without salt.
Water removed from butter by salting,.....................	0.1		
Cream,..	10.0	10	
Skimmed milk,..		90	
		100	

"The average percentage composition of these products is given in the subjoined table:

	NEW MILK.	SKIMMED MILK.	CREAM.	BUTTERMILK.	BUTTER.†	BRINE.‡
Fat,...............	4.00	0.55	35.00	1.67	85.00	0.00
Alluminoids,*......	3.25	3.37	2.20	3.33	0.51	0.39
Milk sugar,.........	4.50	4.66	3.05	4.61	0.70	3.84
Ash,...............	0.75	0.78	0.50	0.77	0.12	0.86
Water,.............	87.50	90.64	59.25	89.62	13.67	94.91
Total,..........	100.00	100.00	100.00	100.00	100.00	100.00

* Caseine and albumen.
† Unsalted.
‡ Brine that separates on working after salting; salt not included.

"WHEN IS MILK OR CREAM READY FOR CHURNING?

It is very difficult, if not impossible, to bring butter from fresh milk, or from thin cream that gathers upon milk kept *cold* for twenty-four hours. It has been supposed that milk should *sour* before butter can be made. This is an error; numberless trials having shown that sweet milk and sweet cream yield butter, as much and as easily as sour cream, provided they have stood for some time at medium temperature. The fat of milk exists in minute globules which are inclosed in a delicate membrane. It was natural to suppose that in fresh milk this membrane prevents the cohesion of the fatty matters, and that, when, by standing, the milk or cream becomes capable of yielding butter after a short churning, it is because the membrane has disappeared or become extremely thin. Experiments show, in fact, that those solvents which readily take up fat, as ether for example, dissolve from sweet milk more in proportion to the length of time it has stood at a medium temperature.

"Readiness for churning depends chiefly upon the *time that has elapsed since milking*, and the *temperature to which it has been exposed* in the pans. The colder it is the longer it must be kept. At medium temperature, 60° to 70° F., it becomes suitable for the churn in twenty-four hours, or before the cream has entirely risen. Access of air appears to hasten the process. The *souring of the milk or cream* has, directly, little to do with preparing them for the churn. Its influence is, however, otherwise felt, as it causes the caseine to pass beyond that gelatinous condition in which the latter is inclined to foam strongly at low temperatures, and by enveloping the fat globules hinders their uniting together. On churning cream that is *very sour*, the caseine separates in a fine, granular state, which does not interfere with the "gathering" of the butter. Even the tenacious, flocky mass that appears on gently heating the sweet whey from Cheshire cheese, may be churned without difficulty after becoming strongly sour.

"Cream churned when *slightly sour*, as is the custom in the Holstein dairies, yields butter of a peculiar and fine aroma. Butter made from sour cream is destitute of this aroma, and has the taste which the Holstein butter acquires after keeping some time. Stirring of cream does not promote souring, but rather hinders it by increasing access of air; it may be advantageous in making the souring uniform.

"THE TEMPERATURE WHILE CHURNING.

which is most favorable for gathering the butter with the proper softness and adhesiveness, is 66° to 70° F. The melting point of butter made on dry hay is slightly higher than that produced on grass, or while feeding with oil cake; correspondingly we find that, in winter, it is customary to churn a few degrees warmer than in summer. Sour cream may be cooled by direct addition of water, but sweet cream is thereby prevented from yielding its butter. In the latter case, cold skim-milk may be used, or the cream should be cooled by water external to the churn.

"THE DURATION OF CHURNING.

as is well recognised in practice, is of great influence on both the quality and quantity of the butter. Half an hour, at least, is considered essential by experienced dairymen for churning, when the volume of cream is considerable, and an hour or even more is not thought too much. The object of churning is to bring the fat globules of the cream or milk, which, by standing a suitable time, have become divested of their envelopes, into contact so that they unite to a coherent mass. The gentler the motion to which the cream is subjected, the more slowly goes on the process of agglutination, and the closer and finer the union takes place. By slow churning the butter leaves the churn in a nearly finished condition, and requires a comparatively small amount of working to complete its preparation. On the contrary, when butter is to come in a few minutes by violent agitation, as in the strife for the repute of quick work in case of trials of new churns, there is obtained, instead of good butter in dense and large clumps, a doughy mass consisting of little balls of fat mixed with buttermilk and cream, and full of air bubbles, which no skill in working can convert into good butter. While it is true that violent churning will produce a greater weight of so-called butter, it is demonstrated by chemical analysis that the milk or cream thus treated does not yield so much of its fat as is obtained by slower and gentler agitation. The greater weight of the product is due to the admixture of butter milk, which is retained in the spongy mass. The fact that churning must go on for some time before any visible change is effected in the cream, and that the butter 'comes' somewhat suddenly, is due to the exceeding minuteness of the fat globules, of which myriads must unite before they attain a size visible to the unaided eye.

"WASHING BUTTER.

To prepare butter for keeping without danger of rancidity and loss of its agreeable flavor, great pains is needful to remove the buttermilk as completely as possible. This is very imperfectly accomplished by simply working or kneading. As the analysis before quoted shows, salting removes but little besides water and small quantities of sugar. Caseine, which appears to spoil the butter for keeping, is scarcely diminished by these means. Washing with water is indispensable for its removal. In Holland and parts of Holstein it is the custom to mix the cream with a considerable amount of water in churning. The butter is thus washed as it 'comes.' In Holland it is usual to wash the butter copiously with water besides. The finished article is more remarkable for its keeping qualities than for fineness of flavor when new. The Holstein butter, which is made without washing, has at first a more delicious aroma, but appears not to keep so well as washed butter. Swedish butter, made by GUSSANDER's method, in which the cream rises completely in twenty-four hours, the milk being maintained at a temperature of 60° to 75° F., is, when prepared without water, the sweetest of all. If, however, it is to be kept a length of time, it must be thoroughly washed before salting.

"SALTING.

"Immediately after churning the mass consists of a mixture of butter with more or less cream. In case very rich cream (from milk kept warm) is employed, as much as one-third of the mass may be cream. The process of working completes the union of the still unadhering fat globules, and has, besides, the object of removing the buttermilk as much as possible. The buttermilk, the presence of which is objectionable in new butter by impairing the taste, and which speedily occasions rancidity in butter that is kept, cannot be properly removed by working alone. Washing, as already described, aids materially in disposing of the buttermilk, but there is a limit to its use, since if applied too copiously, the fine flavor is impaired. After working and washing there remains in the butter a quantity of buttermilk or water which must be removed if the butter is to admit of preservation for any considerable time. To accomplish this as far as possible, salting is employed. The best butter-makers, after kneading out the buttermilk as for as practicable, avoiding too much working so as not to injure the consistency or 'grain' of the butter, mix with it about three per cent. of salt, which is worked in layers, and then leave the whole twelve to twenty-four hours. At the expiration of this time the butter is again worked, and still another interval of standing, with a subsequent working, is allowed in case the butter is intended for long keeping. Finally, when put down, additional salt (one-half per cent.) is mixed at the time of packing into the tubs or crocks. The action in salt is *osmotic.* It attracts water from the buttermilk that it comes in contact with, and also takes up the milk sugar. It effects thus a partial separation of the constituents of the buttermilk. At the same time it penetrates the latter and converts it into a strong brine which renders decomposition and rancidity *difficult* or *impossiblc.* Sugar has the same effect as salt, but is more costly and no better in any respect. Independently of its effect as a condiment, salt has two distinct offices to serve in butter-making, viz.: 1st, to remove buttermilk as far as possible from the pores of the butter; and 2d, to render innocuous what cannot be thus extracted."

TAINTS IN BUTTER-MAKING.

Little things have much to do in dairy management. It is a little thing in butter-making that often spoils a large quantity of butter. Due attention may have been paid to pasturage, to cows, to milking, to setting the milk and churning the cream, and yet the butter turns out to be ill-flavored and inferior for the table. That clealiness and a pure atmosphere for milk and cream are essential to success in butter-making, seems to be one of the most difficult things for people to understand. I have seen butter spoiled by standing the cream in wooden vessels—vessels that had absorbed a taint from decomposed cream and which no ordinary cleansing would remove; nor could dairymaids sometimes be made to believe that so apparently slight a cause would produce the difficulty until a change from wood to stone cream pots changed the whole character of their products. Some dairymen are in the habit of standing their.

CREAM POTS IN THE KITCHEN PANTRY

to take the odors of boiled cabbage, fried onions and the steam of culinary operations on the kitchen stove, and it is from these things, these *little things*, that a taint goes to the cream-pots, and the good woman wonders what is the matter with the butter. The butter-makers of Pennsylvania, who manufacture the celebrated Philadelphia butter, are exceedingly careful that no taints are allowed to come in contact with the cream or milk in the spring-house. You cannot enter their sacred precincts with a lighted cigar, your shoes must be cleansed of all impurities and you are expected to observe all the proprieties that you would on entering a costly-furnished parlor. It is by attention to the smallest details that they have been enabled to accomplish a grand result, and put upon the table a luxury.

CAUSES AFFECTING THE CHURNING.

The food on which a cow is fed has considerable influence, not only on the quantity and quality of the butter she will yield, but on the time required in churning. Generally, when the extra food given is rich in nitrogen, there is less trouble in churning; or, in other words, the butter comes quicker than when such food as potatoes, distiller's slops, etc., is made the sole extra food. If bran, oats and corn meal be given to the cow in connection with the pota-

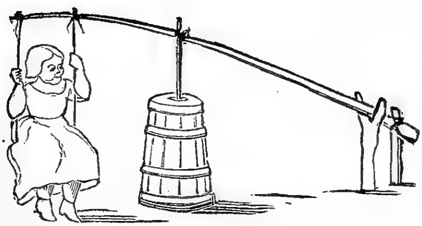


FIGURE 11.

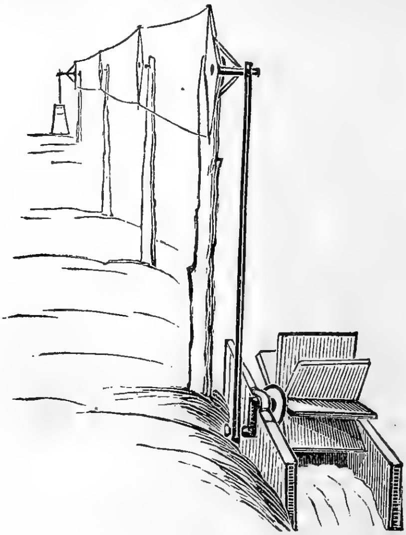


FIGURE 12.

toes, the cream will be of better quality and will be more easily churned than that made from potatoes and hay alone. It may be remarked here that when neither grain nor meal is fed to cows in winter, in addition to hay, and the extra feed is composed of materials of which starch, sugar and water are the chief ingredients, the cream requires to be churned at a higher temperature than that produced from food containing a good proportion of albuminoids. There is another trouble in fall and winter that often retards the churning; the milk and cream are not kept at an even temperature. If the milk is allowed to freeze and thaw, or to fall to a low temperature while being set for cream there is more difficulty in getting the butter speedily. The milk or cream should not be allowed to fall below 50°.

When no conveniences are had for keeping the milk at the proper temperature while the cream is rising, in fall and winter, tolerably good results may be obtained by scalding the milk by placing it in a pan over hot water on the stove. As soon as a little "crinkle" is observed on the outer edges of the thin coat of cream which rises, remove the pan to a room of moderate temperature, or where the temperature does not fall below 50°, and the cream will not only rise rapidly, but can generally be churned with facility. The proper scalding of the milk will be easily learned by experiment. If scalded too much, the amount of cream will be diminished. I do not object to potatoes being fed to cows in milk during fall and winter, but they should have in addition a mess of meal daily, with all the good hay they can eat.

POWER FOR CHURNING.

A great many devices from time to time have been invented for lessening the labor of churning. Commencing with some of the more rude and simple modes of applying power, the preceding cut (Figure 11), is an illustration. It is simply a hickory sapling about twelve or fourteen feet long, fastened firmly at the butt end, while at the other end is fixed a seat in which a child can sit and perform the work with more ease than a grown person in the ordinary way. The dash of the churn may be fastened at any point to accommodate the spring of the pole.

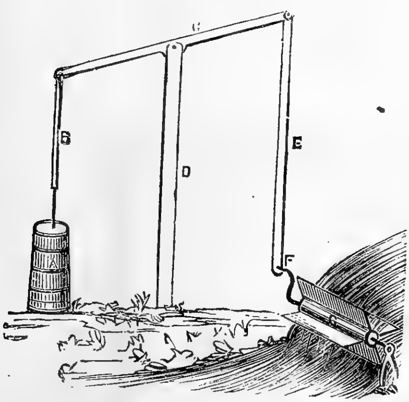


FIGURE 13.

Then we have the simple arrangement of utilizing the water from small streams that may happen to be convenient to the premises. An illustration of such apparatus is shown in figure 12. Figure 12 is a water-power churn, showing the water-wheel fitting easily into the box or flume at the outlet of the dam; or it may be simply placed in a swift-running brook, as it does not require much power or speed. The wheel should be about three feet in diameter. The power can be transmitted any distance by means of two wires fastened upon poles with swing-trees that receive a backward and forward motion from the crank of the water-wheel.

A correspondent of the RURAL NEW YORKER sends to that paper the directions for making one of these appliances, which may prove suggestive and useful to farmers who have an opportunity of using water power for the purpose named. He says:—Take a stick of timber twenty inches in length and six in diameter (marked G,) (see Figure 13) secure it at the ends by iron bands (similar to hub-bands on a carriage-wheel) to prevent splitting while mortising the holes and driving the arms, to which pieces of board seven inches in width and twelve or fourteen inches long must be nailed. These are the paddles to the wheel, and there must be four of them. In one end of the shaft there must be an iron pin, in the other a crank F, similar to the crank of a grindstone. The crank must be just half as long as the play in the churn. Have the end of the crank square where it is driven into the end of the shaft, so as to prevent its moving in the shaft as the wheel goes round. After the end of the crank is driven into the shaft, attach the other end to a piece of board two inches in width E, reaching up to cross piece C, which is made long enough to reach to the place where the churn is to sit. The center of the cross piece is made to play upon an iron or hard wood pin in a groove in the top of a post D, which must be set firmly in the ground, or made firm some other way. At the other end of the cross piece is another stick or light piece of board B, extending downward to the top of the churn dashers, and is secured by boring a hole in each end, tying them together with a good strong string, and all is ready for churning. I have one of these which my son fourteen years old made, after irons were ready, which does my churning in twenty minutes, when the cream is the right temperature.

When considerable quantities of cream are to be churned and hand power is relied upon, the following sketch and description which a correspondent sends us may be useful. He says the machine was invented by a neighbor

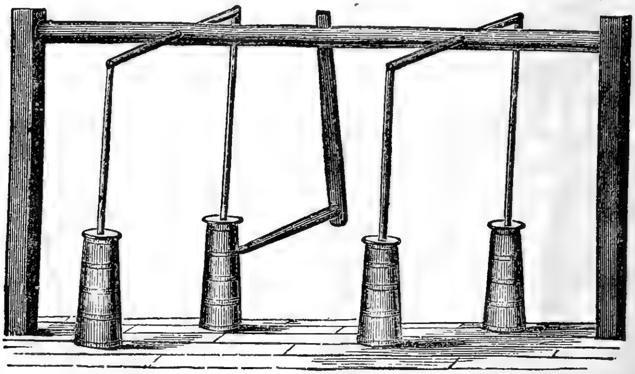


FIGURE 14.

who has used it twenty years and finds it a most convenient and labor-saving appliance, and any farmer who is handy with tools can make all the parts in a short time and it will run one or half a-dozen churns as easily as could be wished. He describes the machine as follows (See Figure 14). A horizontal shaft eighteen inches in circumference, is made to turn loosely in posts or in stationary uprights at either end. In the center of the shaft is fixed a bar that extends nearly to the floor, and at the lower end there is a handle of convenient length for moving the bar to and fro, thus setting the machine in motion. Cross bars are arranged in the shaft to which the churn dashers are attached. When four churns are to be used at once, the posts should be seven feet apart, and the cross bars to which the dashers are attached should pass through the shaft half-way from either post to the perpendicular bar which operates the machine. The churn-dasher handles must be made ten or twelve inches longer than the ordinary handles, and with holes through the top to receive a pin by which they are secured to the cross-bars, making a movable joint. The cut (Figure 15) shows a mechanical contrivance to lessen the labor of hand churning. The system of gearing and balance wheel not only lessens the labor but produces a steadiness of motion or regularity of stroke of the dash which is always desirable in churning. Figure 16 is the old-fashioned dog-churn, and probably as good in all respects as any. The treadwheel should be carpeted, in order to give the dog a firm hold with his toe-nails. Any carpenter can make it with no other directions than the engraving affords. The plain plank treadwheel should be inclined as in the engraving.

DOG AND SHEEP POWER.

The Cortland Co. butter-makers use a machine constructed on the principle as shown at figure 16, except that there is an improved gearing for

FIGURE 15.

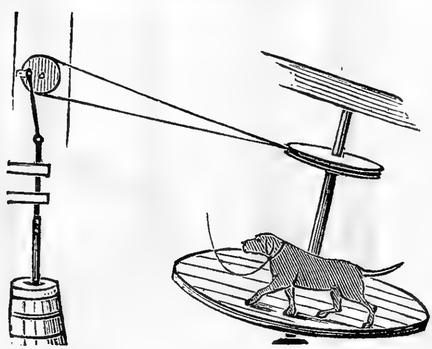


FIGURE 16.

running the churn. In Orange Co. horse-powers for churning are constructed essentially on the same plan. Figure 17 is a vertical wheel with a rim about two feet in width, on the inside of which the animal treads. It is necessary to have this wheel as much as eight or ten feet in diameter. The engraving gives ample insight into its mechanical construction. The EMERY machine, a dog-power, constructed on the railway principle, is very much liked by many, and is a cheap and efficient power. The illustration (Figure 18) shows the form and manner of application.

Among the sweep powers for churning we know of nothing better than the RICHARDSON power—one of the cheapest sweep powers made, and useful for many other kinds of work on the farm besides churning. The cut (Fig. 19) shows its general form.

OVER-WORKING BUTTER AND SPOILING THE GRAIN.

A great deal of good butter is spoiled in the working. There are vast quantities of butter to be found in the markets, of good color, properly salted, the buttermilk expelled, and yet it has a mussy look and lardy taste. Consumers are often at a loss to account for it. The butter is not rancid nor has it any disagreeable odor, but it is poor, nevertheless. This butter may have been made from the nicest cream, with the utmost attention to cleanliness in every branch of its manufacture, from the drawing of the milk to its packing in the firkin. The maker perhaps has expended all her knowledge and every resource within reach to get a prime article, hoping for a name in the market, and an advanced price for a really "tip-top" article. And when the expert affirms that the butter is inferior and must be classed as second or

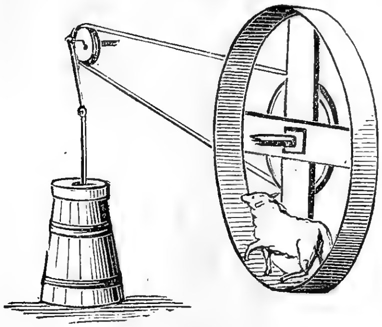


FIGURE 17.

