A TREATISE

ON

AMERICAN BUTTER FACTORIES

AND

BUTTER MANUFACTURE.

BY X. A. WILLARD, A. M.,

Lecturer at the Maine State Agricultural College and at Cornell University, etc., etc.

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NOTICE.

This reprint of a paper originally published, in part, in the Journal of the Royal Agricultural Society of England for 1870, and since revised and enlarged for the Transactions of the Wisconsin State Agricultural Society, has been found of such practical value as to warrant its immediate re-issue in its present more convenient and available form. The specialty to which it is devoted is one of large and growing importance, and the treatise itself is believed to be the most valuable contribution thereon hitherto published.

The distinguished author has been so long before the public, both American and European, as a leading authority in all matters connected with the dairy, that he needs neither introduction nor endorsement from any quarter to insure the careful reading of whatever he may write on this subject.

We are glad to know that this is but the precursor of a most complete and comprehensive work, covering the whole ground of the dairy interest, soon to be issued from the printing house of that able and popular agricultural journal, MOORE'S RURAL NEW YORKER.

J. W. HOYT.

STATE AGRICULTURAL ROOMS,
Madison, Wis., 1871.

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INTRODUCTION.

The American system of associated dairies was inaugurated during the early part of 1851. Though twenty years have elapsed since the plan was conceived, the leading features of the system remain unchanged. Great improvements, it is true, have been made in buildings and dairy apparatus and in the methods of manipulating milk for cheese and butter manufacture; still, in organizing factories, in the manner of delivering milk, in the relation between manufacturer and patron, in the care and disposal of the product,—indeed, in all the general outlines of the system,—it is the same to-day as when Jesse Williams in 1850, mapped it out for the first cheese-factory which he erected early the following year.

After nineteen years' experience in associated-dairying, during which time the system has been put to the severest tests, the American dairyman finds it more economical as regards labor, buildings, dairy machinery, and appliances; while the factory product on an average will sell for enough

more than that made in the individual farm-dairy to pay the entire cost of making.

Another important result of the system has been a constant improvement in dairy management, and the better knowledge of all that pertains to milk and its products, than would naturally obtain under the old system. It has established a special profession or calling, upon which men enter with a view of making it a sole business. They, therefore, seek to perfect themselves in it, and as skill and success are sure to be properly rewarded in this department of labor, great emulation exists among manufacturers to excel in their art.

During the first ten years of the factory system it received much opposition, especially from those who had only a superficial knowledge of its operations. So strong was this opposition among the old dairymen, that it was pretty generally believed that the system could not long endure, and it was confidently predicted that the factories would be abandoned, and those engaged in them would return to the old plan of individual or farm-dairying.

But the factories, meanwhile, were steadily gaining ground; and dairymen entering upon the new system found in it so much relief, as well as profit, that they could not be induced to abandon it; and so to-day associated-dairying in America has come to be regarded as a fixed institution.

In the original plan of Mr. Williams it was not contemplated to apply the system to butter manufacture. But the success of the cheese-factories suggested to the butter dairymen of Orange county, New York, such a modification of the system as would adapt it to their branch of business.

Orange county lies about fifty miles north of New York city, and has long been devoted to producing milk for city consumption. It is a rolling mountainous region, abounding in sweet and nutritious pasturage, with never-failing springs and streams of pure water. The whole farming population of this county has for eighty years, or more, devoted its chief attention to butter-making and the production of fresh milk for

the New York market. From so long attention to a specialty, the butter of Orange county, as was to be expected, was of fine quality, acquired a high reputation, and commanded better prices than any other brand made in the State. By adopting, however, the associated system, together with a new plan for setting the milk and obtaining the cream, the product has risen to the highest point of excellence, and in consequence extraordinary prices are paid for it.

But the farmers under this system have not only reaped better prices for their butter, they have also obtained an additional gain from the skimmed milk, which, under the old system, was fed to swine, but which now is turned into a palatable cheese. This cheese goes into the southern states; it is shipped to China and the East Indies, and not unfrequently commands a price but little below that made from whole milk.

As the manufacture of skimmed cheese is a part of the butter factory system, we shall speak of it more fully under its appropriate head.

THE GRASSES.

Before entering upon the question of butter manufacture and factory management, it will be proper to say a word concerning the food of stock. The excellence of "fancy butter" does not depend altogether upon its manufacture, for, in the first place, good milk must be secured.

"Fancy butter," that will sell for a dollar per pound, cannot be made from bad material, from milk produced on weedy pastures, or upon the rank sour herbage of swamps, or upon land newly seeded with red clover. The experienced butter dairymen, therefore, pay much attention to the feed of their cows and prefer old pastures.

On the old pastures of the butter district there are several varieties of grasses that spring up spontaneously, and are much esteemed as affording sweet and nutritious feed, from which the best qualities of milk and butter are produced. These grasses form a dense solid turf, leaving no intervening spaces. They embrace the June, or blue grass (*poa pratensis*), the fowl mead-

ow-grass (*poa serotina*), meadow fescue (*festuca pratensis*), red top (*agrostis vulgaris*), the wire grass (*poa compressa*), the sweet scented vernal and vanilla grass, together with timothy (*phleum pratense*), orchard grass (*dactylis glomerata*), clover and other forage plants.

The June grass (*poa pratensis*) is regarded as very valuable: it throws out a dense mass of leaves, is highly relished by cattle, and produces milk from which a superior quality of butter is made. It is found growing throughout the butter districts of the country. The wire-grass (*poa compressa*) is deemed one of the most nutritive 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, from which the nicest butter is made. It flourishes well upon gravelly knolls and in shady places, and its stem is green after the seed has ripened. It is found growing in all parts of the country.

The meadow fescue is common in old grass lands where the sod is thick, and grasses of different varieties are mingled together. It starts up early in the spring, is relished by stock, and furnishes good early feed. The milk farmers hold it in high estimation as a reliable grass, tenacious of life, and not running out like timothy (*phleum pratense*) or clover. The white clover (*Trifolium repens*) springs up spontaneously in the old pastures, and is highly esteemed as giving flavor and quality to butter.

The sweet scented vernal grass grows best upon the moist soil of the old meadows. It starts very early and gives off a very agreeable odor.

We have been particular in naming the grasses which are most esteemed for producing a high priced butter, because a record of long and well conducted experiments has proved their utility. It is possible that climate and soil might so modify the character of these grasses, as to render them less worthy of esteem in other countries than among the butter dairymen of New York. Still, as the experience of farmers noted for

their success in a particular direction, is more or less suggestive and valuable, we give the record as it is.

THE STOCK.

It is claimed by some that the flavor and texture of butter are influenced by the breed of cows. Butter from the milk of Breton and Jersey cows is said to be not only more solid and waxy in texture, but to have a finer aroma than that produced from other breeds. The milk of the Jersey or Alderney cow is exceedingly rich in cream, and has a deep yellow color, as is well known.

But this question need not be discussed here. It will suffice to state that among the butter dairymen of New York but little attention is paid to breeding, and no prominence is given to any particular breed. The herds are usually made up of "the common cow of the country and grade cattle." There is a sprinkling of grade Short-horns, Ayrshires, Devons, and Alderneys, and occasionally a dash of Holstein blood, obtained by crossing thoroughbreds upon the mongrel or common cows of the country. But, as we have remarked, reliance for the most part is had upon the so-called native or common cow of the country for making up the herds.

It is proper that these facts in regard to pastures and stock should be stated, in order that correct conclusions may be drawn, in making up an opinion of what we shall have to say about butter factories, and the character of product they are able to make.

As to the size of herds kept on the farms, they are usually smaller than those in the cheese dairying districts. The herds on an average, we should say, will number about twenty-five cows to the farm. Some farms, it is true, carry from forty to sixty cows, but in the majority of cases the herds are small, ranging from fifteen to thirty cows.

THE SYSTEM OF ORGANIZING FACTORIES.

The plan of organizing factories is somewhat similar to that employed in the cheese districts. The first effort of organization in a neighborhood, generally falls upon one or two persons,

who may be desirous of having a factory where they can deliver the milk from their cows, and have it manufactured. They, perhaps, have examined the workings of some factory, and have become convinced that greater profits are to be realized from the factory system than from the farm dairy, besides relieving the wife and daughter from the drudgery attendant upon butter-making at home. They therefore endeavor to bring their neighbors to the same opinion, and to induce them to join in erecting the proper building, &c. They go and talk with their neighbors, and finally call a meeting at some central point in the neighborhood, when all are invited to come and discuss the advantages and disadvantages of the system.

The cost of erecting a good factory, and supplying it with machinery and dairy appliances, is not far from four thousand dollars, and the farmers of the neighborhood are expected to join together, and pay for the erection of the buildings, in proportion to the size of their farms, or number of cows from which milk is to be delivered. The shares are put at from ten dollars to fifty dollars each, so as to be within the reach of farmers who have but few cows. As a preliminary, a simple agreement, something like the following is drawn up and circulated for signature:

"We, the undersigned, residents of the town of —— and county of ——, and state of New York, hereby agree to enter into association, for the purpose of erecting and working a butter factory in the said town. And we severally and individually bind ourselves by these presents, on or before the 1st day of ——, 18–, to pay to our regularly appointed building committee the several sums set opposite to our names, for the purpose of building and furnishing the said factory. And it is understood and agreed that when the said factory shall have been completed and opened for work, each member of the association is to patronize it by delivering milk for one year, in proportion to the number of cows set opposite his name. The manufactured product of the said milk shall be sold by the regularly appointed agent of the association, and each member shall receive his share of the sales in proportion to the quantity of milk delivered, less the cost of manufacturing, &c. This agreement shall not be binding unless the sum of four thousand dollars and the milk of 400 cows are subscribed.

Name.	Amount.	No. of Cows.

This is intended to be only a preliminary agreement. After the stock shall have been subscribed, a meeting is called, officers are chosen, and powers are delegated for the erection of the building, and for putting it in operation.

The structure being completed and furnished, a superintendent is chosen, and help hired for running the factory; and the expenses are shared by the stockholders in proportion to the amount of milk delivered. The cost of repairs, additions, &c., from year to year, is added to the expense account.

At some of the factories having the milk of 400 cows, the expense account for labor has amounted only to a fraction above two mills per quart of the milk delivered, and the gross proceeds from sales gave to farmers about 5 1-2 cents per quart wine measure.

THE MILK BUSINESS.

Since the construction of the New York and Erie Railway, which with its branches, traverses the southern tier of counties, large quantities of milk have been daily sent to New York City by regular milk trains, which gather up the milk at the various depots. The milk trains start late in the afternoon, and milk is forwarded but once a day. A portion of the milk is 36 hours old when it arrives in the city. To carry milk sweet in our hot weather for that length of time requires some art in handling, and is effected in the following manner:

The milk, as soon as it comes from the cow, is strained and put in long tin pails which are set in cold spring water, care being taken that no portion of the milk in the pails be higher than the flowing water that surrounds it. These pails are 8 inches in diameter, and from 17 to 20 inches long.

The milk is stirred occasionally to prevent the cream from rising. It is important that the animal heat should be removed from the milk as soon as possible, at least in an hour's time after it is drawn from the cow.

The old method was to cool the milk in the large carrying cans, but it has been found that it keeps sweet longer by dividing it into small quantities, and cooling it in pails as above de-

scribed. The milk stands in pails surrounded by fresh spring water until ready to be carted to the trains. It is then put into carrying cans holding from 40 to 50 gallons. The cans are completely filled, and the covers, which fit closely, are adjusted so that there shall be no space intervening between them and the milk.

In filling the cans, if there is not quite enough milk for the last can, either a little water is added to make it as full as the others, or the milk is kept back and used for other purposes.

These establishments are conducted on the principle of association, and are called creameries—taking that name on account of furnishing the New York market daily with a certain amount of cream. These creameries, managed on the associated system, return to the farmer a much larger profit than he is able to obtain individually. The manager of the creamery not only takes charge of the milk, &c., as it comes in, but sales are effected by him of all milk delivered.

Members of the association deliver milk night and morning, when it is measured and properly credited to them, and no further trouble is had with it on their part.

Usually the city milk-dealers make contracts with the creameries for a certain quantity of milk and cream during the season, or for such time as may be agreed upon.

Payment is made weekly, or monthly, at so much per quart, at the creamery, or at the nearest railway station.

A part of the milk is skimmed and the cream put up in cans, which, when ready for shipment, are placed in wooden tubs made tapering towards the bottom. The space between the cans and tubs is then packed with ice, the covers fastened down, and in this way the cream goes to market, where it arrives in perfect condition.

As fast as payment is made for milk-sales the money is divided among the patrons in proportion to the quantity of milk delivered. All the transactions are kept, of course, in the manager's books, which are at all times open for inspection and investigation.

BUTTER FACTORIES.

The creamery was the first trial of the associated system by the milk dairymen, and out of it grew the butter factories. The country milk-sales, being under the control of the city operators, it was found necessary to devise means to become independent of combinations that were being made from time to time to reduce the prices of milk and cream. Hence the idea of manufacturing the milk into butter and cheese when fair terms could not be made with the milk dealers. The plan proved at once a success, as it regulated the price of milk in accordance with the value of other products of the dairy, and avoided losses that previously occurred on account of surplus milk, which, under the old system, often had to be retained at the creamery.

The Original Factory.—The first American butter factory was erected by Mr. Alanson Slaughter, of Orange county, New York. The main building is a cheap two-storied structure, arranged on a plan similar to that of the cheese factories. On the ground floor are the milk vats, presses, and other appliances for making cheese, while the second floor is entirely devoted to the dry-room, or department for storing the cheese during the process of curing, &c.

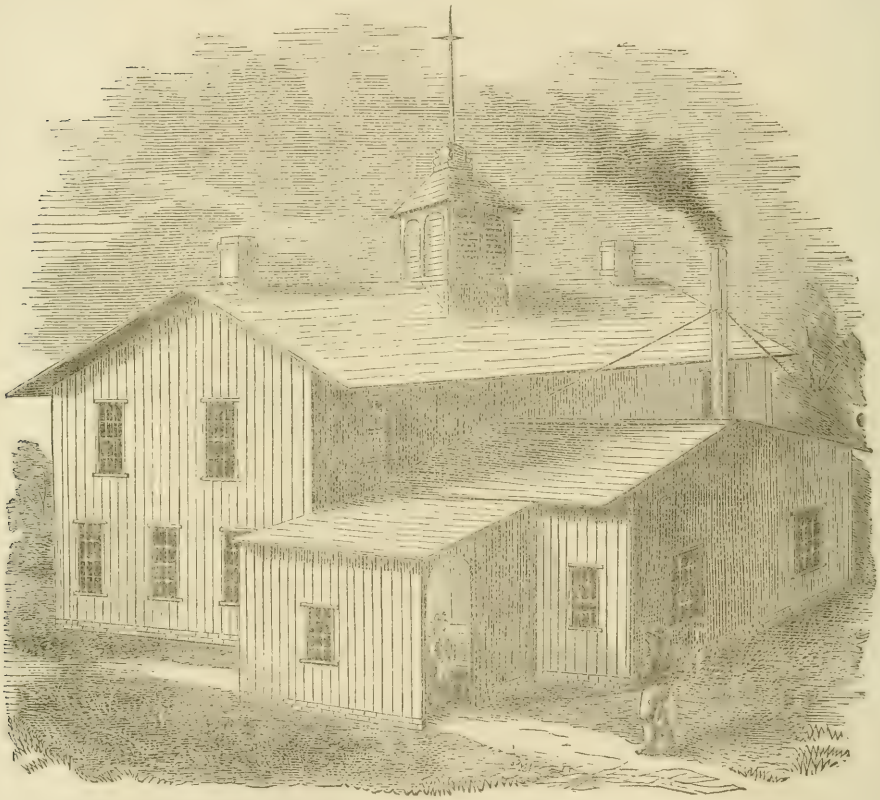
The spring-house is built out upon the end of this structure, forming a wing, and is one story high. It is divided into two rooms, one 12 feet by 16 feet, and the other 14 feet by 24 feet. The packing and churning room is in a separate building, 12 feet by 24 feet, and stands opposite the spring-room, with a narrow alley between. This alley is used for a horse-walk where the teams deliver milk and cart away the products of the dairy. Connected with the packing and churning department there is a horse-gear for churning, and an ice-house and store-room.

THE SPRINGS, AND THE MANNER OF TREATING MILK.

Among the first factories erected, the springs are situated within the enclosure of the spring-house, and vats or tanks

are constructed about the springs for holding the water. These pools are each twelve feet long and six feet wide. The earth is excavated, and the sides of the pool are laid up in solid masonry, or with stout oak plank, so that the water in the pools shall rise no higher than the level of the floor of the spring

Fig. 1—*Butter and Cheese Factory.*



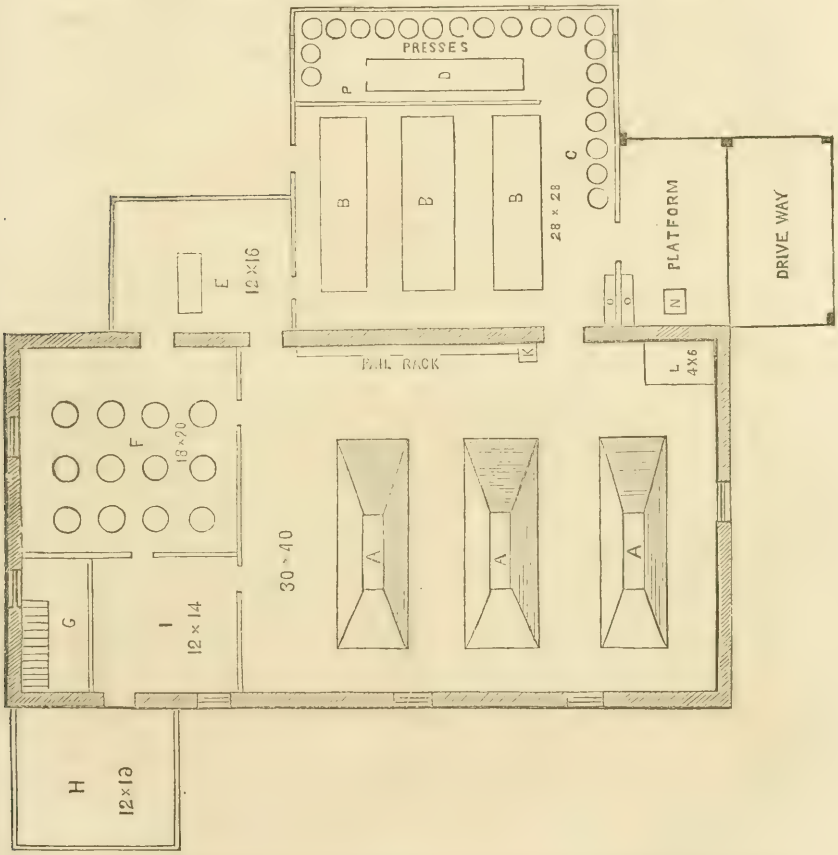
Awarded the Prize by the Northwestern Dairyman's Association.

house. Near the bottom of the pools racks are arranged for holding the cans or pails of milk; the water flows up through these racks and above them to the height of seventeen inches.

