Issued May 11, 1907.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—BULLETIN No. 98.

A. D. MELVIN, Chief of Bureau.

INVESTIGATIONS IN THE MANUFACTURE AND CURING OF CHEESE.

VII.—DIRECTIONS FOR MAKING THE CAMEMBERT TYPE OF CHEESE.

BY

THEODORE W. ISSAJEFF,

Expert Cheesemaker, Dairy Division.

WASHINGTON:
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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., March 22, 1907.

Sir: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 98 of this Bureau, a paper by Theodore W. Issajeff, giving directions for making the Camembert type of cheese. This paper is based upon results of the investigations in the manufacture of European varieties of soft cheese which have been in progress for some time at the Storrs (Conn.) Agricultural Experiment Station by cooperation between that station and the Dairy Division of this Bureau, the author being an expert cheese maker on the cooperative staff.

Readers who may desire fuller information as to the nature and character of Camembert and other soft cheeses, the molds used in their ripening, the methods followed in their manufacture in Europe, etc., are referred to the following publications of the Bureau: Bulletin No. 71, "The Camembert Type of Soft Cheese in the United States;" Bulletin No. 82, "Fungi in Cheese Ripening: Camembert and Roquefort," and an article on "Soft-Cheese Studies in Europe" in the Twenty-second Annual Report (for 1905).

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

INTRODUCTION.

For the past three years cooperative experiments have been conducted between the Storrs (Conn.) Agricultural Experiment Station and the Dairy Division of the Bureau of Animal Industry, United States Department of Agriculture, for the purpose of determining the methods of making and ripening cheese of the Camembert type. This is one of the varieties of European soft cheese imported in considerable quantities and considered by many a great delicacy. There is a growing demand for cheese of this type in the United States, and there is no reason why the industry of making this cheese should not be developed in this country. The directions given in this bulletin are not mere compilations, but are founded upon research work covering a period of more than three years. The Storrs Station is now prepared to assist factories and individuals in undertaking the manufacture of this type of cheese.

L. A. Clinton,
Director Storrs Agricultural Experiment Station.

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ILLUSTRATIONS.

DIRECTIONS FOR MAKING THE CAMEMBERT TYPE OF CHEESE.

THE CHEESE-MAKING PLANT.

The first problem to be considered is the construction of a suitable plant in which the cheese is to be made and ripened. The description which is here given is not of the plant in which our experiments have been carried out, but is rather of one which is designed to meet certain requirements discussed later, and which experience has taught us would be most satisfactory.

The plant suggested consists of three rooms, the first of which is used for the making of the cheese, the second for growing the molds and for the first stage of ripening, and the third for the subsequent and final ripening. The size of these rooms depends chiefly upon the quantity of milk which is to be handled.

EQUIPMENT OF THE MAKING ROOM.

Vats.—For the making of Camembert cheese an ordinary flat-bottomed cheese vat is just as satisfactory as the basins used in France.

Apparatus for determining ripeness.—A Marshall rennet test is useful in testing the ripeness of the milk. A more convenient and accurate apparatus, however, is one for determining the percentage of acidity, and consists of a burette connected by a siphon to a large bottle of a one-tenth normal solution of caustic soda (N 10 NaOH). (Fig. 1.)

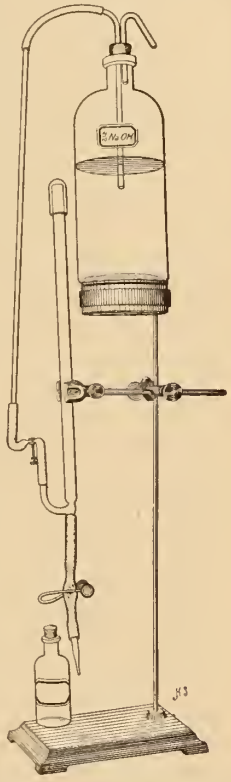

FIG. 1.—Titration apparatus for determining acidity of milk.

