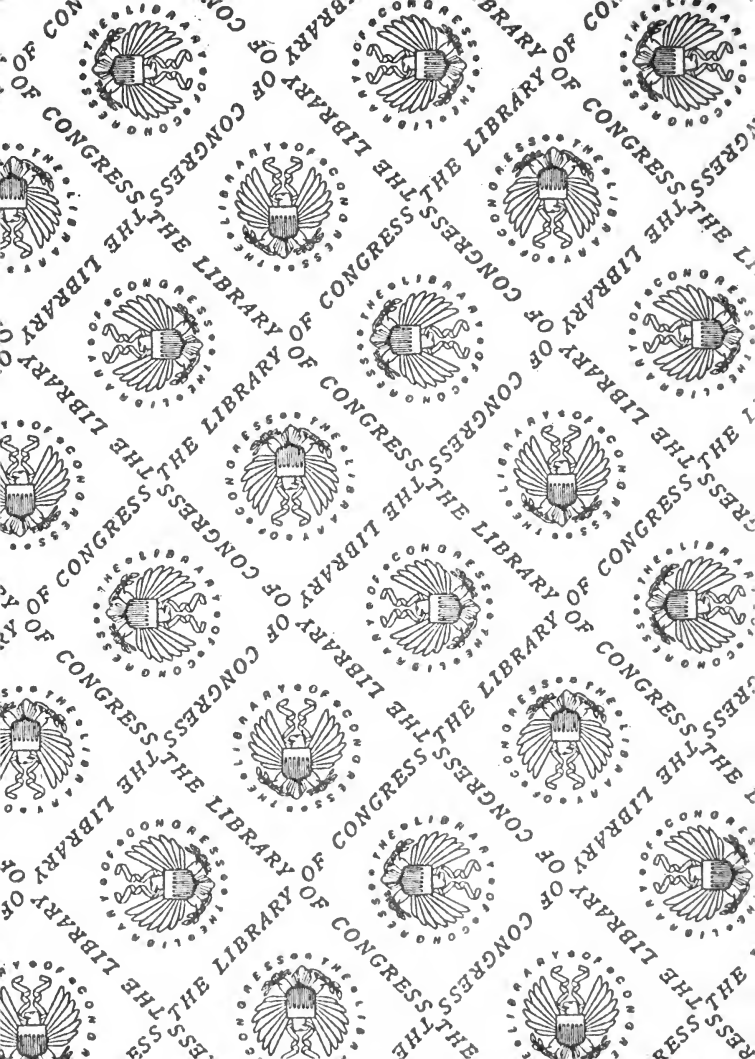
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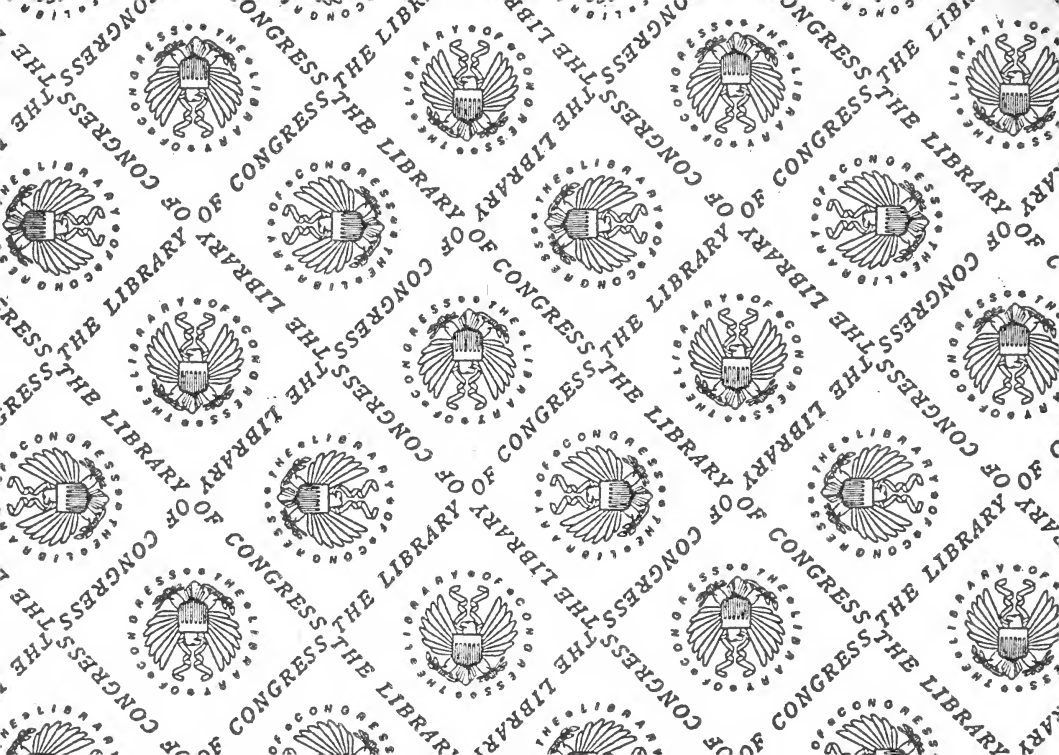
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CHEESE MANUAL

Delineating and Explaining

CHEESE MAKING

By process known as

SOURING IN THE WHEY,

—BY—

H. W. RICHARDSON.

EAST AURORA, NEW YORK.
ADVERTISER PRINTING HOUSE,
1889.

THE conditions of milk and the surroundings under which it is produced, should be such as are conducive to the most favorable results, and among the duties of the cheesemaker ought necessarily to be included that of instructing, advising, and educating his patrons in the matter of care of milk, as well as the use of proper kinds of food and drink for dairy cows.

We shall not enter into the details of milk care at this time, but would refer to the circular issued by the proprietors of Cloverfield Combination for 1889 for a few suggestions upon that subject, which every cheesemaker should insist upon being observed and carried into execution by his patrons.

Cleanliness is a necessity in the production of finest dairy goods, and while we expect the cheesemaker to impress this upon the minds of the dairy farmer on all proper occasions, with a persistency that insures success, he must not forget that it is equally essential and applicable in the management of the cheese factory.

Practice what you preach, is an old adage which applies with remarkable force, when the cheesemaker is pleading with the patron to use greater diligence in the cleansing and care of his milk utensils, while at the same time the fumes and stench from putrid matter is arising from the factory and utensils within, and between the senses of seeing and smelling, the farmer, with ordinary observation, becomes conscious of the loathsome condition of things, and is disgusted therewith. The moral effect of a sermon on care of milk under such circumstances, would not be likely to reach very deep down in the mind of the farmer, or make a very lasting impression thereon. Therefore, if for moral effect only, the factory and utensils should be models of cleanliness and order.

Milk, during the time of being received into the factory, and cheese during the process of being made, are liable to absorb and partake of noxious odors coming in contact therewith, besides, where filth and carelessness abound in a factory, some particles of the putrid matter are almost certain to become incorporated into the cheese. We refer you to hints to cheesemakers 7 and 10 to 21 inclusive in this manual for further information on this subject.