When a spring cannot be had in the spring-house, the pools are sunk below the level of the floor and arranged in the same way as above described, except that the bottoms are cemented

tight, covered with flagging or oak-plank, and the water conducted from the spring through pipes. The pails for holding the milk are of tin, from twenty to twenty-two inches in length and eight inches in diameter. In furnishing a factory, two pails are required for each cow's milk delivered.

Fig. 2.—Ground Plan of Thompson's Butter and Cheese Factory.



As fast as the milk is received the pails are filled within four or five 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 pools. The pails are set close together, and each pool has capacity for holding 2040 quarts of milk. There should be a constant flow of water in

and out of the pools, and the flow should be sufficient to divest the milk of its animal heat in less than an hour.

Some experiments have been made with a view of determining at what temperature the water in the pools enables operations to be conducted with the most success; and the best results in cream (quantity and quality considered) are obtained when the natural temperature of the water flowing into the pools is about 56 deg. Fahr. The pools should not be kept at so low a temperature as 48 deg., nor much, if any, above 57 deg. The range of temperature desired by some is from 56 deg. to 60 deg. It is claimed that more cream, and that of better quality for butter-making, may be obtained by setting the milk on the above plan, than it will yield when set shallower in pans, or when exposed to uneven temperatures.

One feature in the process, deemed of great importance, 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, as this has a tendency to fleck the butter and injure the flavor. The milk of one day is left in the pools until next morning, which gives twenty-four hours for the morning's mess and twelve hours for the evening's mess to cream. The pails are then taken out of the pools and the cream dipped off. In removing the cream a little tunnel-shaped cup, with a long upright handle is used, and the thin cream is dipped off down to the milk-line, which is readily recognized by the blue appearance of the milk.

In the fall and spring of the year the cream, as it is dipped, goes immediately to the churns, and is churned sweet. In summer the cream is dipped into the pails and returned to the pool, and kept there till it acquires a slightly acid taste, when it is ready for the churns.

The cream having been removed, the skimmed milk in the pails is now turned into the cheese-vat to be made into "skim-cheese." The pails then go to the wash-room where they are thoroughly cleansed with soap and water, and set upon a rack exposed to the sun and air. At some factories, the pails, after

being cleansed with soap and water, are placed over a jet of steam and thoroughly scalded. They then receive a jet of cold water and go upon the rack to sun and dry. This arrangement is a very great improvement in cleansing dairy utensils, doing the work thoroughly and expeditiously.

The factories do not all operate alike in regard to the time of setting the milk. Where an extra fancy product of butter and skimmed cheese is desired, none of the milk is set longer than twenty-four hours, and at these factories it is not desired to take all the cream from the milk, but only the best part; and the balance is employed to give quality to the "skim-cheese." At some establishments the cream is allowed to turn slightly sour before churning; but when it is churned sweet the buttermilk goes into the vats with the skimmed milk and is made into cheese. Some factories adopt the plan of holding the morning's milk in the pools for thirty-six hours and the night's milk for twenty-four hours; but as the skimmed cheese by this management is less meaty than by the other method, it is a question whether any more profit is realized from it.

THE CHURNS AND CHURNING.

The churning at the large establishments is done by horse-power. There are a variety of powers, but that most commonly used is simply a large circular platform or wooden wheel, built about an upright shaft, the lower end of which turns in a socket. The wheel sets upon an incline, so that the horse, by walking constantly on one side, keeps it in motion. At the upper end of the shaft, gearing is arranged so as to give motion to the churns. Quite recently a small engine in connection with the heating arrangement for the cheese department has been used to supply power for driving the churns.

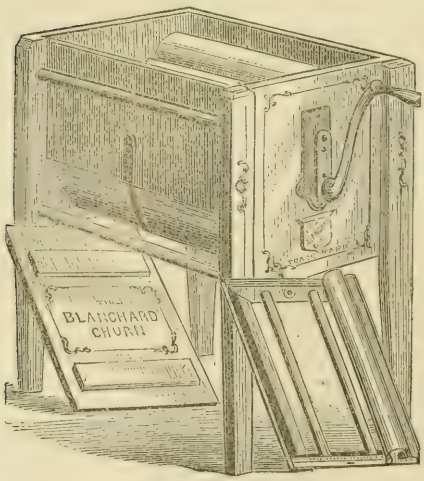
The latest invention for supplying power for churning consists in a system of gearing, driven by a heavy weight attached to a stout rope which is wound about the cylinder of the machine. Sixteen feet of rope will run the power half an hour, carrying the churn-dashers at the rate of fifty strokes to the minute, which is the rate of stroke best adapted for producing

good butter in the dash-churn. It is adapted to any size of churn, and has a regulator to vary the dash without changing the weight.

The "Scientific American," in speaking of the merits and advantages of this machine, says :—"Mechanical powers of this character have not heretofore been very acceptable for domestic purposes, some requiring too heavy weights, and thus using too much rope. The inventor of this movement has produced a churn-power that seems very free from the objections named. It is very compact, occupying a space only of eighteen by twenty inches, applicable for pumping water and many other kinds of light work."

There have been many kinds of churns used in the butter districts, but the factories universally prefer the old-fashioned barrel dash-churn. They use the barrel and a half size with dasher.

Fig. 3.—*The Blanchard Churn.*



Recently a churn has been invented with revolving arms, arranged so that the floats open and close at each revolution, and it does good work. By an opposite revolution to that used in churning, the floats will work the butter, thus combining a churn and butter-worker in one machine. We give its general appearance in Fig. 3.

Usually, four (of the dash-churns) churns are placed side by side, so as to be all worked by the power at the same time. From sixty to seventy quarts of cream are put into each churn, and each mess of cream then receives from twelve to sixteen quarts of water, for the purpose of diluting it and bringing it to a temperature of about 60 deg. In warm weather cold spring water is used, and in cold weather warm water.

Some prefer diluting the cream with water and passing it through a sieve before putting it in the churns, in order that the particles of cream may all be of uniform size; since if the butter does not come evenly, but is mixed with small particles of cream, it will soon deteriorate, and will not make a prime or fancy article. This point is considered of great importance by the best butter makers, and it is claimed that the method of setting the milk in deep pails, by which a thin cream is obtained, rather than the thick leathery masses skimmed from milk set in pans, renders it more evenly churned, and thus secures a better product. It is partly on this account also that it is preferred to have the churning occupy from half to three-quarters of an hour, since it has been found that when the butter comes too quickly it is more or less injured.

In warm weather ice is sometimes broken up and put in the churn to reduce the temperature of the cream; but it is deemed better to churn without ice, if the cream does not rise above 64 deg. F. 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. In churning, the dashes are so arranged as to go downwards within a quarter of an inch of the bottom of the churn, and to rise above the cream in their upward stroke.

The temperature of the cream, while being churned, should be kept below 65 deg.; for if at the close of the churning the butter-milk should be at that temperature or above it, the flavor and color of the butter will be injured. In cold weather, the temperature of the cream, when ready for churning, is a little higher than in warm weather, about 62 deg. being considered the right point. Factorymen prefer that the churning should occupy on an average about forty-five minutes: a half-hour being the shortest space of time, and an hour the longest, that should be employed in this operation. When the butter begins to come, the churn is rinsed down with cold spring water. The butter should come of a firm or solid consistency and of a rich yellow color.

WORKING AND SALTING.

The butter is now removed from the churns, and care is taken never to touch it more than is necessary with the hands. It is lifted with the ladle into elliptical wooden trays, and the buttermilk is rinsed out with cold spring water. In the process the ladle is used lightly, while the water being turned over the butter is allowed to pass off at one end of the tray. This process is repeated two or three times, when nearly all the buttermilk will have been rinsed away.

Salt is now added, and worked through the butter with the butter-worker, at the rate of 18 ounces for 22 lbs. of butter. Great care is taken that the salt be pure, and of those brands that are known to be free from the chloride of calcium, as a trace of this impurity gives a bitter taste to the butter. For butter that is designed to be kept over for the winter markets, a little more salt is sometimes used, often as high as an ounce of salt to the pound of butter. Not unfrequently a teaspoonful of pulverized saltpetre and a tablespoonful of white sugar are added, at the last working, for 22 lbs. of butter.

In the matter of salt, however, the factories adapt the quantity to suit the taste of their customers, or for different markets. Of late years, light-salted butter sells best, and the rate of salting varies from one-half to three-fourths of an ounce of salt to the pound of butter. The butter, after having been salted and worked, is allowed to stand until evening, and is then worked a second time and packed. In hot weather, as soon as the butter is salted and worked over, it is taken to the pools and immersed in water, where it remains until evening, when it is taken out, worked over, and packed. For this purpose a separate pool is provided, which is used only for butter; it is called the "butter pool," and fresh spring water constantly flows in and out of it, as in the pools for setting the milk.

WORKING THE BUTTER.

In working the butter, considerable skill and experience are required that the grain of the butter shall not be injured. The butter must have a peculiar firmness and fineness of texture,

and a wax-like appearance when fractured, which an improper handling, in expelling the buttermilk and working, will destroy. Care is taken, therefore, not to overwork it, nor subject it to a grinding manipulation like tempering mortar, as this spoils the grain and renders the butter of a greasy or salve like texture.

The butter is worked with butter-workers. The one in most common use consists of an inclined slab standing upon legs, and with bevelled sides about three inches high. The slab is four feet long by two feet wide at the upper end, and tapering down four inches at the lower end, where there is a cross-piece, with a slot for the reception of the end of the lever. There is also an opening at this end for the escape of the buttermilk into a pail below. The lever is made either with four or eight sides, and the end fits loosely in the slot, so as to be worked in any direction. It is quite simple, but does good execution and is much liked at the butter factories.

There are other butter-workers in use, and one of the more recent inventions is represented by the subjoined cuts (Figs. 4, 5, 6.)

Fig. 4.

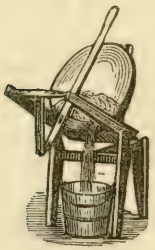


Fig. 5.

Fig. 6.

This is a very convenient and efficient machine, the invention of J. P. Corbin, of Whitney's Point, N. Y. The illustrations above give a good representation of it.

A common butter-bowl is placed and held securely on a light, small stool, firmly against a solid rest that protects it from breaking or springing. It may be revolved either way, at will, also easily tipped 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 is attached to a pendant lever 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 is fastened to the slot 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 fastened to the bottom of the bowl, which slides in an iron groove attached to the lever, and which allows the bowl to be moved round, and, when desired, to be removed entirely from the other parts of the worker.

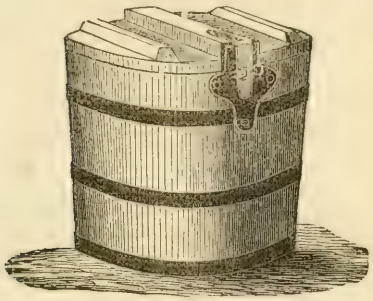
After the butter has been washed in the trays, a batch weighing 22 lbs. is laid upon the inclined slab, or butter-worker, first described, and then spread out with the ladle. Pure Ashton or Onondaga salt, made fine by rolling, is now sprinkled over the mass and the lever applied, first beginning at one side until the whole is gone over. Only a few manipulations of this kind are required to work in the salt and complete this part of the process.

As it is important that the buttermilk should be completely removed, this is facilitated during the working process by applying a slightly dampened napkin to the surface, or by the use of a damp sponge covered with a napkin for the purpose.

PACKING.

The butter is packed in firkins, in half-firkins, and in Orange county pails. The pails are "return pails," that is, they are not sold with the butter, but are to be returned to the factory after the purchaser has taken out the butter. They hold about 60 lbs. of butter, are of white oak, nicely made, and strongly hooped with heavy band-iron. They have movable covers that fit closely, and are fastened with wooden bolts or metallic clasps. The firkins are also made of white oak, heavily hooped, and the sides neatly turned.

Fig. 7—The Wescott Return Butter Pail.



The greatest attention is paid to have the packages perfectly tight, so as not to permit the least leakage. White oak is regarded as the best material for packages, and the butter factories use no other. The firkins hold about 100 lbs. each. The half-firkin is simply the firkin sawed in two, and provided with an oak head, which is nailed on the top of the package after it is filled.

These pails are made of white oak, and are hooped with iron bands. They are manufactured at Belmont, N. Y

The firkin is prepared for use by soaking in cold water, after that in scalding water, and then again in cold water. It is then either filled with brine and soaked twenty four hours, or the inside is thoroughly rubbed with dry salt, and left to stand for a short time, when it is considered ready for use.

In packing the butter it is pressed together as solidly as may be, and when the firkin is filled it is immediately headed up, and a strong brine poured through a hole in the top head, to fill all the intervening spaces. The orifice is then closed, and the firkin is set in a cool cellar until it is ready to be sent to market. When the half-firkin is filled, a dry cloth, cut so as to entirely cover the butter, is spread over it, and covered with a thin layer of salt. The cover is then fastened on, and the package is set away in a dry cool place until it is taken to market.

MARKETING.

The butter factories usually have orders for butter as fast as it is made, so that the consignments are from week to week. In Orange county the manner of marketing butter differs from that practised in other localities. Consignments are not generally made direct to the city dealers, but they are intrusted to "captains," as they are called, or persons who make it a busi-

ness to collect freights of this kind, and take them in charge to New York, making the sales and returning the proceeds to the manufacturer. The "captains" go with their freight twice a week, are men of standing and responsibility, who are well acquainted with the trade, and know how and when to obtain the best prices.

They receive a commission for their labors, and find it to their interest to make good sales, otherwise they lose the confidence of those entrusting freight to their charge, and are liable, therefore, to be displaced. The captains often receive proposals for large lots of butter, which proposals are submitted to the factories, when they are accepted or rejected as seems best to the parties interested. They supply private families and hotels, and by having a line of customers who are willing to pay a high price for an extreme fancy article, very large returns are not unfrequently made to the factories.

By this system, the producer being brought near to the consumer, he must realise full prices for his goods, instead of feeding a class of middle men, each one of whom will take his profit out of the product.

With factories quite remote from the city, the product is either consigned to the wholesale dealer, to be sold on commission, or the brand, having a reputation, is sold directly to city dealers, on contracts for weekly or semi-monthly deliveries.

ADVANTAGES OF BUTTER FACTORIES.

The advantages of butter making on the associated dairy system over that in private families are very great. In the first place, by the association system a uniform product of superior character is secured. Every appliance that science or skill, or close attention 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 100 families each family had the skill and convenience of the factory, and that each would give the subject the same close attention, then, doubtless, there would be no difference as to the 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 the one hundred dairies combined than it would to purchase an individual dairy, and the uniformity and reliability of the product does not entail the losses that are constantly occurring in different small lots by reason of inferior quality. The factories, too, as we have previously remarked, relieve the farmer and his family from a great deal of drudgery, and unless the work can be done by members of the family, who cannot be employed profitably at other labors, it is a matter of economy to have the butter and cheese made at the factory, since what would take one hundred hands scattered over the country to do, is performed in the same time by three or four, when the milk is worked up together in 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 milk is delivered for the season by the payment of a small sum.

THE SKIM CHEESE.

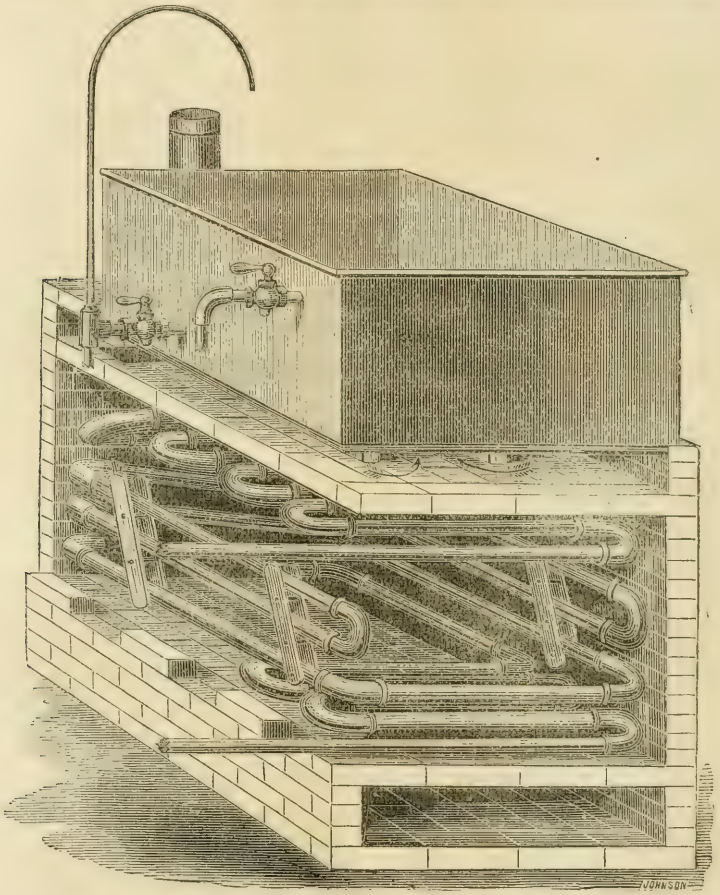
We have referred to the manufacture of "skim cheese" as a part of the butter-factory system. We have said that the cream is dipped from the milk while it is sweet, and that the latter then goes into the milk-vats for making "skim cheese."