Curd knife and dipper.—A curd knife of the ordinary type must be provided in case the curd is to be cut, and also a dipper similar in shape to a soup ladle. (Fig. 2.)

Draining table.—The draining table, one end of which is a little higher than the other, is placed near the vat. The top of this table slopes somewhat from both sides toward the center. It is best to have the table on wheels, so that it will be movable.

Hoops, or forms.—The hoops in which the cheeses are made are cylindrical in shape and open at both ends. They are made of galvanized iron, are 5 inches in height and 4 inches in diameter, and are provided with three rows of holes about 1 inch apart. The size of the holes is about one-eighth of an inch, and there are thirteen holes in a row. A second set of hoops, 2 inches in height, with one row of holes around the center, is made with a slightly larger diameter (one-eighth of an inch larger is sufficient), so that they will slide freely over the others. (Fig. 3.)

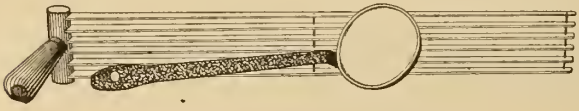

FIG. 2.—Curd knife and dipper.

Boards.—The draining boards are made of whitewood and have parallel grooves on both sides to enable the whey to run off readily. These grooves are about one-sixteenth of an inch wide and of the same depth, and are about one-eighth of an inch apart. The boards are about 14 by 15 inches in size, or large enough to hold nine cheeses of common size. (Fig. 4.)

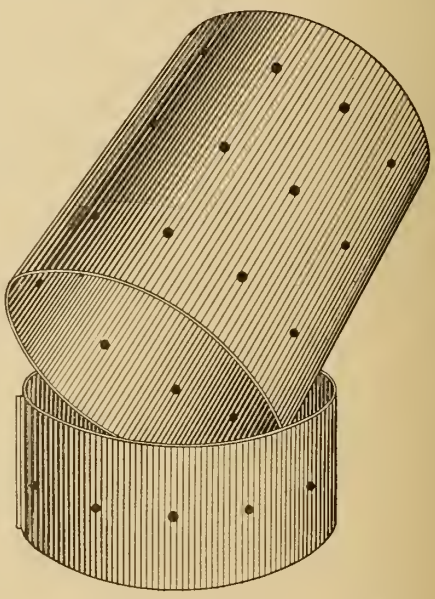

FIG. 3.—Large and small hoops, or forms.

Mats.—Square mats of the same size are needed to cover these boards. They are preferably made of fine bamboo strips, closely fastened together with strings. They resemble somewhat the bamboo strip curtains. (Fig. 5.)

Cane bottoms.—Cane bottoms are often used. They are of the same size as the draining boards and are used as supports for the cheese during the ripening process. (Fig. 6.)

EQUIPMENT OF RIPENING ROOMS.

The equipment necessary for the ripening rooms consists of shelves on which the cheeses rest and means for controlling at all times the

temperature and moisture of the rooms. The shelves are made of hardwood and are abont 5 inches apart, so as to allow the boards and cheeses to slide in and out freely. They are built from floor to ceiling in order to economize space. Steam and brine pipes will best furnish the means of controlling temperature and moisture.

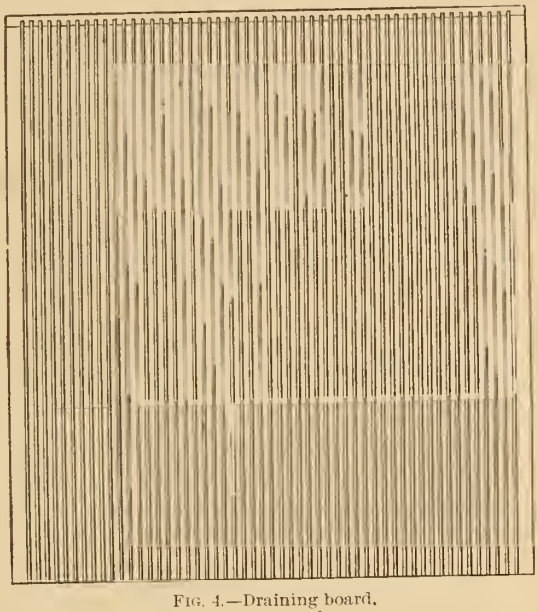

FIG. 4.—Draining board.