The reduction of the bulk of milk, by the separation of part of its water, is the first essential step in the process of cheese-making. This is to be followed by such treatment of the portion retained for cheese as will make it most valuable in the food markets. The varying conditions of milk and

surrounding atmosphere, will allow of no inflexible rule for the cheesemaker's guide. If so, how much the work would be simplified. It is seldom that two vats of milk, as received at the factory, present exactly the same conditions, and under the usual mode of manufacture as now practiced, each day's work is an experiment, requiring the exercise of careful observation and judgment on the part of the cheesemaker. Therefore, anything which tends to produce uniform conditions of milk, helps to simplify the process, and is likely to be the means of producing a more uniform quality of product. Thus we perceive the advantages of

RIPENING MILK.

By ripening milk, as a means of preparing it for cheesemaking, is meant the development of such degree of lactic acid as will produce perfect harmony of rennet action and lactic acid fermentation during the various stages of the work; and if the lactic acid could be developed exactly to a certain point, and be the same in each and every vat of milk at the time rennet is introduced, we would have taken a long stride toward producing that uniformity of conditions which is considered so desirable. The degree of ripeness, or lactic acid desired, is neither easily described nor determined, for it must not be so pronounced as to have arrived at a stage when milk would ordinarily be called sour. At present the only practical means known to be in use by which to determine the degree of acid development (aside from the sense

of smell which cannot as a rule be relied upon) is what is called the

CUP TEST.

This is based upon the principle that the riper the milk (that is the more lactic acid is developed in it) the less time will be required to coagulate or thicken with a given amount of rennet at a given temperature, and on the contrary, the sweeter the milk the longer time will it take to coagulate it under the same conditions. In order to make the cup test most valuable in one combination, each cheesemaker should be provided with the same kind of prepared rennet, either powder or extract, of the same strength; also be provided with uniform and accurate means of measuring the same, so as to be able to measure minute quantities. Great caution and accuracy must be exercised in its use, else the test will be valueless. A few experiments will determine how long a time will be required for a given amount of rennet to thicken a certain sized cup of milk, when the milk is just ripe enough. When this is determined we have our guide for future action. It will be observed that this test depends upon the idea of using an exact uniform quantity of milk at an exact uniform temperature, with an exact uniform amount of rennet of exact uniform strength. Then we must bring the milk to that degree of ripeness which will, as nearly as possible, require an exact uniform time to thicken a sample taken from each individual vat of milk on each successive

day. The bringing of milk to this point is what is meant by ripening it. We now proceed to consider

HOW TO RIPEN MILK.

No doubt something can and ought to be accomplished toward ripening milk by the patrons at their farm, through the advice of the cheesemaker from time to time, by such regulation of temperature at which it is kept over night, as will be most conducive to the accomplishment of end in view. But, in doing so, the danger point must not be approached too closely, for milk, as received at the factory, had better to be too sweet than too sour, as between the two. So it will be perceived that we cannot expect to be able to have the farmer do all the ripening.

There are two methods by which milk may be ripened at the factory. One is by the addition of some kind of acid; the other by the application of heat and time. The use of acids in any form has been condemned by many of our best cheese manufacturers, and, while we do not wish to encourage its use, there is no doubt but that many times the use of sour milk is resorted to without material injury, and, when used prudently, is certainly better than attempting to make cheese from milk that is too sweet, or not properly ripened. The abuses of its use, which are to be avoided, consist in allowing the milk which is added to become too sour, and in using it in too large quantities. In procuring a supply it is better to take from a single dairy of known purity, instead

of from the mass or vat, and store the same in a vessel that is washed and scalded each and every day, and kept in such temperature as will develop a clean, sharp acid, without being allowed to thicken before using.

The other, and probably safer method (although requiring more time), consists in applying temperature and sufficient time to accomplish the work. The milk should be heated to such a temperature as may be necessary, not exceeding 94 degrees, and allowed to stand and eventually cool back to the temperature at which the rennet is to be applied. The cup test, as heretofore described, should be used at intervals as may be deemed necessary, and the temperature of the vat of milk so regulated as to have it at the proper degree when it is just ripe enough to introduce the rennet. The condition of the atmosphere during the time which milk, if kept after being milked, particularly the temperature, also the effect of different kinds of food, as well as the variation of seasons, all exert their influence upon milk, and have an important bearing upon the amount of ripening it will require. These should be remembered by the cheesemaker, and he should not think he is gaining time by introducing rennet into a vat of very sweet milk. The vat will be progressed equally fast, in our opinion, by the process of ripening before setting, as in the usual routine of cheese-making without ripening, and a much better cheese can be produced.

For the purpose of improving the quality of cheese made

in any certain line of factories that may come under our management, and of bringing them nearer to a uniform standard, it seems desirable to secure more uniformity in the process throughout the various stages of manufacture in the different factories; and in order to accomplish this, it seems desirable to develop a system of observation and record of time occupied by the various stages of manufacture, as well as the temperature, the degree of acid, and other important particulars. This system of observation and record will partake somewhat of the nature of an experiment, and in order to be of value, will require close care and accuracy as to time, temperature, acid, etc., and that these be recorded for future reference, otherwise very little or no good will follow. One great object to be gained thereby is that such records, if properly kept, will be of great value to the superintendent in determining much more readily and accurately wherein lies the cause of any defects or lack of quality, which he may discover when testing green cheese upon the factory shelves, or later on when the cheese are cured, so that he may be the better able to suggest the true remedy, and more speedily and positively secure the removal of the difficulty. Through these experiments and observations, the cheesemaker will become the better fitted for his position, in consequence of the skill and knowledge he will gain therefrom. And believing, as we do, that every cheesemaker in this combination desires to stand among the first and best of his

profession, we anticipate the hearty co-operation of all, and hope none will begrudge the little extra time and trouble required to make the desired observations, and note down the proper records. For the purpose of convenience in discribing and recording the time, temperature, etc., and delineating the work, we will divide the interval of time occupied in making cheese, from the stage at which the rennet is introduced, to the stage at which the cheese is ready to go into the curing room, into ten spaces of time. These, for conveniences hereafter, will be designated as intervals and will always be given in minutes. The commencement of each of these intervals will be designated as a stage; therefore we will have eleven stages and ten intervals in the process of manufacture, as shown by the explanatory blank for record of process of cheese making.

Now if we note carefully the time of each stage named in the blank, and record the number of minutes intervening between each of these stages in the proper space in the line designated as time, and then note the temperature at each stage in its proper space in the line for temperature; also record in the plain lines below the degree of acid, as shown by the hot iron test; also note the amount of salt used for 1,000 pounds of milk, we shall have pretty nearly a complete record of the workings of that particular vat of cheese. There is a space left also for remarks, and in this can be noted anything different from the ordinary that may show itself in the condition and develpment of milk or curd.