It should be remarked that at the butter factories the quantity of milk to be manipulated is usually much smaller than at the cheese factories. In making a fancy product it is found advisable that the delivery of milk be kept within moderate bounds, say from three hundred to four hundred cows. The factory milk-vats are all essentially alike in form and size. They hold from five hundred to six hundred gallons.

There is a great variety of heating apparatus, boilers, steamers, tanks for hot water, and what is termed "self-heaters," that is with fire-box attached to, and immediately below, the milk-vat. This kind of heater is very popular at the butter factories, as it consumes but little fuel, is easily managed, and does as good work as the best.

The ordinary 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 heated surface.

Fig. 8.—View of Millar's Heater, with Front and Side of Brickwork removed.



When a boiler and engine are used, power is afforded for driving the churns, and in this respect this system must prove most convenient. Still as the expense is considerably more than for the self-heater, both in the first cost and for fuel, many prefer the latter. We give figures of two kinds of heaters that are very largely in use.

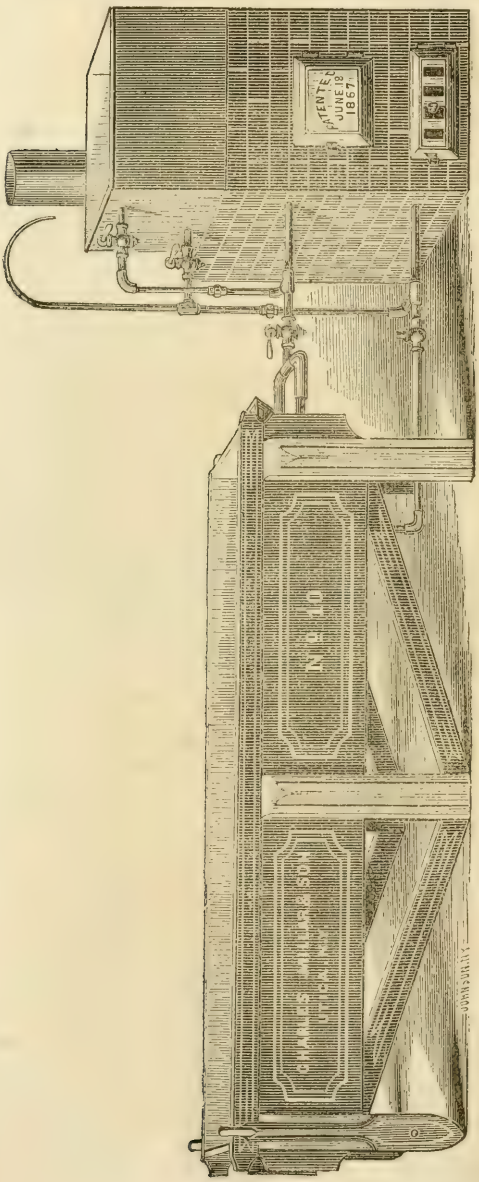
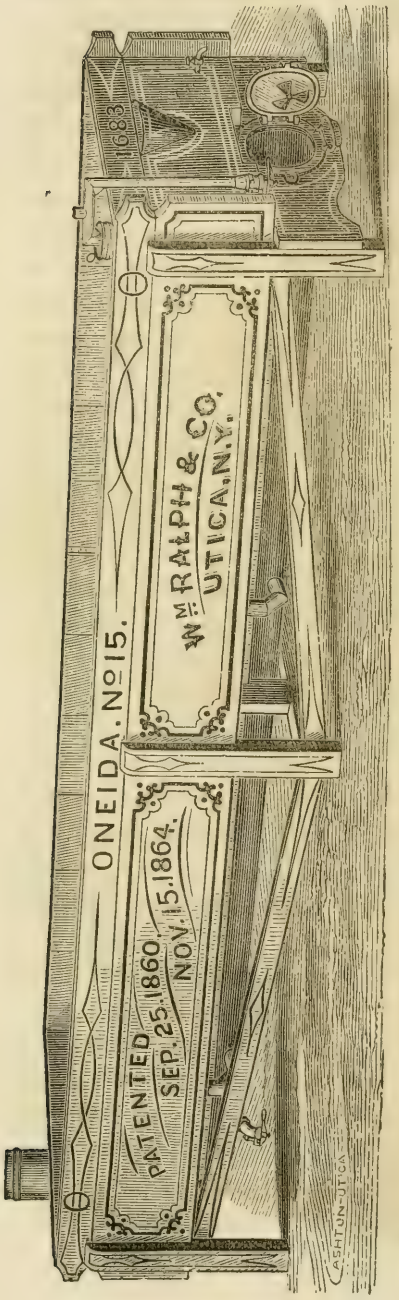


Fig. 9.—Millar's Circulating Coil-Heater for Factory Milk-vat, (consisting of coil of gas-pipe enclosed in brick

The factory vat (Fig. 10) is constructed on the same principle as that for farm dairies. The fire-box underneath runs from end to end. It is simply a copper cylinder with a jacket two inches or more from cylinder on lower side, so that water surrounds the cylinder or fire-box. This vat requires but very little fuel. I have one of the farm vats upon my farm, and my farmer, in summer has done all the work in making cheese from my dairy of 30 cows, using only a "pan of chips," say 10 to 12 quarts. The pipe hanging over the vat is a movable syphon for drawing off whey. It is represented with one end inserted in the tin strainer, which is also movable, or so as to be detached. B is the smoke pipe.

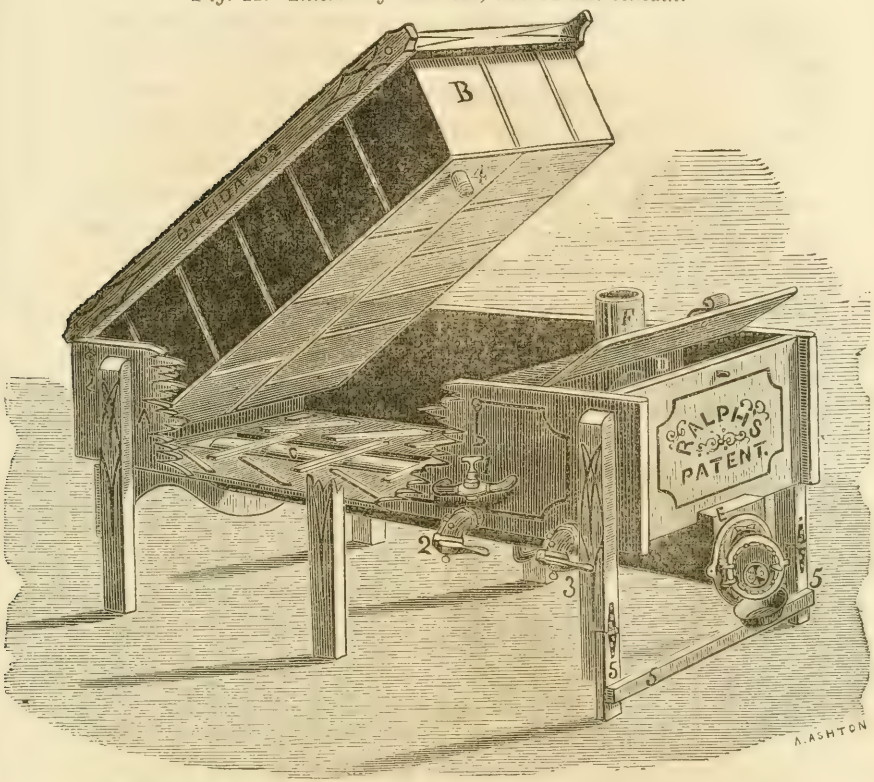
Fig. 10.—*The Oneida, or Factory Vat.*



The next engraving (Fig. 11) represents the tin or inner vat raised, and the sides of the outer vat broken out to show the heater and the supports of the inner vat.

The outer vat is lined with galvanized sheet-iron; B is the inner tin vat; C the copper vat heater, extending the entire length of the vat, and surrounded by water in a semi-cylindrical jacket open at the top, which water also fills the space between the vats. D is the tank or reservoir for hot water, separate from that between the vats, and E the copper heater for tank or reservoir. F smoke-pipe for both vat and tank heaters. The numbers indicate the following parts: 1, faucet connecting water-space between the vats with tank. 2, water-gate in outside vat. 3, water-gate in tank. 4, tube through which the whey is drawn from the strainer inside the inner vat. The strainer and whey faucet are not shown in the engraving.

Fig. 11.—*Interior of Milk-vat, with Heater beneath.*



The above milk-vat is for farm dairies. There is another door or fire-box at the back, similar to that at E, where fire is made to heat the water under the vat (B), when in place.

Fig. 12.

Fig. 13.

Fig. 14.

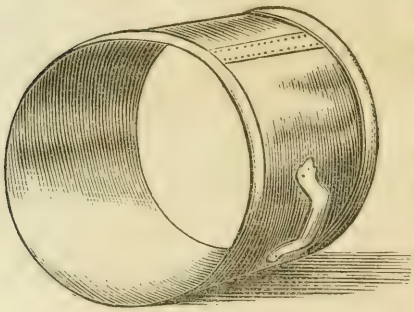
In making skim cheese the milk is set at 82 deg., and sufficient rennet added to coagulate it in from forty to sixty minutes. It is then cut in cheeks with a gang of steel knives, the blades set one quarter inch apart.

It is now left at rest for a short time for the curd to subside, when it is further divided,

the gang of blades being set at an angle of 45 deg. with the bottom of the vat. It is now gently lifted with the hands, and the process of breaking or subdivision completed. Then a slow heat is begun to be applied to the mass; the curd, meanwhile, being stirred to keep it from packing, until a temperature of 96 deg. is reached. This is the highest heat to which the curds are subjected.

When the curds have acquired a sufficiently firm consistency, the whey is drawn, and the curds thrown upon a sink to drain and cool, after which they may be run through a curd mill and salted, and then put to press.

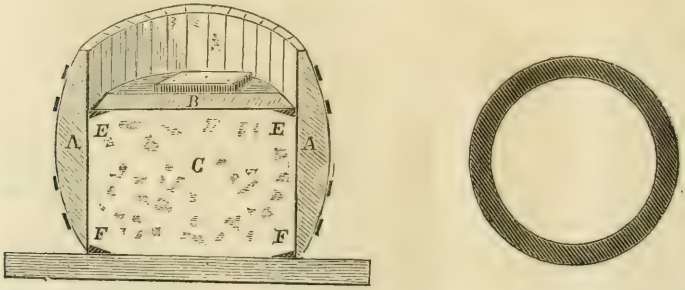
Fig. 15.—*The Iron Clad Company's Metallic Hoop.*



This metallic hoop is an improvement on the wooden hoop, as it allows a close fitting follower, and is not liable to fall to pieces when out of use as with the wooden hoop, on account of shrinkage of the staves and loosening of the band irons.

The rubber ring is an improvement for keeping the edges of the cheese smooth and in good order while pressing. It has now been thoroughly tested. It prevents the curd from pressing up around the follower of a cheese hoop, and takes the place of press cloths.

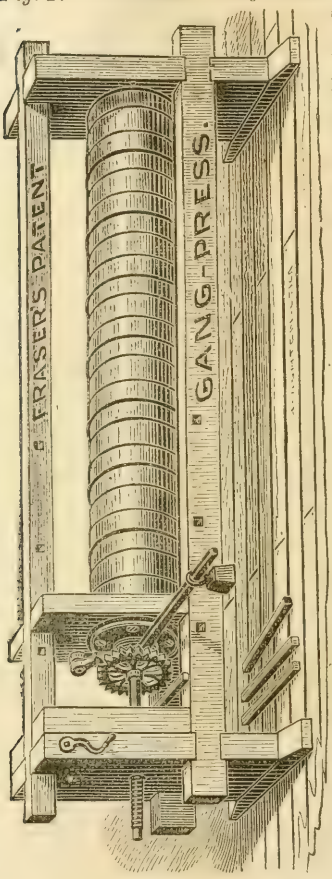
Fig. 1 .—*Millar's Hoop and Rubber Ring.*



The above cut represents a cheese hoop cut in too perpen-

dicularly. A, represents the cheese Hoop; B, the Follower; C, the Cheese; E and F, the Rubber Washers or Rings. One of these Rubber Rings 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. 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.

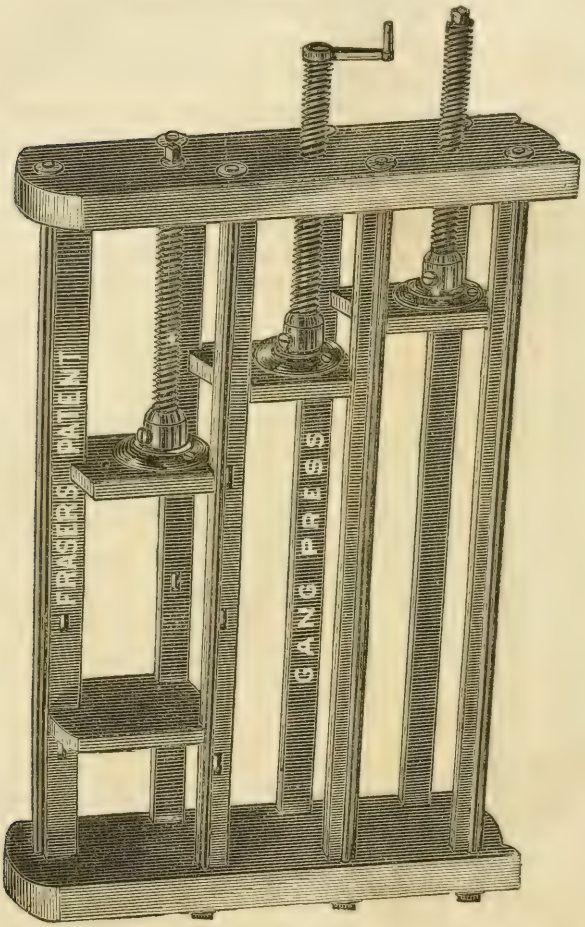
Fig. 17.—*The Fraser Gang Press.*



By using these rubber rings the followers may fit the hoops very loosely. They are more convenient than press cloths, are more readily cleaned, and will last much longer. They are made beveling, so they leave a nice rounding edge on the cheese, and save all trimming.

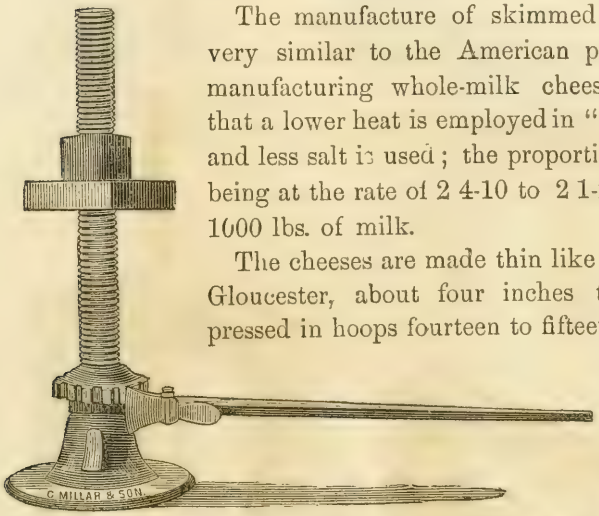
Directions for Using.—Cut the ring once and then fit the rings to the hoops, and if there is any lap cut it out, so that the ends just meet when the ring is fitted closely to the sides of the cheese hoop. Place one at the bottom of the hoop, fill in the curd and put another under the follower. It is not necessary to use any press cloths, though some prefer to use circular cap cloths. If the cheese hoop fits closely to the press board, the lower ring is not always necessary. Several small holes should be made in the cheese hoop, to allow the whey to readily run off.

Fig. 18.—*The Fraser Gang Press.*



The Frazer gang presses are a new invention and are much liked where they have been tried. D. H. Burrell, Little Falls, N. Y., is general agent for them.

Fig. 19.—*The Millar Patent Ratchet Cheese-press Screw.*

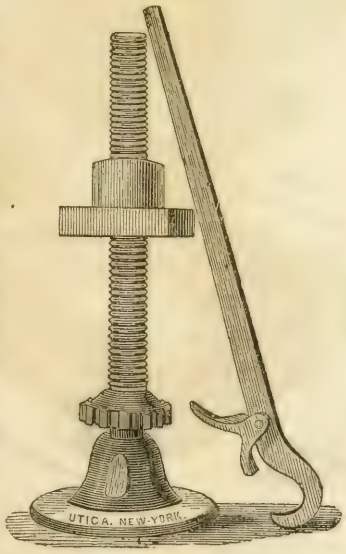


The manufacture of skimmed cheese is very similar to the American process of manufacturing whole-milk cheese, except that a lower heat is employed in "scalding," and less salt is used; the proportion of salt being at the rate of 2 4-10 to 2 1-2 lbs. for 1000 lbs. of milk.

The cheeses are made thin like the single Gloucester, about four inches thick, and pressed in hoops fourteen to fifteen inches in diameter. The style of cheese, however, varies at different factories; some making a small sized fancy shape, eight to ten inches in diameter, and about the same height.