CONSTRUCTION AND CONDITION OF THE ROOMS.

Making room.—One of the first requirements is that of absolute cleanliness. The floor should be of cement or some other water-tight material, and should slope toward a drain-pipe, so that it can be readily flushed with water. The walls can be made of wood or brick, preferably the latter, and should be covered with whitewash or enamel paint. This coat of whitewash or paint should be renewed from time to time after cleaning off any dirt that may accumulate, and also for the purpose of disinfecting the room if this should be needed.

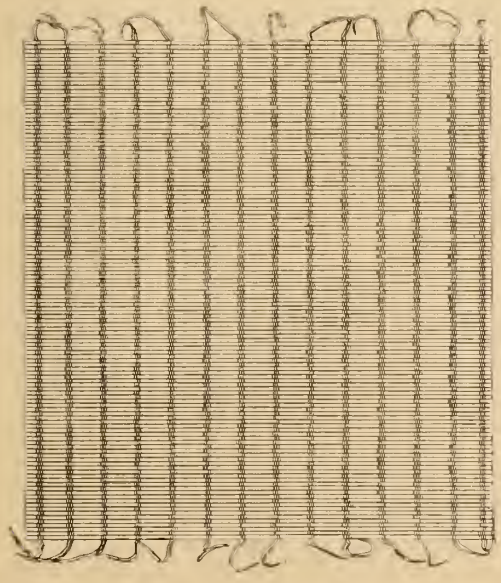

FIG. 5.—Draining mat.

The room must be frequently ventilated, no matter what the temperature of the outside air may be, and yet it is to be maintained at a constant temperature. For this purpose steam should be provided, as stoves or other heating arrangements do not warm the room as quickly or satisfactorily.

An ordinary dairy sink, with water and steam taps, is necessary. The steam pipe should connect with the water pipe by a tee, so that the water can be heated to any desired temperature.

As the tools can not be properly cleaned with hot water alone, it is advisable to provide a steam chest or sterilizer of some sort where they can be left in contact with live steam. A strong wooden box, lined with galvanized iron and having a valve at the bottom as an outlet for condensed water, has been found to be very satisfactory. It is provided with a strong cover, which can be fastened to the box with clamps. The whole arrangement should be made so as to stand a slight pressure. This box is especially useful for sterilizing the boards and cane bottoms used to hold the cheeses during the ripening process.

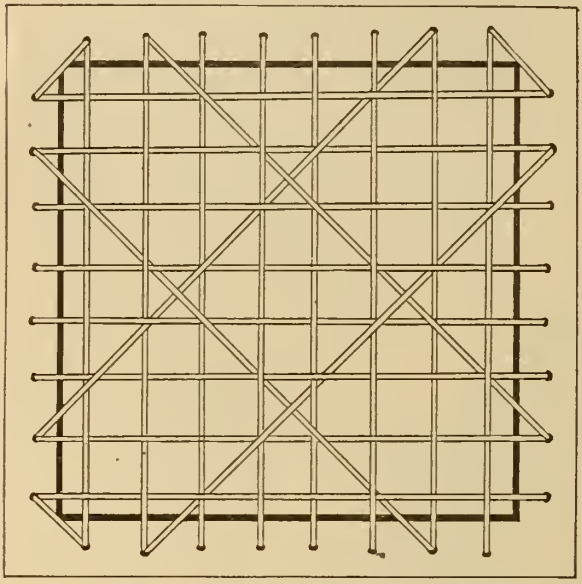

FIG. 6.—Cane bottom for ripening cheese.