1	—Put in renn
	1
2	—First sign o
	2
3	—Ready to c
	3
4	—Turn heat o
	4
5	—Temperatur
	5
6	—Scald is up
	6
7	—1/8 inch of a
	7
8	—Ready to di
	8
9	—Commence s
	9
10	—Put to press
	10
11	—Taken out o

The first thing to be done in the morning after the milk is received, is

HEATING,

or raising the temperature, for which purpose always use water in wood vat against the tin. All changes of temperature with milk or cheese during the working must be very gradual, the milk being stirred often, never being allowed to rest more than one or two minutes at a time. Steam should be turned off early enough to prevent the temperature of milk from rising above the proper degree for setting (unless it is necessary to apply additional heat for the purpose of ripening), always bearing in mind that the temperature is likely to go up 2 to 4 degrees after steam is turned off, depending upon the quantity in the vat, and whether heating has been done fast or slow, in case the cheesemaker should ever be indiscreet enough to allow fast heating. After steam is turned off allow time enough to elapse before setting (with frequent stirring) for the heat from water under the vat to have become absorbed into the milk, so that temperature of the water is only a trifle above it, thus avoiding any possible danger of the curd that forms on the bottom of the vat coming quicker or harder than in the center, because of being over heated. The temperature of setting is usually 84 degrees in summer, and 86 degrees in spring and fall. Some good cheesemakers think it injurious to heat part of a vat of milk in cold mornings and then add cold milk thereby

suddenly reducing the temperature. We are inclined to think this is correct.

When a vat of milk is ripened, and at the proper temperature, in case colored cheese are to be made, the coloring should be carefully measured and diluted with cold water to the extent of one gallon to a vatfull of milk. This should be emptied over the surface and thoroughly and quickly stirred into the milk, not allowing it to stand at all after first poured upon it, and then receive 5 minutes stirring.

STAGE ONE.

We now introduce rennet by reducing it first, the same as was the coloring, and pouring over the vat surface from end to end quickly, and immediately stirring with circular motion around the vat, then crosswise back and forth for 3 to 5 minutes, so there will be no mistake but that it is equally distributed, when the mass should be allowed to rest, except the surface, which should be kept gently agitated with the back of the dipper during the remainder of

INTERVAL ONE.

The object of this surface agitation is to prevent the cream from rising, and great care must be exercised not to continue it too long, or after thickening commences. If this is done, serious damage will be the result. During interval 1 the vat should have almost constant attention, and not be left for more than 1 minute at a time, and the space of time of this

interval should be noted very accurately on such days as blank reports are to be filled out.

STAGE TWO

is the point of time at which coagulation or thickening first begins to show on the outside of a dipper of quite hot water as it is set into the vat of milk. When coagulation first begins a film forms upon the outside of the dipper of hot water. This is curd, and the high temperature induced by the hot water contained in the dipper causes earlier thickening, therefore coagulation can be discovered earlier in this way. No stirring, or agitation must be allowed now, and the vat should be covered immediately.

INTERVAL TWO

is a period of perfect rest. The vat should always be covered during this interval, and care taken not to jar the factory floor so as to produce a tremble, and interfere with the perfect rest desired. The time of this interval should also be noted with exactness, as we desire to compare the time of intervals 1 and 2 as to the number of minutes occupied by each, for the purpose of eventually establishing, if possible, definite rules which will be a safe guide for the relative time of these two intervals.

STAGE THREE

is the point of time at which cutting is to commence, and requires careful observation, in order that each and all vats may be cut when in exactly the same condition as regards

firmness. The tests usually applied to determine this condition are, first, by dipping the finger into and under the curd, raising it carefully to the surface. As soon as it will break over the finger with a smooth fracture it is ready to cut. Another test is by laying the back of the fingers and hand on the curd near the edge of the vat, and bearing it away from the side. As soon as it will cleave from the vat it is ready to cut. When cutting is commenced, after passing the knife once through the vat hold it over the strip cut, and if this strip is nearly or quiet as wide as the knife, the curd has been allowed to come to hard; but if the strip cut is only ⅔ to ¾ as wide as the knife, this indicates that the cutting has been done in about the right time. Careful observation and experience will soon give the maker more definite information on this point.

INTERVAL THREE

covers the time of cutting and stirring, to the time when steam is turned on. Cut first lengthwise the vat, then diamondwise, then crosswise, with a perpendicular gang knife (a horizontal knife would be preferable for second cut). This makes three cuts, each of which should be done with care, making the different strokes match, by carrying a steady even hand, so as to make the curd as even as possible, and with fair speed that it may be cut smooth. Turn the curd over with the hands, by stirring once around the vat, freeing the sides from curd. Now it will probably need

cutting crosswise, making 4 cuts; and in cases it may be necessary to lap one-half during this last cut, which would be equivalent to 5 cuts. Five cuts are all that any curd from good sweet milk will ever need, if cut at the proper time. And we are of the opinion that 4 cuttings are enough and right for the average curd, and possibly 3 will answer. These points must be determined from time to time by the superintendent. During spring, on hay milk, the curd requires to be a little finer than in summer. Keep ever in mind that the softer curd is when cut, the finer it will be when cooked, provided it is handled the same otherwise. As soon as cutting is completed the curd should be agitated or stirred very gently, but continuously, keeping it all loose and separate, and never allowing it to settle on the bottom of the vat. The old theory of allowing curd to stand and settle after once cutting we believe to be all wrong; only stop long enough to turn it over once with the hands, as above indicated, before the cutting is finished. All curds, excepting quick vats, should be stirred carefully 10 minutes or more after the last cut before heat is turned on.

STAGE FOUR

is the time when steam is turned on. Heat very gradually, and handle the curd very carefully, giving it no rest, but keep stirring gently so that it will not break and mangle. Use 35 to 40 minutes in raising the temperature to 90 degrees. During intervals 4 and 5 the moisture is passing out

of the curd, and this result is best promoted by heating slowly. A film or skin is formed upon the outside of the kernels of curd, which is a part of the curd and porus like it, but through the gradual shrinkage which this skin or film undergoes these pores are reduced in size, so that while the moisture is allowed to pass through them, the butter globules are strained back and retained in the curd. When heat is hurried this skin or film will be shrunken too much, and the pores therein closed so small as to prevent the free passage of moisture from the curd, and the cheese produced will be unsatisfactory, being dry on the outside and wet on the inside of the kernels or pieces, thus making an uneven curd. In case milk is over-ripe, and acid developing too fast in the curd, the acid eats away and prevents the forming of this film or skin, and we are likely to have a curd with rough or honeycombed surface, and more butter passes off in the whey. With this honeycombed surface, the curd, acting like a sponge, absorbs the free moisture which had previously been expelled from it, making a wet sour cheese. With such curds hurried heating is the least of the two evils, and in extreme cases is an absolute necessity, in order to save the cheese from utter ruin. Bear in mind the fact, that a few minutes of neglect during this interval, during which time matting or lumping of the curd once commences, can never be wholly overcome by after management; therefore, should necessity compel you to leave a vat for even 2 or 3 minutes,

steam should be turned off a few minutes before you do so leave it, and not turn on again until your return.

STAGE FIVE.

When the temperature reaches 90 degrees should be carefully noted.