The Oblong Shape.—Recently a new form, or style of cheese, has been introduce which promises to be a success. The advantages claimed for it are—

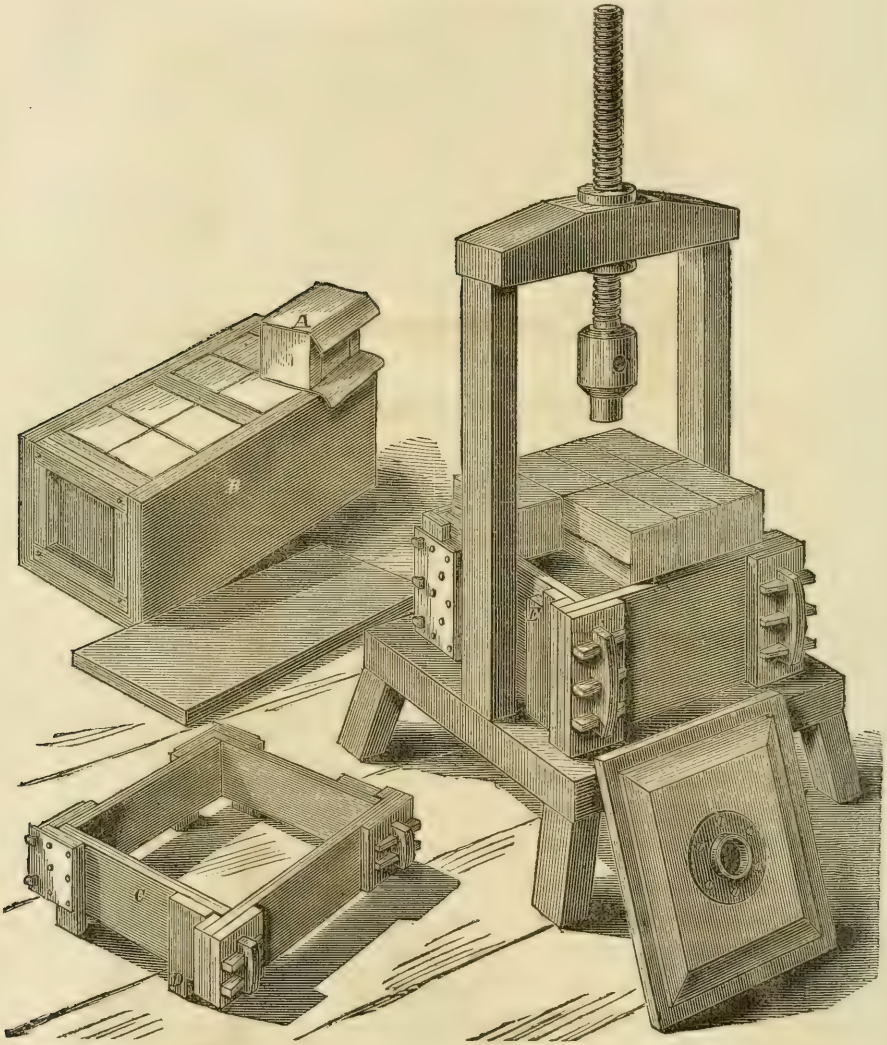
Fig. 20.



1. The curd is pressed in a large cake (pressing in one curb or mould from ten pounds to one thousand or more) and then cut into blocks of any desired size. These blocks are then bandaged, and placed in the mould in layers, and again pressed, and the whey starts again, especially at the freshly cut sides. In this manner cheeses may be made weighing from ten to one hundred pounds each, to suit any market, and

small cheeses can be made at very nearly the same expense as large ones.

Fig. 21.—*Cheese-press and Mould used for the Holdridge Cheese.*



A. Cheese with bandage. B. Composite Cheese-mould. C. Square Hoop.
D. and E. Morticed slips for connecting the Hoops.

2. The escape of the whey by evaporation is greatly facilitated by this form of cheese-cakes, for, as the whey percolates

towards the bottom of the cakes (these cakes being turned from time to time only a quarter of a revolution), the whey, instead of turning back toward the centre of the cheese—as is the case with all round cheese—is turned at right angles thereto, and is consequently always tending towards the outside; and the whey is so far expressed and evaporated that decomposition is much less liable to take place.

3. These cakes, being entirely covered with bandage, may be cured with or without greasing, and are thus rendered safe from flies.

4. They are much more easily turned and handled than round cheese.

5. They are shipped to market in boxes of thin stuff of any kind of timber. Any farmer can make them, making the boxes of such size as he chooses, and at an expense much less than for round boxes. For ten-pound cheese, boxes are used with success containing 18 cheeses, 180 lbs.; and for thirty-pound cheeses, 8 in a case, 240 lbs. This item of boxes is a great advantage. The boxes are solid, and there are no covers to come off. The cleats on the outside of the boxes prevent them from being packed too closely together in carrying or in store-houses. There is a great saving in weight, as, in the old style, down weights are given in each cheese, while in this shape only one down weight is given for 18 small cheeses or 8 large ones.

6. For retail trade this form of cheese is of great advantage. The dealer can weigh the whole cheese, and cut by measure the exact weight required, and many of the cheeses are sold without cutting.

7. For family use small cakes are a great success. A ten-pound cheese is 10 inches in length and 5 inches square, and is cut for table use as follows:

Turn the bandage back from the end, cut a thin slice from the end of the cheese, then cut off the desired slices for the table, and replace the thin slice and bandage; set the cheese on end and it is sealed, and as safe as an uncut cheese.

8. These cheeses cure much better than round ones, as the gases, if any be generated, escape from the ends, and are not forced back and forth through the cheese as with round ones.

9. They take less room in the dry-house, and women and children can easily turn and handle them.

10. For exportation they greatly excel the round cheese. They can be packed closer, boxes cost less, and small cheese can be boxed and shipped at nearly the same expense as large ones. They have been shipped to England with great success

When curd is ready for pressing it is placed in the mould E. of a square or rectangular form and with one side arranged to open by removing pins at the corners. After the curd is pressed into a broad flat cake it is vertically cut with a firm saw into blocks as represented in cut, and bandaged with muslin. These are placed one upon another in layers, say two deep in the mould, with thin boards or other plates between them, and are again subjected to the action of the press, by which the whey is still further pressed out, especially of the freshly cut sides of the cakes. The pressing is continued as long as needed, after which the cakes are removed to the shelf or curing-room, to allow the remaining whey to escape by evaporation. This is claimed to be facilitated by the form of the cake, because, as the whey percolates towards the bottom, and in turning as is required, from time to time, the cakes are only turned a quarter of a revolution, the whey instead of being turned directly back in its course is turned at right angles, and is consequently always tending nearer to the exterior.

In this way, together with the pressing, it is claimed the whey is so far dissipated that decomposition is much less liable to take place, and therefore, the cheese may be preserved without the greasing commonly employed.

BUTTER-MAKING AT THE CHEESE FACTORIES.

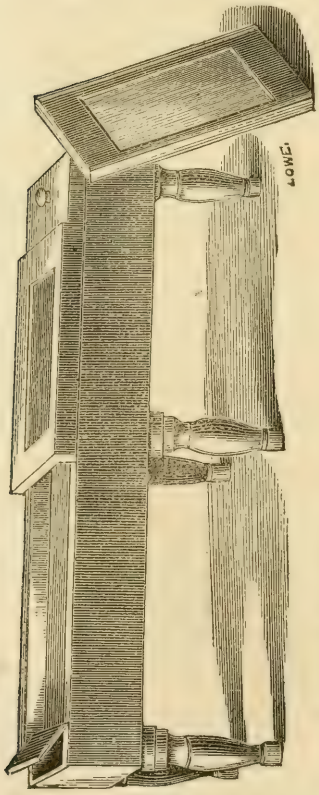
Within the last three or four years a good quality of butter has been made at some of the cheese factories. The plan adopted is to spread out the night's milk in the vats used for making

cheese, allowing a stream of water to flow under the inner vat, or to fill the space between the inner and outer vats. The milk is by this means reduced to about 60 degs. and what cream rises during the night is skimmed off in the morning and made into butter.

The morning's milk is then added to the skimmed milk as it comes to the factory, and is made into cheese by the usual process, except that a lower heat and less salt is used than for the whole-milk cheese.

By careful manipulation and skill, very nearly, if not quite, as good a product of cheese is made as at the factories making whole-milk cheese; at least, with good milk and high skill, experts are unable to detect the difference.

Fig. 22.—C. F. Jenning's Milk Pan for Setting Milk, fitted with movable Covers of Netting to keep out Dust and Flies.



At one of these factories, which we visited in 1870, the delivery of milk for the day amounted to 6,839 lbs. The cream taken from the night's mess of milk made 87 lbs. of butter, and when the morning's milk was added to the skimmed milk it made 9 cheeses of 72 lbs. each.

In some factories, in order that the night's milk may not be massed together in too large quantities, resort is had to a large shallow pan set in a wooden vat with space between the two for water. The milk is set in these pans from 2 to 3 inches deep, and a stream of cold water kept flowing in the space between the pan and the vat during the night. These pans are from 8 to 12 feet, or more, long, by 2 to 3 feet

wide, and are arranged so that the milk may be drawn off through an orifice in the bottom. The skimming is effected with a tin scoop.

The above figure (25) will illustrate this apparatus. It does its work very effectually.

THE JEWETT PAN.

The Jewett pan is somewhat similar in construction to the Jennings Pan, and the same principles are involved in its operation. I have tested the *Jennings pan* in my own dairy, and am well pleased with it; and I believe these pans are a very great saving both in labor and product over the old system of setting the milk in small pans They can be made of any desired size to accommodate the entire mess of milk from a moderate sized dairy. Usually, one surface foot of pan bottom will be sufficient for two cows; so that any one may calculate pretty accurately what will be needed for his dairy. The sides of the pan are about five inches high.

In farm dairies, where the milk rooms are not constructed on the Orange county plan, or that described for making Philadelphia butter, these pans serve a very important purpose, since the milk, by means of running water, may be kept at a pretty even temperature in an ordinary, or less expensive milk room. The way to use them is to put one milking of the entire dairy into one pan, adjusting the faucet in 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—say from 60 to 62 deg. At the time the fourth pan is wanted for use, the first will be ready to skim; then stop the water from running into 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 American *Artizan* thus describes the following cut of the Jewett pan:

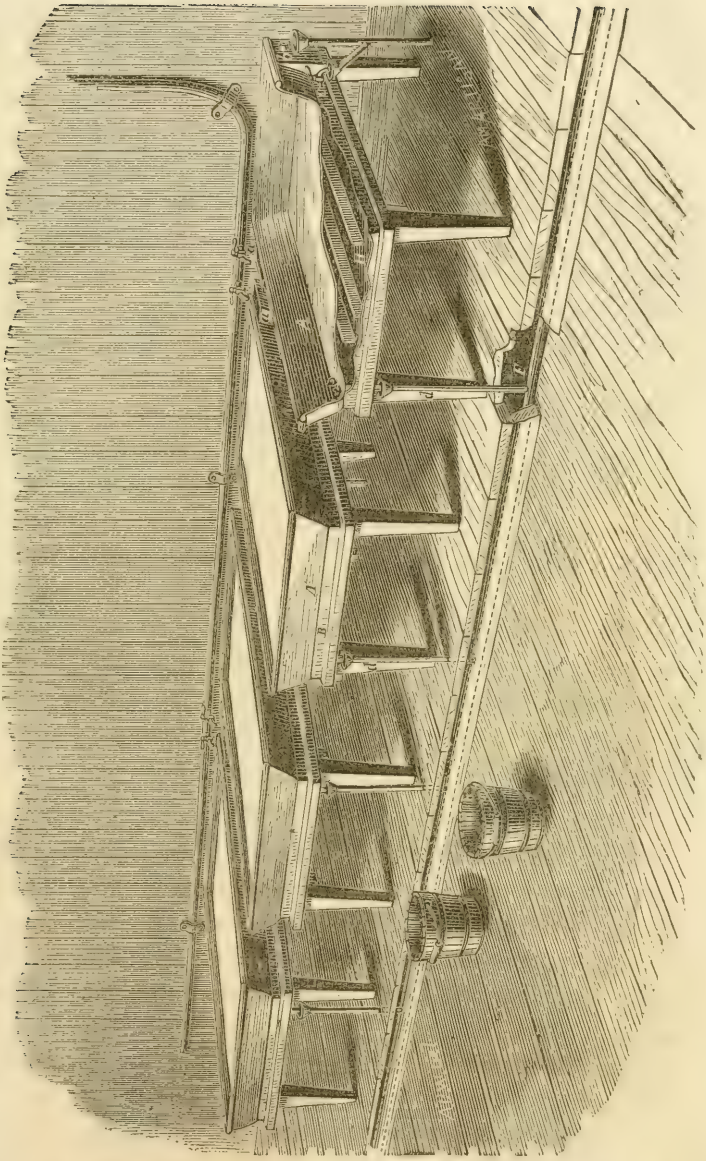


Fig. 23.—The Jewett Pan.

"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 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.

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 row 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.

WHEY BUTTER.

At the whole-milk cheese factories a new process is beginning to be adopted for taking the butter out of whey and preparing it for table use. Whey butter is not equal in flavor or texture to the fancy product manufactured at the butter factories. Still, by the new process, whey butter may be made very palatable, and, when fresh, commands a good price.

We have seen whey butter side by side in the markets with that made from cream in the usual way, and dealers have selected the former in preference to the latter, not for a moment suspecting its origin. Indeed, so fine are some of the samples, and so neatly are they put up, that it has been sold week after week at the Little Falls market for the same price as good brands of butter made in the farm dairies.

Whey butter soon deteriorates in flavor, and should be consumed when freshly made. We give description of apparatus and process of making as follows:

Apparatus.—The apparatus is a copper-bottomed vat 12 feet long by 3 feet wide, and 20 inches deep. These dimensions may be varied to accommodate the size of the dairy. The vat sets over a brick or stone arch, and is accommodated to the use of 18 or 20 inch wood. The floor is a slightly inclined plane towards the back of the vat. The vat and arch should be placed a little lower than the milk-vat so as to enable the whey to be easily drawn off by means of a syphon.

The process.—After drawing the whey from the curd into the vat over the arch referred to, one gallon of acid is added to the whey for every 50 gallons of milk, if the whey is sweet. If the whey is changed a less quantity will be sufficient, and if the acid is not sharp, one pound of 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 170° to 180° Fahrenheit. The cream now begins to rise, and is skimmed off with a tin scoop; and when it has all been removed it is set in a cool place, and left to stand for 24 hours. It is then churned at a temperature of from 56° to 68°, according to the temperature of the weather, and is then worked and salted in the ordinary manner of butter-making. This process gives on an average 20 pounds of butter from 500 gallons of whey.

Making the Acid.—The acid is made by taking any quantity of whey after extracting the cream, heating it to the boiling point, and adding a gallon of strictly sour whey for every 10 gallons of boiling whey, when all the casein and albuminous matter in the whey will collect in a mass, and may be skimmed off. The whey is now left to stand for 24 or 48 hours, when it will be ready for use as acid.

After the butter is made by the above process, the whey is

considered by those who have made experiments with it, to be better for feeding to swine than whey not subjected to the process, as the sugar of milk is retained longer without change.

RESULTS OBTAINED AT THE BUTTER FACTORIES—LABOR, ETC.

The average product from the milk during the season at the butter factories is a pound of butter and two pounds of skim cheese from 14 quarts of milk. There is a variation in the quality of milk at different seasons of the year; and in the fall, when the cows are giving a smaller quantity, it is, of course, richer in cream, and better results are obtained from the same quantity than early in the season. This will be seen from the following examples of a single day's work, taken at random from the book of one of the factories:

On May 18th, from 3512 quarts of milk, wine measure, there was produced 213 lbs. of butter and 560 lbs. skim cheese. On May 26th, from 3,300 quarts of milk, 210 lbs. of butter and 550 lbs. of cheese. On September 12th, from 3,180 quarts of milk, 200 lbs. of butter and 546 lbs. of cheese. On October 14th, from 2,027 quarts of milk, 120 lbs. of butter and 407 lbs. of cheese.

In the working of any system, practical men always desire statistics of results. The following is a statement of receipts and expenditures at one of the small butter factories, where a portion of the milk was sold.

The quantity of milk received from April 10th to December 1st, was 627,174 quarts, of which 27,308 were sold at a little above 7 cents per quart, leaving 509,866 quarts to be made up into butter and cheese. The product was as follows: 31,630 lbs. of butter, 81,778 lbs. skim cheese; 15,908 lbs. whole milk cheese; 2,261 quarts cream sold at 19 6-10 cents per quart, and 1,561 quarts skim milk, at 15 cents per quart.

The net cash receipts, after deducting transportation and commissions were as follows:

For pure milk sold	$1,926.22
For skim milk sold	24.02
For butter sold	13,344.21
For skim cheese sold	11,659.08
For whole-milk cheese	1,065.44
For 2,261 quarts cream	443.33
Hogs fed on whey	446.24
Buttermilk and sundries	207.49
Making total of	$29,116.03

The expense account was as follows:

For labor	$1,476.40
For fuel	79.96
For cheese boxes	653.17
For 20 sacks of salt	89.25
For rennets, bandages, &c.	483.55
For carting cheese and butter to station	273.10
Paid for hogs	179.90
Total	$3,235.33

This gives an aggregate net receipt of $25,880.70.

From these statements it appears that the butter averaged 42 1-4 cents per pound, the skim cheese 14 1-4 cents, and the whole-milk cheese 18 cents per pound, while the average amount received on the whole quantity of milk was 4 1-10 cents per quart. The whole expenses of the factory were a little over one-half cent per quart.

For working this factory there were employed, besides the superintendent, three hands, viz., two men and one woman. The labor account for conducting this factory, it will be seen s a little over two mills per quart.

MEANS EMPLOYED FOR DETECTING DILUTED MILK.

The most unpleasant feature of the factory system appears when dishonest patrons attempt to rob the association by the delivery of watered milk. The laws of New York are very severe on persons found guilty of this misdemeanor, punishing with heavy fines and imprisonment. The factory manager keeps watch over the milk as it it is delivered, setting aside small quantities from time to time for observation and experi-

ment with the hydrometer. Each factory is also provided with a set of small glass tubes, upon which the names of the patrons are pasted. As milk is delivered a small sample is placed in the different tubes corresponding with the name of the patron, and set aside. If the milk is not all right, the hydrometer and these samples give warning; the milk is then subjected to a more careful test, by the use of the cream-guages and per cent. glass, which are represented in the following figures.

Instruments for Testing Milk.

Fig. 24.

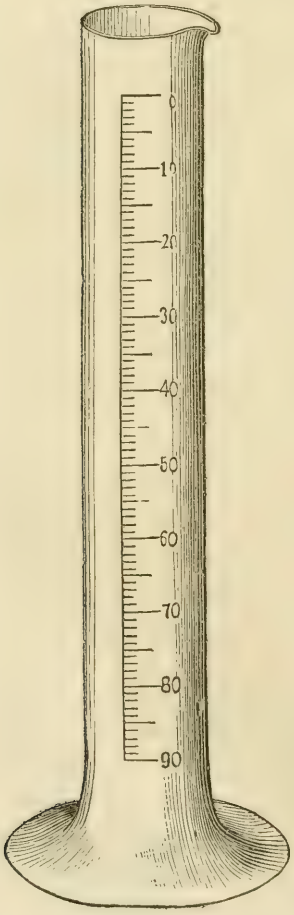


Fig. 25.

Fig. 26.