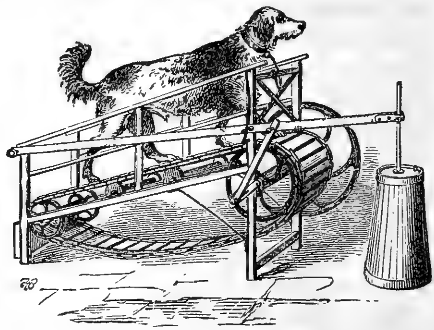


FIGURE 18.

third rate, it is very disheartening, and some give up in despair of ever learning the "knack" of manufacturing a strictly nice grade of goods. They cannot imagine why butter upon which so much care and attention has been bestowed should be condemned as having a greasy look and taste. If inquiry be made concerning the fault in manufacture, the dealer, if he be an expert, will be very likely to say, "My dear sir, or madam, your butter has no grain;" but, as it is somewhat difficult to define what is meant by

THE "GRAIN" OF BUTTER,

and as the manufacturer does not understand where the trouble lies, no improvement is made. What is meant by the term grain as applied to butter, is a waxy appearance, and the more it resembles wax in its appearance the better the grain. When properly churned, both as to time and temperature, the butter becomes firm with very little working, and is tenacious. It then may be easily molded into any shape, and may be drawn out a considerable length before breaking. It has a smooth and unctuous feeling on rubbing a little between the finger and thumb. When the grain is injured the butter spreads like grease, and the more it resembles grease the more is the grain injured. Good butter that has not been injured in the grain will not stick to the knife that cuts it. Butter that has no grain is brittle, and when broken presents a jagged surface and will not spread with that smooth, waxy appearance belonging to good butter. It is only when butter has this waxy consistency that it preserves that rich, nutty flavor and smell which impart so high a degree of pleasure in eating it. So it will be seen there is very good reason for consumers rejecting butter that has been overworked into grease, even though it may have all the essentials of the best quality when taken from the churn.

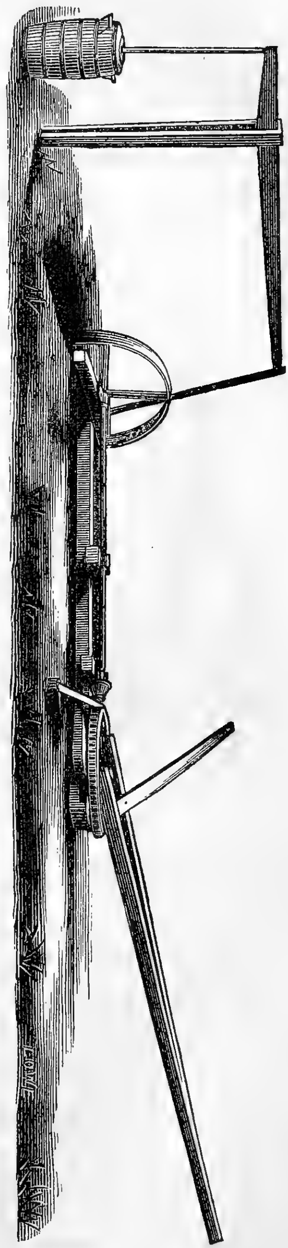


Figure 19.

IN WORKING BUTTER.

the hands should not come in direct contact with the butter. Gather it together with a wooden butter ladle in the tray or butter bowl, turn off the buttermilk and wash with fresh spring water. Gash it around the whole circumference, making channels lowest at either end, so that the buttermilk can readily run off. Do not grind it down against the tray, after the manner of tempering mortar, for in this way you will be likely to injure the grain. It is not well to attempt to work out all the buttermilk at once.

But very little manipulation is required in washing out the buttermilk; then salt with pure, fine salt and set aside in a cool place for twelve hours, during which time the action of the salt will liberate more of the buttermilk. Then work a second time, either with the ladle or butter-worker, using precautions not to overwork or grind the butter by rubbing it down against the tray, and then the work is done and the butter is ready for packing.

BUTTER-WORKER.

Quite a number of butter-workers have been introduced from time to time, some of them useful and others liable to injure the grain of the butter from their peculiar construction. On a previous page I have given a cut of the butter-worker used largely in Orange Co. Among the butter-workers of Cortland Co., N. Y., I found an instrument very much like those illustrated in figures 20 and 21, largely in use. They appeared to be inferior to the Orange Co. machine. The subjoined cuts will illustrate some of the butter-workers that have been in use from time to time (see Figures 22, 23 and 24). Figures 22 and 23 consist of a table and fluted roller. The roller is made of hard wood, and being pressed over the butter expels the buttermilk. It may also be made to incorporate salt with the butter. A table is in some cases made with a marble top; but it has been urged against such that the acid of the buttermilk decomposes the stone, and the lime becoming mixed with the butter, injures it. Hence wood, maple or oak, is preferred.

The Eureka or Corbin butter-worker, is a recent invention, and from its simplicity and ease of operation is a valuable addition to this class of implements. A common butter-bowl is placed and held securely on a small, light stool, firmly against a solid rest R (see Figure 25) that protects it from breaking or springing. It may be revolved either way at will, also easily tipped

FIGURE 20.

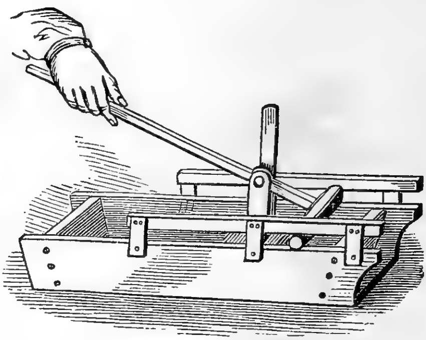


FIGURE 21.

by a lever to drain off the fluids, and as readily removed from the stool as from a table, and bowls of different sizes may be used on the same stool. The ladle, H, is attached to a pendant lever, F, G, that enables a person to press directly through hard butter in all parts of the bowl without drawing or sliding it; also to cut, turn and work it in every manner desired. It is light, strong and simple, everything about it is practical, with nothing to get out of place or order, and it is as handily moved, washed and dried as any butter bowl and ladle. The lever, E, is fastened to the slot, J, while the butter is being worked, and is raised up to discharge the buttermilk from the bowl as occasion requires. There is a circular iron rim fastened to the bottom of the bowl which slides in an iron groove attached to the lever K, and which allows the bowl to be moved round and when desired to be removed entirely from the other parts of the worker. I have tested this machine for working butter and am pleased with its operation.

SALT.

A great many people do not understand the importance of keeping salt in a dry, pure atmosphere. Of course a pure article of salt should be obtained in the first place; then keep it where it will not absorb foul gases and bad odors. Salt that is allowed to get damp and is exposed in this condition to the effluvia of rotten vegetables, the odors from carrion, the sink or cess-pools is not fit to put into butter. Butter is often spoiled in flavor by inattention to the manner in which salt is kept—allowing crumbs and other refuse matter from the pantry to fall into the salt dish—taking out salt with dirty hands, etc., thus leaving impurities to be gathered up and added to the butter.

HAIRS.

It may also be added that human hair is no improvement, either in the flavor or quality of butter. I have seen choice samples of butter rejected on account of a *single hair* having been discovered in it. So strong was the impression that the butter was made by a dirty, shiftless person, that no argument could prevail upon the customer to take it.

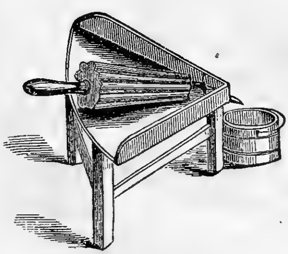


FIGURE 22.

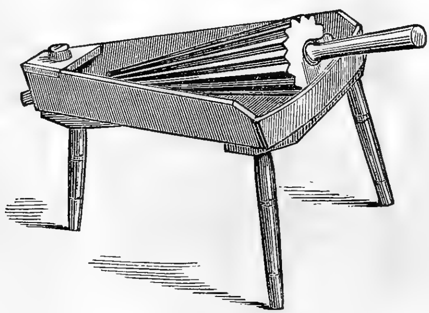


FIGURE 23.

PACKING BUTTER AND BUTTER PACKAGES.

A great many people make good butter and spoil it in the packing. Probably there is no article of food in which fine quality is more eagerly sought after than butter, and none for which a large price is more cheerfully paid. It is true a good deal of butter is spoiled in the making, but it seems such a wanton waste to deliberately convert a good material into grease for want of a little foresight in packing, that we cannot refrain from bringing the question fairly before the butter-makers of the country. Dairymen should understand that

BUTTER WILL NOT KEEP IN EVERY KIND OF A TUB OR FIRKIN,

and he who packs butter in shabbily-made, badly-hooped tubs, does it as a cheat and a wrong to somebody. It is impossible to keep butter any length of time in a leaky tub, exposed as it must be more or less to foul air and odors, before it reaches the consumer. Those who make "gilt-edged" butter pay the greatest attention to packing, and a good share of its superior quality (a quality which frequently sells at from seventy-five cents to a dollar per pound) is due to extra packages and the extra care taken in all the details while packing. No "gilt-edged" butter is filled in firkins or pails standing in the house-cellar, surrounded by decaying vegetables, in the vicinity of soap tubs, stale beef brine, and accumulations of soap grease. Some people pack and store butter in these places, and then complain because they cannot get the market price on the day of sale.

A few years since a dairyman of my acquaintance, who had been particularly unfortunate in his sales, sent for a noted butter-maker to learn the secret of making a high-priced article. The man came and looked over the premises, and the only advice given was, "You need a clean, sweet, well-ventilated cellar for storing butter, and it must be used for nothing else;

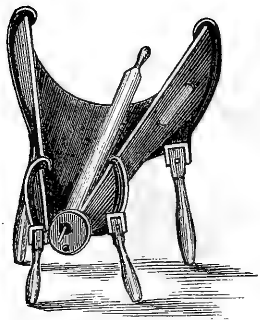


FIGURE 24.

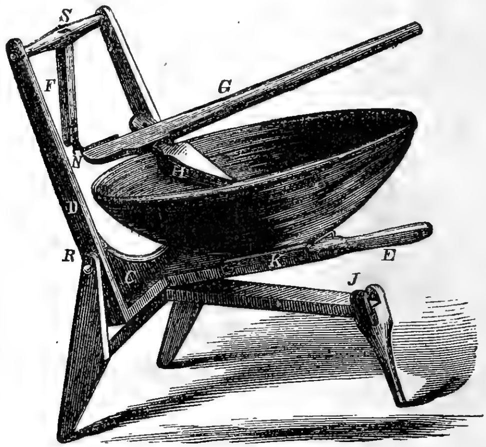


FIGURE 25.

THEN GET OAK FIRKINS, HEAVILY HOOPED, AIR-TIGHT,

and made just as handsome as the best cooper can turn them out. You need not change in your process of manufacture. This is all you have to do, and I will warrant your success." These suggestions were at once adopted and quick sales, large prices and heavy profits were the result. That dairy has now an enviable reputation, and the butter is eagerly sought after. A dirty-looking package will often lose a good sale. It should have a fresh, clean, sweet appearance when it reaches the consumer, that will please the eye of the most fastidious.

THE KIND OF WOOD FOR PACKAGES.

There are only a few kinds of wood that are fit to pack butter in. Wood of the ash is extensively used in some sections. It contains an acid very objectionable for butter, and should be rejected. Spruce, pine and other gummy woods are often used, but they impart a disagreeable flavor to the butter.

White oak makes an excellent package, but the wood should be thoroughly seasoned before using. If the package is to be filled at once and immediately sold, a price may perhaps be obtained for it as a good article, but unless it goes into immediate consumption some one finds himself cheated with rancid grease. Just where the cheat comes in, and who are the guilty parties, the thousands of persons who are being cheated never know. I have given on previous pages cuts representing the Orange Co. packages and the Philadelphia butter package. One of the best return packages is the Wescott return butter pail represented in figure 26. It is made of the best kiln-dried white oak, matched and turned perfectly smooth inside and outside, oiled and varnished, with extra heavy iron hoops, nicely fitted and perfectly secured cover by means of galvanized ears of malleable iron, with bar, spring key and galvanized hasp. It is a neat, substantial, secure and durable article. The twenty-five pound white oak pail furnished by the Oak Pail Manufacturing Company is also a desirable article. It is designed for packing choice butter for family use, and not being liable to breakage, and being made of the best

Figure 26.

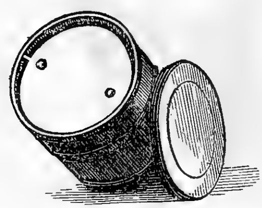


Figure 27.

materials and in the best manner, it is to be recommended. Recently small packages made after the Wescott return pail, each package holding about five pounds of butter, have been introduced. Twelve of these packages are placed in a box in double tiers and are thus sent to market.

The Elmere package is a Vermont invention, and consists in what may be termed a follower nearly as large as the inside of the tub, with a projection at two opposite points that slide down in grooves about an inch, and then become fast by sliding into another groove running in an opposite direction. The object of the follower is for salt to be placed upon it in such quantity as to produce a brine that will keep the air entirely excluded from the butter, preserving it from rancidity. The article is represented in figure 27.

PREPARING FIRKINS FOR USE.

In preparing firkins and tubs for use, boiling water should be poured into them and left to soak for twenty-four hours. Then fill with strong brine for two or three days, turn out and rinse with pure, cold water, and rub the sides with, pure fine salt. Tubs, after being fitted should be headed and brine poured in at a hole in the top so as to fill all intervening spaces. Firkins when filled may be covered with a thin piece of muslin, upon which is spread a layer of fine salt, and then closed with a wooden cover. Store in a clean, sweet, well-ventilated butter cellar until ready for market. Good butter in good tubs, properly packed and stored, need not wait long for a customer at top prices.

WHEY BUTTER.

At the farm dairies and among the early factories the butter taken from the whey was not considered of much account beyond furnishing a kind of grease for oiling the cheese. The whey was run into vats or tubs, and after standing from twelve to twenty hours, or longer, the cream was taken off and a sufficient quantity being obtained, it was placed in a kettle over the fire and "tried out" something in the manner of preparing lard. At the farm dairies it was often churned and the butter purified by heating over a fire and pouring the oil from the sediment. The opinion did not at that time generally prevail that any thing more than a respectable kind of grease could be obtained from whey cream. A few years ago, however, processes were adopted for obtaining whey butter and preparing it for table use. In this some factories have met with great success, being able to produce a quality of butter that, when freshly made and nicely put up, will sell in the market at the same price as the ordinary samples of butter made at farm dairies. Whey butter, however, both in texture and flavor, is inferior to fancy butter made from cream, and though when freshly made it may be made to pass for cream butter for table use, still it does not possess long-keeping qualities and should go into immediate consumption as soon as made. The following is a description of the processes by which whey butter is manufactured for the table. Under that entitled the hot process five hundred gallons of whey on an average is said to yield twenty pounds of marktetable butter.

THE HOT PROCESS.

In this process the whey is drawn sweet directly from the curds to a vat having a copper bottom, and setting over an arch similar to those used for boiling sap in sugar making. The butter works are separated from the cheese manufacturing department, the arch and vat being arranged lower than the cheese vat, so that the whey may be readily drawn, simply by having a conductiug pipe from one vat to the other. After drawing the whey one gallon of acid is added for every fifty gallons of milk, if the whey is sweet. If the whey is changed a less quantity of the acid will be sufficient, and if the acid is not sharp one pound of fine, pure salt should be incorporated with it. The acid having been added in the above proportions heat is immediately applied to the mass until it indicates a temperature of from 175° to 185° F. As the cream rises to the surface it is skimmed off and set in a cool place until next day. It is then churned at a temperature of from 56° to 68°, according to the temperature of the atmosphere, and then worked and salted according to the usual method of butter-making. The acid is made by taking any quantity of whey after extracting the cream, heating it to a boiling point, and adding a gallon of sharp, sour whey to every ten gallons of boiling whey, when all the caseine and albuminous matter remaining in the whey will collect in a mass. This is skimmed off and the whey left to stand for twenty-four to forty-eight hours, when it will be ready for use.

THE COLD PROCESS.

The other process, called the EGGAR, or cold process, is said to make very good butter, but I am not so familiar with its operations or the quality of the butter produced as in the process I have first described. In the cold process the whey is drawn into a zinc vat, or one having a metal bottom. This vat is fifteen inches high, three feet wide and of convenient length. It sets in a wooden vat with space between the two for cold water. The whey is then drawn into the upper vat, and a handfull of salt added to every ten gallons of whey. During the first two hours it is stirred thoroughly from the bottom every fifteen minutes. Afterward it is left to stand quiet for about twenty-four hours, when it is skimmed. The cream is then churned at a temperature of about 58°. If the temperature of the cream is above 60° cool it; if below 56° warm it. It is churned until the butter becomes granulated about the size of buckwheat kernels, when it is left to stand about five minutes, then let the buttermilk run off, and throw on cold water. Let it stand until it is hard before stirring much, then rinse with cold water until the water runs off clear, then churn it together or gather it and press the water out, and salt it at the rate of one pound of salt to fourteen pounds butter. Let it stand till next day and work and pack as with other butter.

APPENDIX.

DAIRY BARN.