INTERVAL FIVE

is simply a continuation of the same operations as interval 4, requiring continual stirring, so as to allow no lumping or matting. Each particle of curd should be kept separate from each other particle, so they will immediately float out separate as soon as stirring the whey is commenced. Remember that lumpy curds do not cook evenly, and thus two kinds of curd are produced in the same cheese. Also bear in mind the fact that lumpy curds usually means mangled curds, which in turn causes loss ot butter, and destroys that fine silky texture of the cheese when cured. In order to preserve the most fat, the lowest temperature which will cause the complete expulsion of the surplus moisture should be used, though with some vats of milk a higher cook is necessary than with others. 98 degrees or blood heat is considered the most favorable temperature for expelling the moisture, or cooking a curd as it is termed, when milk is in normal condition and the cheese is working fairly well. Still variations from this may become necessary at times, in order to harmonize the cook with other conditions. As with heating milk, the steam must be turned off early enough,

making proper allowance for the rise in temperature which will be caused in the vat by the water beneath the tin being warmer than the whey.

STAGE SIX

represents the time when the highest heat is reached (say 98 for common), or according to common expression, THE SCALD IS UP, although the word scald would seem hardly appropriate at a temperature of 98 degrees. Too much importanc cannot be attached to the idea of being exact about the temperature at which the mass is now to be held; for if 98 is right 97 or 99 are not right, and a higher or lower temperature should not be tolerated than that which the curd requires. Thus we observe the importance of testing all thermometers by a fixed standard, and marking plainly any variations from the standard we may discover. These tests should be made often, at least once a fortnight.

INTERVALS SIX AND SEVEN

should be periods of an exactly even temperature up to stage 8 (when the curd is ready to dip), unless it be found that the milk was so ripe that acid is being developed too fast for the cook, in which case it may be necessary to raise the temperature 1 to 4 degrees. Keep the curd agitated until it reaches that stage of contraction at which it will not pack readily, when it may be allowed to rest and the vat be covered so as the better to retain the heat. Agitation must be continued at intervals,, and often enough to prevent kernels of curd

adhering together so but that they will float out separately again by gentle agitation. Remember that the cases when temperature is to be sent up 1 to 4 degrees are to be the exception, and when necessary today try and have the milk in condition that it will not be necessary tomorrow, for it means injury to quality and loss in quantity. The use of a little more steam, to be applied occasionally, will no doubt be necessary in order to preserve the uniformity of temperature desired.

STAGE SEVEN.

When acid has so developed as to string 1/8 inch on the hot iron should be carefully noted when blanks are to be filled out. We will not attempt to name an exact time which it would be most desirable for intervals 6 and 7 to cover, in order to produce that harmony of acid and cook so desirable, but it should never be less than two nor more than three hours.

STAGE EIGHT

is perhaps the most important period in cheese-making, inasmuch as at this time a well made cheese can be ruined or a poorly made cheese can be much improved, all in the space of a very few moments according as the management and handling is correct or otherwise. Two important factors must be kept in mind, to wit, ACID DEVELOPMENT and COOK. The word COOK is an expression used among cheesemakers to indicate both the PROCESS of, and the DEGREE of separation

of moisture from curd. Thus, a curd with a heavy cook indicates that a large percentage of moisture has been expelled, and one with light cook that a small percentage of moisture has been expelled. These two factors, acid and cook, must HARMONIZE. The lighter the cook the less acid development will be required in order to preserve HARMONY of action, and the heavier the cook the more acid development will be required for the same reason. In order to produce fine cheese it will be necessary to not only preserve this HARMONY, but that the cook must be developed to the correct degree, retaining in the curd just moisture enough and not too much. With properly ripened milk, and correct manipulation and management from stages 1 to 8, the correct degree of cook is almost assured at the start. Therefore, ripening milk cannot be too emphatically urged in this connection, for every cheesemaker knows that when curd remains very much too long in the whey the result is not only a heavy cook, but it is likely to become whey soaked, and is almost certain to make cheese of inferior quality. Supposing a mistake has been made, and cook is not sufficient when acid shows on the iron, we must dip earlier with less string. We would then have a mellower cheese if handled the same thereafter during interval 8. But by prolonging interval 8, and giving more time and hand stirring in sink before salting, more moisture will be expelled, and we are able to secure a cheese that will compare more favorably

with our usual make. All light cooked and wet curds require this treatment during interval 8. The kind of cheese desired must be taken into consideration in determining the amount of moisture to be retained in curd at interval 8, and if for early use and home trade more should be retained than for cheese intended for export trade. It is a delicate point to determine the degree of cook, or amount of moisture existing in curd. Various tests may be used, one of which is chewing the curd until it dissolves in the mouth, and noting how readily it will do so. Another is by squeezing a handful for a short space of time to expel the free moisture, and then opening the hand to see how readily it will fall apart to its former shape. Another by noting to what degree curd will squeak in the teeth. Each cheesemaker must educate himself to these or some other tests, and be governed in this important particular by his own judgment. Heretofore, in considering the matter of cook and moisture as connected with curd, our remarks apply to moisture that is enveloped in the curd constituting a part of it as it then exists. We now proceed to consider

FREE MOISTURE,

or moisture that is retained on the outside of the kernels of curd. An excess of free moisture must be avoided in order to produce fine cheese. There are various causes which produce it, among which we mention:

1st. Too much acid development in milk, or a quick working vat.

2d. By allowing the mass to cool, or temperature to fall back during intervals 6 and 7.

3d. Rough handling, so as to break or mangle the curds during intervals 4, 5, 6 or 7.

4th. Too little acid development in the milk at starting, consequently a slow working cheese. In this case we are liable to have too little moisture in the interior or inside of the curd and too much outside or free moisture, and the curd is too dry within and too wet without.

Free moisture is retained upon the outside of the kernels of curd generally because the surface or skin is rough or honeycombed, acting like a sponge, which roughness is produced by some such cause as we have indicated. The remedy lies in producing and retaining a smooth, fine surface or skin to the curds, avoiding whey-soak, mangling, and too much acid development.

ACID DEVELOPMENT.

The degree of acid development required at time of dipping must vary considerably at different seasons of the year, owing to different qualities of milk and other conditions, so that no definite rule can be given, but must be determined from time to time by the cheesemaker aided by the advice of the superintendent. As has been heretofore stated, different degrees will be required in order to conform to, and harmonize with the degree of moisture retained in the curd. Quick vats with light cook must go into the sink with light acid,

and when acid is developing in curd rapidly the whey must be drawn somewhat earlier than when developing slowly, because it will advance more during the time the whey is being drawn off. Observation teaches us that as a rule when the weather is hot cheese are likely to have more body, and when cold less body under the same management. Therefore, we think we can safely say, in cold days during summer a little stronger acid development must be had before dipping, and in hot days a little less. Also with soft flashy feed, caused by an abundance of wet weather, run a stronger acid, and with dry hard feed produced in dry weather, less will be necessary.

THE HOT IRON TEST

is the principal reliance for determining the degree of acid. The word STRING used in this connection, denotes the fine threads that spin out from a hot iron by holding to it a handful of curd from which all the free moisture has been expelled by squeezing in a cloth for several seconds. At a certain point these threads will break off from the lump of curd, their length indicating the degree of acid. For filling out reports, or for the information of the superintendent, always take their measurement after they have so broken off. The iron must be clean from grease, just hot enough and not too hot, and held very steady and away from any current of air during the test. Tender and slippery curds, such as are produced from very sweet but tainted milk, sometimes will

not string readily under the hot iron test when sufficient acid is developed; therefore the cheesemaker who has no other guide is liable to be deceived. This demonstrates the advisability of cultivating the sense of smell and taste, as an assistant guide in determining the degree of acid.