In testing, one of the cream-guages is filled to guage-mark 10, with milk known to be pure, and drawn from several cows. This will be the standard for pure milk for that day. Another guage is filled to the same number (10), with milk from a can which you wish to test. To avoid any mistake, the first jar containing pure milk is marked with the letters P. M. on the side or bottom. The jars are set away side by side, a sufficient length of time for the cream to rise. Now note the quantity of cream in 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," as it is usually called) into the jar marked P. M., and note on the scale-mark when it floats. Then remove it to the other jar, and note also when it floats. If it sinks lower than in the first jar, the evidence is considered almost positive of dilution with water. Replace the lactometer in jar marked P. M., from per cent. glass filled with water exactly to nought or zero pour into P. M. jar until the lactometer sinks exactly to the same point as in the other jar. Now count a number on per cent. glass from zero down (each mark represents one-half of one per cent.) and you will have precisely the per centage of water with which the milk you are testing has been diluted.

Although there may be considerable variation in the specific gravity of milk from different cows, it has been found that when the milk of several cows is mingled together, and when the milk of different herds of a neighborhood are compared, there is but little difference in the specific gravity of the several samples.

These tests have been very effectual in bringing offenders to justice, and with the very strict law on the subject, very little trouble is now had on account of adulterated milk.

ANNATTOINE.

The butter factories prefer to give color to their butter by having the cows well fed, and by getting up the cream as

quickly as possible after the milk is drawn. Sometimes, in winter, a little coloring may be used, and for this purpose as well also as for coloring the cheese, nothing has given so much satisfaction as annattoine, or the dry extract of annatto recently introduced.

The modes of preparing annatto for commerce are various and intricate. M. Le Blond, a French chemist, gives an account of its manufacture as follows; he says:

The pods of the true *Bixa Orellana* being gathered, their seeds are taken out and bruised, and placed in a vat, which is called a steeper, when they are covered with water. Here the substance is left for several weeks or even months. It is then squeezed through sieves placed above the steeper, that the water containing the coloring matter in suspension may return to the vat. The residuum is preserved under the leaves of the banana or palm, till it becomes hot by fermentation, when it is again subjected to the same operation, and this treatment is continued till no more color remains. The precipitate is boiled in copper to a consistent paste; it is then suffered to cool, and is dried in the shade. The annatto of commerce, as is well known, is often largely adulterated, during the boiling process, with red ochre, powdered bricks, calcothar, farinaceous substances, chalk, sulphate of lime, turmeric, &c., while salt and oil are added as preservatives against a bug which is generated in annatto, especially that which is adulterated with farinaceous substances.

Instead of this long process, which engenders disease by the putrefaction induced, and which affords an inferior product, M. Le Blond proposed simply to work the seeds until they are entirely deprived of their color, which lies wholly on the surface; to precipitate the same by means of an acid, and to boil in the ordinary manner, or to drain in bags as is practised with indigo. This process, it is said, has never been successfully carried out on a large scale until now (1870), as no precipitate could be found that did not in one way or another injure the color. Small quantities were prepared according to Le Blond's

theory, and the French dyers found it to be worth four times more than the ordinary annatto of commerce, that it was more easily employed, that it required less solvent, that it gave less trouble in the coppers, and that it furnished a purer color.

The American preparation of G. De Cordova, under the name of annattoine or dry extract of annatto, is claimed to be an improvement on, and a perfection of, the Le Blond and Vauquelin theories. The latter asserts that boiling injures the color, and as this has been clearly proven, Cordova reduces the precipitation to a powder, instead of boiling it to a paste. As this preparation gives a beautiful color, and is very much cheaper than any preparation of annatto in the market, at the same time being free from any deleterious adulteration, the managers of American factories are greatly pleased with it, and it is rapidly taking the place of other preparations.

It is cut or made ready for use in the following manner: 1st. 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. 2nd. 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 (Nos. 1 and 2) together. 3d. 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 tea-cup full 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 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 potash will remedy the trouble.

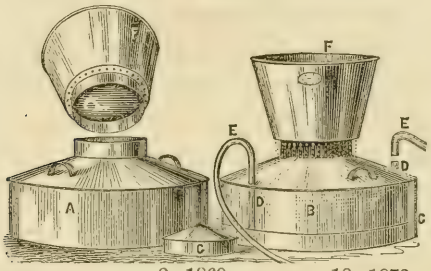
When annattoine is used for coloring butter, a portion of the prepared liquor is added to the cream, at the commencement of churning. It gives a very rich color, and may be used in winter-made butter with advantage.

MILK COOLERS.

In order that milk may be properly preserved in its transit from the farm to the factory, milk coolers have been introduced among the farmers to cool the milk at the farm as fast

Fig. 27.

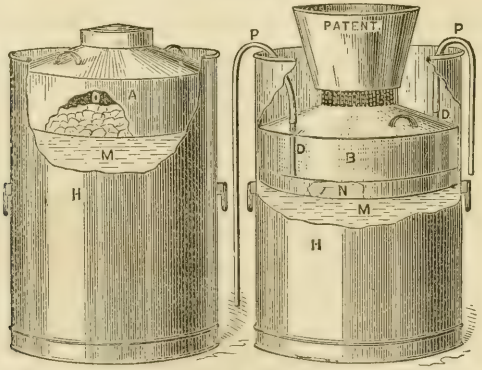
NATIONAL MILK COOLERS.



PATENTED NOV. 2, 1869, AND OCT. 18, 1870,
By A. P. BUSSEY, Westernville, Oneida Co., N, Y.

as it is drawn from the cow. There is a great variety of these implements. We give figures of the National Milk Coolers, and the Monitor and Iron Clad Cans used for hauling milk to the factory. Cold water or ice may be used for the purpose indicated.

Fig. 28.



A. Cooler, for water (N) and ice (O). B. Cooler, arranged for introducing water by means of syphons E, E, fixing on tubes D, D. C. Cover. F. Strainer. G. Body of cooler. H, H. Carrying-cans with coolers floating on the milk (M).

SWINE.

The keeping of swine to consume the whey or refuse slops resulting from butter and cheese manufacture is considered a

necessary part of the dairy business. The hogs are either kept at the factory or upon the farm. When kept at the factory, grounds are selected near the buildings, but so situated that offensive odors are out of the reach of the milk room and curing department; and upon these grounds pens are erected and the whey-reservoir is placed. Usually the grounds are large enough to give the hogs sufficient space for a range in the open yard. The pens are arranged so that each patron of the factory can have a place for his swine separated from the rest. The patrons therefore may keep their hogs in separate pens or allow them to run in common.

Monitor Carrying Cans, for Milk.

Fig. 29.

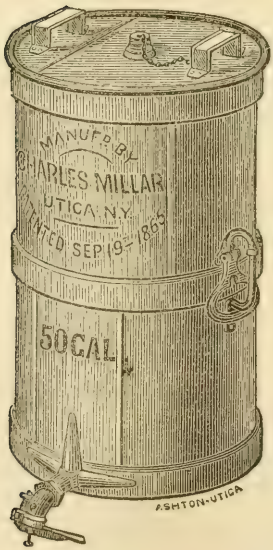
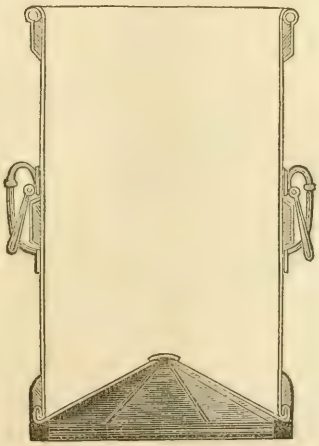


Fig. 30.



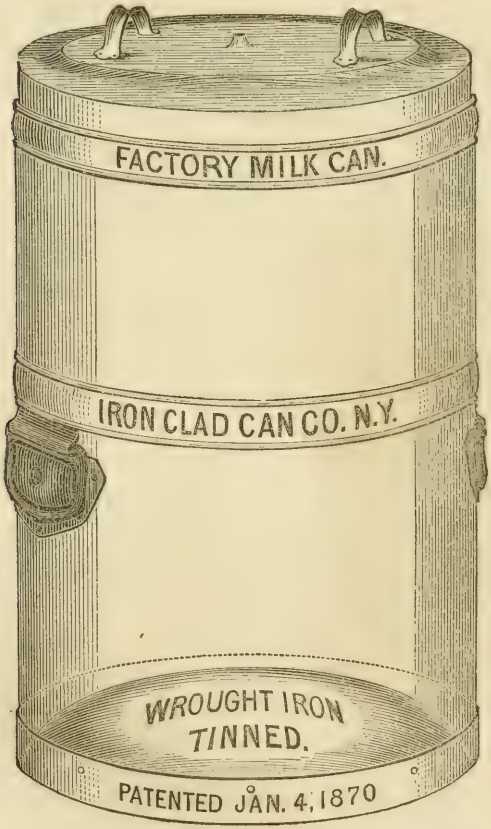
Pipes are arranged so as to conduct the whey from the reservoir to the troughs simply by opening the whey gates or a faucet. By this arrangement the feeding troughs are so supplied that each animal gets its daily rations of whey.

Each patron is allowed the keeping of one hog for every four or five cows from which he delivers milk. The proportion of hogs varies of course with the supply of whey. Patrons

who do not care to keep swine at the factory have the privilege of carting a certain amount of whey from the factory to the farm, and feeding as desired.

The difficulty of keeping the factory premises free from bad odors has induced many factory men to break up the pens and banish swine entirely from the establishment. In such cases

Fig. 31.—*Iron-Clad Carrying Can.*



the whey is run into a reservoir a considerable distance from the buildings, and patrons, after delivering milk, fill the carrying-cans with whey, and cart back to the farm.

In feeding whey to swine, bran, ship-stuffs, or some kind of meal, should be mingled with the whey. When this is done a

good quality of pork is made, and considerable profits are often realized from the whey. We do not approve of feeding hogs entirely upon whey: it does not contain the elements of nutrition in the right proportion to preserve the animal in good health and make the best quality of pork.

Hogs, it is true, will live on whey and take on fat, but the pork is soft, watery, and of inferior quality. It is doubtful whether such pork is a healthy article of food, as swine fed exclusively on such watery slop soon show symptoms of disease. Still, many dairymen keep a portion of their hogs on whey alone, and sell in early fall to the butcher or packer.

Millar's Patent Milk-can Handle and Sink Caster.

Fig. 32.

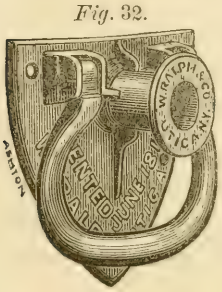
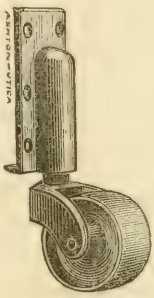


Fig. 33.



Absorbents, such as muck, sawdust, dry earth, etc., should be used freely about hog-pens to take up the liquid manures, and free the premises from disagreeable odors; and this course is especially desirable when hogs are kept in connection with butter factories, or in the vicinity of the farm-dairy. In addition to the benefits resulting from absorption and in keeping the air free from bad odors, another important advantage is gained in the increased quantity of manure.

PHILADELPHIA BUTTER.

In this connection, it may not be out of place to give a brief account of the manner of making Philadelphia butter, which has long held a very high reputation in America, and which often sells in Philadelphia at a dollar per pound. It is no bet-

ter in flavor and texture than fancy brands made at the butter factories of New York; but it is equally as good, and being put up in small rolls, or prints, and packed in refrigerators, it arrives in market as perfect as when it left the hands of the butter-maker.

The best Philadelphia butter comes mainly from Chester, Lancaster and Delaware counties, Pennsylvania.

The spring-house is about 18 feet by 24 feet, built of stone, with its foundation set deeply in the hill-side, the floor being about four feet below the level of the ground at the down hill-side. The floor is of oak, laid on sand or gravel; this is flowed with spring-water to the depth of three inches, and at this height the flowing water passes out into a tank at the lower side of the spring-house. The milk, when drawn from the cow, is strained in deep pans, which are set in the water upon the oaken floor. Raised platforms or walks are provided in the room for convenience in handling the milk. The walls of the spring-house are about ten feet high, and at the top on each side are windows covered with wire-cloth for ventilation. The depth of the milk in the pans is about three inches, and the flowing water which surrounds the pans maintains a temperature of about 58 deg. Fahrenheit.

The milk is skimmed after standing 24 hours, and the cream is put into deep vessels having a capacity of about 12 gallons. It is kept at a temperature of 58 deg. to 59 deg. until it acquires a slightly acid taste, when it goes to the churn. The churn is a barrel revolving on a journal in each head, and driven by horse-power. The churning occupies about an hour, and after the buttermilk is drawn off cold water is added and a few turns given to the churn, and the water 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 buttermilk. 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 at the ends, and then goes immediately to market. Matting is drawn over the tub, and it is surrounded again by oil-cloth so as to keep out the hot air and dust, and the butter arrives in market in prime condition, commanding from seventy-five cents to one dollar per pound.

Mr. Isaac A. Calvert, who markets his butter at these high prices at Philadelphia the year round, gives the following particulars of his management in a communication to Mr. J. B. Lyman, of the New York *Tribune*. He attributes his success to three points: 1st, the food of his cows; 2d, temperature; 3d, neatness and dainty refinement at every step from the moment the milk flows from the udder till the dollar in currency is paid for the pound of butter. He says, "I have found that I make my best butter when I feed on white clover and early-mown meadow hay. I cut fine, moisten, and mix in both corn-meal and wheaten shorts. Next to meal, I regard shorts, and prefer to mix them together. I feed often, and not much at a time. I do not use roots, unless it be carrots. My pastures and meadows are quite free from weeds. I cannot make this grade of butter from foul pastures, or a low grade of hay.

"*Temperature.*—This I regard as a matter of prime importance in making butter that commands a high price. Summer and winter I do not want my milk-room to vary much from 58 deg. In summer I secure the requisite coolness by spring-water of the temperature of 55 deg. Fahrenheit flowing over stone or gravel floor in the milk-house. This can be accomplished without water in a shaded cellar ten feet deep. As good butter can be made without water as with, but the milk and cream must be kept at all times a little below 60 deg.

"We skim very clean, stir the cream-pot whenever a skimming is poured in, and churn but once a week summer and winter. Just before the butter gathers we throw into the churn a bucket of ice-cold water. This hardens the butter in small particles and makes a finer grain. In the hot months this practice is unvarying.

"In working we get out all the buttermilk, but do not apply the hand. A better way is to absorb the drops with a linen cloth wrung from cold water. The first working takes out all the milk; at the second we handle delicately, with fingers as cool as may be. The salt is less than an ounce to a pound, but not generally much less. The balls each weigh one pound, and receive a uniform stamp. On packing for market, each ball is wrapped in a linen cloth, with the name and stall of the marketman written upon it. Our tubs are made of cedar-plank, 1 1-2 to 2 inches thick, and lined with tin. On the inner face are little projections on which the shelves rest. The balls are not bruised or pressed at all, and pass into the hands of the consumer as firm, as perfect in outline, and as spotless as when they left the spring-house.

"We find *uniformity* to be a prime virtue in the butter-maker. We produce the same article whether the cows stand knee-deep in white clover-blooms, or sun themselves on the lee-side of the barn in February.

"There is a small ice-chamber at the end of the oblong tub which we use in summer, so that in dog-days the heat within the tub does not get higher than 60 deg. Fahrenheit. I need not add that we observe a scrupulous, a religious neatness in every act, and in every utensil of the dairy. Milk which upon leaving the udder passes through an atmosphere loaded with stable fumes, will never make butter for which we can get a dollar per pound. No milk sours upon the floor of the milk-room; none is permitted to decompose in the crevices of the milk-pans; the churn is scoured and scalded till no smell can be detected but the smell of white cedar.

"Our customers take the napkins with the prints, wash,

iron, and return them when they come to the stand the butter-days. These are generally Wednesdays and Saturdays. With these prices we have no difficulty in making a cow pay for herself twice a year; if she cost 60 dollars, we sell 120 dollars worth of butter from her in twelve months.'

It may be remarked that the sour milk is employed by the Philadelphia butter-makers as a feed for swine. It is estimated that such milk will make 100 lbs. of pork per cow.

The cows in the district where the Philadelphia butter is made are well sprinkled with the Jersey or Alderney blood, and about a pound per day from each cow is considered a fair average for the best dairies.

CROZIER'S MILK CELLAR.

A committee consisting of Mr. J. B. Lyman and Frank D. Curtis, from the American Institute Farmers' Club, recently visited the farm of Mr. William Crozier. The following report regarding a milk cellar seen on this farm, was presented by Mr. Lyman to the club. The walls are 36 x 18 feet, and it is divided into ice house, milk room and butter kitchen as in this plan. 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 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 degrees. As the milk room has thick walls and the windows are high, this flood of air at 35 degrees is able to lower the mercury to 62 degrees, and even lower, in July. Sometimes he closes one tube to keep the room from growing too cold. The draft 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 draft 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 his January butter. He makes "June butter" the year round.

The stone work was much of it done by farm hands. The hemlock cost $20 per thousand, and the pine $30 to $35. The whole building cost him $650. He gets ten cents a pound over the highest market price. Making, say 200 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. Your committee could see nothing wrong, and much that was exactly right about this house and this system, and wherever ice forms to the thickness of three inches and over, it may confidently be recommended to every butter maker who milks a dozen cows.

BUTTER AFFECTED WITH CASEINE.

From a little manual published by the Messrs. Blanchards of Concord, N. H., and which they furnish to go with their churn, we find the following very sensible remarks:

"The proportion of caseine remaining in butter, as ordinarily manufactured, is quite variable, depending upon the manner in which the cream is separated from the other portions of the milk. By the old method of setting milk in shallow pans and permitting currents of dry air to sweep across the surface of the milk, much caseine became dried to the cream so firmly as to be inseparable during all the after processes, finally becoming a portion of the butter. By the latter and more improved processes, with sufficient painstaking in the after manipulations, the proportion of caseine may be reduced to a mere trace. Upon this, and the proportion of the oleine and the neutral or flavoring fats, the quality of the butter depends, and to the accomplishment ot these two specific ends, he who would succeed must direct his efforts.

"The increase of the fatty matter is dependent upon the feeding and care of the animal, and to that branch of our subject such allusion has been made as our space will permit.