First ripening room.—The first ripening room must be nearly saturated with moisture and kept at a temperature of about 60° to 62° F., as these conditions are most suitable for the proper growth of mold.

Second ripening room.—This room is to be kept somewhat cooler (56° to 60° F.), as the ripening proceeds more uniformly at this temperature. Here it is not necessary to keep such a high percentage of moisture as in the first room. There should be just enough to keep the cheeses from drying out. The walls and floors of both of these rooms should be like those of the making room—that is, easy to clean.

Both of the ripening rooms should be well ventilated and steam heated. The steam can be used not only for heating, but also for maintaining the desired degree of moisture. In summer the outside heat would raise the temperature of the rooms, causing the cheese to ripen too fast and not uniformly. For that reason some means of cooling must be provided.

PROTECTION AGAINST INSECTS.

A very important item is that of protecting the cheese against flies and other injurious insects. The outer doorways, the windows, and every other possible opening should be carefully guarded by screens with as fine a mesh as can be procured, as the smallest flies produce the most trouble. If this is not carefully attended to the cheeses are sure to become infested with fly maggots. In the ripening rooms protection against these insects can be secured to a considerable extent by keeping the rooms dark, for flies will not readily breed and multiply in a dark place.

THE MAKING OF THE CHEESE.

THE MILK.

The milk used in making Camembert cheese should be of the best quality—that is, clean and fresh. Two quarts of milk are required for each cheese.

RIPENING THE MILK.

The milk is poured into the vat and by the aid of water and steam is heated to 85° F., this being the temperature best suited for the growth of the lactic bacteria. A starter is added, the amount depending upon its strength and capacity for developing lactic acid, usually 3 quarts of a medium starter for every 100 pounds of milk. After adding the starter the milk is allowed to stand until the desired degree of acidity is reached.

This method of ripening the milk before setting is not the rule in France, where they generally set the milk at a very low degree of acidity without any attempt at previous ripening of the milk. The acid, however, develops later in the curd while the cheese is draining. In our experience serious trouble from gas has been avoided by ripening the milk before setting. Especially during the hot weather it is advisable to use a higher degree of acidity. The percentage of acidity used by us is rather high (about 0.35 per cent). This is, however, partly because of the low temperature of the room in which our experiments are made. In France the making rooms are generally kept quite warm, and the cheese will naturally drain faster there and develop the acid in the curd.

Several experiments have shown us that it is not entirely necessary to use such a high degree of acidity to secure a properly drained cheese, but by using a starter which will work rapidly after the cheese is dipped very satisfactory results have been obtained. The milk in such cases was ripened only to about 0.2 to 0.25 per cent of acid.

THE STARTER.

It is best to use a starter which is a pure culture of lactic organisms, prepared by inoculating sterilized milk with these bacteria. In cheese and butter making some homemade starter is generally used, such as sour milk or buttermilk. These often give excellent results, but are by no means pure cultures and can not be depended upon; in fact, they sometimes cause considerable trouble.

The various commercial starters have been used here and have produced excellent cheese of a mild type. The one found most satisfactory, however, was prepared from a certain brand of imported cheese. This cheese has a peculiar flavor of its own, which differs from that of any other brand. Experiments to produce this flavor have been carried out here. After many of these imported cheeses had been carefully examined and analyzed a certain kind of lactic-acid organism was found by the bacteriologist. This organism was separated, and from it a pure-culture starter prepared, which was used in the making of the cheese with excellent results. The flavor sought for has been produced repeatedly with this starter. As this brand of cheese is more popular than almost any other, this starter is probably the best that can be used in the manufacture of this cheese.[a]

ADDING THE RENNET.