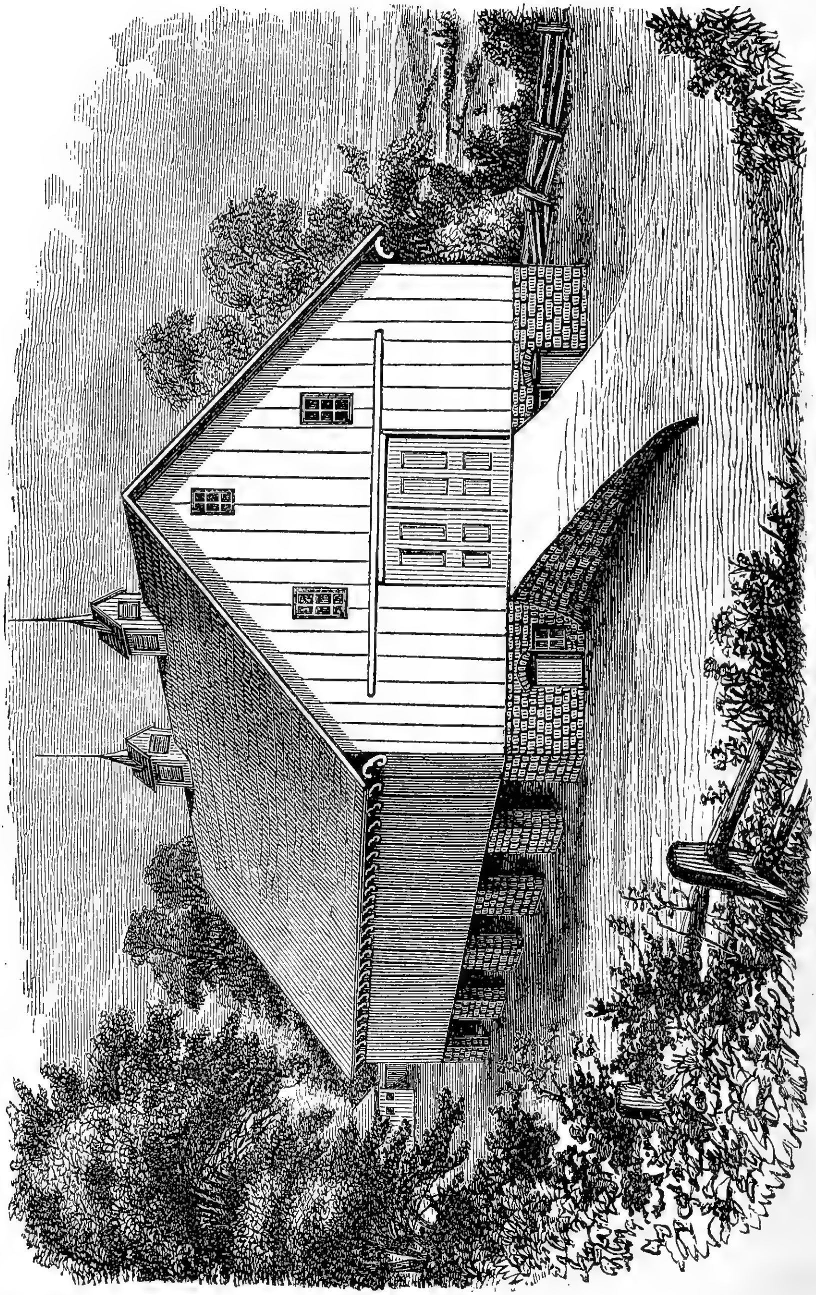
Since writing the description of Dairy Barns, in the fore part of this volume, a correspondent of the Rural New-Yorker sends to that paper the following plans of a convenient dairy barn, which we think offer good suggestions to those who propose to erect this kind of building on dairy farms. He says:—This barn was designed and is now owned by D. W. Clark, Esq., of Schuyler's Lake, N. Y., who is one of the leading dairymen of Otsego County. The principal advantages attained in its construction are a dry, light and well ventilated stable for cows, convenience in feeding and caring for the same, ample storage for all the forage needed during the winter, besides room for all the grain raised on a large dairy farm; also depositories for manure, so arranged that it is protected from the washings of heavy rains without incurring the risk of injuring the health of stock or rotting the timbers which support the stable floor, as is the case where the manure cellars are directly under the stable.

By referring to the engravings, the reader will understand how these advantages are secured. The basement walls are built on a foundation of stone, hammered into the soil, and are twenty inches thick, of quarry stone, laid in lime mortar, and are eight feet high; the sills are bedded in mortar, and are of yellow pine. The cross sills are supported by two cast-iron columns (set on a thick stone, four feet square) under each bent. The piers under main sills are two by four feet, of quarry stone. There are six bents in the frame, the posts of which are braced and pinned at both top and bottom. The feed holes or traps are directly beneath the cupolas, which, together with the windows in rear of stables, are hung on hinges, and may be swung up to secure perfect ventilation. That portion of the basement devoted to stabling is thirty by seventy feet. Total area of building, fifty-two by seventy; has capacity for stabling forty-two cows, together with feed, horse-power machinery for cutting feed, &c. The root cellar is near the barn, where there is a stream of water convenient for washing roots and watering stock. The siding is of inch pine, planed and matched, and thoroughly painted. Total cost, $3,000.

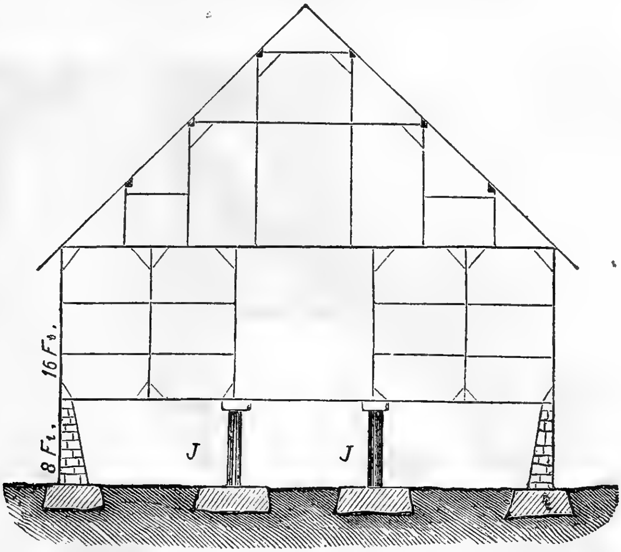
SUMMER TEMPERATURE OF THE DAIRY REGION.

Mr. Anson Bartlett of Ohio, in an address before the American Dairymen's Association, gives the following:

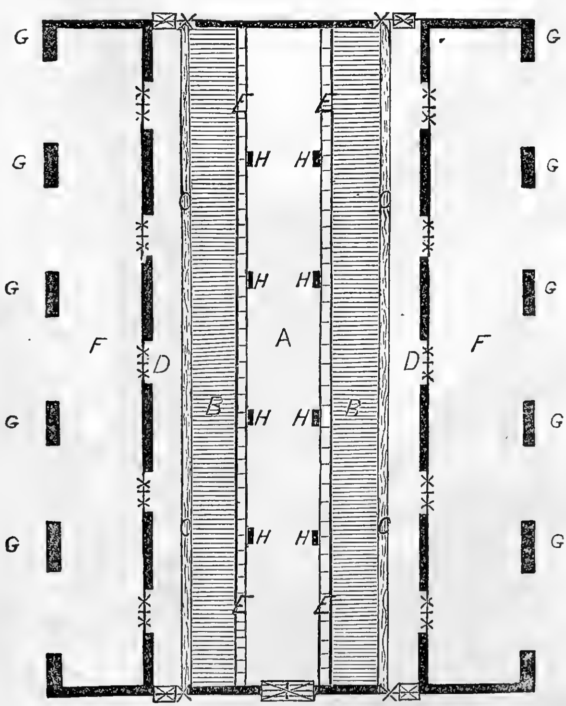
It is well understood by practical cheese-makers that, in a temperature of 65° or below, there is very little difficulty in preserving milk, providing ordinary care is used to keep all utensils used for or about it clean and sweet, and that while such a temperature is maintained the merest tyro can produce a fair article of cheese, but that when the temperature of the atmosphere rises above that point, ascending as it does in some parts



A MODEL FARM BARN.—ELEVATION.



END VIEW OF FRAMEWORK.—The ends or outside bents have walls clear across under sills, instead of iron columns. I, I, Iron columns. Hight of basement, 8 feet; hight of post from basement to rafters, 16 feet; roof, one-half pitch.



Basement.—A, alley. 8x70 feet; B, stall floor, 4½x 70 feet; C, ditch or drop, 14 inches wide; D, space or walk; E, stanchions; F, manure cellar; G, piers, 2x4 feet; H, columns under cross sills; W, windows; I, doors.

TABLE SHOWING THE TEMPERATURE OF THE DAIRY REGION.

Stations.	State	Highest Degree of Summer Heat.	Lowest Degree of Winter Cold.	Mean Annual Temperature.	Mean Temperature four warmest months, June, July, August, Sept'r.	Mean Temperature four months, Dec'r, January, February, March.	Mean Temperature for April and May.	Mean Temperature for October and November.	Mean Annual Rain Fall in inches.	Mean Temperature each of four months. June.	July.	August.	September.	Mean Rain Fall during four months, inches.	Years of Observation.
Orleans County, Craftsbury, Vt.		90	—28	40.3	59.1	20.7	45.5	38.1	44.09	60.	66.	61.3	52.6	15.66	1863–66
Chittenden Co., Burlington, Vt.		87	—29	43.	62 5	24.5	47.5	40.	40.78	62.	68.	66.	54.2	15.77	1863–64
Rutland County, Brandon, Vt.		96	—22	45.8	65.5	25.	52.	43.	40.42	65.	72.	68.2	57.6	17.72	1863–66
Hampden Co., Springfield, Mass		103	—21	46.5	65.5	24.5	50.2	44.5	36.25	65.5	73.	63.2	60.5	11.42	1864–66
Berkshire County, Williams College, Mass.		96	—18	44.5	62.	25.5	49.	43.5	35.56	64.5	69.	62.	58.	16.73	1866
Albany, ...	New York.	96	—18	50.5	70.	31.2	57.5	46.5	38.81	68.5	72.1	70.	61.4	20.04	1866
Orange Co., Newburgh, ...		99	—15	50.3	70.2	31.	54.5	49.5	38.82	69.	77.	67.	68.	17.20	1866
Oneida Co., South Trenton, ...		91	—22	44.	65.	25.	44.5	43.4	55.25	64.5	72.5	59.2	64.	24.77	1866
Oneida Co., Clinton, ...		96	—20	48.	68.	24.	50.5	44.5	43.67	69.	69.	67.	61.	17.15	1858–63
Jefferson Co., Theresa, ...		93	—27	44.5	64.	23.5	48.2	42.5	40.71	63.	71.	68.	55.	9.00	1863–64
Madison Co, Oneida, ...		98	—26	46.2	65.5	25.	50.5	46.	62.55	64.	70.5	65.	62.	32.29	1863–66
Oneida Co., Utica,					66.5		.	.		64.	68.5	66.7	58.4		
Oswego Co., Oswego, ...		90	—15	45.75	64.	27.	44.	45 5	44.00	62.2	69.6	66.5	58.	13.02	1863–66
Monroe Co., Rochester, ...		95	—10	47.3	46.2	27.5	51.	45.	35.88	66.5	73.	67.5	58.	12.57	1863–66
Erie Co., Buffalo,.		97	— 9	48.	66.5	28.	48.	45.5	44.11	66.	73.5	68.	60.5	15.42	1858–66
Chatauqua County Jamestown, ...		97	—17	46.	67.	25.75	49.	41.5	50.34	66.5	72.	70.	59.	18.30	1864
Ashtabula County, Austinburg, ...	Ohio.	92	—14	47.75	66.	28.75	52.	44.	43.39	63.5	71.5	71.	58.	13.77	1863–64
Columbiana Co., E. Fairfield, ...		93	— 8	48.2	66.	25.5	54.	46.5	59.44	67.	73.	64.	60.	28.64	1866
Geauga Co., Welshfield, ...		94	—12	48.8	68.5	30.	52.5	43.	51.88	69.	73.2	71.	61.	18.01	1858–64
Cuyahoga County, Cleveland, ...		95	—11	49.5	68.5	30.	52.	46.5	40.84	70.5	74.	67.	62.	18.96	1857–66
Huron Co., Norwalk, ...		91	—13	48.5	67.5	25.5	53.5	46.5	39.81	67.	73.	70.	60.	18 88	1866
Wayne Co., Wooster, ...		98	—10	48.8	71.	27.7	54.5	44.5		70.	76.	73.5	63.		1864
Erie Co., Kelley's Island, ...		93	—13	49.	69.8	29.8	52.	48.5	31.07	68.5	75.	72.	63.5	13.69	1863–66
Lake County Madison, ...		95	—10	49.2	72.	30 5	52.5	43.	46.54	68.8	71.7	68.4	64.6	15.53	1857–58
De Kalb Co, Sandwich, ...	Illinois.	96	—26	45.2	67.75	23.	52.5	41.	35.75	69.	75.	68.	59.5	17.40	1864–66
La Salle Co., Ottawa, ...		104	—25	47.5	68.75	25.75	51.5	42.5	38.91	69.	74.75	69.5	62.	13.38	1857–66
Winnebago Co, Winnebago, ...		98	—28	44.	68.	26.	52.	41.	35.17	69.	74.	68.5	60.	17.77	1858–66
McHenry Co., Marengo, ...		99	—17	45.5	66.2	22.2	51.	44.5	43.92	66.5	75.	65.	59.	24.94	1866
Kane Co., Aurora,		96	—20	46.5	67.5	23.5	53.	44.	31.86	67.	76.	68.	57.	16.55	1866
Monroe County, Monroe, Mich.		95	— 4	48.75	67.2	28.5	56.5	42.5	39.52	67.5	73.2	68.5	59.2	18.81	1863–66
Ingham Co. Agricultural College, Mich....		99	—22	45.8	66.	25.2	50.	42.5	28.12	66.5	73.5	66.5	57.	10.71	1864–66
Cincinnati, Ohio, ...		99	—12	55.	74.	37.	58.	49.	41.31	73.	78.3	74.3	67.3	15.82	1857–66
Louisville, Ky.		96	—10	54.5	75.	34.5	58.2	49.	52.31	72.2	78.5	73.	66.5	23.17	1864–66
Montgomery County, Clarksville, Tenn...		102	0	56.75	73.	40.5	54.5	51.5	48.49	72.5	77.5	73.5	68.5	15.49	1864–66

of our country to 98° or 100°, the real troubles and difficulties of a cheese-maker begin to be experienced; and tainted milk, that worst of all forms of milk, is met with, I believe, only when the thermometer marks a mean temperature for the day of over 70°.

The preceding table, prepared with care, and compiled with a great deal of labor, shows the highest temperature, the lowest degree, mean annual temperature, mean temperature of summer, mean temperature of winter (counting four months, June, July, August and September, as summer, and four months, December, January, February and March, as winter), the mean temperature of two spring months, the mean of two fall months, the mean annual rain fall, the mean temperature of each of the four months, June, July, August and September, and the mean rain of all these four warmest months, at some thirty-four different stations, beginning in the Northeast part of Vermont and Western Massachusetts, extending through New York, Northern Ohio, Southern Michigan and in the Northern part of Illinois, one station in Cincinnati, in Southern Ohio, Louisville, Ky., and Clarksville, Tennessee.

COMPARATIVE STATEMENT OF MILK IN GALLONS, CARRIED ON THE ERIE RAILWAY, FOR THE YEARS 1861, 1862, 1863, 1864 AND 1865.

	1861.	1862.	1863.	1864.	1865.
January	386,907	389,085	398,295	393,995	422,327
February	368,537	372,297	384,917	413,277	410,687
March	447,227	448,525	469,755	521,430	540,902
April	486,192	501,000	550,722	582,657	630,865
May	580,167	613,992	715,500	755,087	809,195
June	623,127	644,877	786,852	815,975	935,972
July	655,457	689,915	782,845	808,065	941,667
August	604,895	652,975	796,092	780,577	871,332
September	521,265	556,650	671,995	640,587	733,760
October	499,247	509,107	604,672	611,342	640,753
November	394,522	407,192	492,992	516,920	528,470
December	400,222	394,920	423,805	456,825	490,256
Total	5,967,770	6,180,537	7,078,455	7,296,740	7,956,189

RECAPITULATION.

1861, total gallons		5,967,770
1862,	do	6,180,537
1863,	do	7,078,455
1864,	do	7,296,740
1865,	do	7,956,189

DAIRY PRODUCT OF THE STATE OF OHIO AND THAT OF HERKIMER COUNTY, N. Y.

The statement is made on the authority of the Ohio Farmer that for the past ten years there has been a gradual decline in the dairy products of that State. The statistics given show that in 1860 there was a larger amount of cheese and butter made in the State than in 1868. These statistics are as follows:

OHIO DAIRY PRODUCT.

	Pounds Butter.	Po'nds Cheese.		Pounds Butter.	Po'nds Cheese.
1860	38,440,498	24,816.424	1865	32,450,139	16,947,905
1861	35,442,858	20,637,253	1866	36,344,608	22,198,929
1862	34,065,629	20,752,097	1867	34,833,445	19,985,486
1863	31,121,275	19,130,750	1868	37,005,378	17,814,599
1864	31,141,876	18,097,095			

HERKIMER COUNTY, N. Y., DAIRY PRODUCT.

	Pounds Butter.	Po'nds Cheese.		Pounds Butter.	Po'nds Cheese.
1864	492,673	16,767,999	1867	204,385	16,772,031
1865	313,755	16,808,352	1868	241,682	15,734,920
1866	232,961	18,172,913	1869	204,634	15,570,487

ABSTRACT OF OHIO FACTORY REPORTS FOR 1865.

NAME OF FACTORY, OR DAIRY.	LOCATION.	Whole number of cows..	Average number of cows	Pounds of milk..........	Gallons of milk..........	Pounds of green cheese.	Pounds of cured cheese.	Average price per pound	Size of cheese............	Average weight dry.....	Per cent. of shrinkage..	Pounds of milk to one of green cheese...........	Pounds of milk to one of cured cheese...........	Price got for making ....
Twinsburg......	Summit County..	490	408	1,192,740	......	......	122,389	16.6¼	15 & 18	53	....	......	9.74	1½ ct.
Bartlett's........	Fowler's Mills, Geauga Co....	807	671	2,519,228	......	277,558	255,390	16.	15 & 9	51	8	9.0767	9.8	10 ⅌ ct.
Sthanhope's.....	Bainbridge, do..	...	575	....	180,135	......	190,514	15.52	16 inches	68	....	......	......	1 cent.
Smith's.........	Thomson, do..	347	...	....	109,574	......	113,270	......	15 & 10	....	....	......	......	1½ ct.
J. M. Clark's....	Huntington, Loraine Co......	26	25	....	......	......	12,972	14.9	....	54	....	......	......	......
Shaw's..........	Mecca, Trumbull Co...........	420	400	1,403,892	......	......	141,333	......	20	85	....	......	9.8575	10 ⅌ ct.
Hall's..........	Claridon, Geauga Co...........	596	...	....	212,083	......	225,623	15.35	15 & 22	....	....	......	......	10 ⅌ ct.
Hood's.........	Auburn, do..	906	800	....	313,739	......	337,635	15.59	20 & 15	....	....	......	......	1½ ct.
Pope's..........	Troy, do..	608	530	2,125,145	206,324	......	228,513	16.50	18	....	....	......	9.3	......
Armstrong's... .	Huntsburg, do..	...	...	2,023,373	......	......	209,253	15.60	15	....	....	......	9.67	1 6-10c.
Chester X Roads	Geauga Co......	900	850	3,011,817	273,801	......	301,843	15.75	15	....	....	......	9.975	1½ ct.
Carter's.........	Leroy, Lake Co.	100	...	....	......	......	36,971	16.6¾	22	100	....	......	......	......
Sinclairville.....	Chautauqua Co., N. Y.........	830	793	1,847,830	......	......	186,950	17.60	15	63	....	......	9.885	2 3-10c.
Canadawa.......	Arkwright, do..	710	650	1,837,750	......	......	187,909	15.93	15	63	....	......	9.78	2 2-10c.

CHEESE STATISTICS.

The following tables in relation to the product of cheese made at different factories of New York and the price at which it sold—going over a series of years from 1863 to 1871—will be found useful. They are taken from the official reports of the factories sent to the Secretary of the American Dairymen's Association, and printed in the annual transactions of that Society from year to year:

CONDENSED REPORTS.