"*Setting and Cooling the Milk.*—From time immemorial the practice of setting the milk in very shallow pans has prevailed, and the opinion was formerly believed established, that only through a shallow mass of milk could the cream rise to the surface. This practice had its origin in the necessity for cooling the milk soon after it is drawn from the cow, to prevent its souring before the cream could rise, and not, as has been very erroneously inferred, from any difficulty about the rising of the cream. Hundreds or even thousands of experiments have been conducted with the view to permanently settle this question, and we have yet to learn of the first one which has not resulted in sustaining the principle that with proper apparatus for cooling, it is of no possible consequence how deep the milk is set for the purpose of raising the cream.

"The cooling of the milk is of the first importance. It contains within itself the elements of decay, and when left to itself fermentation and putrefaction speedily ensue. But by reducing the temperature to about 58° or 60°, the process is retarded, not prevented, and time is afforded the cream to rise before the other parts of the milk become so changed in their structure as to entangle and hold the oily portion of the cream. But precisely the same effect may be produced by the application of heat, and we not unfrequently hear it recommended. In this case, however, the very important circumstance, that the oils which flavor the butter become volatilized and escape, is quite overlooked.

"It is believed, then, to be practically settled, that the best results are attained by reducing the temperature of the milk as soon as practicable, after it is drawn, to about 58° F. The milk should be placed in the vessels where it is to remain before the cooling is commenced, that the rising of the cream may not be retarded by subsequent agitation. The only really practicable method of cooling the milk, without agitating it, is to place it in comparatively narrow vessels, and surround them with cold water, as high or higher than the surface of the milk within. It is idle to attempt to cool milk or any other fluid by the application of any cooling substance to the bottom. If the vessel itself be of a material which is a good conductor, it is a little help, but the process is at best slow and unsatisfactory.

"We make the rule that milk should be set in vessels placed in water, and the temperature reduced as soon as may be, to about 58° F., but that the temperature of the room should be about 65° or 70° F.

"The form of the vessels is not material, if only they be so narrow that the cooling is effected in season to prevent the souring of the milk before the cream has risen.

"The most economical arrangement of which we have any knowledge, consists of a long, narrow tank, with a jacket of tin for the cold water. The most approved form is 8 inches broad, 11 inches deep, and 6 feet long, which is made from a single large sheet of tin, without seam or solder, except where the end and jacket are attached. If more than one is required to hold the milk at each milking, they should be placed side by side in the

same frame or sink. In this case it is more economical to dispense with the jacket and use a wooden vat for the water.

"There is, in this form of vessel, a very large saving in the cream which adheres to the sides of the smaller style of vessels; but the economy of labor in the cleansing and care of the vessels is really the greatest of all.

"Whatever the form of the milk vessels, running water is the best and most economical agent to be employed in cooling the milk. Well water answers a very good purpose, but the labor of raising it is sometimes a bar to its successful use.

"Ice should never be used in butter-making in any of its departments, except to reduce the temperature of water, and then it is well to *beware* of ice cold water. The immediate contact of ice with milk, cream or butter, does in some manner not well understood, exert a disorganizing effect, and the product is permanently injured thereby.

"*When and how to Skim.*—Milk cooled and set as has been recommended, will keep sweet as long as is necessary for the cream to rise, however warm the room; and the time for removing the cream may be subordinated to the convenience of the dairyman. The more convenient and profitable time will generally be found to be from 24 to 30 hours after setting. It should not, in any case, be deferred until the milk begins to turn sour.

"The old form of skimmer, required to separate a film of cream almost as tough as a leather apron from a body of hard loppered milk, is not adapted to the removal of the cream that rises on milk cooled as above described. The cream, under these genial influences, having been constantly parting with its caseine instead of becoming encased in it, is in a condition of fluidity and must be removed by dipping instead of skimming. The most approved implement for this purpose is made of tin in the form of a cone, and holds about a pint. The small end should be made pointed. The edges of the large end should be left sharp, and not be rolled or wired. An upright, straight handle should be attached to the large end of the cone. When used it should be pushed perpendicularly down through the cream into the milk, until the cream runs in on all sides at the same time. If some of the milk is taken with the cream, no injurious result will follow; indeed many good butter-makers prefer taking enough, so that the cream may not become too stiff during the operation of churning.

"Cream may be kept several days, if necessary, but it is better, as a rule, to churn every second or third day. The practice which has acquired among many, of keeping cream several days, and drugging it from time to time with saltpetre or something else, can not be commended.

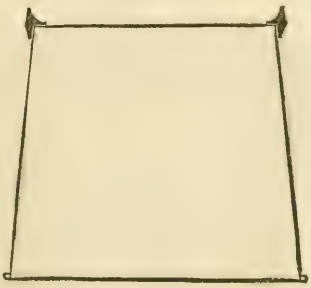
"When milk sours, it is because of the formation of lactic acid from the milk sugar. This chemical change is the result of the growth of a microscopic vegetable organism, which, according to Hallier's late investigations, is of the same origin as common yeast. Like common yeast, this plant requires oxygen for its development. This it gathers from the air if the latter have access;

but in the comparative absence of air, as when growing in milk, it decomposes the sugar, and a lactic acid is the chief result of this metamorphosis. If milk, which by short exposure to the air has had the microscopic germs of the ferment-plant sown in it, be then excluded from the air as much as possible, the plant, in its growth, is necessitated to decompose the milk sugar, and hence the milk rapidly sours. On the other hand, exposure to the air supplies the ferment-plant with free oxygen, and the milk remains sweet for a longer period. Such is the theory of the change. That low temperature should prevent souring, is in analogy with all we know of chemical changes.

" Stirring the cream does not promote souring, but rathers hinders it by increasing access of air ; it may be advantageous in making the souring uniform.

Fig. 34. *Millan & Son's Milk Pails.*

Fig. 35.



" *When to Churn.*—Although the milk should never be permitted to sour before skimming, the cream, on the other hand, should become slightly acid before churning. To accomplish this end most expeditiously, the temperature may be raised slightly ; keeping it in the warm milk room will usually suffice ; but previous to putting it in the churn it should be again cooled, according to the quality of the cream. If it be rich summer cream 55° is most favorable ; if it be the product of short, poor feed, or of straw, or of roots, or if the cows have been exposed to cold storms, and under the necessity of exhausting the oleine of the butter, the temperature must be raised to correspond ; and it may even require so much heating that little of the butter flavor will remain. For all ordinary cases the range may be set down as from 55° to 65°."

MILK PAILS.

The importance of using milk pails that will not absorb

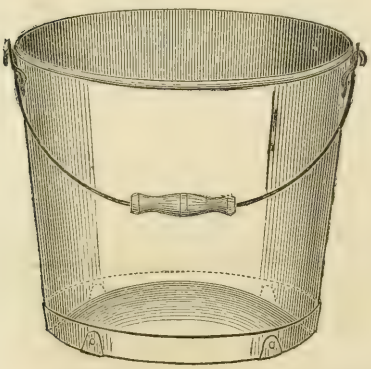
paints and which can be easily cleaned, can not be over-estimated.

Wooden pails should never be used for milk, because of the difficulty of keeping them in order.

Chas. Millan & Son, of Utica, N. Y., have recently brought out a superior tin milk pail, a cut of which we give in the figures on the preceding page.

They are made in the best possible manner, 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 enclosing 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 enclosed by the tin and then soldered so that it cannot rust.

Fig. 36.—*Iron Clad Pail.*



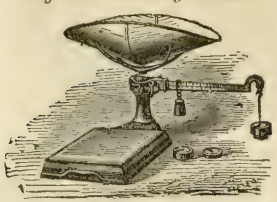
The pail is made from the best tinned wire.

The Iron Clad Co. of New York city makes a very substantial pail with convex bottom, upon which are rests to keep it out of the dirt, which ensures cleanliness in this part. The accompanying cut shows the form of this pail.

SCALES.

Another important requisite for the dairy is a convenient and accurate pair of scales.

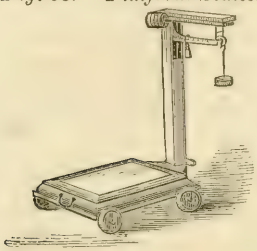
Fig 37.—*Family Scales.*



Edward F. Jones, of Binghamton, N. Y., manufactures a very desirable article in this line. The Universal or Family Scale, of which we give a cut, has both platform and

scoop, and combines all the advantages of a portable and counter scale. Its capacity is from 1-2 ounce to 240 pounds, and is best adapted to the purposes of the butter dairy, or when any light article is to be weighed.

Fig. 38. —*Platform Scales.*

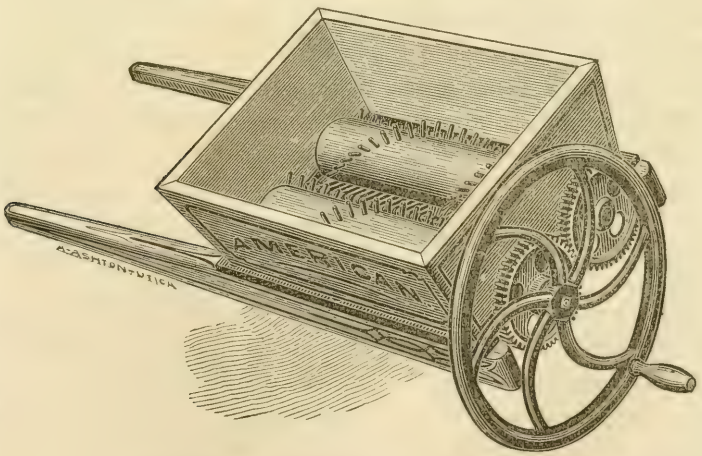


The 600 pound portable platform scale on wheels is the size usually used in cheese factories. The accompanying figure represents it.

In cheese manufacture, especially where the milk is liable to become changed or is not delivered in good order, the curd mill is of great service.

Butter factories should always be provided with this machine if skim cheese is made in connection with butter. One of the best curd mills made is the *American*, manufactured by Wm. Ralph & Co., of Utica. It has a double cylinder, and being provided with a heavy balance wheel is worked with greater ease and more efficiency than some mills. We give an illustration of the mill in the following cut:

Fig. 39.—*The American Curd Mill.*



THE BUTTER DAIRIES OF CALIFORNIA.

In 1870 I crossed the continent and made an examination of some of the butter making districts on the Pacific. My ob-

servations were given in a series of articles in MOORE'S RURAL NEW YORKER, from which I select and quote the following:

The Coast Range of California, etc.—California is estimated to contain within its boundaries 189,000 square miles. About 50,000 square miles are supposed to cover the entire range of coast-valleys and mountains.

There are large tracts of country on the coast range adapted to grazing and the dairy, though, taking the whole state together, I was told the dairy lands were of comparatively limited extent. One great advantage which the coast lands possess is a low, even temperature—a temperature averaging about 60 deg. Farenheit during summer and winter, and subject to no extremes of heat and cold, like that prevailing in the middle and north Atlantic states. The winters are so mild that cattle do not require to be housed, and during most of the time can procure sufficient sustenance in the field. Indeed, cattle are often wintered without a particle of food other than that which they pick for themselves over the ranches—though it is not generally considered good economy to allow the herds to thus shift for themselves during the first part of the rainy season, since the rain washes out the nutritive elements of the old grasses, while the new vegetation springing up, is flashy, or too immature to afford the requisite nourishment for the thrift and well-being of the animal. Hence in November and December it is considered good economy to eke out the pastures by giving the herds a daily allowance of fodder.

The Climate, Grasses, etc.—To understand fully how stock is fed in California some explanation of the seasons and the character of herbage found upon the ranches will be required. If we except the higher mountainous ranges, the California year may be divided into two seasons only—the wet and dry. The rains begin to fall during the latter part of October and continue during November and December. The moisture is sufficient to start vegetation into a vigorous growth. Green past-

urage is abundant in January, February, March, April, and up to about the first of June and July. Then comes the dry season, during which no rain falls until the latter part of October or first of November, and sometimes it holds off until December.

Most of the native grasses are annuals. The wild oat grass and bunch grass are regarded of most value. The Gramma, or bunch grass is exceedingly nutritious. Stock thrive upon it at all seasons, except, perhaps, at the beginning of the rainy season, when, for a few weeks, its nutritiousness is impaired from the causes which have been previously explained.

In July and August, it as well as all others, becomes dry and brown, and the fields present hardly a vestage of green. Indeed, the fields are so devoid of any green or growing plant, and the tufts of grass are so brown and dried up that the eastern stock-grower can scarcely rid himself of the impression that the whole country is of little, if any, value for grazing, and would supply only a meager sustenance for a few goats; and yet immense herds are seen cropping this withered, dead, or perfectly dry, crisp herbage, and the animals look sleek and fat, and fit for the shambles. Nothing astonished me more than this seemingly incongruous state of things; for to an eastern farmer, fat cattle at pasture are always associated with luxurious vegetation and an abundance of succulent food. It is true, along the borders of streams, in the narrow valleys or deep gorges, a fringe of green breaks the monotony of the dead and apparently worthless vegetation, covering the hills, and stretching away to the distance on the plains; but these are scarcely sufficient to account for the uniformly fine condition of stock.

It becomes evident, therefore, that from the peculiarity of the climate, and perhaps from the nature of the plants themselves, their nutritive elements are retained; and that the standing grass in the field is cured as perfectly for food in a natural way as farmers at the east do it by artificial means. And this is more readily explained from the entire absence of

rains, the dryness of the atmosphere, and the uniform temperature of the climate. Evidently, in case of the bunch grass, which grows in dense tufts, the dry weather coming on arrests the further growth of a mass of foliage, thoroughly curing it upon the root before its nutritive elements have been lost or changed into woody fibre, while a large proportion of those stalks bearing seed have also been checked in growth and dried in time to retain a large proportion of nutrition.

In comparing California, as a dairy region, with grazing lands on the Atlantic slope, the winter and spring months correspond with our best grazing season. From the first of January to June, the grasses grow in great luxuriance. July, August and September, correspond with our fall and early winter, while November and December, when stock require a little feed, may be set against our six months of cold and snowy weather. It is evident, so far as climate is concerned—so far as the storing of cattle-food and the necessary breadth of land for growing such food, the advantages are all in favor of the Pacific. But on the other hand, our nearness to the markets of the world, the permanency of our grasses, our established system and skill in manufacture, must, in a measure, compensate for the rigors of the climate, and other disadvantages which do not obtain in more favored sections.

Comparative Profit from Grazing Lands.—From what I saw of California, and California farming, I became strongly impressed with the idea that the grazing lands of the state, for stock-growing and the dairy, can be made to pay quite as largely as lands devoted to almost any other special agricultural interest. Fruit trees of all kinds grow with great rapidity, and produce enormously. But, at present, the markets are limited, and the supply so much beyond consumption that there is no profit in fruit-growing.

I saw peach trees producing choice varieties of fruit, (only across the bay from San Francisco, and where daily transport of fruit could be made for a mere trifle), that were paying nothing to the owner beyond affording food for swine, the fall-

ing fruit being carted out for that purpose. The product of large apple orchards is often left to rot on the ground, or a portion only of the fruit converted into cider for vinegar.

The vineyards, can, perhaps, be made to pay well for wine, since the climate and soil are so wonderfully adapted to grape culture that grapes can be grown at a mere trifling expense.

The Largest Butter Dairy Estate in the World.—But I set out to speak of some of the dairy lands visited, and perhaps a brief description of the Howard & Shafter Ranche will be of interest. This is probably the largest butter dairy estate in the world. It is at least the largest that has come under my own immediate observation, whether in this country or in Europe.

Some general idea of its extent may be gathered from the fact that it has a coast range of fifty miles, and contains seventy-five thousand acres. About one hundred miles of fence have been erected on this estate at a cost of $400 per mile. It is located in Marin county, at Point Reyes.

Marin county lies directly north of San Francisco and the Golden Gate. At the northwest point of the county Tomalis Bay, a long, narrow body of water extends southward, and is nearly met by Sir Francis Drake's Bay pushing northward. This makes a neck of land, which has the appearance on the map of projecting into the ocean. Now, by extending a line in a southeasterly direction from Tomalis Bay toward San Francisco, so as to give us a strip of country on the east coast of Sir Francis Drake's Bay, we have on the west of this line and bounded by the two bays and the ocean the famous Point Reyes Ranche.

The character of the country over the Point Reyes estate may be described as a succession of hills and valleys. In some places there are large, level tracts. Good roads have been made over the lands, and as the carriage winds over the hills and through the canyons the scenery is most picturesque and charming. The climate here is delightfully cool and refreshing. Fanned by the breezes of the Pacific, the temperature

scarcely ever rises above 65° or sinks below 50°, while the average through the year is not far from 60°.

Bunch grass, wild oats, and other natural grasses, grow in great luxuriance, and are depended upon as pasture for stock.

About three thousand cows are in milk on the estate, and they are divided up into twenty-one dairies, averaging about one hundred and fifty cows to each. The different farms or ranches are substantially fenced with red wood pickets six feet long, driven into the ground about six or eight inches apart, with a rail placed horizontally about two feet from the top to which each picket is nailed. As there is no frost here, these fences keep their position, and will stand without needing repair for twenty years. Generally, each ranche has interior fences dividing the land into four fields.

Mr. Howard states that he commenced improving his stock about the year 1858 by crossing common eastern cows with two thoroughbred Short-Horn bulls of good milking family brought from Vermont at a cost of $10,000.

One of the Vermont bulls was an exceedingly fine one, and his stock proved to be excellent milkers.

A year or two after, twenty-two head of Devon cattle were purchased and introduced among the herds. This breed did not prove satisfactory, and it was discarded, and in 1865 he commenced again with the Short-Horns, raising annually one-fifth of the calves from the best cows. In this way the stock has been improved so that a good flow of milk is obtained.

Size of Stock Influenced by the Surface of the Country.—I have stated that the Point Reyes estate was broken up into numerous hills and valleys. Many of the hills almost approach the dignity of mountains. Their sides are rounded, and do not generally present an abrupt surface, but are of a sufficient inclination to be readily reached in all their parts by cattle. This uneven surface, requiring the climbing of hills and descent into valleys in quest of food, has had a strongly-marked influence on the size and form of the stock. The animals are quite small for Short-Horns, and apparently more active than is

usual for that breed, showing, in a very marked degree, what a controlling influence the surface of a country has in moulding the form of animals. The stock I found universally in fine condition as to flesh, and in every respect it appeared to be in vigorous health; but the smallness in size was a point of interest to me, as showing how animals bred for several generations in a hilly country gradually adapt themselves to the surfaces over which they are compelled to travel in quest of food.