INTERVAL EIGHT

begins with the commencement of dipping curd to the sink, and extends to the time salting is commenced. Healthy curds require brisk stirring to prevent packing or adhering together. But with tender or slippery curds, which are not inclined to pack, it is well to stack or pile (stirring occasionally) for the purpose of inducing and encouraging the tendency to adhere together inherent in healthy curds. The duration of interval 8 should depend upon circumstances, and more time be given with light cooked curds, also curds saturated with free moisture or damp curds, in order to eliminate and expel the surplus moisture before salting. Moisture is expelled from curd much faster in the sink before salting than in the whey, while acid is not developed any faster. Thus we are presented with an opportunity to correct mistakes that have been made earlier in the work that have prevented securing sufficient cook before dipping. Hand-stirring is also another element in freeing the curd from moisture, and while healthy curds are expected to be stirred continually during interval 8, a little brisker agitation may be necessary and desirable with some curds than others, to

assist in expelling moisture. Keeping curds well together in sink, and not allowing currents of air upon them, tends to assist in increasing cook and expelling moisture, and on the contrary sprawling in sink in a warm room will tend to stop the cook, and can be utilized with over-cooked curds, But in no case should curds be subjected to currents of air, or unnecessarily exposed in a cold room during interval 8. But beware of overdoing this matter, especially in spring on hay milk, for like many good things, too much is perhaps as bad or worse than not enough. It is not uncommon to find cheese made in spring from hay milk, that is corky and tough at 20 days, which had been ruined simply by a little too much time and stirring in sink before salting. There is more danger at this season than any other, but the general principle to be kept in mind is, that when a curd is sufficiently cooked and dry without it, you must not hold too long in sink before salting.

STAGE NINE

is when the first salt is mixed with the curd. The hot iron test is used by some makers to assist in determining when to salt, and it might be well to cultivate this test. The quantity of salt used must be varied to correspond with other conditions, which are quality of milk and dryness of curd when salted. Larger quantities of salt tend to retard curing, and make dryer cheese. Smaller quantities to hasten curing; therefore the market for which cheese are intended must be

considered in determining the quantity to use. Also the sooner a curd is salted after dipping, and the more moisture still present at time of salting should be taken into consideration in this connection, as in these cases more salt will run off with the whey. The range most commonly used in this section is 2½ to 3 pounds to 1,000 pounds of milk, and must be determined from time to time by the superintendent. Only a portion of the salt should be applied to the curd at one time, making 3 or more applications at intervals of a few minutes between.

INTERVAL NINE

extends from time salt is first applied to curd until put to press, and during summer all good curds should stand 2 to 3 hours, while fermented and spongy curds frequently need 5 to 6 hours. When the salt is all on the curd it should receive the most thorough stirring and stacking, by spreading the curd from each end of the sink in turn over the center third evenly, thus insuring absolute uniformity throughout the mass. After salt is thoroughly mixed with curd stir often enough to prevent adhering together, also to prevent the surface from becoming too cool or too highly colored from atmospheric exposure. The temperature of the make room should be reasonably warm while curd is in sink, and no currents of air allowed to strike the curd not even in hot days. In case the make room cannot be warmed in cold weather, the curd sink should be kept covered as much as

possible. During early spring do not hold as long in sink after salting as in summer. Consult the superintendent on this point from time to time.

STAGE TEN.

The curd is now ready to put to press, and is supposed to have received careful attention and stirring, so that each kernel is separate from any other and retains its original shape as when first cut. Measure carefully, so as to produce cheese of uniform size, measuring their height daily as taken to the curing room. Crowd down with the hand in hoop after each pail is emptied, and keep an eye to their neat appearance generally.

INTERVAL TEN.

covers the time in pressing, which should be light at first, the screws tightened every few minutes for the first hour, gradually increasing in force. After cheese are turned in hoop and bandages straightened (which should not be done until the curd is thoroughly united) apply full pressure. Oil screws often, and see that the screws and followers play free and work easy, otherwise the pressure will not be sufficient. Tighten down screws several times after being turned at night, also at intervals in morning, leaving the cheese in press as long as possible next day. Observe the followers and see that they are level, so as to produce a regular shaped, handsome looking cheese. In case a cheese is not pressing level change its position under the screw until it does.

STAGE ELEVEN.

Cheese are now taken from press to curing room, and should be wiped and carefully examined to see that they have a perfect exterior, rind, and neat appearance, and in case a cheese is found to which these points have not been secured, it should be immediately returned to press and the defect remedied.

CURING CHEESE

is promoted by placing and keeping it in such conditions and temperature as will induce and facilitate the ripening and breaking down of the tissues of curd, and rendering them mellow and plastic. Curing should commence immediately and be continuous after cheese is taken from the hoop. The temperature most desirable is 68 to 72 degrees. Many cheese are injured by being allowed to stand in a cold room when green, and especially if a little mellow or wet they become bitter, and the flavor is ruined ; therefore we wish to call especial attention to this matter of keeping all green cheese in a proper temperature. During the spring and fall months hurry them forward to the central curing house, and insist upon their going often and immediately when a small load is ready (don't wait for large loads), and while at the factory keep them warm. Excessive heat is also injurious, and should be avoided and guarded against in every possible way: Cool your curing rooms during the night in hot weather by opening windows, closing them in morning so as to bottle up

and retain the cool air as long as possible. Always use a thermometer, and examine it often and know what you are doing to promote curing the cheese. For the purpose of testing and proving the quality, it is necessary for the superintendent to try nearly every day's make of cheese, and the cheesemaker should follow with grease, and paste down bandages and cloths as soon as done being tried, so as to preserve and retain perfect surfaces, thus avoiding danger from flies, and to exclude atmosphere and mould. The use of factory cloth pressed on the surface, and retained there while curing, produces a hard dry rind, which tends to lessen the danger of injury during transportation and storing in boxes, and is becoming to be considered a necessity. These cloths can be used over and over again, but must be washed clean, thoroughly removing all the grease, or else they will not stick the second using, and a cracked and damaged cheese will be the result. By soaking these cloths in sour whey over night the removal of the grease is facilitated.

HOW TO MAKE A SOFT, MUSHY CHEESE FROM GOOD MILK.

Use a large quantity of rennet, cut very coarse, let the heat run down while cooking, allow the curds to stand without stirring and lump up, dip in a cold room and cool the curds suddenly in sink. Such cheese will be very undesirable, and in order to make them still poorer and very bitter, allow them to cure in a low temperature.

TO MAKE A DRY, HARD CHEESE FROM GOOD MILK.

Use very little rennet, cut very fine, stir very fast, breaking and mangling the curd so as to waste the butter, keep temperature to 100 while cooking, run a heavy acid, hold a long time in sink before salting, use plenty of salt. Such cheese would make very good cart wheels.

HOW TO MAKE A CRACKED SURFACE CHEESE.

Press very hard at first, causing curd to burst up on sides of followers, allow press-boards, hoops and followers to become sour, by not washing and scalding according to hint No. 21. Use greasy, dirty cap cloths that will not stick to cheese while being cured, thus allowing them to dry and crack. Such cheese will disgrace any cheesemaker.