The following Table gives the average number of cows, amount of cured cheese, average price, and average pounds of milk to one of cured cheese for the several factories from which full reports have been received for the year 1864:

NAME OF FACTORY.	LOCATION AND COUNTY.	Average number of cows.	Am'nt of c'd cheese made in pounds.	Av'e price per lb., in cents and fractions.	Av'e lbs. milk for one cured cheese.
McLean	McLean, Tompkins	937	302,084	.....	9.60
Adams Cheese	Adams, Jefferson	700	142,518	23.09	9.95
Blodgett Mills	Cortlandville, Cortland	290	71,800	21.00	10.12
Gilbert Mills	Gilbert Mills, Oswego	350	110,465	18.96	10.10
Oneida Cheese	Oneida, Madison	....	119,346	13.32	9.87
Hart	Oneida Lake, Madison	270	55,422	21.42	10.30
Oneida Cheese	Oneida, Madison	....	174,848	21.05	9.94
Roberts'	Floyd, Oneida	200	....	22.17	.....
Woodworth's	Yorkshire, Cattaraugus	420	124,284	23.00	9.51
Higginsville	Higginsville, Oneida	245	65,776	21.81	9.75
Pecksport	Eaton, Madison	850	284,543	20.50	9.91
Frankfort	Frankfort, Herkimer	475	191,702	21.23	9.42
Herkimer County Union	Little Falls, Herkimer	460	151,980	22.43	9.88
Mannsville	Mannsville, Jefferson	600	162,000	23.06	10.01
Parker's	Wardwell, Jefferson	300	72,010	21.50	9.85
Center Brook	Otego, Otsego	....	21,945	25.00	9.23
C. H. Curtiss'	Waterville, Oneida	250	61,140	22.54	10.18
Decatur	Decatur, Otsego	600	207,634	.....	9.50
Wallkill Creamery Association	Middletown, Orange	400	73,100	.....	.....
Philadelphia	Barber's Corners, Jefferson	....	90,401	21.68	10.26
Week's	Verona, Oneida	530	173,691	21.31	9.59
Daniels'	McDonough, Chenango	500	149,131	19.50	9.75
Holmesville	Holmesville, do	400	114,246	20.62	9.90
Miller's	Constableville, Lewis	580	182,111	22.77	9.54
Collins	Collins, Erie	851	249,608	20.73	9.85
Hawleyton	Hawleyton, Broome	265	68,660	21.80	.....
Coal Creek	Coal Creek, Herkimer	475	176,000	18.80	10.00
Stevens	Lowville, Lewis	750	207,121	21.60	10.16
Charleston	Charleston, Montgomery	335	98,101	22.25	9.84
Nelson	Nelson, Madison	575	199,884	19.69	9.78
West Schuyler	West Schuyler, Herkimer	550	196,916	21.90	9.71
Springfield Center	Springfield Center, Otsego	300	137,866	21.29	9.97
Mile Strip	Fenner, Madison	360	122,105	21.14	9.85
West Exeter	West Exeter, Otsego	500	172,894	21.75	10.07
Brookfield	Brookfield, Madison	200	64,999	24.25	8.31
Orwell	Orwell, Oswego	250	72,557	21.70	10.00
North Litchfield	North Litchfield, Herkimer	375	127,275	21.70	9.90
Deansville	Deansville, Oneida	275	83,094	21.33	10.38
Deerfield and Marcy	Marcy, Oneida	1,032	295,115	20.07	10.26
Stanley's	Adams, Jefferson	400	134,050	18.80	9.90
Scriba	Scriba, Oswego	400	100,744	20.00	9.35
East Berkshire	Franklin, Vermont	500	101,539	24.00	10.00
Ingraham & Hustis'	Adams, Jefferson	600	142,518	23.09	9.95
Whitestown	Whitestown, Oneida	600	204,025	22.70	10.05
Turin	Turin, Lewis	730	206,333	19.68	9.58
Sears'	Cuyler, Cortland	770	206,897	.....	9.93
Loraine	Loraine, Jefferson	400	106,000	21.25	9.72
Brown's	Columbus, Chenango	375	114,429	22.00	9.64
Canton	Canton, St. Lawrence	....	68,032	.....	9.76
E. N. Carrier's	....	400	126,625	.....	9.59
Westcott's	Watertown, Jefferson	318	91,639	23.37	9.52

The following table gives the average number of cows, amount of cured cheese, average price, and average pounds of milk to one of cured cheese for the several factories from which full reports have been received for the year 1865:

NAME OF FACTORY.	LOCATION AND COUNTY.	Average number of cows.	Am'nt of c'd cheese made in pounds.	Av'e price per ℔., in cents and fractions.	Av'e lbs. milk for one cured cheese.
Whitesboro	Whitesboro, Oneida	600	206.567	17.25	10.05
Willow Grove	Trenton, do	688	275,270	16.12	9.75
Bagg's	Holland Patent, do	432	168,592	....	9.42
Chuckery	Paris, do	600	169,714	15.90	9.53
Foster's	Durhamville, do	250	74,146	16.00	10.43
Weeks'	Verona, do	500	174,110	15.89	9.99
Rathbun's	Stittville, do	650	206,000	16.27	9.68
Herkimer County Union	Little Falls, Herkimer	580	226,017	16.50	9.91
Starkville	Starkville, do	580	168,037	....	9.90
West Schuyler	West Schuyler, do	1,000	401,884	16.06	9.61
Herkimer	Herkimer, do	490	190,538	16.05	9.99
Oneida	Oneida Castle, Madison	525	191,681	16.09	9.79
Lamunion & C., No. 3	Stockbridge, do	350	118,171	16.00	9.74
Hunt's	Hubbardsville, do	400	135,552	15.43	9.91
Houseville	Houseville, Lewis	800	257,029	15.60	9.50
High Market	High Market, do	460	148,981	15.58	9.21
Miller's	Constableville, do	750	261,364	16.01	9.35
Hall's	Barnes' Corners, do	560	125,752	14.55	9.63
Rees'	Martinsburgh, do	150	58,680	15.41	9.29
Barker's	Richville, St. Lawrence	640	181,465	14.50	9.43
Southville	Southville, do	100	45,060	15.17	9.45
Olin's	Canton, do	354	106,227	15.25	9.44
Volney Center	Volney Center, Oswego	200	46,886	15.00	9.87
Prattville	Prattville, do	400	116,154	14.70	10.00
Gilbert's Mill	Gilbert's Mills, do	340	131,042	15.25	9.84
East Sandy Creek	E. Sandy Creek, do	1,000	292,494	14.64	10.44
Parker's	Wardwell, Jefferson	400	140,183	15.25	9.87
Leffingwell's	Henderson, do	135	66,847	....	9.99
Bonfoy & Co.'s	Loraine, do	800	220,865	16.25	10.03
Union	Watertown, do	170	42,453	....	9.73
Ingraham & Co.'s	Adams, do	875	262,800	15.60	10.10
Cayadutta	Fonda, Montgomery	845	323,436	15.61	9.81
Charleston Four Corners	Charlest'n 4 Cor., do	600	183,584	15.50	10.00
Springfield Center	Spring. Center, Otsego	442	141,136	15.12	10.54
Smith's	West Exeter, do	500	182,951	15.75	10.02
Center Brook	Otego, do	100	30,696	17.45	9.77
McLean Association	McLean, Tompkins	1,300	556,211	....	10.10
Freeville Union	Freeville, do	650	237,836	....	9.78
Burnham's	Sinclairville, Chautauqua	793	186,950	17.60	9.88
Canadawa	Arkwright, do	650	187,909	15.93	9.78
Coon's (4)	Mina & Sherman, do	1,350	490,000	....	...
Throopsville	Throopsville, Cayuga	450	125,000	....	....
Simpson's	New Hudson, Allegany	300	77,198	15.00	9.69
Beattie's	Truxton, Cortland	600	222,453	16.07	9.82
Holmesville	Holmesville, Chenango	650	219,034	15.25	9.84
Brown's	Columbus, do	500	179,206	16.00	9.66
Maine	Maine, Broome	200	39,560	15.50	9.75
Michigan Creamery	Middletown, Orange	....	92,000	16.00	....
Wallkill	Middletown, do	....	87,686	....	....
Worcester Co. Association	Warren, Massachusetts	450	131,379	15.33	10.17
East Berkshire	East Berkshire, Vermont	800	233,351	17.00	9.50
Mason's	Richmond, do	80	29,600	....	....
Bartlett's	Fowler's Mills, Ohio	671	255,390	15.60	9.80
Baker's Dairy	Fairfield, Michigan	46	29,440	16.50	....
		27,756	9,452,567	15.76	9.81

The following Table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight, for the several Factories, from which full Reports have been received, for the year 1866:

NAME OF FACTORY.	LOCTION AND COUNTY.	Whole number of Cows.	Shri'k-age. Per ct.	Amount of cured cheese made, in pounds.	Aver. price ℔ ℔., in cts. and fract'ns	Aver. w't.	Aver. lbs. milk for one cured cheese
Whitesboro	Whitesboro, Oneida	865	....	311.881	18.07	65	9.88
A. Blue's	North Gage, do	140	....	59,277	17.58	67	9.56
Roberts'	Floyd, do	275	5⅔	82,100	17.41	90	10.12
Dorn's	Ava, do	350	....	96,716	....	...	9.75
Chuckery	Paris, do	590	3	168,561	17.54	96	9.72
Weeks'	Verona, do	620	3¾	212,975	17.92	77	9.74
Cedarville	Cedarville, Herkimer	575	....	233,802	17.32	61	10.10
First National	Frankfort, do	650	....	259,064	17.02	...	10.24
Lamunion & Clark's	Stockbridge, Madison	400	....	118,412	17.50	72	9.86
Hunt's	Hubbardsville, do	600	....	183,479	17.91	71	9.33
Excelsior	Brookfield, do	300	4⅛	97.000	17.25	72	9.25
Empire	Florida, Montgomery	260	....	77,784	17.25	61	10.00

Table for 1866.—Continued.

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of Cows.	Shri'k-age. Per ct.	Amount of cured cheese made, in pounds.	Aver. price pr lb. in cts. and fract'ns	Aver. w't.	Aver. lbs. milk for one cured cheese
Charleston Four Corners...	Charl'tn 4 Cor., Montgomery..	525	....	163,896	17.25	...	10.00
Smith Creek	Palatine, do ..	675	....	222,390	17.25	79	9.95
Gilbert's Mills........	Gilbert's Mills, Oswego........	430	....	151,621	16.70	...	9.73
Ingell & Smith's........	Volney, do	375	....	126,939	16.70	...	9.72
Pratville........	Mexico, do	516	....	134,181	14.83	102	9.96
Trumbull's........	Pulaski, do	270	....	67,406	16.00	...	9.62
Miller's........	Constableville, Lewis........	650	6.45	229,852	18.01	...	9.51
Glensdale........	Glensdale, do	700	....	273,490	17.10	91	9.59
Sulphur Springs........	Lowville, do	770	....	214,282	15.48	106	9.84
High Market........	High Market, do	450	....	136,157	17.21	...	9.35
Canton	Canton, St. Lawrence........	675	....	167,878	.....	83	9.56
Adams........	Adams, Jefferson........	800	....	248,376	16.76	...	9.98
Bonfoy, B. & A........	Lorraine, do	530	....	181,686	17.32	...	9.69
Collins Center........	Collins Center, Erie........	662	....	246,739	15.86	...	9.88
First Collins........	do do	625	....	216,479	16.52	72	9.43
Brant Center	Brant, do	300	....	105,466	16.75	70	.....
Canadawa........	Arkwright Chautauqua........	687	....	186,608	15.43	57	9.65
Sinclairville........	Sinclairville, do	1,049	....	288,060	16.67	55	9.39
Beattie's	Truxton, Cortland	468	....	150,720	17.59	83	9.85
Throopsville C. M. A	Auburn, Cayuga........	400	....	139,455	16.41	95	.....
Simpson's	New Hudson, Allegany........	400	....	136,030	16.13	...	9.29
De Witt C. M. A........	De Witt, Onondaga	300	....	103,453	.....	...	10.07
Hawleyton........	Hawleyton, Broome	200	....	60,000	18.89	...	9.28
Springville........	Springville, Pennsylvania.....	....	....	....	18.00	75	.....
Bridgewater	Bridgewater, do	200	....	62,000	17.50	70	9.06
Spring Hill........	do do	148	....	44,016	17.61	...	9.55
Valley	Hinesburg, Vermont	500	4⅞	128,196	16.60	62	9.82
Fairfield........	Fairfield, Michigan	260	....	101,335	16.42	...	9.58
Wilder's	Evansville, Wisconsin........	339	....	103,650	.....	...	9.60
Compton	Compton, Quebec, Canada	250	....	60,000	.....	...	9.25
		18,779	4.64	6,356,412	17.02	76⅓	9.68

The following Table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight, for the several Factories from which full Reports have been received, for the year 1867:

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of Cows.	Amou't of c'd cheese made, in pounds.	Ave. price per lb., in cents and fractions.	Aver-age weight	Aver. lbs. milk for one lb. c'd cheese.
Verona Landing C. M. A....	Higginsville, Oneida	200	79,763	14.00	68	9.75
Weeks'........	Verona, do	740	250,510	14.40	75	9.91
Manheim........	Manheim, Herkimer........	450	184,141	.....	70	9.75
Miller's........	Constableville, Lewis	1,050	349,503	14.42	..	9.58
Markham's	Colliersville, do	400	117,696	13.94	80	9.77
Root........	Root, Montgomery	475	128,560	13.02	..	10.00
Lenox........	Oneida Lake, Madison	500	147,967	13.50	..	10.07
Hamlet........	Hamlet, Chautauqua........	646	129,633	.....	70	9.90
Port Byron C. M. A........	Port Byron, Cayuga	175	38,891	14.67	..	10.12
Gowanda	Gowanda, Erie	550	179,440	13.13	76	9.54
Collins Center........	Collins C'tr do	681	271,410	15.12	66	9.48
Gilbert's Mills........	Gilbert's Mills, Oswego......	450	158,984	13.08	79	9.64
Union	Mexico, do	1,200	244,609	13.16	..	10.02
Prattville	do do	260	66,592	12.50	..	10.20
Granby Center	Granby Center, do	220	51,771	11.50	..	9.75
Union	Colosse, do	500	133,662	12.13	..	9.88
S. W. Oswego........	Oswego, do	220	37,750	12.50	..	10.50
Rhodes'........	Scriba, do	138	37,000	12.50	..	10.00
Union	do do	325	88,400	13.00	..	9.86
Vermillion........	Vermillion, do	490	104,898	12.20	..	9.91
Volney Center........	Volney, do	350	120,463	12.26	..	9.91
Smith's........	Fulton, do	500	148,548	13.00	..	9.41
Union	Sandy Creek, do	229	70,030	12.92	..	10.00
Pennellville	Schroeppel, do	350	107,588	13.00	..	9.75
Phœnix	do do	475	126,500	13.00	..	9.97
Smith's	New Haven, do	175	33,646	12.50	..	9.70
Bowen's Corners........	Granby, do	489	155,462	12.75	..	9.33
Fairfield........	Fairfield, Michigan	540	215,498	14.00	..	9.53
		12,778	3,779,045	13.12	73	9.83

The following Table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight, for the several Factories from which full Reports have been received, for the year 1868 :

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of Cows.	Amount of cheese made.	Average price per 100 pounds	Average weight	Aver. lbs. milk for one pound cheese.
Bagg's	Holland Patent, Oneida	526	169,249	15.80	..	9.92
Wilcox's	Paris, do	140	42,126	15.13	..	10.26
Verona Landing	Higginsville, do	300	118,770	15.33	..	10.17
Weeks'	Verona, do	560	183,616	16.09	60	9.80
West Canada Creek	North Gage, do	350	124,075	16.50	..	9.75
Cook, Ives & Co.'s	Salisbury, Herkimer	550	183,319	16.00	69	10.15
Newville Association	Newville, do	650	193,110	16.64	..	10.00
North Cazenovia	Chittenango Falls, Madison.	300	73,450	15.00	..	.....
Lebanon	Leonardsville, do	450	148,750	.....	..	9.50
Brown & Co.'s	Georgetown, do	550	179,473	15.47	..	.....
J. F. Torpy's	do do	140	42,284	15.35	..	.....
Beech & Co.'s	do do	200	58,185	15.62	..	.....
Mack's	do do	175	52,530	15.86	..	.....
B. Fletcher's	do do	300	102,184	15.63	..	.....
Sulphur Springs	Lowville, Lewis	500	129,111	15.66	56	9.91
Miller's	Constableville, do	1,000	300,649	15.87	..	9.88
Leyden Cheese Association	Leyden, do	552	170,246	15.32	..	9.75
Evans Mills	Evans Mills, Jefferson	1,100	335,850	15.21	60	9.88
Cooper's	do do	270	51,078	15.33	68	9.65
Jefferson County Factories.	(Aggregate)	23,692	6,245,806	15.33	60	10.00
Mexico Union	Mexico, Oswego	800	164,256	15.02	78	10.06
Prattville	do do	450	82,324	14.60	75	10.28
Colosse	Colosse, do	400	77,573	15.00	75	10.12
Hastings	Hastings, do	130	12,675	14.00	..	10.32
Smith's	Volney, do	475	153,577	14.60	..	9.31
Smith's	New Haven, do	130	26,120	15.50	..	9.14
Root	Root, Montgomery	530	139,351	15.53	74	9.90
Delphi	Delphi, Onondaga	450	148,765	15.25	..	10.17
East Fabius	Fabius, do	450	142,623	15.30	..	9.58
Beattie's	Truxton, Cortland	600	169,233	15.75	..	10.27
Orangeville	Orangeville, Wyoming	357	109,487	15.29	..	9.63
Lancaster	Lancaster, Erie	200	....	.....	..	9.80
Simpson's	New Hudson, Allegany	535	160,881	15.16	..	9.50
Meadow Valley	Ellicottville, Cattaraugus	175	55,327	15.06	..	9.75
H. & S. Smith's	West Exeter, Otsego	375	115,624	15.65	..	10.19
Sinclearville	Sinclearville, Chautauqua	813	203,567	15.27	53	9.67
Canadawa	Arkwright, do	968	258,348	15.01	55	9.62
Clear Spring	Fredonia, do	410	74,078	15.60	70	10.38
Gerry	Gerry, do	400	86,916	.....	60	9.90
Valley	Hinesville, Vermont	400	123,100	.....	..	9.90
Carter's	Painesville, Ohio	200	41,039	15.00	..	9.80
Wilder's	Evansville, Wisconsin	300	78,745	16.25	..	.....
Elk Mountain	Asheville, North Carolina	230	30,000	25.00	..	.....
Blue Grass	Childsburg, Kentucky	250	72,500	16.70	..	10.10
Ontario	Norwich, Ontario, Canada	300	72,670	14.10	..	9.87
		42,643	11,505,640	15.65	65	9.88

The following Table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight, for the several Factories from which full Reports have been received, for the year 1869 :

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of Cows.	Amount of cheese made.	Average price per 100 pounds	Average weight	Aver. lbs. milk for one pound cheese.
Whitesboro	Whitesboro, Oneida	800	260.307	16.69	..	9.93
Willow Grove	Trenton, do	1,000	389,876	17.02	68	9.99
Wilcox	Sauquoit, do	200	51,226	15.25	..	10.09
Lee Center	Lee Center, do	400	139,675	16.38	..	9.47
Waterville	Waterville, do	780	215,693	16.17	..	9.46
West Branch	West Branch, do	....	....	.....	..	9.44
Ward's	Holland P't'nt, do	275	99,101	16.34	..	9.77
Vernon	Vernon, do	650	....	16.52	..	9.68
Verona Landing	Higginsville, do	400	140.500	16.00	..	9.75
Weeks'	Verona, do	590	199,506	16.71	62	9.85
Newville Association	Little Falls, Herkimer	856	311,906	17.45	..	9.82
Herkimer County Union	do do	350	111,848	16.55	..	10.11
Danube Cold Spring	do do	200	77,439	16.56	..	9.66
Smith's	Frankfort, do	800	311,413	16.77	67	9.90
Cazenovia	Cazenovia, Madison	581	189,531	15.75	65	9.69
Bridgeport	Bridgeport, do	300	97,418	15.00	..	9.86
Excelsior	Brookfield, do	400	136,490	.....	68	9.55
Otis'	Deer River, Lewis	350	129,618	16.25	54	9.54
Turin	Turin, do	550	169,806	15.98	60	9.53
Sulphur Spring	Lowville, do	571	158,537	16.13	62	9.64
Evans Mills	Evans Mills, Jefferson	1,140	350,191	15.84	64	9.45
Hamlin's	Rutland, do	350	102,176	16.22	65	9.90
Alexandria Bay	Alexandria Bay, do	320	93,262	15.72	60	9.71

Table for 1869.— Continued.