It seemed to me that the Ayrshires were the kind of cattle best adapted to this locality, and I strongly advised an infusion of this strain of blood among the herds of Point Reyes.

System of Rentals.—The management of so large an estate is not without difficulties. Recently Mr. Howard has introduced a system of rentals, which relieves the proprietors from a vast amount of care and vexation. With the exception of what is termed the "Home Ranche," all the places are rented at a fixed rate per cow. The general features of this rental are as follows: The landlord furnishes land, cows and buildings, making the rent at $30 per cow. The tenant is required to raise one fifth of the calves, and build or keep in repair certain fences, the landlord furnishing the material. All implements of husbandry and dairy utensils are furnished by the tenant. The dairies, on an average, make about one hundred and eighty pounds of butter per cow, which is sent to San Francisco, and commands from thirty-three to thirty-five cents per pound.

Quality of Butter.—The butter made at Point Reyes is good, and dealers in San Francisco informed me that it was the best that was brought into the market. The texture, when well made, is exceedingly fine, being more waxy in its consistency than much of the butter of New York. With the same skill as that exercised in the butter factories of Orange county, I should say that the very finest fancy product could be obtained. The low, even temperature of the climate favors the obtaining of milk in the best possible condition. The water is soft and

pure, and the feed is said to be sweet and free from plants that give a taint to milk.

The Dairies.—I visited quite a number of dairies, traveling, in all, nearly a hundred miles over the estate. The dwellings are neat and substantial, each place provided with dairy house, corrals for enclosing cattle, and sheds and barns for storing fodder. The cows are milked in the open yard, and the milkers empty the milk into a receptacle outside the building, from whence it is strained and flows into a receiving can in the milk room. From this it is drawn through a faucet into pans, which are immediately set upon the racks. Water, either conducted by pipes from springs, or pumped into reservoirs, is in the corrals, and supplies the dairy. The temperature of the milk rooms is scarcely ever above 65°, and artificial heat is more frequently required in the milk rooms than too high a temperature resulting from natural causes. I saw the process of butter making in all its stages, but perhaps a detailed description of the work at two or three ranches may be sufficient to give the reader some general idea as to the manner in which California dairies are managed.

On the Point Reyes estate several of the dairy establishments, or farm buildings, are located in the canyons or valleys; though where there are large, level tracts of land and conveniences of running water, advantage is taken of the situation to establish "headquarters" for the rancho. The tenants, or those managing the several ranches, are mostly from New England or New York.

In some cases unmarried men with Chinese house-servants carry on the establishment; but usually married men with their families are located here. At one point I found a school for the education of the children, taught by a genuine New England "school mistress," who received $30 per month and board for services. During my trip I not unfrequently saw "little lassies" going and returning from school mounted on mustang ponies. Regular water communication is soon to be

established between Point Reyes and San Francisco, which, of course, will render the estate less isolated.

A few days before my arrival, a division of the estate had been made between the three partners, which gives each some 25,000 acres of land. In the division, that portion lying upon Sir Francis Drake's Bay falls to Mr. Howard. The point at the head of the bay is exceedingly lovely, the harbor is excellent, and the level stretch of land back from the shore seems to be admirably adapted to the location of a town or city. Indeed, the natural advantages for a town at this point are so great, that the time cannot be far distant when this spot will be utilized for that purpose.

Muddy Hollow.—The buildings here are substantial and conveniently arranged. The dairy house, or milk-room, stands on one side of the corral, and is twenty-four feet square. Racks are arranged along the sides of the room for setting the milk—the pans resting on slats in tiers, one above the other. The cows are milked in the corral or open yard, and as fast as each milker fills his pail, he carries it to a platform on one end of the milk-room, where it is emptied into a receiving conductor provided with a strainer, from whence it flows into a large tin can in the milk-room. In this way the floor of the milk-room is not soiled by the feet of the milkers, and slops and dirt are avoided in straining the milk. The milk is drawn from the can through a faucet, each pan getting about half a gallon of milk, or a quantity sufficient to set in the pan from two and a-half to three inches deep.

Management of Milk.—The climate here is so cool that the temperature of the milk-room does not rise above 65°, and in summer it is often so cool that a little fire is necessary in the room to keep the milk at the desired temperature for the cream to rise. The milk usually stands about forty-eight hours, and is allowed to get slightly acid before skimming. The pans are then removed to a bench in the center of the room, the cream loosened on the edges of the pan by running

a thin wooden blade around it, when the pan is canted up, and the cream flows off into a large tin cream can. The milk then goes into a slop reservoir on the bench, arranged with pipe at the bottom for conducting it off to vats away from the building, where it is to be used for the feeding of swine. The portion of conducting pipe in the milk room is arranged in a double curve, or V, so that in cleansing the water remaining in the curve prevents gases from passing through into the room from below.

Churns and Churning.—Churning is done every day by horse power, a common lever power located outside the building being employed here as well as at the other dairies. Mustangs are attached to the lever and put the machine in motion by travelling round and round in a circle. An oblong box churn is used. The ends are twenty-seven inches square and the length of the box is five feet. It hangs horizontally upon a frame supported by two iron gudgeons at the ends of the box, and upon which it revolves. On one side of the box there is a door, which opens to receive the cream, when it is closed and the churning accomplished by set g the power in motion and revolving the box. The temperature of the cream when it goes to the churn is about sixty-two degrees, and churning is usually perfected in from one-half to three-quarters of an hour. The butter, when it comes from the churn, is washed in soft water, worked and salted at the rate of one ounce of salt to the pound of butter, when it is set aside until next day and then worked a second time and packed for market. It is manipulated but very little at the second working, just enough to get it into shape.

Butter-Worker.—The butter-worker at these establishments struck me as a very handy appliance. It consists of a heavy oak slab, in a perfect circle, about three and a-half feet in diameter, set at an inclination, so as to allow the buttermilk to pass off, and revolving on rollers arranged in a standard which supports it in the center. At the lower end of the machine, just beyond the circular plank, there is an upright, at the top of

which is fastened a metal socket for the reception of the lever used in working the butter. This socket works on a universal joint, so as to be moved in any direction. A plank with groove near the outer edges, is arranged below the circular slab to catch the buttermilk and moisture flowing from the butter during the process of working, and it is also slightly inclined, so that all slops pass off along the grooves and are deposited in a tub. By this arrangement, it will be seen the circular slab or bed of the butter worker can be moved backward or forward on the plane of its circle, while the universal joint to which the lever is attached, allows the lever to be handled in any direction. These butter workers are the most convenient of of the kind of any I have seen, and can be profitably introduced into some of our New York butter factories.

Molding and Packing.—The butter is put up and sent to market in two forms—in barrels, half barrels, and in two pound rolls placed in packages. The barrels are of oak, nicely made and strongly hooped. They hold about two hundred and twenty-eight pounds of butter. The butter is packed solid, the cask headed, and brine as strong as it can be made is poured in to fill up all the interstices. Butter going to market in this way brings from two to three cents less price per pound than that put up in rolls. The rolls are made three inches in diameter and nearly seven inches long. A mold is used for the purpose of forming the rolls, and it has two iron handles crossing each other on a pivot, and worked like a pair of nippers. The molds being opened a bit of butter is nipped up sufficient to fill the mold, and by pressing the two arms or handles together a powerful leverage is brought to bear upon the butter mold, compressing the butter into a solid roll. Then with a thin wooden knife, or paddle, the ragged points of butter which have been forced out on either end of the mold, are cut off even with the mold and smoothed down, and the instrument opened, when out drops a neat roll of butter, weighing just two pounds. The whole mass having been rapidly molded in this way, and the rolls dropped upon the

table, the next process is to wrap each roll in cloth. Fine thin bleached cambric, cut in strips of the desired length to go round each roll, and wide enough to leave about half an inch projection of cloth at each end of the roll, are moistened in strong brine and placed upon the table. Then one of the strips is spread out, the roll of butter laid on one edge and rapidly rolled forward, the cloth adhering smoothly to the package. The cloth on the ends is now pressed down in place, and you have a dainty little roll in neat white muslin wrappers, with a little golden circle at the ends to show its texture and quality. Then the rolls are set on end in an oblong box of cedar or red wood, the cover fastened down, and thus they go to market.

The wholesale price for butter, put up in rolls, has ranged from thirty-three to thirty-five cents per pound when it arrives at San Francisco.

The Stock.—In the Muddy Hollow dairy there were one hundred and sixty-six cows in milk. I found the cows in fine condition as to flesh, notwithstanding the feed upon the hills was brown, dry and crisp. Mr. HAGERTY, the manager, stated that in "flush of feed," when cows were doing their best, the average yield of butter per day was one and one-fourth pounds per cow. The cows have a large range, and it struck me as somewhat difficult to collect all the animals together in the corral, night and morning, since the numerous hills and valleys must be looked over to find loitering beasts; but I was assured that there was seldom any trouble from missing animals. At milking time two persons, mounted upon mustangs, are sent out to collect the herd together. Each driver has his beat or range to look over, and the mustangs scour the hills and valleys, starting the cows into line; and as the drivers are responsible for missing cows, and are discharged for neglect in bringing them to the corral, they become exceedingly expert and sharp in looking over their range that no animals are left behind.

Character of Butter.—At this as at other ranches, I tested nothing but fresh or newly made butter. The color was a light yellow, but much deeper than could have been expected from the dry and brown feed. The distinguished characteristic of all the butter I saw, was its solid, waxy texture. The flavor was fair, but it had less of that peculiar aroma which the finer fancy samples of New York butter possess. This may have been attributable to the condition of dry feed in part, and perhaps in part to the manner of manufacturing.

I tested the milk and buttermilk in numerous instances and found it of excellent flavor, and in no instance could I detect a taint or anything objectionable in flavor. I should say that such milk, in such a cool even climate, ought to make, if properly manipulated, the finest quality of both butter and cheese.

The Home Rancho.—This rancho is about ten miles west of Olema, a small village on the road to San Rafael. It contains three thousand acres, has four hundred and thirteen cows and one hundred and fifty-eight horses—mustangs, roadsters and lasso horses—including an imported English stallion, a thoroughbred racer.

Mr. Nichols, the very intelligent foreman of this establishment, informed me that there were about two thousand head of beef cattle connected with this rancho, or under his management, and four hundred heifers, which were being raised for cows. The beef cattle go to market at San Francisco, and other parts of the state, at three years old and upward, bringing from $40 to $60 per head.

The buildings at the Home rancho are commodious and more extensive than at some of the other places. They are situated in a lovely little valley, surrounded by round hills, over which the cattle roam and feed.

Butter is made here, as at the other dairies, and the appliances and mode of manufacture are similar to what has been previously described. From twelve to fourteen men are employed on the rancho, and they get at the rate of $30 per month and board, for a period of six months, or during the busy season.

The hay here, like all California hay, consists of oats cut while the straw is green. About one hundred tons have been harvested during the present year, and this quantity has been grown on fifty acres.

Growing the Hay Crop.—Mr. Nichols says he begins to plow for the oat crop in November, sowing in December at the rate of one hundred and fifty pounds of seed to the acre. The crop is cut with mowing machines just before the oats have ripened, and as no rains fall during harvest time, the curing of the crop is accomplished in the most perfect manner. Upon this rancho they commence feeding stock in August and up to November, or until the rains begin to fall and fresh grass is started. The feeding in August is only occasional, and depends altogether upon the weather. If the weather is windy, so that stock cannot feed in comfort on the hills, an allowance of oat hay is given; but in mild weather, when the animals can get about over the range, no extra food is given. Beets are also raised here in considerable quantities for cattle food. They are cut up, roots and tops together, and each cow in milk gets a pail full per day. Stock run out over the rancho all winter, and during some seasons no extra food is required.

Cows commence dropping their calves in December, and continue till March, at which time it is desired that they should all be in milk.

Usually it takes the labor of four men to care for the stock on this rancho.

Here, as upon other ranchos, the "bunch grass," or gramma, is depended upon for pasturage. It grows with great vigor at all seasons, when there is sufficient moisture. It is enduring, and cattle prefer it to any other grass, thriving upon it, whether it be green, or crisp and brown, during dry weather.

The sour milk and buttermilk go to the hogs, a considerable number of which are thus fattened for market. They are sold on foot when ready for market, and bring from six to eight cents per pound.

This rancho is substantially fenced in, with red wood pickets, and the stock I found in remarkable thrifty condition.

I spent a night at the home rancho, and the two young Chinamen cooks served up repasts as toothsome as the famous cooking at the Occidental. It is true, the courses were not so elaborate, but the meats, and a great variety of vegetables, were dished up in a manner that would have delighted the most fastidious "good liver." And here a word may not be out of place in reference to

Chinese Servants—Everywhere in which they came under my observation, I found them neat, attentive, respectful, quick to anticipate one's wants, quiet in manner, and altogether "filling the bill in full," of what is understood by a good servant. The better class in San Francisco, who have had abundant opportunity of testing their faithfulness and capacity in the various relations of household work, are unbounded in their praise. They make excellent cooks, are unsurpassed as laundresses, and learn the ways and requirements of household work with a rapidity that is perfectly astonishing. And I could not help thinking what a vast relief it would be to the dairymen of central New York, if this class of labor could be introduced. Now, all through the dairy districts of the east, it is extremely difficult to obtain male and female labor except of the most inferior kind. The cost, too, of labor is excessive and eats up the entire profits of many a man's farm. Hundreds of farmers are mere slaves to hired help—help that are indeed "lords of the manor"—who will not work unless they are watched; who take delight in wasting and destroying their employer's property; who are brutal to all animal life under their control or entrusted to their charge, and who hang like a dead weight upon the farmer's family, because they cannot be dispensed with.

Go among the farmers to-day through central New York, and hear how gladly they would rid themselves of this incubus, and do all the work on the farm with their own hands, if it were possible to do so. Not that they are unwilling to pay

for labor, but because they are obliged to pay for *inefficiency*—vexed, tortured in mind and body, and made slaves to the help they hire.

There is no place here to discuss Chinese immigration in its moral and social aspect, but the question of labor is growing every year and every day more and more intricate and difficult to be solved, and there is among farmers an irrepressible desire for relief.

Throwing the Lariat and Catching Wild Cattle in California.—We rise in "the gray dawn" and breakfast early, on the morning of August 2d, for Olin was to have a new four-horse team from the rancho and drive us out on the plains among the wild cattle; following Mr. Nichols and a band of old Californians mounted upon mustangs, and each armed with the lariat. This meant sport, and Olin drew his lines and handled his long lash in a way that plainly indicated there was to be no "small driving," so long as he filled the box.

I had had a taste of "break-neck speed" the day before, down steep declivities, along the edge of mountains where a foot's deviation from the track would have plunged carriage and horses in a shapeless mass below, making our hair stand on end at the reckless way he turned a corner or passed a ten-mule team on the edge of a precipice. But Mr. Howard assured us that "Olin's head was level," and that we were safe in his hands. So we shut our eyes over the worst places, and heard the whip crack and felt the carriage sweep and sway as it plunged after the galloping horses and slackened speed only at the next ascent.

And so this morning we dashed along over mountains, and down into deep canyons, until we struck a broad plain in sight of the cattle, and here we halted. Then we saw in the distance, the wild bulls, with flying tails, rushing over the plain, pursued by the horsemen. Now they plunge into the tall grass, and again the scamper and hurry of feet is heard as the horsemen turn the herd in the direction of the carriage. On they sweep in a body, led by a famous red bull, fleet as the

wind. The men urge forward their mustangs, dashing "pell mell" for the leading bullock. One of the horsemen is now ahead. We see him swing the lariat; but he is yet too far back of the frightened bull. Onward they come, the horse steadily gaining, and now the lariat swings round and round, and then shoots forward. Has he caught him? Yes!—No!

"By George! sir," the lasso is over his horns; but the end of the cord has been jerked from the rider's hands, and the bull bounds along uncaught. Then the race is pushed faster and faster, and the horseman is seen swaying over and almost touching the ground. He has caught up the dragging lariat, and with a loud bellow from the bull he is checked in his flight.

On come the other horsemen, and again a swing of the lariat round and round, and the mustang stops, holding from the pommel of the saddle the lariat, which is fastened at the other end to the hind leg of the bullock. Another horseman swings his lariat and clutches the foreleg, and in a moment the poor bullock falls upon his side, bellowing lustily in his fright and rage. Then the horsemen loosen the animal, and sweep off in a body after fresh victims, and thus bull after bull is caught, and cheer after cheer goes up from our carriage—for this, indeed, is rare sport, the most exciting and best we have seen in crossing the continent.

It is perfectly astonishing what skill these men have acquired, and how unerringly they throw the rope, and lasso the mark desired.

In their riding one can almost fancy them a part of the horse, for they can sway over and touch the ground when the horse is on a run; and they descend the steep declivities of high bluffs, urging their mustangs at their full speed, and you wonder how they can make these frightful rides without being dashed upon the ground, a mangled mass of broken bones and jelly.

Other Dairies.—Turning partly about, we drive to the Evans dairy, of one hundred and forty cows, and from thence to

other ranchos numbering from one hundred and fifty to one hundred and sixty cows. At these places the buildings, management of cows and manufacture of butter, are all on the same plan as that previously described. At some dairies the average yield of butter at the time of my visit, was at the rate of half a pound a day for each cow; but in the best season, it had been from a pound to a pound and a quarter. At one place of 1,200 acres, I found a corral of heifers, a hundred of which were two years old, and fifty were three years of age. Here, during the early part of the season, the average daily make of butter was one pound per cow. These heifers were of fine form, with a good proportion of Short-Horn blood; and Mr Howard thought at four years old, they would make an annual average of two hundred pounds of butter per cow.

System of Farming, Suggestions, &c.—The system of farming over these lands is now, of course, rude and wasteful; but Mr. Howard is organizing a plan for the application of manures. What it seemed to us should be done, is to divide the lands up into smaller farms—say of capacity to keep a dairy of seventy to eighty cows—and then establish butter and cheese factories at convenient points, where both cheese and butter can be made on the associated system. In this way the estate would become better colonized, schools and churches would grow up, and the families would not be so isolated. At the same time by relieving the tenant from the manufacture of dairy products, more time and opportunity would be had in improving farms.