The milk while ripening cools down unless carefully watched. If this has occurred, it must be brought back to the original temperature (85° F.) before adding the rennet. At this temperature it has been found necessary to use a curdling time of one and one-half to two hours to secure the texture of the curd desired for Camembert cheese. The amount of rennet required to curdle the milk in this time is calculated by means of the Marshall rennet test or the titration apparatus.

CUTTING THE CURD.

In France the method in general use consists in dipping the curd directly into the forms. Equally good results in most respects, however, have been obtained here with the curd cut. In cutting, the curd knife is passed through the curd in the vat in two directions at right angles, thus producing vertical columns of curd. When the curd has been cut in this way it drains faster, and for that reason a lower degree of acidity is used than with the curd uncut.

[a] As soon as a demand for this starter arises in the trade, cultures of it will be furnished to such companies as regularly supply starters for other creamery work.

The most satisfactory acidity with cut curd has been found to be from 0.3 to 0.35 per cent. If it is less, the curd is likely to be too soft; if higher, the curd will drain too rapidly, will become hard and compact, and will not ripen properly. The acidity is tested as follows: A sample of milk is taken with a Babcock pipette holding 17.6 c. c. and is transferred to a glass or beaker. A few drops of phenolpthalein are added and N 10 NaOH is run in from the burette, drop by drop, until a pink color just begins to appear. The number of cubic centimeters of soda solution used, divided by 20, gives the percentage of acid in the milk.

The higher the acidity of the milk the less rennet it takes. In case the acidity is 0.3 per cent, it will take about 8 to 10 c. c. of the ordinary rennet extract to every 100 pounds of milk to bring the curd to the right consistency in one and one-half to two hours. The necessary amount of rennet is poured into a glass of water and then mixed thoroughly with the milk. The milk is now left to stand until it has coagulated to the proper consistency. It is impossible to describe any test which will show when the curd is firm enough. This can only be ascertained by practical demonstration; after a little practice the maker can generally tell just when the curd is ready to cut. The curd of Camembert cheese is much firmer than that of Cheddar or Swiss cheese.

After the curd has been cut it is stirred gently once or twice with the dipper to separate the columns and hasten the separation of the whey. Then it is allowed to stand for about fifteen minutes to make it a little firmer. The whey separates out at the surface and the bulk of it is dipped off.

If, however, the curd is quite firm, less of the loose whey is dipped off. The contents of the vat are now stirred to insure uniformity, otherwise part of the cheese would be softer than the rest.

DIPPING THE CURD INTO THE FORMS.

The next operation is the dipping. This is done with a ladle which just fits into the forms. Place the draining table near the vat, and upon it arrange the boards, each covered with a mat and holding nine of the high forms. Into each of these forms a dipperful of curd is placed, care being taken to bring the dipper inside the forms in order to prevent splashing and breaking the curd. After one dipperful is placed in each form the operation is repeated, the dipping continuing until the forms are all filled to the top.

After the curd has all been dipped into the hoops the latter are piled up, together with the boards, one upon the other. This is done partly to save space and partly to cover up the cheese and thus keep off any

dirt or flies which otherwise might fall upon them. The top of the pile is then covered with an extra board. (Fig. 7.)

The curd is now allowed to drain without any artificial pressure for four or five hours. At the end of this time it will have shrunk to about half the original volume and will be ready for inoculation of molds and turning.

INOCULATION AND TURNING.

Although it is not customary for French cheese makers to inoculate Camembert cheese with mold, we have found it very desirable. Under the conditions found in Normandy the cheese acquires its moldy covering rapidly enough by accidental inoculation. Even then undesirable molds often appear to the injury of the cheese. In our experimental work artificial inoculation on the day of making has been necessary to secure satisfactory results.