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of Cows.	Amount of cheese made.	Average price per 100 pounds	Average weight	Aver. lbs. milk for one pound cheese.
South Champion	South Champion, Jefferson.	400	142,129	15.73	..	9.65
Union	Mexico, Oswego	950	257,946	15.86	..	9.76
Gilbert's Mills	Gilbert's Mills, do	500	163,746	15.43	87	9.17
Bowen's Corners	Bowen's Cor's, do	350	110,581	15.10	62	9.40
Hermon	Hermon, St. Lawrence	700	218,349	15.81	..	9.14
Root	Root, Montgomery	639	184,478	15.88	..	9.80
Beattie	Truxton, Cortland	390	112,705	.....	52	9.77
Scott	Scott, do	150	48,112	15.30	..	9.45
Gowanda	Gowanda, Cattaraugus	600	196,716	15.67	..	9.35
First Collins	do do	730	306,239	16.28	..	9.00
Farmersville	Farmersville, do	345	127,107	15.53	..	9.33
Clear Spring	Fredonia, Chautauqua	325	119,533	15.41	..	9.68
North Collins	North Collins, Erie	450	150,451	16.15	..	9.22
East Log	Pike, Wyoming	200	71,496	.....	..	....
Sugartown	Sugartown, do	355	113,650	15.10	81	9.43
Sharon Center	Sharon Center, Schoharie	250	47,221	15.75	60	....
Eagle	West Edmeston, Otsego	900	304,567	16.62	..	9.73
North Bend	Middle Granville, Wash'n	250	96,224	15.92	..	9.75
Fort Ann	Fort Ann, do	290	....	.....	..	....
Franklin Creamery	Franklin, Delaware	....	....	.....	..	....
Valley	Hinesburg, Vermont	700	167,758	.....	..	9.48
Carter's	Perry, Ohio	400	137,161	15.42	..	9.90
Delaware	Delaware, Iowa	100	20,000	17.00	..	....
Rosendale	Rosendale, Wisconsin	280	60,500	15.50	..	9.96
		22,167	6,928,193	16.02	65	9.64

The following table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight for the several factories from which full reports have been received for the year 1870:

NAME OF FACTORY.	LOCATION AND COUNTY.	Whole number of cows.	Amount of cheese made.	Average price per 100 lbs.	Av'ge weight	Average lbs. milk for one lb. cheese.
Willow Grove	Trenton, Oneida	900	363,302	14.25	67	10.10
Weeks	Verona, do	700	221,061	14.28	60	10.00
Rome Association	Rome, do	750	252,685	14.06	72	10.78
Lee Center	Lee Center, do	650	198,448	14.00	68	9.94
Stittville	Stittville, do	800	267,271	14.24	..	10.30
Wilcox	Sauquoit, do	150	38,294	13.15	54	10.50
Hampton Association	Hampton, do	450	147,099	13.65	..	10.04
Glen	Glen, Montgomery	725	181,600	13.50	65	10.21
Smith Creek	Fort Plain, do	1,000	315,384	14.75	..	9.90
Root	Root, do	775	185,462	13.83	..	10.42
South Jordan	Brookfield, Madison	425	136,553	13.80	66	9.66
New Woodstock	New Woodstock, do	840	244,611	13.80	..	9.95
Valley	Stockbridge, do	600	171,787	13.87	..	9.78
North Fairfield	North Fairfield, Herkimer	500	168,217	14.83	60	9.68
Sulphur Spring	Lowville, Lewis	450	157,102	13.62	..	10.16
Leyden Association	Leyden, do	370	114,609	13.43	..	9.92
McLean do	McLean, Tompkins	525	200,261	....	77	9.62
South Berlin	South Berlin, Rensselaer	270	70,777	13.45	..	10.12
Pierrepont	Pierrepont, St. Lawrence	420	93,787	13.65	..	9.42
Simpson	New Hudson, Allegany	700	196,072	15.00	..	9.99
East Ashford	East Ashford, Cattaraugus.	550	129,961	13.75	70	9.76
Gowanda	Gowanda, do	430	158,900	13.82	..	9.49
Burnham's (3)	—— Chatauqua	1,734	529,705	13.23	..	9.89
Riverside	Rochester, Minnesota	180	38,727	....	..	9.70
Cold Spring	Whitewater, Wisconsin	150	41,111	....	..	9.53
		15,044	4.622,786	13.90	66	9.95

THE CHEESE TRADE—1869, 1870 AND 1871.

The following tables are copied from the columns of the Utica Herald:—We give below full tables of the cheese trade for the years 1869 and 1870 and up to August, 1871, showing the receipts of boxes of cheese in New York city and the exports, the highest quotation in Liverpool and New York, and the highest price of gold for each week of the two years. The totals of 1870 show a healthy growth, both in production and foreign trade, over 1869. The average highest quotation of gold from the first week of May to the close of the year 1869 was 131⅜; and for the same portion of 1870, 117. The average highest quotation of cheese in the city for the same period of 1869 was 18¼c., and of 1870, 15⅛c.:

1869.		Receipts.	Exports.	Price in Liv'rpool.	Price in N'w York.	Price of Gold.
January	9	2,359	9,547	73s.	20 cts.	135⅛
	16	1,928	8,065	73s.	20	136
	23	2,012	6,086	74s.	21	136
	30	855	4,765	74s.	21	136
February	6	2,269	2,208	74s.	21	135⅜
	13	1,317	4,042	74s.	22	135⅝
	20	2,837	1,300	74s.	22	133⅜
	27	1,045	848	74s.	22	132
March	6	364	610	74s.	22	130¾
	13	1,278	580	74s.	22	131
	20	1,423	621	74s.	22	131
	27	2,693	1,133	74s.	22	131
April	3	1,107	1,220	74s.	22	131½
	10	1,258	2,480	76s.	22	133
	17	3,508	3,041	79s.	23	133
	24	1,219	5,317	76s.	21	133
May	1	3,382	5,317	80s.	23	135
	8	4,280	2,370	83s.	23	138
	15	9,028	4,236	83s.	23	139
	22	14,520	7,076	82s.	23	141
	29	12,038	8.700	82s.	23	140
June	5	22,247	14,179	80s.	22	138⅝
	12	22,202	18,564	79s.	21	139
	19	34,250	32,250	78s.	19	136¾
	26	42,571	38,685	73s.	18	137
July	3	46,118	34,249	67s.	16	137
	10	33,137	42,008	64s.	15½	135⅞
	17	47,501	45,153	62s. 6d.	15	135½
	24	54,098	44,141	61s.	15	136½
	31	62,527	49,681	62s.	15½	136½
August	7	94,642	65.329	62s. 6d.	16	136½
	14	61,716	59,357	62s.	16	134
	21	51,857	34,803	62s.	16	132
	28	50,492	47,753	62s.	16½	134
September	4	44,977	39,294	61s. 6d.	16½	136½
	11	31,976	29,197	61s. 6d.	16	135½
	18	34,367	19,500	61s. 6d.	16	137
	25	47,523	33,656	63s.	16½	136
October	2	81,337	27,600	64s.	16½	130
	9	24,872	47,280	65s.	16½	130
	16	38,958	28,401	67s.	18	130
	23	57,359	15,997	67s. 6d.	19	131
	30	45,325	6,237	69s. 6d.	19	129
November	6	35,671	11,381	69s.	18½	127
	13	35,159	7,716	69s.	18	127
	20	24,910	6,387	68s. 6d.	18	126½
	27	35,551	8,446	68s.	18	124
December	4	34,627	9,274	68s.	17⅜	123
	11	26,628	2,687	68s.	17½	123
	18	22.733	18,890	68s.	18	120½
	25	8,286	4,606	68s.	18	120½
	31	6,530	4,020	68s.	18	120½
Total		1,332,017	926.411			

1870.		Receipts.	Exports.	Price in Liv'rpool.	Price in N'w York.	Price of Gold.
January	8	3,450	2,726	70s.	17¾ cts	122
	15	4,040	1,703	71s.	18	121⅜
	22	3,362	7,813	71s.	18	120¾
	29	5,540	4 103	72s.	18	121
February	5	3,789	6,604	72s.	18	120⅞
	12	4,000	2,600	72s.	18	119⅞
	19	4,992	2,740	73s.	18	118¾
	26	5,791	3,628	74s.	17½	115⅛
March	5	1,484	5,735	73s.	17½	113⅞
	12	1,500	11,017	71s.	17	112
	19	5,266	7,478	70s. 6d.	16	112
	26	6,726	6,956	69s.	15½	111½
April	2	5,815	14,705	70s. 6d.	15½	111½
	9	8,791	8,627	71s. 6d.	16	113½
	16	6,956	6,378	71s. 6d.	17	113⅛
	23	4 576	7,396	73s. 6d.	17	113½
	30	9,543	10,293	74s.	17	115
May	7	4,554	9,639	74s.	17	115
	14	8,868	9,484	74s.	17	115
	21	13,270	11,[illegible]33	74s.	16½	114½
	28	18,722	12,636	72s.	16	114½
June	4	16,324	15,750	68s. 6d.	14½	114½
	11	19,088	22,842	68s.	14½	113½
	18	14,025	36,861	67s.	14½	113
	25	40,247	40,034	66s.	14½	111
July	2	55,355	47,500	66s.	14½	112
	9	25,274	45,378	64s.	14¼	112
	16	72,830	51,401	63s.	14¼	116¾
	23	58,546	59,056	63s.	14¼	119⅞
	30	64,491	50,751	63s.	14½	121½
August	6	66,291	58,090	63s.	14½	121½
	13	58,352	60,537	62s. 6d.	14	117⅝
	20	31,546	41,886	62s.	14	114¾
	27	32,069	39,354	61s. 6d.	14	116⅝
September	3	60,106	37,819	61s. 6d.	14	114
	10	69,324	62,007	61s. 6d.	14	114
	17	60,263	42,082	61s.	14½	114
	24	6[illegible],239	24,453	61s.	14½	113
October	1	61,607	31,431	64s.	14½	114
	8	38,006	24,491	65s.	15	113½
	15	43,792	19,880	66s.	15	113½
	22	28,279	12,022	67s. 6d.	15½	113
	29	60,619	28,033	69s.	15¼	111½
November	5	53,330	18,844	69s. 6d.	15¾	110⅜
	12	63,251	19,931	69s. 6d.	15¼	111½
	19	40,695	19,245	71s. 6d.	16	112⅜
	26	28,338	20,539	71s. 6d.	16	111⅜
December	3	64,361	34,627	72s. 6d.	16	111¼
	10	59,489	23,059	72s. 6d.	16½	110¾
	17	32,316	22,733	72s. 6d.	16½	110¾
	24	13,174	13,935	73s.	16½	110⅝
	31	11,636	6,663	73s.	16¼	110¾
Total		1,592,403	1,184,687			

1871.		Receipts.	Exports.	Price in Liv'rpool.	Price in N'w York.	Price of Gold.
January	7	9,574	7,150	73s.	16 cts.	110⅞
	14	4,870	6,685	73s.	16	110⅝
	21	6,468	6,685	73s.	16	110¾
	28	2,385	9,722	73s.	16	110¾
February	4	5,414	9,459	72s.	16	111½
	11	4,532	9,130	72s.	16	111½
	18	3,967	11,174	72s.	16	111⅜
	25	2,993	17,653	72s.	16½	111⅝
March	4	5,330	8,344	71s.	16½	111
	11	5,938	9,365	71s. 6d.	16½	111¼
	18	5,927	8.364	71s. 6d.	16½	111⅛
	25	8,012	9,671	70s.	16½	110⅞
April	1	6,856	4,381	70s.	16	111
	8	3,519	10,661	70s.	16	110¼
	15	4,092	10,062	69s.	15	110¾
	22	2,860	8,178	69s.	15	111⅛
	29	3,608	7,559	69s.	15	111¼
May	6	3,636	7.559	69s.	14	111¼
	13	5,164	10,062	66s. 6d.	14	111½
	20	9,141	11,698	66s.	15	112
	27	16,029	16,927	64s.	14	111¾
June	3	22,630	20,472	63s.	13	112⅛
	10	26,580	22,742	61s. 6d.	13	112⅜
	17	43,258	37,543	60s.	13	112¾
	24	48,799	37,293	59s.	12½	112½
July	1	47,517	45,533	58s.	12½	113¾
	8	46,345	41,340	56s.	12¼	113
	15	56,478	55,869	55s.	11½	112⅜
	22	67,679	63,420	53s.	11	112
	29	59,986	61,321	52s.	11	112⅛

MILK.

We take the following from the Farmers' and Mechanics' Manual:—"The milk of nearly all animals contain the same ingredients. *The best known varieties* consist nearly of

	Woman.	Cow.	Ass.	Goat.	Ewe.
Caseine	1.5	4.5	1.8	4.1	4.5
Butter	3.6	3.1	0.1	3.3	4.2
Milk Sugar	6.5	4.8	6.1	5.3	5.0
Saline Matter	0.5	0.6	0.3	0.6	0.7
Water	87.9	87.0	91.7	86.7	85.6
	100.0	100.0	100.0	100.0	100.0

"One gallon of *pure* water weighs nearly 8⅓ pounds avoirdupois, hence a pint weighs about a pound. One quart of milk, wine measure, weighs 35 ounces. One quart of milk, beer measure, weighs 41 ounces."

LIST OF CHEESE AND BUTTER FACTORIES,

AS REPORTED TO AMERICAN DAIRYMEN'S ASSOCIATION, IN 1871.

NEW YORK.—946 FACTORIES.

ONEIDA COUNTY.—94 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*	*Name of Factory.*	*Location.*	*No. of Cows.*
Rome C. M. A	Rome	650	Northwestern C. M. A	Northwestern	—
Excelsior	do	600	Crill's	do	—
Greenfield's	do	—	Bronson's	do	—
Cady's	do	300	Verona Landing	Higginsville	400
D. D. Carpenter's	do	600	Doxtater's	do	250
Dick's	do	—	L. S. Davis'	Florence	500
Squires'	Delta	—	Cold Spring	do	400
Ridge Mills	Ridge Mills	300	Mad River	do	250
T. D. Roberts'	do	300	Vernon	Vernon	720
E. Lewis'	Deerfield	900	Clark's	do	500
Tanner's	Oriskany	700	M. Snell	do	300
Mitchell's	Remsen	200	Bronson & Co	Vernon Center	300
Thomas'	do	400	West Canada Creek	North Gage	500
Starr Hill	do	100	A. Blue's	do	150
Weeks'	Verona	600	J. C. Blue's	do	700
Burrell's	do	400	Briggs'	Marcy Hill	—
Verona Central	do	325	Wood's	Turin	—
Willow Grove	Trenton	1,000	Shepard's	do	—
W. W. Wheeler's	do	350	Franklin	Franklin Iron Works	500
J. C. Owen's	do	550	Camp's	Westmoreland	400
Powell's	do	—	Cheney's	do	350
Whitaker's	do	250	Hampton C. M. A	do	500
Wight's	Whitesboro	900	Marshall's	Waterville	700
Bagg's	Stittville	700	Curtis'	do	250
Deerfield & Marcy	Utica	400	Shearman's	New Hartford	500
South Corners	Vienna	400	Hampton	Stanwix	500
Vienna	do	350	Schuyler's	do	300
West Vienna	West Vienna	—	Foster's	Durhamville	425
Blossvale	Blossvale	406	J. H. Brook's	Steuben	590
Glenmore	Annsville	500	Chuckery	Paris	450
Bagg's	Holland Patent	500	Wilcox	do	—
J. G. Cotes'	do	400	A. S. King's	Sauquoit	—
J. F. Pierce's	do	550	A. Session's	do	—
G. W. Palmer's	North Bridgewater	600	A. Tucker's	do	250
Deansville	Deansville	700	S. Thomas'	Cassville	300
Hill's	Westernville	200	E. A. Palmer's	Clayville	200
Williams'	do	200	Union Grove	Camden	150
Waldo's	do	350	Harvey's	Boonville	—
Kirkland	Kirkland	300	Reed & Co	do	500
Wallace's	West Branch	400	Knoxboro	Knoxboro	400
Countryman's	do	—	Rathbun's	New London	400
J. L. Dean's	Hecla	200	New London C. M. A	do	300
Lowell	Lowell	600	Ray's	North Bay	—
Wood s	Lee Center	500	Spinnings'	Taberg	—
Saxton's	do	300	G. M. Wood's	Stokes	—
Charton's	do	400	Hurlburt's	Ava	—
Capron's	do	—	Jones'	do	—

WAYNE COUNTY.—13 FACTORIES.

Walworth	Walworth	300	Wilbur's	Newark	—
Butler Center	South Butler	240	Lincoln	West Walworth	—
Williamson	Williamson	—	Marion	Marion	—
Palmyra	Palmyra	—	Lee & Sheffield	Rose	400
Safford's	Savannah	175	Alloway	Lyons	500
South Butler	South Butler	—	Naing's	do	—
Macedon	Macedon	300			

CHENANGO COUNTY.—24 FACTORIES.