HOW TO MAKE A RICH, MELLOW CHEESE IN SUMMER.

Use rennet sufficient to coagulate in 35 to 40 minutes Allow the curd to come fairly firm before cutting, thus making a moderately coarse curd. Never break or mangle the curds while working. Dip with less acid, so as to correspond with extra moisture in curd. Salt fairly quick after dipping. Such cheese will suit the home trade generally.

TO MAKE A LONG-KEEPING, HEAVY-BODIED CHEESE IN SUMMER.

Use moderate amount of rennet sufficient to coagulate in 50 to 55 minutes, cut comparatively soft. thus securing a moderately fine curd, run more acid to correspond with the less moisture secured by previous management. Hold a little longer in sink before salting.

TO MAKE GOOD CHEESE FROM OVER-RIPE, OR TOO ACID MILK.

Hurry every stage of the work until curd is in the sink. Use a little more rennet. Coagulation will take place sooner than with the same rennet in sweet milk, therefore be ready with the knife and commence cutting as soft as possible without mangling, hurrying the cutting to prevent curd getting too hard before finishing. Cut a little finer than usual, turn on steam at once, do not stand for ceremony but move right along with the work. Sometimes 1 to 4 degrees extra heat is required. Do not allow so much acid to develop before

dipping. Dry curd out well in sink, but avoid over-acid development before salting. This heroic treatment means loss of butter, and waste, and is to be deplored, but is sometimes necessary in order to save the cheese. The degree to which it may be necessary to carry this hurrying depends upon the degree of acid at commencement, therefore exercise caution and sagacity in the premises, and not spoil good milk thinking it is sour.

TO MAKE GOOD CHEESE FROM VERY SWEET MILK.

Ripen it up to the proper point before putting in the renet, then work according to instructions laid down in this manual.

HOW TO HANDLE SPRING MILK.

Use sufficient renet to coagulate in 20 to 25 minutes. Cut moderately soft, and fine, heat to 98 ordinarily (with possibly a degree or so added when you have less than half a vat of milk, in order to overcome the lack of pressure of whey). Do not hold long in sink before salting. Use ¼ to ⅙ less salt than in summer. Have making room warm. Avoid sprawling curds over too much surface in sink, thus allowing too much exposure to atmosphere. NEVER allow the cheese to stand in a COLD ROOM after being taken from press.

HOW TO MAKE MOTTLED CHEESE.

1st. By not mixing color thoroughly with the milk.

2d. By mixing old and new curds together.

3d. By mixing curds of different vats of same day's make.

4th. By not stirring the rennet in thoroughly.

5th. By allowing cream to rise and stand upon the vat of milk before coloring it, and then by pouring the color upon the cream as it lies at the surface.

6th. By allowing coloring to lie a few minutes on surface after being poured over it and before mixing thoroughly with the milk.

7th. By stirring rennet into vat of milk before the heat has been turned off long enough for milk to have absorbed the heat from water under vat, so but that the bottom of vat will come sooner and firmer than the remainder, thus producing two kinds of curd in same vat.

8th. By allowing the surface of vat to cool while coming, so that surface will not come as firm as the rest of the curd, thus producing two kinds of curd in same vat.

9th. By failing to agitate and keep down cream during interval 1.

10th. By allowing curds to mangle and then lump up during intervals 4, 5, 6 and 7.

11th. By using a leaky globe valve, thus allowing milk or curds at bottom of vat to become over-heated, thus producing two kinds of curd in same vat.

12th. By hurried heating during intervals 4 and 5, thus searing the kernels of curd over so suddenly as to prevent a free separation of moisture.

13th. By too free a use of sour milk, or by using milk

that is loppered for the purpose of ripening milk preparatory to setting.

14th. By such management as will produce a cheese containing free moisture. STUDY FREE MOISTURE.

15th. By failing to stir the curd frequently in sink, so as to prevent color from intensifying at surface by too long contact with the air in one position.

There may be other causes, but we have enumerated sufficient to demonstrate the principle that different kinds of curd in the same cheese are very likely to show up in different colors, thus producing mottled cheele.

TO AVOID MAKING MOTTLED CHEESE.

Work according to ALL THE PRINCIPLES HEREIN LAID DOWN, and do NONE of the things, nor suffer any of the CONDITIONS to exist heretofore mentioned as liable to make mottled cheese.

GASSY CURDS.

This may mean much, or it may mean little, for the reason that we have to deal with all degrees of gassy curds from that which develops small pin holes only after being dipped into the sink, and in which the peculiar odor attending gassy curd is hardly perceptible, to the regular floater which brings the curd to surface of the whey as soon as or before acid begins to show on the hot iron, and which sometimes causes the whey to blubber and foam like soap suds, and also develops that rank, putrid, gassy odor which is not easily described, but which is understood by cheesemakers generally.

The principal cause of gassy curd is a fevered condition of milk, and may be produced by over-exertion and consquent over-heating of the cows' blood by worrying, dogging, or hurried driving.

Another, and still more serious cause, is a fevered or injured udder. Therefore gargety milk, or milk from cows with fevered bag ought never to be allowed to enter a cheese vat. There is no doubt but that stagnant and impure water, and putrid or fermented food are also prolific in creating this fevered condition of cows' blood which results in the production of gassy curds. Thus the necessity of allowing milch cows to consume nothing but the most wholesome food and purest water.

Still another, and perhaps the most common source, is because of not removing the animal odor by aeration, thus creating fevered conditions in milk that would otherwise have been healthy had it been properly cared for as soon as milked.

Gassy curds are most common in hot dry weather, for the reason that the causes as enumerated are then more common, besides the heated atmosphere tends to develop and aggrevate these conditions which would many times lie dormant if the weather was cool. By enumerating some of the principal causes which produce gassy curds we have aimed to suggest the most effectual remedy for them; to wit : the removal of the causes indicated. While this remedy lies largely in the hands of the dairymen, we insist that the duty of the cheese-

maker is not performed so long as he fails to do all in his power to learn and induce the farmer to produce milk that is free from these conditions. Thorough aerating will go a long way toward driving out the fever and preventing this trouble.

TO HANDLE GASSY CURDS.

Should the peculiar odor heretofore mentioned be so pronounced as to be discovered before cutting of curd is completed we should expect a genuine floater, and would cut a little finer. The treatment thereafter would not differ much from usual until time to dip, when a little more string will be necessary in order to secure the same acid, as well as enough to overcome the dryer curd induced by finer cutting. Such curds usually require to be worked longer in sink before salting. A little powdered saltpetre should be thoroughly mixed in the salt, using not to exceed one ounce to 1,000 pounds of milk. After salting, the curd requires more time and handling in sink before putting to press, say 4 to 6 hours, or sufficient time for the gas to expend its energy and collapse, so that the round holes will flatten and the sides of cavities settle together. Milder types of gassy curds, such as possess nearly the natural odor and which do not develop until curd is in the sink, simply require more time and handling in order to overcome the gas as indicated above. A loss of quality as well as quantity will follow with curds that are much gassy.

HINTS TO CHEESEMAKERS.