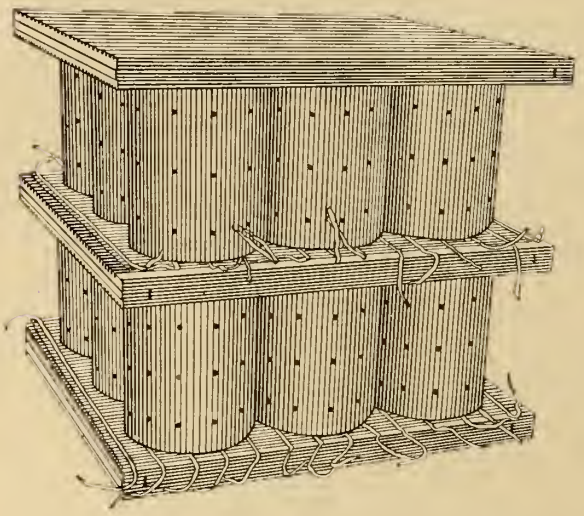

FIG. 7.—Cheese boards, mats, and forms as arranged for draining cheese.

Where dependence is placed upon accidental inoculation undesirable molds often get on the cheeses ahead of the Camembert mold, the result being either a poor cheese or one spoiled entirely. On the other hand, if a cheese is inoculated with the Camembert mold at the outset, this will grow and cover the cheese rapidly, which practically protects the cheese from the infection of other molds. A very good proof of this statement is that one can almost always find some other species of molds on imported cheese, while the molds found on inoculated cheeses are generally pure cultures, unless the culture with which they were inoculated was of poor quality. It is necessary that the maker should know the right mold when he sees it.

A most satisfactory way of inoculating is as follows: Take a small jar with a tin cover which has been punched full of small holes, like an ordinary pepper box, fill it half full with water, add a piece of moldy cracker or a piece of cheese with a good growth of the proper mold, and shake thoroughly. The contents of the jar are now sprinkled upon the surface of each cheese, then the cheeses are turned and inoculated in the same manner on the other side.

Another simple and very convenient way of inoculation, especially adapted to use in large factories, consists in taking two cheeses well covered with mold and knocking them together over the hoops. In this way enough spores drop upon the cheese to give good results.

This inoculation is by the *Penicillium camemberti;* but a second mold, *Oidium lactis*, seems to be necessary for the production of flavor in Camembert cheese, as has been indicated in a previous paper.[a] The latter is mostly found in milk and will appear on the cheese slowly. To insure its rapid growth the cheese may be inoculated with it also. The same method of inoculation may be employed as with the other mold, except that *Oidium lactis* is grown in a gelatin-culture medium instead of upon crackers.

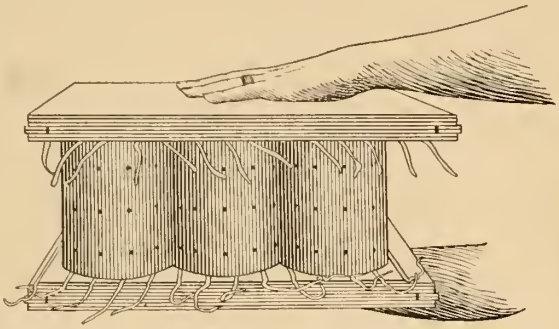

FIG. 8.—Method of turning cheese.

The cheeses are turned, not only to secure the inoculation of both sides, but also to prevent them from becoming too compact on the underside on account of the greater pressure there and to insure a smoother surface on both sides. The quickest and easiest way to turn the cheeses is to cover the nine forms with a second mat and board. Place one hand under the lower board and the other over the upper, and then invert. (Fig. 8.) If the cheeses thus turned do not rest flat on the bottom they are straightened out by moving the forms.

FIG. 9.—Salting the cheese.

After turning and inoculating, the cheeses are left without any further handling until the next morning, when they are taken out of the forms and salted. By this time they have shrunk almost to their final size. In case they are not yet hard enough to be safely handled, they are turned again and left to stand until they are sufficiently firm.

SALTING.

The salting is done by taking two cheeses together and rolling the edges and rubbing their surfaces in salt. (Fig. 9.) The salt to be used should not be too fine, as this would produce oversalting.