Tuttle	Columbus	230	Lewis Andrews	South Otselic	—
Hiram Brown's	do	400	Holmesville	Holmesville	650
A. R. Sage's	New Berlin Center	800	Daniels'	McDonough	600
Holmes & Co.'s	Columbus	600	Lincklaen	Lincklaen	500
George Buel's	King Settlement	600	Wheeler's	do	—
Sherburne	Sherburne	700	Harrington	do	—
Smyrna	Smyrna	—	Norwich C. M. Co	Norwich	500
Billings'	do	—	Frink's	do	—
Plymouth	Plymouth	—	Leach's	do	—
Buckley & Co.'s	Oxford	—	Sage's	South New Berlin	—
Harrisville	Sherburne	350	Rich's	do	—
White & Son's	do	—	Brown, Sage & Co	do	860

CORTLAND COUNTY.—26 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*	*Name of Factory.*	*Location.*	*No. of Cows.*
Cuyler Village	Cuyler	600	Blodgett Mills	Blodgett Mills	150
Cold Spring	do	300	Raymond's	Preble	600
Isbell's	do	250	Kilt's	do	425
Keeler's	do	200	Homer C. M. Co.	Homer	600
Cuyler Hill	do	450	Tuttle's	Freetown	400
New Boston	do	650	Cincinnatus	Cincinnatus	400
L. Sears'	DeRuyter	1,000	South Cortland	South Cortland	—
Kenney	Truxton	400	Meecham's	Marathon	300
Beattie's	do	400	Brown's	Taylor	400
Blodgett's Mills	Cortlandville	300	Keeney Settlement	Keeney Settlement	700
East Homer	East Homer	450	Whitmarsh	do	—
Wightman's	Marathon	—	H. H. Smith's	Apulia	—
Potter & Barber's	Scott	300	Harford	Harford	—

OSWEGO COUNTY.—58 FACTORIES.

M. Pierce's	South Richland	300	Fairdale	Fairdale	—
Gilbert Mills	Gilbert Mills	430	McMullen's	Hinmanville	—
Dick's	Pennellville	—	Mead's	East Sandy Creek	—
Volney Center	Volney	310	Bauder's	Caughdenoy	—
Whittemore's	Scriba	500	Smith's	New Haven	200
Ingell & Smith's	Volney	375	Daggett's	do	400
East Sandy Creek	East Sandy Creek	—	Donnelly's	North Scriba	400
Robbins & Co.'s	do	600	Southwest Oswego	—	—
Suydam's	do	400	Vermillion	Vermillion	500
Trumbull's	Pulaski	270	Smith's	Volney	500
Hall's	do	300	Hubbard's	—	250
Cold Spring	do	300	Jennings'	Palermo	100
Jones'	South Richland	400	East Scriba	—	2[illegible]0
L. Willis	do	300	Sweet's	Schroeppel	200
Blunt's	Orwell	150	Gregg's	do	260
Union	Colosse	400	First National	Phoenix	472
Union	Mexico	500	Central Square	Central Square	130
Weygint's	Pratville	530	West Manual	—	250
Banaska's	Phoenix	—	Granby Center	—	220
Morton's	Orwell	600	Rhodes	Scriba	150
Sweet's	Phoenix	—	Union	Sandy Creek	230
Smith's	Hastings	—	Union	Scriba	325
Hastings C. M. Co.	do	—	Amboy	Amboy Corners	200
Oswego Center	Oswego Center	400	Smith's	Fulton	—
Bowen's Corners	Bowen's Corners	—	Loomis'	Palermo	—
Wilcox's	Oswego Falls	—	Clough & Co.'s	Constantia	—
West Monroe C. M. A.	West Monroe	—	Cold Spring	Richland	—
Titus & Wilson	Hannibal	—	P. Wyman's	Orville	—
Gardner's	South Hannibal	—	Burr's	Molino	—

MADISON COUNTY.—65 FACTORIES.

Norton's	Eaton	—	Chapman's	Oneida Lake	300
Morse's	do	600	Hart's	do	250
Ingram's	West Eaton	500	Morrell's	do	150
Pecksport	Bouckville	450	Cole's	Munnsville	350
Erieville	Erieville	700	Lincklaen	DeRuyter	300
Seymour's	Lebanon	400	DeRuyter	do	600
Smith Valley	—	600	Kirkville	Kirkville	500
Hill's	Oneida Castle	700	Fletcher's	Peterboro	750
Cazenovia	Cazenovia	600	Valley	Stockbridge	450
C. Bridge	do	—	Adam's	do	—
Blodgett's	do	200	New Woodstock	New Woodstock	800
Perkins'	do		Hunt's	Hubbardsville	200
Canaseraga	Canaseraga	450	Lamunion & Co	Morrisville	400
Elphick's	Clockville	500	Morrisville	do	600
North Cazenovia	Chittenango Falls	300	Nelson's	Nelson	600
Chittenango	do	—	Ellison's	Brookfield	200
Lebanon	Leonardsville	500	Excelsior	do	350
Allard's	Georgetown	150	York	do	225
Quaker Basin	do	300	Union	do	200
Torpy's	do	150	South Brookfield	South Brookfield	250
Mack's	do	160	Bridgeport	Bridgeport	300
Brown & Co.'s	do	500	Lakewood	do	273
Beech & Co.'s	do	175	Fort Bushnell's	Lakeport	400
Fletcher's	do	200	Gifford's	do	—
Stafford's	Fenner	300	Tucker's	Mile Strip	300
Solsville	Solsville	700	Lenox C. M. A.	Canastota	500
Pine Woods	Pine Woods	600	Merrill's	Madison	—
Baker's	Earlville	300	Madison C. M. A	do	—
Chenango Valley	do	—	Siloam	Siloam	400
Cowasalon	Wampsville	500	Pratt's Hollow	Pratt's Hollow	250
Hunt's	Hamilton	—	Shedd's Corners	Shedd's Corners	—
Keith's	North Brookfield	—	Downing's	Pine Woods	—
East Boston	East Boston	—			

SCHUYLER COUNTY.—2 FACTORIES.

Cook & Co.'s	Havana	—	Alpine	Alpine	—

DUTCHESS COUNTY.—1 FACTORY.

Sheldon's	Stissing	—

FRANKLIN COUNTY.—6 FACTORIES.

Bombay	Bombay	—	Fort Covington Center	Ft. Covington Center.	—
Malone No. 1	Malone	—	Sargent's	South Bangor	—
Fort Covington	Fort Covington	—	Patterson	Chateaugay	—

LEWIS COUNTY.—39 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*	*Name of Factory.*	*Location.*	*No. of Cows.*
Sulphur Springs	Lowville	800	Union	West Martinsburgh	500
Folts'	do	750	Green's	do	400
Hall's	Barnes' Corners	200	Kelsey's	do	450
Miller's	Constableville	1,000	West Lowville	West Lowville	800
Wilder's	do	—	Searles'	do	500
McDonald's	do	—	Alexander	do	300
Valley	do	450	Vary	Harrisburgh	590
High Market	High Market	460	Clark's	do	600
Houseville	Houseville	800	Lanphere's	do	500
Glensdale	Glensdale	700	Knapp's	do	—
Sugar River	Leyden	940	Union	Deer River	270
Wood's	Turin	400	Deer River	do	450
Bush's	do	500	Austin	Denmark	700
Shepherd's	do	250	Markham's	Collinsville	400
Williams'	do	150	Lyon's	Lyon's Falls	—
Evans'	do	550	Leyden C. A	Leyden	550
Carpenter's	Houseville	150	Post's	Port Leyden	—
Rees'	Martinsburgh	200	Whitney's	Copenhagen	400
Dunton's	do	350	Bent's	do	250
New Bremen	Crogan	—			

MONTGOMERY COUNTY.—36 FACTORIES.

Charleston Four Corners	Charleston Four Cor.	525	Root	Root	600
Smith Creek	Fort Plain	1,000	Wier's	do	—
Dunkle's	do	—	Glen	Glen	—
Roof's	do	—	Diefendorf's	Amsterdam	—
Empire	Burtonville	500	W. Green's	do	—
Florida	do	—	Dorn's	do	—
Hallsville	Hallsville	600	Florida	Minaville	—
Freysbush	Freysbush	—	Switzer Hill	Fonda	—
Hessville	Sprout Brook	—	Schuyler's	do	—
Cold Spring	Stone Araba	500	Mohawk	do	—
Waterville	Ames	750	Cold Spring	Palatine Bridge	—
Flat Creek	Flat Creek	300	Union	do	500
Brookman & Co.'s	Fort Plain	600	Failing's	do	—
Ford's Bush	Minden	675	Gatesville	Randall	—
Cayadutta	Fonda	800	Mother Creek	St. Johnsville	400
Bates, Snell & Co	St. Johnsville	350	Buel	Buel	600
Snell, Smith & Co	do	—	Mapletown	—	—
Humphrey's	Charleston	—	Kilts'	Canajoharie	—

ORLEANS COUNTY.—1 FACTORY.

Cooley & Thompson's	Albion	—

STEUBEN COUNTY.—8 FACTORIES.

Spalding's	Howard	400	J. Davis'	Greenwood	250
Bennett's	do	500	Mason's	North Cameron	400
Kanona	Kanona	300	Spalding & Co	Avoca	—
Wing's	Campbell	—	Sitterly's	Bath	—

ONONDAGA COUNTY.—32 FACTORIES.

L. H. Webster's	Fabius	500	Belle Isle	Belle Isle	—
Delphi	Delphi	450	Sherwood's	Brewerton	—
Salisbury's	Apulia	600	DeWitt C. M. A	DeWitt	300
Alexander's	Lysander	—	Talbot	Fabius	400
Edwards'	Manlius	—	Euclid	Euclid	—
Hopper's	Collamer	160	Navarino	Navarino	140
Hiscock's	Jamesville	—	Kirkville	Kirkville	450
Seneca	Baldwinsville	150	Goodrich's	Otisco	200
Spafford	Spafford	—	Little Utica	Little Utica	300
Loomis'	Cicero	—	Betts' Corners	Betts' Corners	—
Van Bramer's	do	—	Cole Settlement	Fabius	150
Sternberg's	Cicero Center	—	Block	do	—
S. L. Vail's	Delphi	—	Southard's	Pompey Center	—
Elbridge	Elbridge	400	Palmer C. M. A	Oran	250
Abbott & Rodgers'	Tully	—	Plainville	Plainville	400
Marvin's	Jack's Rifts	—	Young s	Euclid	—

CLINTON COUNTY.—3 FACTORIES.

Platt's	Plattsburg	—	Smith Dale	Peru	—
Rouse's Point	Rouse's Point	—			

COLUMBIA COUNTY.—2 FACTORIES.

Hudson	Hudson	—	Chatham	Chatham Center	—

MONROE COUNTY.—4 FACTORIES.

Genesee Valley	Sonyea	300	Mendon	Mendon	—
Riga	Riga	—	Perinton	Fairport	—

ONTARIO COUNTY.—3 FACTORIES.

Cold Spring	West Farmington	450	East Bloomfield	East Bloomfield	—
Flint Creek	Flint Creek	—			

FULTON COUNTY.—8 FACTORIES.

Stuart's	Oppenheim Center	—	Cold Creek	Brockett's Bridge	—
Fulton	do	—	Brockett's Bridge	do	—
Cross Roads	Johnstown	350	Perth Center	Perth Center	200
Stoller's	do	—	Slate Hill	Ephratah	600

ST. LAWRENCE COUNTY.—16 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*	*Name of Factory.*	*Location.*	*No of Cows.*
Olin & Smead's	Canton	675	Beech Grove	Russell	500
Southville	Southville	200	West Canton	Canton	—
Richville	Richville	640	South Canton	Crary's Mills	450
Jones'	do	—	DeKalb	DeKalb	700
Potsdam	Potsdam	500	Gouverneur	Gouverneur	500
Hailesboro	Gouverneur	600	Pike's	Shingle Creek	—
Sprague Corners	Shingle Creek	600	West Fowler	do	—
Russell Village	Russell	500	Hermon	Hermon	—

WYOMING COUNTY.—29 FACTORIES.

George Hoye's	Attica	—	Tozier's	Johnsonburg	—
Java Village	Java Village	450	Sheldon C. M. A.	Sheldon	—
North Java	North Java	—	Wyoming	Wyoming	—
Stryker & Co.'s	do	—	Chapman's	Perry	—
Empire	Java	400	Hermitage		—
Arcade C. M. A	do	—	Orangeville	Orangeville	600
Nile	Nile	—	Wilder & Co.'s	do	—
Bennington	Bennington	400	Strykersville	Strykersville	—
East Bennington	East Bennington	375	East Coy	Pike	250
Arcade	Arcade	500	Lillibridge	do	—
Wells'	do	—	Empire	East Pike	—
Castile	Castile	400	Oatka	Gainesville	—
Gardlant's	Attica	—	Cowlesville	Cowlesville	450
Chapman's	Paris Center	—	Java Lake	—	350
Stephens'	Dale	—			

NIAGARA COUNTY.—4 FACTORIES.

Sanborn C. M. Company	Sanborn	300	Middleport	Middleport	—
Johnson's Creek do	Johnson's Creek	—	J. C. Francis'	do	—

BROOME COUNTY.—5 FACTORIES.

Maine	Maine	250	Squires Center	Kirkwood	275
Hawleyton	Hawleyton	—	Page Brook Valley	North Fenton	500
Killawog	Killawog	—			

WASHINGTON COUNTY.—8 FACTORIES.

North Bend	North Granville	—	South Granville	South Granville	—
North Bend	Middle Granville	250	Middle Granville	Middle Granville	500
Granville	Granville	450	Greenwich	Greenwich	135
Fort Ann	Fort Ann	—	Hawley's	Ford Edward	—

JEFFERSON COUNTY.—72 FACTORIES.

Adams	Adams	—	Heath's	Adams Center	—
Alexander's	Henderson	—	Hamlin	Rutland	325
Antwerp	Antwerp	950	Harper's Ferry	Rutland Center	—
Ayers	Watertown	—	Henderson	Henderson	—
Babcock's	Champion	—	Howard	Stone Mills	300
Barber's	Philadelphia	—	Lorraine Central	Lorraine	300
Bonfoy & Bettinger	Mannsville	—	Limerick	Dexter	300
Belleville	Belleville	—	Leffingwell's	Henderson	—
Bent	Antwerp	—	Mannsville	Mannsville	775
B. P. Smith	Black River	—	Maple Grove	Lorraine	—
Brownville	Brownville	400	Muscallonge	Dexter	—
Brown	Watertown	—	Muzy's	Smithville	—
Benjamin & Co.'s	Camp's Mills	—	Pillar Point	Dexter	—
Carter Street	Stone Mills	—	Philadelphia	Philadelphia	—
Cascade	Rutland	—	Pitkin's	Lorraine	250
Champion Village	Champion	—	Rodman	Rodman	—
Cooper's	Evans' Mills	—	Rodman Branch	Burrville	—
Cold Spring	Watertown	—	Rogers'	Ellisburgh	700
Cold Spring	Belleville	—	Rogers'	Lorraine	—
Cold Spring	Roberts' Corners	—	Rutland Valley	Watertown	—
Campbell's	South Rutland	150	Sherman's	Watertown	—
Dry Hill	Watertown	—	Springer's	Redwood	—
Davis'	Smithville	—	Smithville	Smithville	—
Eames'	Rutland	250	South Champion	South Champion	450
East Rodman	East Rodman	—	Springside	Dexter	—
Earll	Carthage	—	Sterlingbush	Antwerp	—
Ellisville	Ellisburgh	—	Tifft's	Lorraine	—
Evans Mills	Evans Mills	1,000	Timmerman's	Orleans Four Corners	—
Excelsior	Perch River	—	Warner	Adams Center	—
Excelsior	South Champion	—	Westcott	Watertown	375
Farr	Pierrepont Manor	225	Whitesville	East Rodman	—
Foreman's	Woodville	—	Wicks	Antwerp	—
Griswold & Reed	Lorraine	—	Wilson	Watertown	—
Gardner's	Watertown	—	Wright	Depauville	—
Grinnell & Co	Pierrepont Manor	300	Woodville	Woodville	—
Hadsall's	Felts Mills	—	Worth	Worthville	500

GENESEE COUNTY.—11 FACTORIES.

Batavia Union	Batavia	—	Darien Center	Darien Center	400
Batavia C. M. A.	do	500	Oakfield	Oakfield	200
Byron	Byron	—	West Bethany	West Bethany	—
Richville	Pembroke	—	East Bethany	East Bethany	—
Linden	Linden	—	Foster's	Batavia	—
Stafford	Stafford	—			

SCHENECTADY COUNTY.—2 FACTORIES.

Mariaville	Mariaville	—	Rotterdam	—	—

SARATOGA COUNTY.—4 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Ballston	Ballston Center	—
Empire	South Galway	250
Galway	Galway	—
Charlton	Charlton	—

ORANGE COUNTY.—43 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Circleville	——	400
Coilaburgh	——	225
Rockville	Middletown	200
Unionville	——	250
Walkill Association	——	375
D. Mullock's	Middletown	250
Orange Co. M. A.	Michigan	550
do do	Chester	325
Gouge & Co.	Hamptonburgh	600
Bates & Co.	do	250
Gouge & Youngs'	Florida	400
T. J. Taylor's	do	175
Carpenter Howell	Amity	415
do	Warwick	350
Sanford & Smith	do	300
H. Milburn	do	250
T. Durland	do	150
Brown, Bailey & Co.	Edenville	400
Foster Clark's	Wickham's Pond	350
W. H. Clark & Co.	Minisink	300
Barton Spring	Monroe	100
Parlor	Blooming Grove	—
Wood's	Chester	200
Kidd's	Walden	—
J. F. Vail & Co.	——	450
Brown, Lane & Co.	——	250
Wawanda	——	375
J. B. Halsey & Co.	——	300
E. Bull's	Chester	150
Bankers Brother's	do	200
F. Davis'	do	225
P. Holbert's	Middletown	275
Mapes & Co.	do	425
James Hulse	do	250
Wm. Mead & Co.	do	250
Christee & Co.	Unionville	300
O. F. Green	Greenville	300
H. Reamey	do	125
Finchville	Otisville	375
J. A. Wood	Slate Hill	200
Howell & Co.	Monroe	400
Sugar Loaf	Sugar Loaf	550
Union Cond'sed Milk Co.	New Milford	—

GREENE COUNTY.—4 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Towner's	Jewett	—
Hunter's Creamery	Jewett	—
Smith's	Ashland	—
Kirkland	Durham	—

ALLEGANY COUNTY.—44 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Simpson's	New Hudson	600
Reservoir	Seymour	600
Rushford	Rushford	1,000
Forsythe's	Whitesville	200
S. Sherman & Co.	Nile	125
Richburg	Richburg	100
Curtis'	do	—
D. T. Burdick's	Alfred	400
Greene's	do	—
Friendship	Friendship	400
Centerville	Centerville	400
Ackerley's	Rushford	600
Barns'	Fillmore	700
Andover	Andover	350
Black Creek	Black Creek	409
Oramel	Oramel	450
Niel	——	250
Wellsville	Wellsville	300
Lyndon	Cuba	700
Pettibone's	Alfred	—
Dodge's Creek	Portville	—
Jackson's	Belmont	—
Morley's	Whitney's Crossing	—
Flanagan's	Cole Creek	—
Crandall's	Dodge's Corners	—
Belvidere	Belvidere	—
Rice's	do	—
Granger	Granger	—
Little Genesee	Little Genesee	—
Carr Valley	Almond	400
A. Congdon's	West Clarksville	250
Babbit's	Hume	350
Philips' Creek	Philips Creek	450
Vandermarsh	Scio	275
R. Smith's	Cuba	350
West Almond	West Almond	—
G. West's	Alfred Center	—
J. Wilcox's	Wirt Center	150
Wiscoy	Wiscoy	200
Genesee	Little Genesee	120
Elm Valley	Andover	150
Angelica	Angelica	—
Olean	Olean	350
McHenry Valley	Alfred Center	300

YATES COUNTY.—1 FACTORY.