1. Use every endeavor to educate your patrons how to produce milk of the best quality, with most profit.

2. Give each one a copy of Rules and Suggestions for Patrons.

3. Carefully inspect the milk cans, especially the seams inside the covers, once every week ; any offensive matter appearing yellow when wet with milk is most dangerous to the flavor and keeping qualities of the cheese.

4. Insist on a careful straining immediately after milking.

5. Visit promptly the farm, pasture, stable, milking-yard, milk-house and milk-stand of every patron whose milk comes tainted, after he has been notified of its bad quality ; some apparently trivial matter that has escaped attention will generally be found as the cause.

6. Where whey is returned in the milk cans, urge the owners to empty them as soon as received, and not to feed the whey near a milk-stand, milking yard or other place where milk is kept.

7. Examine carefully the inside and outside of the opening from the weighing can into the milk conductor ; and just after using look into the conductor very closely for any traces of the yellow matter referred to in No. 3.

8. Do that every day.

9. Never use a leaky globe valve which will allow steam to pass through and heat your vat out of season.

10. Never use a strainer cloth, dipper, pail or thermometer which feels greasy, or has about it any deposit of foul foreign matter.

11. Empty, thoroughly cleanse and scrub whey vat at least twice each week.

12. Lift the tin cheese vats from their places for a thorough cleansing of wood vats once a fortnight, and oftener in case of leaky tins.

13. In case of suspicion that the tin vat is leaky never allow water to come as high between vats as the milk is in the tin vat.

14. Always keep your factory and surroundings in such condition as you would be proud to have them while entertaining company.

15. Keep your wood pile cleaned up from bottom, using chunks so that it will present a neat appearance at all times.

16. Particular care should be taken to use only pure, warm water when turning the cheese for bandaging, before the rinds are fully formed.

17. Greasy water is sure to percolate into the body of the cheese and leave nasty flavors.

18. Cap cloths and cloths for rinding cheese must be thoroughly cleansed and entirely free from grease each time they are used. Soaking in sour whey over night and the use of salsoda water will greatly facilitate cleansing them.

19. Curd sink racks require thorough scrubbing on both sides every day, and should be turned out for airing.

20. Occasional soaking of sink cloths over night in a strong salsoda solution is beneficial,

21. The hoops, press-boards and followers require to be rinsed with hot water every day, and these with the presses should be scrubbed every two days.

22. No cheese should be taken to the curing room until the shape is true and the edges well made.

23 Bandages should never be cut to exceed three inches wider than the height of cheese. Wide bandages are a waste of cloth, and injure looks of cheese.

24. Mark all cheese on the side neatly with stencil figures soon as taken from press according to the following style :

4 (representing day of the month)		4
24 (representing factory number)	thus	24
2 (representing vat number)		2

25. Never mark with factory stencil or shave boxes of cheese which are being forwarded to central warehouse to be cured, but mark the box covers with led pencil in neat, small, plain figures the date, factory number and vat number, according to style in Hint No. 24.

26. The curing room floor should be frequently swept, the shelves thoroughly cleaned after each shipment, and the air kept pure by suitable ventilation.

27. Mark the weights of each cheese in NEAT, PLAIN, medium sized figures on the HOLLOW SIDE of the box and near the center so that there will be no danger of figures being covered by rim of box cover.

28. Always use scaleboard on both ends of cured cheese when boxing, but not on green cheese with cloths on to send to central warehouse.

29. The edge of box should be level with cheese all around when boxing cured cheese and covers should fit close.

30. Insist on teamster using only clean wagon boxes in which to haul cheese, and see that the load is properly protected from sun and storm.

31. Never allow cheese to be drawn standing on edge in warm weather.

32. See that superintendent tests thermometers every two weeks at least.

33. See that the flues of the steam boiler are cleaned out every week.

34. Keep everything in and about the factory scrupulously clean.

35. Keep a correct and detailed record of the workings of two or more vats of cheese each week, filling out the blanks furnished for recording the same.

36. Fill out monthly statements and forward promptly to the proprietors at the end of each month.

37. Finish all of every day's work each day in the very best way you can.

38. Occasionally compare the workings of your factory in all its details with the foregoing reccommendations.

TESTING MILK.

In testing milk for adulteration use graduated jars, these should be filled exactly as high as they are graduated, and should be at a uniform temperature of 80 degrees soon after receiving the same. The Lactometer is introduced and careful note of standing of each sample taken and recorded in test book. Then set aside in jars until cream has all risen, a careful examination made and the per cent. of cream noted in test book.

Extreme caution must he used that a fair sample of the milk be obtained; and this can be done most effectually by putting the whole into the weigh can and dipping from the mass, after stirring the same thoroughly with a dipper. In testing for taint, it is better to take from the delivering cans. taking a fair proportion from each and every can of each individual dairy, thus avoiding any danger of contamination and taint that may be left in the weigh can from one dairy of milk with another dairy which comes after it. Tumblers will be used for testing for taint, and it is very essential that they are thoroughly clean, and so handled in taking samples of milk for testing that there will be no danger of getting any

filth into them, nor of getting them displaced so as not to be able to tell positively to whem any sample saved belongs.

Should the test indicate that any patron is watering or skimming, the milk committee or the proprietors, or both, should be informed and the patron properly dealt with at once.

A general test should be made twice each month for adulteration, and any suspected patron's milk should be tested daily until the matter is corrected or suspicion removed.

Testing for taint, should be made as often as is necessary, at least once each week, and daily, when cheese show that milk is not properly cared for, until the difficulty is remedied.

Each cheesemaker should educate his taste and smell, so as to be able to judge milk as it is received, also to assist him in judging the work of manufacture.

In testing for taint a sample of each patron's milk should be taken and placed in a shallow box of warm water, except in hot weather. This box should have a number on the bottom for each patron.

In testing for adulteration, paste a number on each jar, and stand them in cold water, except when weather is cold, when a room away from the fire will do just as well.

Our object in issuing this manual is to aid and assist the cheesemaker in the line of his duties by explaining many of the general principles of cheesemaking.

Many of the precepts laid down are based upon old ideas, related in order to refresh the memory, and for the purpose of the more fully setting them forth with view to making this a handy reference and guide.

Do not suppose, however, that this manual can or is expected to do all the thinking for the cheesemaker. He must think for himself, and stand upon his own bottom. We hope however, by this, to inspire in the mind of each the habit of thinking for himself, thereby becoming the better fitted to put in practice the principles and ideas herein advanced.

We also hope to arouse in each that habit of persistent perserverance so necessary to success. We also desire that this be read and re-read until these ideas and principles become perfectly familiar, and are adopted as their guide unless proven impracticable,

We believe it possible for the cheesemaker to make every cheese a fine one from milk that is in reasonably fair condition. No poor cheese are made but there exist some cause for the defect, which lies in the power of the cheesemaker to remedy, if he sets himself to work with a will. And like the general who commands an army and is held responsible for

its success, regardless of conditions, so must the cheesemaker be judged, and stand or fall by the results of his labor. If conditions are not favorable, make them so.

If milk is delivered to the factory in improper condition, take measures to correct the difficulty at once. When milk is too sweet, ripen it. If you have no way to determine when it is properly ripened to receive the rennet, study out and devise means to accomplish it, and so along down the line to the end of the chapter. Finally, if your are not succeeding as well as you ought, apply more brain work and more persistent perseverance, without which failure is sure to be the verdict.