Mr. Howard thought it quite probable, now that a division of the estate had been made, that dairy farms could be purchased at very reasonable prices, say $25 to $30 per acre. Considering the climate and the nearness to the markets on the Pacific coast, the situation has many advantages for practical dairymen who desire a residence on this part of the continent.

Looking out on the Pacific from the most Western Limit of Central California.—Desiring to see the most western limit of central California and come face to face with the broad Pacific, we

kept on our way to the rocky cliff, or sharp point of land jutting out into the ocean, the extreme point of Point Reyes. Here the government light house is in progress of erection, Mr. Howard having sold to the United States a hundred acres for that purpose.

Looking down the cliffs upon the rocks, upon which the waves of the ocean were dashing and throwing up columns of spray, while the unceasing moan and sobbing of the mighty waters echoed along the shore, the sight had a sublimity which made a deep impression upon our hearts, and one never to be effaced from memory in this life.

Here and there the seals were basking upon the rocks, or making their way in the foaming waters, now and then exposing a head above the waves that ma le us almost fancy that they were human beings shipwrecked on the coast, and struggling to lay hold of the slippery rocks. Here we looked out upon the broad Pacific—as we had done a few weeks before upon the Atlantic, from the shores of Maine—hardly able to comprehend how the journey across the continent had been made in so brief a time, and with thanks and praise in our hearts to the good God who had permitted us to see all these wondrous works of his hand, and who had held us without harm in his holy keeping; and then we turned our way back over the rancho to San Rafael—a journey through the country of nearly fifty miles, which Olin, by a relay of galloping horses and incomparable driving, brought us over safely before midnight.

Cheese Making.—Cheese is manufactured in California, but the quantity is comparatively small. It is made in farm dairies, though one or two factories are soon to be established. I went through the storehouses in San Francisco and examined numerous samples of cheese. Some of it was very well made, meaty in texture and fair in flavor; but I saw nothing that could be called a "fancy article," as that term is understood in New York.

One of the largest dealers in San Francisco had upon his

shelves about a half million of pounds. It was placed on shelves on each side of the store-house, extending from the floor to the ceiling. No samples shown me were in boxes, although the firm, I was told, dealt in New York factory cheese to some extent. With a climate so favorable for the production of good milk, and especially for the curing and keeping of cheese, I should expect California to be able to excel in the finer "fancy grades." Indeed, I know of no region having a temperature so admirably adapted to the production of clean, sweet-flavored dairy products as the coast range of California.

Influence of Climate upon Dairy Products.—The importance of a moderate, uniform temperature for the manufacture of choice dairy goods, can not be over estimated. Much of the butter and cheese made in the middle and eastern states during hot weather, is more or less affected in flavor on account of the overheated condition of milk as it comes from the cow. The driving of cows from the pasture to the stable when the temperature is from 90 to 100 deg., has a tendency to overheat and injure the milk of such cows before it is drawn, and it is extremely difficult to collect a herd together during the intense heat of our summers without over-exercising some of the animals to that extent that the milk will be feverish, and unsuited to the manufacture of fine flavored goods. Add to this the difficulty of making and keeping dairy products in a temperature not above 70 deg., when the temperature of the atmosphere is above 90 deg., and it will be seen why such vast quantities of butter and cheese made during hot weather are condemned as ordinary, inferior, and positively bad.

The summer of 1870, as compared with the season of 1869, practically illustrates my position. The season of 1869 was unusually cool and even in temperature, and at no time in the history of dairying has the aggregate annual cheese product proved to be of so uniform good flavor. The English shippers and cheese mongers were very greatly astonished at the marked improvement in the flavor of American cheese that year, and many attributed it to the progress which had been

made in American manufacture. The English shipper, Mr. Webb, in summing up his remarks on the quality of American cheese, says that "the whole season's make (of 1869) shows a *decided improvement in the average quality, and larger* proportion of *really choice cheese* than in any former year."

In my address before the American Dairymen's Association, January 12th, 1870, I pointed out quite clearly what, in my opinion, was the main cause of the marked improvement in the flavor of American cheese for the season then just passed; and I now quote from that address the following paragraph, as summing up my views on that point:

"Seasons like the past, (1869,) are exceptions, and the like may not occur again in years. It approximates more nearly to the summers in England than those common with us, and to the peculiar condition of the climate, more than anything else, may be attributed the general good flavor of our cheese the past season. And if there was anything more needed to establish the fact of climatic influence, reference may be had to the hot summer of 1868 in England, and the consequent depreciation that year of English cheese."

Now, the extremely hot weather of the year 1870, put its black mark upon the cheese made during the time of its continuance. Loud complaints were heard among dealers in all the markets, of the "hot, strong flavor" of nearly all the cheese sent out by the factories from the middle of July to the middle of August. And this condition of things will prevail more or less during every hot summer until some plan is inaugurated in the construction of curing rooms, so that temperature may be controlled; and even then the trouble from faulty milk, on account of overheated cows, will not be obviated.

It will be seen, then, what an immense advantage in climate the coast range of California possesses, where the average temperature is about 60°, and the highest heat seldom goes above 70°. The advantage of mild winters in saving of fodder, requiring the storing of comparatively little fodder to carry

stock along, has been alluded to. This point need not be enlarged upon, since dairymen who are accustomed to feed stock during our cold winters, where six months' store must be provided, will at once appreciate what advantage a milder climate is to the stock keeper.

Wherever, therefore, there are grass lands in California having the climate I have indicated, they should be employed for dairying, and they will prove in course of time, I believe, more valuable than the grain lands; and even now, taking one year with another, can be made the most remunerative.

Markets.—Of course, the question of markets is one to be considered; for if the time comes when the Pacific slope has a surplus of dairy products, where is to be the market or outlet? I believe a very profitable trade could be opened with China or India for this class of goods. Indeed, some of the San Francisco dealers told me that shipments of cheese had been made to China, and with good profits to the shipper, the only objection being that the length of the voyage made rather slow returns. But a regular and steady trade opened is a different matter from chance shipments, and hence I see no reason why the dairy could not be made remunerative and enduring upon the Pacific slope. It is quite probable, for some time to come, that home consumption and home trade will take all the cheese that will be likely to be made upon this slope.

Milk Dairies.—Wherever there are large cities or considerable towns, a supply of milk must be had, and milk dairies naturally follow and develop into a specialty. I was unable to get statistics as to the quantity of fresh milk used in San Francisco, but I obtained some facts in regard to one of the largest dairies employed in furnishing fresh milk for city consumption, and this was the

Dairy of A. F. Green & Co.—It is located at Millbrae, in San Mateo Co., and numbers six hundred cows. San Mateo county lies south of San Francisco, and is bounded on the northeast by the Bay of San Francisco, and west by the Pacific.

The rancho where this dairy is kept, embraces about 6,000 acres. Three hundred and fifty cows are kept in milk all the time—that is, whenever any of this number dry up or fail in milk, others from the reserve are coming in milk to supply the vacancy, and thus the dairy is kept good all the year.

The average quantity of milk delivered at San Francisco from this dairy is seven hundred gallons per day. It is put up in cans holding three gallons, and sold to the milk-dealers at seventy cents per can. The transport of the milk from the rancho to the city, costs about four and a-half cents per can, which leaves sixty-five and a-half cents for the milk, or nearly five and a-half cents net per quart to the proprietors. The milk is retailed in the city at ten cents per quart. The average temperature upon the rancho is about 60 deg, and the milk is cooled off as soon as drawn by setting the cans in water tanks. In order to have the cans reach the city in time to be distributed by the milk-carriers, the cows are milked at 12 M. and 1 o'clock at night.

Management and Feed of Cows.—At this establishment there are extensive buildings for storing fodder and housing the cows. The cows run out to pasture every day through the year, but extra feed is commenced to be given about the first of July. The extra feeding is carried along as the cows require, generally up to the middle of February.

The pasturage from the first of November to the first of January is rather flashy, and is not alone of sufficient nutrition to keep the cows in milk. Young stock may, perhaps pick their living from it; still, it is not considered good economy to allow animals, whether young or old, to depend wholly on pasturage during this season. The pasturage begins to be good about the first of January, and continues to be abundant up to the first of July.

The extra feed adopted for this dairy consists per day for each cow as follows: ten pounds California hay, four pounds oil meal, four pounds Chili bean meal, and four pounds bran. The hay is cut and mixed with the several ingredients, when

it is steamed and the cows are fed of it morning and evening. Animals not in milk are fed loose hay.

Mr. Green informed me that barley straw, cut green, made the best hay. The barley is sown about the first of January, and the crop is cut the last of May, yielding at the rate of two and a half tons to the acre, if the land has been properly prepared and manured at the time of putting in the crop.

Mr. Green says that the most trying time for the dairy stock in California is from the first of November to the first of January, so far as feed is concerned; for, although the pastures begin to dry up and are brown in July, still there is sufficient nutrition in the "bunch grass" to carry the stock along."

The season of 1870 had been unusually dry, and more trouble had been had on account of the scarcity of water than for any previous year.

The cows in this dairy make an average of about ten quarts of milk per day for the year; but during the "flush feed" the yield is from four to seven gallons of milk to the cow per day. About the last of May or first of June the dairy is usually doing its best.

In answer to my inquiry in regard to preserving an even temperature in the milk room, Mr. G. stated that not the least difficulty was had in keeping it at 65° the year round.

Comparisons.—I have now given some of the leading features of California dairying. Having travelled over the dairy districts of Great Britain, France and Switzerland; with an intimate acquaintance of the dairy lands of the eastern and middle states; of the Canadas and several of the western states, I found upon the Pacific slope, conditions different from anything seen before. The climate, the soil and the grasses are different, and, indeed, as compared with other dairy sections, so unlike, that I often found it difficult to draw satisfactory conclusions.

Up to the present time stock has been kept upon extensive ranges. The soil is wonderfully productive in cultivated crops, but whether any of our artificial grasses can be intro-

duced to take the place of those natural to the soil; whether, indeed, the bunch grass, under close cropping and long continued dairying, will prove enduring, are questions not satisfactorily solved.

While the climate of the coast-range is low and uniform in temperature, some of the valleys in the interior are intensely hot in summer. In the Sacramento valley the heat is sweltering, and, of course, dairying in such portions of the state could not profitably be carried on. The absence of meadows and the sowing of oats or barley for hay is a feature that at first would not strike an eastern dairyman favorably. Yet when it is taken into account that stock run out all winter in the fields, and comparatively little fodder is required, meadows, it would seem, are of very little account and can well be dispensed with. Looking over the country, as I did, at its worst season, when every thing is dry and parched, one would not be likely to be misled with impressions too favorable. And yet, from what I saw and heard, I was favorably impressed with California dairy lands. I found stock universally in fine, thrifty condition.

It was plainly evident that much less labor was required in the care and feeding of stock here than at the east; that under ordinary management there must be a much less per centage of loss in stock from disease and accident, on account of the more favorable climate; that fancy goods could be easily made, and that with proper skill in manufacture, poor stuff ought to be the exception rather than the rule; that with the same prices for dairy products as at the east, large profits could be realized, because dairies could be managed at less expense, to say nothing of the difference in the price of lands. These, with other advantages, could not be ignored. And in saying this, I do not wish it to be inferred that I advise eastern people with good farms, eligibly located, and who are doing well, to pull stakes and go to California, for I believe something in the old adage, to "let well enough alone." Still, to young men seeking homes in the west, who are active and en-

ergetic, and have skill in dairy management, California, in my opinion, offers some inducements which cannot be readily found elsewhere.

CONCLUSION.

Cooking Food for Animals.—In conclusion it may not be out of place to refer briefly to the cooking of food for animals, as it begins to occupy the attention of dairymen.

Mr. E. W. Stewart, of N. Y., who has experimented and written largely on this subject says: "Steaming food is less practicable, but even more important than cutting. Cooking food for animals is of comparatively recent date. A brief notice of its rationale will demonstrate its importance, as well to animals as to man.

Perina says: "To render starchy substances digestible, they require to be cooked in order to break or crack the grains; for of the different lamina, of which each grain consists, the outer ones are the most cohesive, and present the greatest resistance to the digestive power of the stomach, while the internal ones are the least so."

"Starch," says Raspail, "is not actually nutritive to man until it has been boiled or cooked. The heat of the stomach is not sufficient to burst all the grains of the feculent mass which is subjected to the rapid action of this organ.

"The stomachs of graminiverous animals and birds, seem to possess, in this respect, a particular power, for they use feculent substances in a raw state. Nevertheless, recent experiments prove the advantage that result from boiling the potatoes and grain, and partially altered farina, which are given to them for food; for a large proportion, when given whole, in the raw state, passes through the intestines as perfectly unat fected as when swallowed."

Braconnot found unbroken starch grains in the excrement of hot blooded animals fed on raw potatoes; hence he adds, "The potatoes employed for feeding cattle should be boiled, since, independently of the accidents which may arise from the use of them in a raw state, a considerable quantity of alimen-

tary matter is lost by the use of these tubers in the unboiled state."

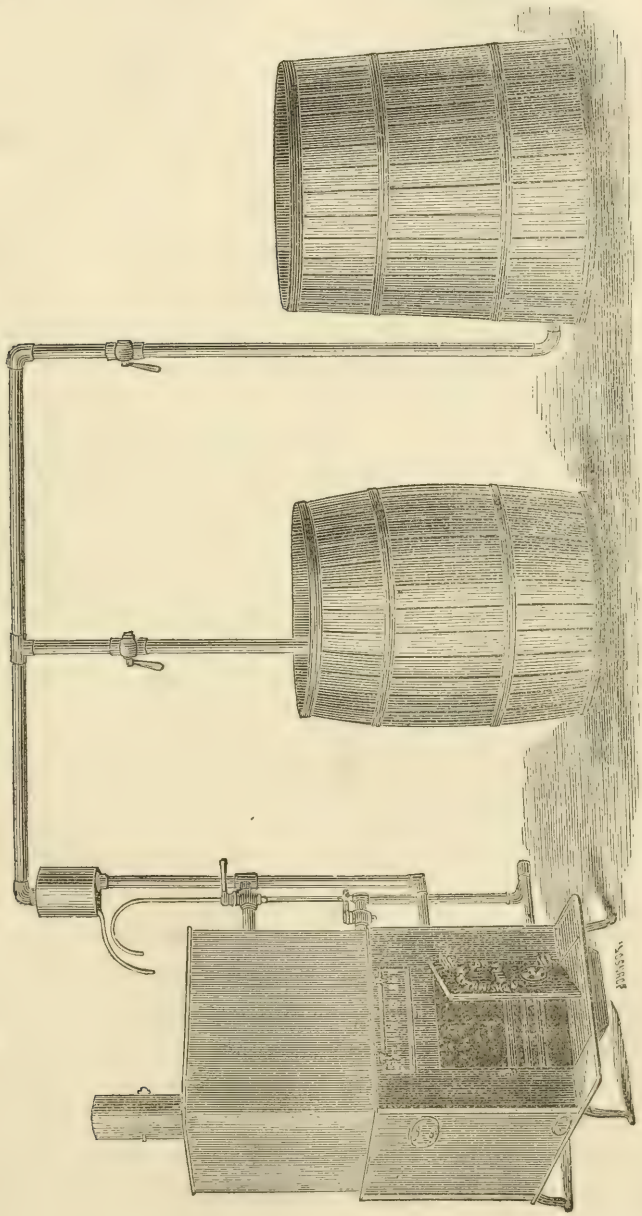


Fig. 40.—The Miller Heater as an Agricultural Steamer.

So much for the effect of heat upon grain and roots; but it may be asked whether we can derive the same benefit from cooking hay, straw, and other coarse fodder for stock. The following quotation from Regnault will show what difference exists between them, the stems containing woody fiber as well as cellulose, while roots and grains do not:

"A microscopic examination of the various component parts of plants shows them all to be constituted of cellular tissue, varying in form according to the part of the vegetable subjected to examination. The cavities of the tissue are filled with a very diversified matter; sometimes, as in the case of wood, the parrities of the cells are covered by a hard and brittle substance called lignum, or woody fiber, which frequently almost completely fills their interstices; while, at other times, as in the grains of the cerealia, potatoes and other tubers, the cells contain a quantity of small ovoidal globules, varying in size, constituting ficula or starch; and lastly in the case of the young organs of plants, the cells contain only a more or less viscous fluid, holding in solution mineral salts and various organic substances. The principal of which are gum, gelatinous combinations, designated by the general name of *albuminous substances.*" We conclude then, that if heat aids in rendering the nutritive principles of woods and grains more accessible to the assimilating faculty, it will also assist in softening the fiber of hay and straw. The cell walls which imprison the alimentary substances mentioned will, by the joint processes of cutting and steaming, be more or less broken and weakened.'

The following extract from Johnson's Agricultural Chemistry shows the further effect of heat upon starch itself:

"When wheat flour, potatoes or arrow root starch is spread upon a tray and gradually heated in an oven to a temperature not exceeding 300° Farenheit, it slowly changes, acquires a yellow or brownish tint, according to the temperature employed, and becomes entirely soluble in cold water. It is changed into dextrine gum. During the baking of bread this conversion

of starch into gum takes place to a considerable extent. Thus Vogel found that flour which contained no gum gave, when baked, a bread of which eighteen per cent., or nearly one-fifth of the whole weight consisted of gum. Thus one result of baking is to render the flour starch more soluble, and therefore more easily digested."

Of starch, he says: "It is a property of starch of all kinds to be insoluble in cold water, but to dissolve readily in boiling water, and to be thickened into a jelly or paste as it cools."

It is supposed that, by digestion, starch becomes converted into gum or sugar, and the latter probably becomes absorbed. It is also an element of respiration, and according to Liebig, contributes to the formation of fat in animals. This theory is, no doubt, well founded, and explains the fattening of animals when fed upon Indian corn.

Referring to the preceding engraving, representing the coil heater and steamer, the only difference between it and the cheese vat heater is that a check-valve is substituted for the lower stop-cock to the tank, and the pipe furnishing the hot water or steam instead of extending out horizontal, is carried up perpendicular, 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 circulates 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 generated, when the mixed steam and water is 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.

AMERICAN BUTTER FACTORIES

AND

BUTTER MANUFACTURE,

— BY —

X. A. WILLARD, A. M.,

Lecturer at the Maine State Agricultural College and at Cornell University, etc., etc.