Name of Factory.	*Location.*	*No. of Cows.*
Italy Hollow C. M. A.	Italy Hollow	—

ERIE COUNTY.—54 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Stickney's	Collins	1,100
W. G. Huntington	Pontiac	800
North Concord	Concord	—
First Collins	——	800
Collins Center	Collins Center	1,100
Brant Center	Brant	550
Marshfield	Collins Center	1,100
Morton's Corners	Morton's Corners	600
Richmond & Co.'s	Sardinia	500
Glenwood	Glenwood	400
Dick & Co.'s	Willink	350
North Collins	Shirley	—
Kirby's	Shirley	—
Young's	Alden	300
Wheelock's	——	300
Gowanda	Gowanda	400
Staffin's	Collins	200
W. Smith's	——	300
Ballard's	——	350
Henler	Grand Island	150
Cotesworth	Grand Island	100
North Boston	——	450
Boston Center	——	350
Colden	Colden	300
Marilla	Marilla	—
Kimball's	Lancaster	—
Cheese M. A.	Spring Brook	—
Boston	Boston	400
Concord Center	Woodward's Hollow	500
Wales	Wales	450
Paxton's	Eden	600
Sisson's	Shirley	600
North Evans	North Evans	500
Angola	Angola	360
Brant	Collins	400
Springville	Springville	1,200
Blakeley's	East Aurora	—
Jackson's	East Hamburg	300
Hamburg	Hamburg	300
North Evans	North Evans	250
East Evans	East Evans	300
Eden Corners	Eden Corners	350
North Concord	North Concord	600
Sardinia Valley	Sardinia Valley	450
Newton	Sardinia	250
Hosmer's	do	—
Wales Center	Wales Center	400
Fuller's	do	—
South Wales	Wales	450
Elma	do	300
Burroughs & Co.	do	—
Francis	——	—
Farrington's	Holland	—
Moulton's	Protection	—

TIOGA COUNTY.—2 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Speedsville	Speedsville	—
Jenksville	Jenksville	—

HERKIMER COUNTY.—69 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Herkimer Co. Union	Little Falls	700
Manheim Center	do	600
Manheim Turn	do	500
Newville C. M. A.	do	860
Rice, Broat & Co.'s	do	900
G. W. Davis	do	600
Cold Spring	do	—
Top Notch	do	450
Van Allen's	do	—
Fairfield Association	Fairfield	—
Old Fairfield	do	900
North Fairfield	do	600
Eatonville	Eatonville	600
Locust Grove	do	150
Mohawk Valley	East Schuyler	450
Richardson's	do	360
Budlong's	West Schuyler	300
Warren's	Warren	400
Fort Herkimer	Fort Herkimer	400
Bellinger's	do	400
Beckwith's	Cedarville	300
Cold Spring	do	—
Stewart's	do	—
Howard's	do	—
Cedarville	do	300
Smith's	Frankfort	800
A. G. Norton's	do	—
Frankfort Center	do	—
Russell's	Russell's Hill	—
Wetmore	do	—
D. Hawn's	Starkville	800
Snell's	Russia	600
Nash's	Frankfort Center	—
Rider's	Cedar Lake	—
Stuart's	Cedarville	—
Richardson's	West Schuyler	—
Skinner's	South Columbia	—
Kling's	Paine's Hollow	—
Middleville	Middleville	750
Northrup's	Litchfield	300
Kinney's	do	600
Walrath	North Litchfield	300
Van Hornsville	Van Hornsville	215
Young's	do	—
Lackey's	West Winfield	300
H. C. Brown's	do	400
Wadsworth's	do	200
W. Palmer's	do	—
Edick's	Mohawk	225
Mort's	do	—
J. Clark's	Winfield	500
B. Bartlett's	do	300
North Winfield	North Winfield	700
Moon's	Russia	300
Poland Cheddar	Poland	450
Herkimer	Herkimer	600
Herkimer Union	do	250
G. W. Pine's	do	600
Newport	Newport	—
Morey's	do	800
Cook, Ives & Co.'s	Salisbury	400
L. H. Carr's	do	—
W. Peck's	do	159
Old Salisbury	do	600
Avery & Ives'	Salisbury Center	500
Norway Association	Norway	600
J. D. Ives'	do	—
Columbia Center	Columbia Center	—
J. Russell's	Graefenberg	300

CAYUGA COUNTY.—8 FACTORIES.

Throopsville C. M. A.	Auburn	450
Moravia	Moravia	250
Sennett	Sennett	400
Carpenter's	New Hope	—
Ira	Ira	—
Lincoln's	Conquest Center	400
Port Byron C. M. Co.'s	Port Byron	200
Meridian	Meridian	—

OTSEGO COUNTY.—46 FACTORIES.

Wykoff's	Richfield Springs	500
Bush's	do	—
E. D. Lamb's	Unadilla Forks	350
Center Brook	Otsego	200
Stocker & Fox's	East Springfield	600
Casler & Andrews	Springfield Center	450
Hartwick	Hartwick	200
Pitt Cushman's	Edmeston Center	200
Col. Gardner's	Burlington Flats	150
Ed. Gardner's	do	150
Benj. Smith's	Spooner's Corners	400
Brockway's	Richfield	400
Smith & Wilber	West Exeter	400
Fly Creek	Fly Creek	200
Park's	Burlington Green	350
Parley Phillips'	Unadilla Forks	200
Wm. L. Brown's	do	200
Clark's	Schuyler's Lake	200
Edmeston Center	Edmeston Center	750
Warren Chase's	West Edmeston	250
Joseph King's	Burlington Green	200
George Clark's	Hyde Park	300
Nearing & Co.'s	Butternuts	—
Russell Bower's	Exeter	300
Perkin's	do	—
Hind's	Cooperstown	—
Hoxie's	do	—
Hoxie's	Unadilla Forks	—
R. L. Warren's	East Springfield	—
West Burlington	West Burlington	300
Parker's	South Edmeston	400
Pope's	do	306
L. N. Brown's	West Edmeston	600
Ed. Loomis'	Richfield	150
L. O. Vebber's	Exeter Center	600
H. & S. Smith's	West Exeter	300
J. H. Pratt's	do	400
Lyman Johnson	Burlington Flats	500
Colman's	do	200
Newel N. Talbot's	do	105
Hartwick Union	Cooperstown	—
Chamberlain's	Richfield Springs	—
Cherry Valley	Cherry Valley	300
Tuttle's	South Edmeston	250
Rider's	Schuyler's Lake	100
Baker's	do	600

CHAUTAUQUA COUNTY.—12 FACTORIES.

Hamlet	Hamlet	1,100
J. E. Robertson's	Busti	660
Clear Spring	Fredonia	700
Burnham's	Sinclairville	1,049
J. S. Hulbert's	Forrestville	400
Villanova	Villanova	400
Brainard's	Hamlet	650
Coon's	(3) Mina	1,250
do	Sherman	457
Canadawa	Arkwright	680
Gerry	Gerry	500
Cassadaga	Cassadaga	400

SCHOHARIE COUNTY.—9 FACTORIES.

Sharon Center	Sharon Center	250
Seward Valley	Seward	200
Hindsville	Hindsville	200
Gardnersville	Gardnersville	—
Cobleskill	Cobleskill	—
Argusville	Argusville	600
Carlisle	Carlisle	300
Barneyville	Barneyville	200
Esperance	Esperance	—

RENSSELAER COUNTY.—1 FACTORY.

Matteson's	South Berlin	—

TOMPKINS COUNTY.—9 FACTORIES.

Dryden Union	Etna	600
Groton	Groton Hollow	500
Ellis Hollow	Ithaca	—
Arnold's	Ithaca	—
McLean Association	McLean	700
Freeville Union	Freeville	700
Slaterville	Slaterville	—
Peru	Peruville	—
Ridgway Creamery	Caroline Depot	—

CATTARAUGUS COUNTY.—55 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
Welch's	Dayton	—
Perrysburgh	Perrysburgh	550
Ticknor's	Versailles	500
Slab City	Slab City	—
Leon Center	Leon Center	—
Randolph	Randolph	200
First Collins	Gowanda	700
Stebbin's	Cattaraugus	—
Waverly	Waverly	—
Safford	East Otto	—
Union	do	—
Tiffts'	do	400
Crump's	do	—
Ashford	Ashford	600
Westville	Westville	—
West Ashford	Ashford Hollow	—
Machias Corners	Machias Corners	—
Woodworth's	Yorkshire	450
Maple Ridge	Fairview	660
Gowanda	Gowanda	550
Dwight's	do	—
Allen's	Eddyville	350
Maple Grove	Ellicottville	200
East Ashford	East Ashford	550
Follett's	Machais	400
Lewis & Haskell's	Sandusky	—
Elton	Elton	400
Rawson	Rawson	—
Farmersville	Farmersville	400
Cook & Brothers	do	—
Napaer	do	—
J. K. Button's	do	—
Ischua	Ischua	—
Portville	Portville	—
Olean	Olean	—
Hinsdale	Hinsdale	—
Cady's	Franklinville	—
Union	Ellicottville	600
McMahon's	do	—
Meadow Valley	do	—
Little Valley	Little Valley	—
Great Valley	Great Valley	—
Merrilly's	Napoli	—
Lyndon	Lyndon	—
Cadiz	Cadiz	850
New Ashford	New Ashford	400
Yorkshire Center	Yorkshire Center	500
New Albion	—	600
Jenk's	Gowanda	1,000
Pigeon Valley	— —	369
West Valley	West Valley	400
Ballard	—	400
Bigelow's	Ashford	—
Vedder's Corners	do	—
Gamp's	Ashford Hollow	—

CHEMUNG COUNTY.—3 FACTORIES.

Bunnell & Horton's	Millport	750
Rundle's	Horseheads	—
Van Duzer & Son's	Horseheads	—

OHIO.—103 FACTORIES.

GEAUGA COUNTY.—26 FACTORIES.

Rocky Dell	Bissell's	250
Andrews'	do	800
Bartlett's	Chester Cross Roads	800
Bartlett's	Mulberry Corners	300
Hood's	Auburn	500
Odell's	do	600
Smith's	Ford	600
Freeman's	South Newbury	500
Hall's	Fowler's Mills	600
Murray's	Chardon	800
Randall's	Chardon	700
Pope's	Welshfield	500
Russell	—	500
Colton & Co.	Nelson	—
Spring Brook	Welshfield	300
Grove	do	300
Munson's	Fowler's	400
Pope's	Welshfield	500
Randall's	Burton	700
Hall's	Claridon	400
Armstrong's	East Claridon	700
Smith & Co.'s	Parkman	600
Armstrong's	Huntsburgh	800
Randall's	Montville	800
Murray's	do	500
Smith's	Thompson	500

PORTAGE COUNTY.—13 FACTORIES.

E. B. Higley	Windham	—
Horr & Risden	Shalersville	—
H. S. Johnson	Garrettsville	—
Hurd & Bro	Aurora	—
Harmons & Root	Aurora	—
T. C. Bradley	Mantua	—
I. C. Scram	Ravenna	—
H. F. Hudson	Ravenna	—
Beman Spring	Ravenna	250
Hinkley's	Mantua	—
Burrows	Freedom	—
Aurora Grove	Aurora	500
Anderson's	Ravenna	300

ASHTABULA COUNTY.—12 FACTORIES.

S. E. & H. N. Carter	Windsor	500
Lattimer's	New Lyme	—
Osborn's	Morgan	—
G. C. Dolph	West Andover	—
Austinburgh	Austinburgh	—
Morley Bros	Andover	—
J. Pelton's	Wayne	—
Wire's	Austinburgh	—
Weldon & Brown	Conneaut	400
Pierce's	Eagleville	—
Harrington & Randall	Morgan	—
Alderney	New Lyme	—

TRUMBULL COUNTY.—13 FACTORIES.

J. M. Trew	Farmington	—
B. H. Peabody	Kinsman	—
Cold Spring	do	—
Caldwell & Lewis	West Farmington	—
Farmington Center	Farmington Center	—
E. C. Cox	Mesopotamia	—
do	North Bloomfield	—
Baldwin's	Fowler	—
Cortland	Bazetta	—
Raymond's	Mesopotamia	—
Cowdery & Craft's	Bazetta	—
Sager & House	Bristolville	—
Harshman & McConnell's	Southington	—

HENRY COUNTY.—1 FACTORY.

Ridgeville	Ridgeville Corners	—

FULTON COUNTY.—1 FACTORY.

Royalton	Royalton	—

LORAIN COUNTY.—8 FACTORIES.

Camden Cheese Co.	Kipton	—
Mussey & Viets	Elyria	—
Horr & Warner	Huntington	—
Magraugh & Whitlock	Wellington	—
Snow's	Huntington	—
G. H. Van Wagnen & Co.	North Eaton	—
Corning & Hanee	Grafton	—
Penfield	Wellington	—

LAKE COUNTY.—5 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*
S. E. Carter	Leroy, Painesv'le P.O.	—
H. N. Carter	Perry	—
R. Freeman & Co	Madison	—
Hitts	Willoughby	300
Bartlett & McKee	South Kirtland	—

MEDINA COUNTY.—6 FACTORIES.

McDowell Bros.	Medina	—
Fellows	Chatham	—
Benedict & Brooker	Litchfield	—
Crane & Co.	Sharon	—
Colbetzes & Co	Spencer	—
Chatham	Chatham Center	—

SUMMIT COUNTY.—8 FACTORIES.

Twinsburg Cheese Ass'n.	Twinsburg	—
Wm. Wilcox	Twinsburg	—
S. Straight & Co	Twinsburg	—
do	Hudson	—
Richfield	West Richfield	—
S. Straight & Co.	Streetsboro	—
Oak Hill	Peninsula	—
M. D. Call	Hudson	—

ASHLAND COUNTY.—2 FACTORIES.

Drake, Eaton & Co.'s	Sullivan	—
Clark & Bailey	Sullivan	—

HURON COUNTY.—3 FACTORIES.

Haviland & Conant	Greenwich	—
J. W. Jenne	New London	—
Wakeman Cheese Co	Wakeman	—

CUYAHOGA COUNTY.—3 FACTORIES.

A. J. Lockwood	Bedford	—
J. Q. Lander	Solon	—
Wyatt's	Brecksville	—

ILLINOIS.—46 FACTORIES.

Hainesville	Hainesville, Lake Co.	—
Burchard's	Sumner, Kank'ee Co.	—
Patterson & Mix	Momence, do	800
Wm. Keeney's	Mantino, do	800
W. C. Richards	Momence, do	100
W. A. Clark's	Sherburnv'le, do	200
Wanzer & Co	Herman, Kane Co.	—
R. R. Stone's	Richmond, McH. Co.	800
R. R. Stone's	Spring Grove, do	—
Thompson & Abbott	Greenwood, do	500
Huntley Grove	Huntley, do	250
Marengo	Marengo, do	300
Greenwood	Woodstock, do	300
Marsh & Jackson	Union, do	500
Boies	Kingston, DeKalb Co.	200
Sugar Grove	Aurora	300
Dunton	Dunton	250
Kennicott	do	200
Cameron	do	200
Perry	do	150
Williams'	do	150
Gould & Hammond's	Hanover	425
Tuttle's	Lodi	350
Gould & Hammond's	Elgin	425
Barber & Co	Polo	300
Albro & Co.	Wayne	600
Winslow	Shirland	400
Kilbor's	Richmond	—
Buckland's	Ringwood	—
Jones'	Hebron	—
Conn's	do	—
Woodstock	Woodstock, McH. Co.	—
Riley	Riley, do	—
Buena Vista	Huntley, do	350
Spring Grove	Richmond, do	300
Garden Prairie	Garden Prairie	—
Mead's	Hebron	300
Milk Condensing Co	Elgin	—
Rockton	Rockton	400
Stuart Bros	Hebron, McHenry Co.	500
Oneida	Rockford	—
Belvidere	Belvidere, Boone Co.	—
Hale	Hale, Ogle Co.	500
Wanzer's	Hanover	—
do	Elgin	—
Cameron	Northfield	—

KENTUCKY.—5 FACTORIES.

Chilesburg	Chilesburg, Fay'te Co.	300
Clark	Winchester, Clark Co.	300
Shelby City	Shelby City	—
Versailles	Versailles, W'df'd Co.	200
Madison County C. M. A.	Richmond	—

MINNESOTA.—4 FACTORIES.

Anderson	Mower City	—
Wells	Wells	—
Star	Rochester	—
Owatonna	Owatonna	—

WISCONSIN.—34 FACTORIES.

C. H. Wilder's	Evansville, Rock Co.	400
Springvale	Nanaupa	—
Eldredge	Afton	200
Elkhorn	Elkhorn	200
Rosendale	Rosendale	600
Hazen's	Ladoga	459
Sparta	Sparta	200
Favil's	Lake Mills, Jeff. Co	—
Barrett's	Burnett Station	—
Coolidge	Windsor, Dane Co	—
Waterville	Waterville, Wauk. Co.	—
Boynton's	Waupun	—
Howard's	do	—
Johnson's	do	—
Downey's	do	—
Carpenter's	Kenosha	—
Holt's	do	—
Johnson's	Kenosha	—
Long's	do	—
Pierce & Simmons	do	—
Truesdell's	do	—
White's	do	—
Fort Atkinson	Fort Atkinson	—
Spring Mills	Somers	—
Bullock's	Rockton	—
Cold Spring	Whitewater	—
Coburn's	do	—
Drake's	Lake Mills	—
Gilbert & Co.'s	Hazel Green	—
Tappan's	Morrison	—
Wilbur & Co.'s	Wilmot	—
Strong & Co.'s	Oakfield	—
Cochran's	Trenton, Dodge Co.	—
Reigart & Ross	Beloit	—

MASSACHUSETTS.—26 FACTORIES.

Name of Factory.	*Location.*	*No. of Cows.*	*Name of Factory.*	*Location.*	*No. of Cows.*
Worcester Co	Warren	500	New Lenox	Lenox	—
Union	Hardwick	—	Cheshire	Cheshire	—
New Braintree	New Braintree	542	Petersham Cheese Co	Petersham	—
Barre Central Cheese Co.	Barre Center	—	Cheshire do	South Adams	—
Barre Cheese Co	Barre	375	Westboro' do	Westboro'	—
Southwest	do	125	Lewis Milk Condensing	West Brookfield	—
Hardwick Center	Hardwick	500	Coy's Hill Cheese Co	Warren	300
Boise's	Blandford	—	South Williamstown	South Williamstown	—
Williamstown	Williamstown	—	Walker's	Greenwich	—
West Brookfield	West Brookfield	—	Dana C. M. C.	Dana	—
Lanesboro'	Lanesboro'	—	Putnam's	Belchertown	—
North Marlboro'	North Marlboro'	—	Slater's	Tyringham	—
Lenox	Lenox	—	Greylock	South Adams	—

VERMONT.—32 FACTORIES.