CHEESE FACTORY RULES.

1. At the annual meeting of our patrons, resolutions were adopted prohibiting the use of sugar meal, whey, apple pomace brewer's malt, and decayed vegetables as food to cows of dairies furnishing milk for the factory. While the articles above named are considered particularly objectionable, many other things may be fed that are also objectionable, and which will produce bad results. We believe that every patron who wishes the success of the factory, is interested in main-

taining a high standard for Cloverfield cheese, and should co-operate with the proprietors in seeing that this rule is maintained and carried out. And we hope and ask that any violations of the same coming to your notice will be promptly reported to the cheesemaker or the proprietors.

2. All milk delivered to the factory is to be whole milk, containing all the cream, not even a spoonful is to be removed, nor any strippings kept back. The statute fixes penalties for violation of this the same as for watering milk, and we take this method of calling attention to the matter so that none may plead ignorance. As regards October and November milk, notice will be given at the proper time. We ask the co-operation of our patrons in maintaining and carrying out this rule also.

3. Milk from healthy cows only should be used, and not until at least four days after calving.

4. Any harsh treatment that excites the cow lessens the quantity and injures the quality of her yield.

5. A supply of salt should be placed where cows have access to it EVERY DAY.

6. Cows should not be permitted to drink stagnant, or impure water.

7. Cows should be milked with dry hands, and ONLY AFTER the udders have been washed or well brushed.

8. All milk should be promptly strained immediately after being milked.

9. All utensils for milk should be of tin, thoroughly cleansed, scoured with salt and scalded each day.

10. The milk should be properly aired, stirred and sufficiently cooled so as to keep in good condition over night.

11. The morning's milk requires airing as well as the evening's.

12. Do not allow milk to stand where it can come in contact with ordors from the barnyard, pig pen or any other noxious odors.

13. It is even more necessary to air and stir milk when weather is cool than when it is warm.

14. Milk will keep better over night in small quantities, therefore it should be divided in all your cans, or kept in tin pails.

15. When both messes of milk are carried to the factory in one can, the mixing of morning's and evening's milk should be postponed till the wagon is ready to start.

16. While the milk is warmer than the surrounding air it should be left uncovered, but when colder it may with advantage be covered.

17. Covered milk-stands or houses should be provided by every dairyman, in which to keep milk over night. These should be inclosed on all sides with narrow slats, with slat door, thus affording protection from rain and sun, also from the intrusion of cats and dogs, at the same time providing a free circulation of air. These should be located at a perfectly

safe distance from any possible noxious odors. A lock could also be used if desired as protection against tramps.

SUGGESTIONS.

In order to insure finest dairy goods, the importance of pure, wholesome milk, from which to manufactare the same, will be admitted by all. But we fear that many dairymen who supply milk to cheese factories do not realize how sensitive milk is, and how easily it is contaminated and injured by contact with impurities surrounding it, or how quickly it is affected from minute quantities of foreign or impure matter remaining about the cans, pails or strainer.

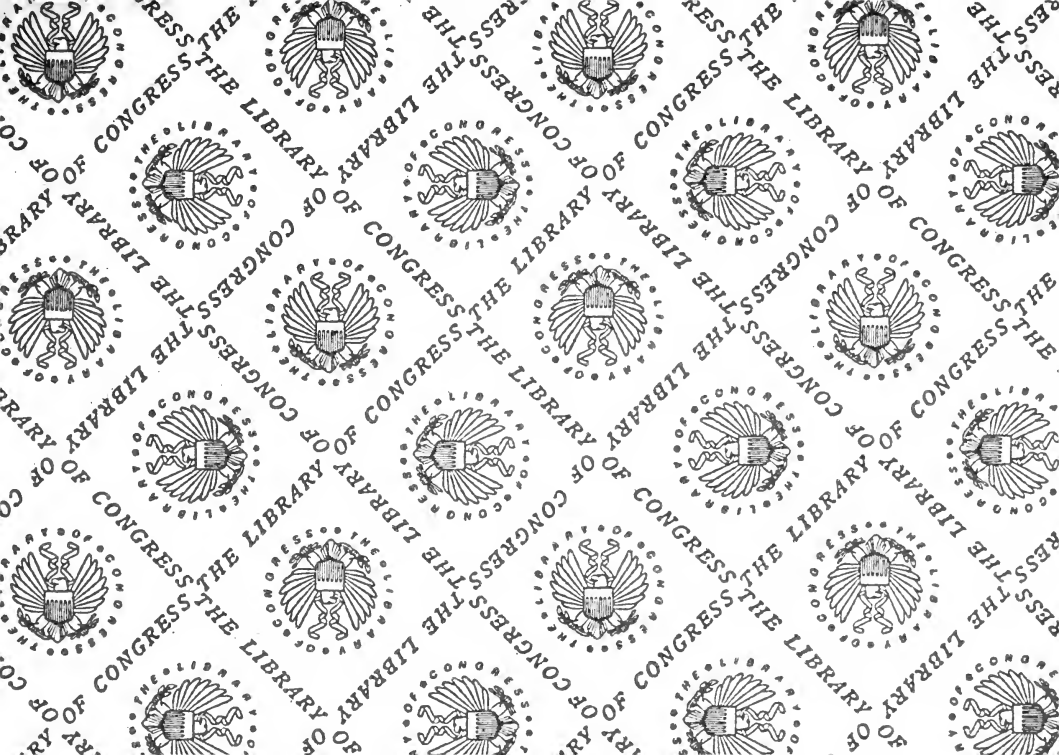
As milk is drawn from the cow it is impregnated with animal odor, which should be driven out, by bringing as near as possible every particle of it in contact with pure air IMMEDIATELY after it is milked. When new milk is placed in a can immediately after milking, and allowed to stand over night without being stirred, even in cold weather, the animal order will remain in it, and putrefaction or taint soon commence its work, although the milk might still remain sweet. This taint would gain such a foothold, that when heated during the process of cheesemaking, it would develope ahead of the acid, and bad results follow. Thus will be seen the necessity of neutralizing or holding in check the putrefaction or taint, which can best be accomplished by thoroughly airing the milk, either by stirring, dipping and pouring, or by the use of some kind of purifier or aerater,

which we hope soon to be able to procure and introduce, which will do the work better and easier. Agitation and atmospheric exposure purifies milk upon the same principle that water in running streams is purified, by continual motion and exposure to the air. The purity of running water as compared with ponds or stagnant pools is understood by all, and the same principles that purify water will, if applied to milk, purify it as well.

The morning's milk should be aired as well as the evening's, for if shut up in the cans during transportation, without first being purified by a thorough airing, it is liable to receive injury thereby.

Pure air is also essential for milch cows, therefore, as much as possible avoid allowing them to stand in foul smelling, or poorly ventilated stables, and NEVER allow them to inhale the poisonous odors arising from carrion or other putrid matters. Such poisonous air breathed into the lungs comes directly in contact with the blood, contaminating it, thence conveying its poisons to the milk.

We hope by issuing the foregoing rules and suggestions, to assist the dairyman in the matter of caring for milk, and trust that as near as possible these ideas may be carried out by each patron of the Cloverfield combination.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