East Berkshire	East Berkshire	400	Missisquoi	North Sheldon	—
Enosburgh Factory Co	Enosburgh	600	Gleason's	Shrewsbury	—
North Enosburgh	North Enosburgh	400	Mason's	Richmond	80
East Franklin	East Franklin	600	Valley	Hinesburg	650
Middletown	Middletown	600	East Poultney	East Poultney	300
Rose	West Rupert	625	Wallingford	Wallingford	—
West Pawlet	West Pawlet	475	Williams'	Danby	—
Hill	Middletown	100	Rutland	Rutland	—
West Tinmouth	West Tinmouth	—	West Orwell	Orwell	450
Norton's	Wells	—	East Orwell	do	350
Valentine's	Tinmouth	125	Hosford's	Charlotte	350
Otter Creek	Center Rutland	200	Milton	Milton	—
Billing's	Rutland	—	Milton Falls	Milton Falls	—
Sheldon's	West Rutland	—	Ferrisburgh	Ferrisburgh	—
Wickham's	Pawlet	800	New Haven	New Haven	—
Camp's	Stowe	—	Shoreham	Shoreham	—

MICHIGAN.—22 FACTORIES.

St. Clair	St. Clair	450	Spring Brook	Farmington	400
Fairfield	Fairfield	700	Gilt Edge	do	400
Horton's	Adrian	—	Ionia	Ionia	—
Hoadley's	Oakford	—	Reading	Reading	450
Saunders'	Trenton	—	Fowler & Co.'s	do	—
Smith's	Augusta	—	Adrian C. M. Co	Adrian	—
White's	Ceresco	—	Ames'	Hudson	—
Maple Grove	Farmington	600	Sawin's	Mattison	—
Canton	Canton	400	Utica	Utica	—
Beal's	Rollin	—	Welton's	North Adams	—
Clayton	Clayton	—	Hillsdale	Hillsdale	—

VIRGINIA.—1 FACTORY.

Holston .... Saltville, Smith Co.... —

NORTH CAROLINA.—1 FACTORY.

Elk Mountain .... Asheville, Bunc'e Co. 230

TENNESSEE.—1 FACTORY.

Stratton's .... Crossville, Cumb'd Co. —

KANSAS.—1 FACTORY.

Americus .... Americus .... —

CONNECTICUT.—1 FACTORY.

Eagle Cheese Co........... North Colebrooke..... —

PENNSYLVANIA.—14 FACTORIES.

Springville	Springville, Susq. Co.	158	Venango	Venango, Crawf'd Co.	—
Bridgewater	Bridgewater, do	200	Keystone	N. Richmond, do	—
Gage	do do	80	Cambridge	Rockdale, do	—
Worth's	Marshallton, Ch'tr Co.	—	Ellis & Smith's	Waterford, Erie Co.	—
Damascus Creamery	Damascus, Wayne Co.	—	New Milford Creamery	New Milford, Susq. Co	200
Woodcock First Premium	Woodcock, Crawf'd Co	—	Spring Hill	Spring Hill, Brad. Co.	150
Woodcock Boro' Cream'y	Woodcock Boro' do	—	Earl's	Carthage	360

IOWA.—7 FACTORIES.

Smith's	Mason City	—	Strawberry Point	Fayette Co	—
Hickling's	do	—	Kidder's	Epworth, Dubuque Co	—
Wyoming	Wyoming, Jones Co	—	Pierce's	Belmond	—
Clear Lake	Clear Lake	—			

INDIANA.—2 FACTORIES.

Name of Factory.	Location.	No. of Cows.
L. B. Merrill's	Merrillsville	—
Brookman's	Crown Point	—

CANADA.—35 FACTORIES.

Name of Factory.	Location.		No. of Cows.
Smith & Son's	Norwich, Ox. Co., Ont.		400
Galloway's	Ingersoll,	do	150
Josiah Collins	Mount Elgin	do	350
Moyers'	West Zorra	do	100
Adams'	Nissouri,	do	450
Wade's	Cobourg	do	450
James Harris	Ingersoll,	do	400
do Branch	do	do	200
H. Farrington's	Norwich,	do	300
do Branch	do	do	200
Chas. Banbury's	St. Mary's	do	300
Harris & Adams	Mt. Elgin	do	250
Ballard's	Norwichville,	do	300
Ballantyne's	Sebringville	do	400
Ontario	Norwich,	do	300
Pioneer	do	do	550
People's	do	do	—
E. Nissouri	Ingersoll	do	—
Lossing's	Durham, Prov. Ont.		250
Scott's	Lobo,	do	—
Kearn's	Oxford,	do	200
Dodge's	do	do	200
Silverthorn's	do	do	70
Tho. Abram's	Norwich,	do	275
G. Dunkin's	do	do	200
Wm. Bailey's	do	do	175
Andrew Pickert	Lowville,	do	150
Richard Carter	Brampton,	do	175
Wilmot's	Milton,	do	250
Cambell's	do	do	200
Lawson's	Salford,	do	450
Degeer's	Queensville,	do	—
Pearce's	Tyrconnell,	do	—
Middlesex	Bowood,	do	—
Smith & Cochrane's	Compton, Pr. Quebec.		250

INDEX.

LIST OF RURAL BOOKS,

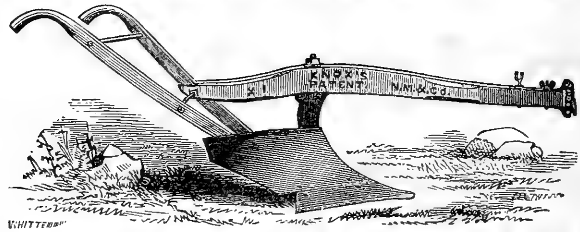
FOR SALE AT THE OFFICE OF

MOORE'S RURAL NEW-YORKER,

Or Sent by Mail, post-paid, on Receipt of Price.

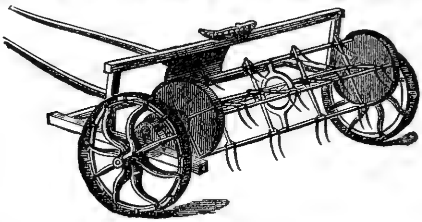
Allen's [L. F.] American Cattle	$2 00
Do. New American Farm Book	2 50
Do. Diseases of Domestic Animals	1 00
Do. Rural Architecture	1 00
American Bird Fancier	30
American Pomology [290 Illustrations]	3 00
American Practical Cookery	1 75
American Rose Culturist	30
American Sharp-Shooter [Telescopic Rifle]	50
American Wheat Culturist [Todd]	2 00
Architecture [Cummings & Miller] 382 Designs and 714 Illustrations	10 00
Architecture, National, [Geo. E. Woodward]	12 00
Architecture, Principles and Practice of [Loring & Jenny]	12 00
Bee-Keepers' Text-Book, Paper	40
Do. Muslin	75
Bement's Rabbit Fancier	30
Bicknell's Village Builder [55 Plates, showing New and Practical Designs]	10 00
Bommer's Method of Making Manures	22
Boussingault's Rural Economy	1 60
Breck's Book of Flowers [new]	1 75
Bridgeman's Gardener's Assistant	2 50
Buist's Family Kitchen Gardener	1 00
Do. Flower Garden	1 50
Burr's Vegetables of America	5 00
Chemistry of the Farm [Nichols]	1 25
Chorlton's Grape Grower's Guide	75
Cider Maker's Manual	1 50
Clater's New Illustrated Cattle Doctor, [Colored Plates]	6 00
Cobbett's American Gardener	75
Cole's American Fruit Book	75
Cole's American Veterinarian	75
Cotton Culture	1 50
Cotton Planter's Manual [Turner]	1 50
Crack Shot [Barber]	1 75
Cranberry Culture [John J. White's] Ills.	1 25
Dadd's American Cattle Doctor	1 50
Do. Modern Horse Doctor	1 50
Dana's Muck Manual	1 25
Darlington's American Weeds and Useful Plants	1 75
Darwin's Animals and Plants	6 00
Dead Shot; or, Sportsman's Complete Guide	1 75
Downing's Cottage Residences	3 00
Do. Fruits and Fruit Trees of America [1100 pp.]	5 00
Do Landscape Gardening	6 50
Do. Rural Essays	3 50
Drainage for Profit and Health	1 50
Du Breuil's Vineyard Culture [Warder]	2 00
Dyer and Color Maker's Companion	$1 25
Eveleth's School House Architecture	10 00
Eastwood's Cranberry Culture	75
Elliott's Lawn and Shade Trees	1 50
Everybody His Own Lawyer	1 25
Farm Drainage [H. F. French]	1 50
Farm Implements and Machinery [J. J. Thomas]	1 50
Farmer's Barn Book	1 50
Farming for Boys	1 50
Field's Pear Culture	1 25
Fishing in American Waters [Scott]	3 50
Flagg's European Vineyards	1 50
Flint on Grasses	2 50
Fulton's Peach Culture. A Hand-Book and Guide to Every Planter	1 50
Do. Milch Cows and Dairy Farming	2 50
Frank Forrester's Field Sports [2 vols]	6 00
Do. Fish and Fishing [100 engravings]	5 00
Do. Manual For Young Sportsmen	3 00
Fuller's Illustrated Strawberry Culturist	25
Do. Forest Tree Culturist	1 50
Do. Small Fruits [Illustrated]	1 50
Gardening for Profit [P. Henderson]	1 50
Gardening for the South	2 00
Grape Culturist [A. S. Fuller]	1 50
Gray's Manual of Botany and Lessons	4 00
Do. School and Field Book of Botany	2 50
Do. How Plants Grow [500 Illustrations]	1 12
Do. Manual of Botany in the Northern States [700 pp., Illustrated]	1 25
Do. Introduction to Structural and Systematic Botany and Vegetable Physiology [1300 Illustrations]	3 50
Gregory on Squashes	30
Guenon on Milch Cows	75
Gun, Rod and Saddle	1 50
Harney's Barns, Outbuildings and Fences	10 00
Harris on Insects	4 00
Do. on the Pig—Breeding, Management, &c	1 50
Hatfield's American House Carpenter	3 50
Hibbard's Rustic Adornments for Homes of Taste. [Colored Plates]	9 00
Hints to Horse Keepers [Herbert's]	1 75
High Farming Without Manure	35
Holly's Art of Saw-Filing	1 50
Holly's Carpenter's Hand-Book [new]	75
Hooper's Dog and Gun	30
Hoope's Book of Evergreens	3 00
Hop Culture	40
How Crops Feed	2 00
How Crops Grow	2 00
How to Cook, Carve and Eat	1 50
Hunter and Trapper	1 00
Hussmann's Grapes and Wine	1 50

STEEL AND IRON PLOWS.



Knox's Patent and Improved Eagle. Improved Swivel —for Side Hill and Level Land, that leave no Ridges or Dead Furrows. Boston Steel Clipper. Sessions and Knox's Patent Hard Steel. Mapes' Improved Subsoil.

THE AMERICAN HAY TEDDER,



Enables the most important Agricultural product of America to be cut, cured and stored in the barn in one day. Improves the quality and increases the value of the Hay Crop. Prevents all risk of damage from storms and sudden showers. Is simple, durable and of light draft. Was awarded the New England Agricultural Society's only First Prize at the Great Field Trial at Amherst, Mass., in 1869, as being superior to all others, and the best and only perfect machine for tedding or turning hay.

THE PERRY GOLD MEDAL MOWER.

Burt's Self-Adjusting Horse Hay Rake. Boston Horse Hoe. French's Patent Cultivator. Harrington's Patent Single or Combined Seed Sower and Hand Cultivator.

MADE ONLY BY

AMES PLOW COMPANY,

Manufacturers of Agricultural Implements and Machines, Dealers in Seeds, Fertilizers and other requirements of Agriculturists and Agricultural Districts. Factories at Worcester and Ayer, Mass.

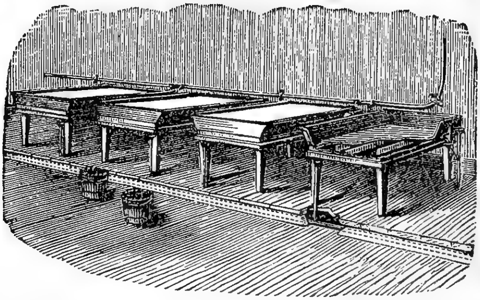
Warehouses, Quincy Hall, Boston, and 53 Beekman Street, New York.

☞ **ORDERS FILLED PROMPTLY.**

Price Lists and Descriptive Circulars on application.

A FULL SET OF

Jewett's Patent Milk Pans.



They extract the animal heat from the milk and keep it at the desired temperature in a warm, dry room, while the cream is being raised, without cooling or dampening the room, thereby producing more butter and a better quality than has been heretofore made from the same amount of milk.

It is not necessary to move them from the tables during the dairying season, the milk and rinse water running from them without being lifted, thereby reducing the labor of taking care of the milk to a mere trifle.

They render butter factories practical and profitable, and are adapted to large and small dairies, by making them of any required size.

READ THE TESTIMONIALS:

L. R. TOWNSEND—*Sir:* It is with pleasure that I certify to the superiority of the Jewett Patent Milk Pans over all known arrangements for butter making. When I first commenced work in my butter factory I set my pans in wooden vats, containing running water, but soon found that I could not control the temperature of the milk, and the evaporation from the water made the room too damp, and after experimenting for some time I finally dispensed with the entire arrangement, and put in the Jewett Pans. I am fully satisfied with them, and that there is no other process by which so much cream can be got from a given quantity of milk, and by which butter of an equal quality can be made, as by using these Pans. My last sale of butter brought me thirty-three cents per pound.
Chateaugay, Sept. 23, 1871.

A. M. BENNET.

L. R. TOWNSEND:—I did not get your Patent Milk Pans to work in perfect order until the best of the butter season was over, and for that reason I cannot give you what would be a fair estimate; but I can say, after all the disadvantages which I have labored under, I have used them about eight months with great satisfaction. My pans are large enough for fifty cows; I have had only twenty-seven the past season. I elevate the water about ten feet, and it takes about five barrels every twenty-four hours, and makes about one-fifth more butter, which sold for five cents more per pound. It is one-half less labor to take care of a dairy than with the small milk pans. I would say for the benefit of those who have to elevate the water, that it can be used for the pans, and then conducted into a trough for cattle, just as well as to pump it for them in the first place. I am so well pleased with the pans that I shall increase my dairy to one hundred cows another season, and procure another set of pans.
Brasher Iron Works, N. Y., Sept., 1871.

R. W. SMITH.

We, the undersigned, Trustees of the Berry Butter Factory, at Malone, N. Y., have had in use three set of the Jewett Patent Milk Pans during the past season, and cheerfully certify to their many good points, viz:—They save a great deal of hard labor; we can keep the milk at just the right temperature, be the weather hot or cold; more cream can be produced than by any other known process; it is in better condition; it makes better butter; the butter is more uniform in quality; it sells for five to eight cents per pound more than the best butter made in private dairies. These advantages are sufficient to give it the precedence over all other arrangements for making butter, and we recommend it to the attention of dairymen everywhere.
Malone, Sept. 22, 1871.

SEYMOUR L. ANDRUS,
JOHN C. WILLIAMSON,
LEVI M. ELDRED.

This is to certify that I purchased a set of Mr. Jewett's Patent Milk Pans this spring, large enough to hold the milk of twenty cows. I have used them four weeks, and am well pleased with them. I use well water for cooling the milk. It takes from fifteen to twenty minutes per day to pump water sufficient for use. I can keep my milk any desirable temperature I wish. I think I make fifteen per cent. more butter and of better quality than I did with the old pans, and it does not require one-third of the labor.
Stockholm, June 25, 1871.

E. REEVE.

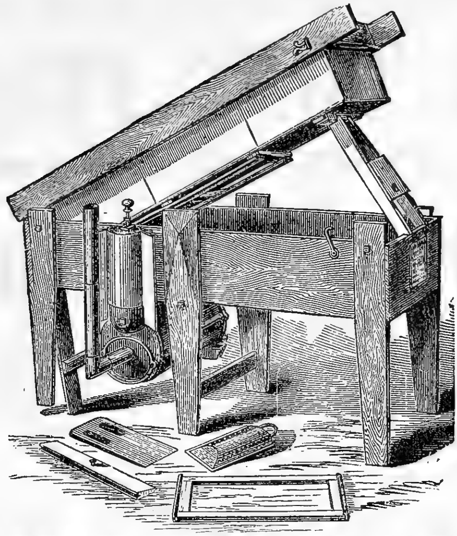
Parties wishing to learn more about them, or desirous to purchase territory, or to secure territory for which to manufacture and sell by royalty, may address B. F. JEWETT, at North Bangor, Franklin Co., N. Y., who will give them the desired information.

For information in relation to the Pans, for the State of New York, address L. R. TOWNSEND, Malone, Franklin Co., N. Y., who owns the right for the State, and manufactures them at that place, and is an authorized agent for the sale of all unsold territory.

L. R. TOWNSEND,
Malone, Franklin Co., N. Y.

B. F. JEWETT,
North Bangor, Franklin Co., N. Y.

THOROUGHLY TESTED.—PERFECT IN EVERY RESPECT.



ROE'S PATENT PREMIUM CHEESE VAT,

FOR

DAIRY AND FACTORY USE,

Has been before the public for a longer time than any other fixture of its kind, and has proved to be the best apparatus ever offered to the public for the manufacture of cheese. These Vats are furnished with an IMPROVED HEATER and VALVES TO REGULATE THE HEAT. By this means the heat is perfectly controlled, and they are rendered the MOST EFFICIENT, SIMPLE AND DURABLE VATS in use. Manufactured and for sale by

H. H. ROE & CO.,
Madison, Lake County, Ohio.

We respectfully invite the attention of all interested in Cheese Making to our list of manufactures, comprising everything necessary for the equipment of

From a Dairy of 20 to a Factory of 1,000 Cows.

We mention in this connection only a few of the more important of these, such as

Single or Associated Dairy and Factory Vats, with Improved Heaters; Large Factory Vats, complete, with Pipes for Distribution of Steam; Curd Drainers; Presses; Hoops; Screws; Carrying Cans; Weighing Cans; Sackers; Conductors, &c., &c., &c.

We use only the best materials, and employ the most experienced workmen in making these goods. In this way we are able to guarantee everything to be of the best quality in market. A trial could not fail to convince of this.

FACTORY AND DAIRY SUPPLIES.

There has been, heretofore, no place this side of the State of New York, where a full list of Dairy and Factory Supplies could be obtained at all times, and on short notice. We have determined to supply this need, deeply felt by the dairymen of Ohio and the West, in whose interests our business will be conducted, and the continuance of whose patronage, so liberallyextended to us during the past, we earnestly solicit for the future.

We shall endeavor to keep constantly on hand a full assortment of CHEESE BANDAGE STRAINER CLOTH, ANNATTO, ANNATTOINE, RENNETS, FACTORY FILLED SALT, CURD KNIVES, THERMOMETERS, MILK-TESTING INSTRUMENTS, SCALES, CURD SCOOPS, MILK PAILS, and in fact *everything wanted in the manufacture of Cheese.*

☞ Send for Circular and Price List. Please state where you saw this notice.

H. H. ROE & CO.