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[a] Bulletin No. 82, Bureau of Animal Industry.

After salting, the cheeses are placed upon dry boards, so that the sides which were previously at the top will now be at the bottom. The next morning it will be found that all of the salt has dissolved, and that most of it is diffused in the cheese. The cheeses are again transferred to another dry board or cane bottom, after turning, and are ready for the ripening process. The reason for transferring them to dry boards is that a dry board is less apt to become covered with mold.

MAKING CHEESE FROM UNCUT CURD.

A cheese from uncut curd is made somewhat differently. Although the cut curd drains more rapidly, the draining of the uncut curd can be greatly facilitated by allowing the milk to become more acid before adding the rennet.

In our experiments the degree of acidity giving the most satisfaction in the uncut curd has been about 0.40 per cent. The amount of rennet to be added varies inversely as the acidity. When the curd has reached the proper consistency, it is dipped into the hoops in the same way as the cut curd, but the operation should be carried out more slowly. After the forms have been filled the cheeses are allowed to stand without turning until the next morning. This is because the successive dipperfuls of uncut curd do not stick together readily at first and must be given more time.

While turning the cheese the next morning they are to be inoculated. They must then be left until the following morning, by which time they are ready to be salted. After salting they remain another day in the making room, making three days altogether, instead of two as in the case of the cut-curd cheese.

In France the cheeses are always made of uncut curd, but no reason has ever been given for the practice, so far as the writer knows. In a series of experiments where cheeses were made of the same milk with cut as well as uncut curd for comparison we found that in almost every case the uncut-curd cheese, even when fully ripe, did not decompose as quickly as the cut-curd cheese. Other advantages are that more cheese is produced from the uncut curd from the same amount of milk, and the loss of fat in the whey is not so great.

THE USE OF THE LOW FORMS.

Both cut and uncut curd cheeses should be hard enough to bear handling at the time of salting, but often they are not yet hard enough to retain their shape. In such cases they should be put at the time of salting into the low forms, where they remain until the next morning. When they can hold their shape without the aid of the forms they are taken to the ripening room.

RIPENING THE CHEESE.

The cheeses are removed to the first ripening room. Here they are placed on smooth boards upon shelves. The boards are of the same size as the draining boards, but have a smooth surface. The cheeses remain on these boards during the whole ripening period. Cane bottoms are frequently used and are preferable to the boards for the following reasons: When boards are used the molds are apt to grow into the wood, causing the latter to stick so tenaciously that on turning the cheeses over the rind is torn off. On the other hand, when cane bottoms are used the mold can grow more uniformly on both sides of the cheeses, and as they do not stick to the bottoms so tenaciously, it is necessary to turn them but once or twice in the first room, which reduces the labor considerably. The cheeses resting on boards must be turned daily.

During the first week any ripening which occurs is not noticeable, and the cheese remains in the form of hard curd. The surface of the cheese often becomes slightly slimy, and some change in the color can be noticed. Toward the end of this first week the mold can be seen upon looking closely.

During the second week the mold, when once started, grows very rapidly; and in the course of one or two days it covers the cheese completely, giving it a snow-white, cotton-like appearance. This white coat of mold turns to a gray green within two to four days, and by this time the cheese begin to show actual ripening. The cheese first becomes soft just under the coat of mold, and the ripening proceeds gradually toward the center. On cutting the cheese open a thin layer of softened curd can be observed under the mold. The texture of this ripened part is creamy and soft, just as the whole cheese will be at the time of complete ripening.

If the cheeses remain upon the shelves in the ripening room under proper conditions, as they often do in France, they will ripen completely. But under our conditions, where the air is dryer, we have found it necessary to wrap the cheeses during the second week in parchment paper or tin foil. This prevents evaporation and hardening, checks the growth of mold, and promotes the growth of the other organisms, thus hastening the ripening. When the cheeses appear dry and tend to become hard, tin foil seems to give the better result, but in the factories in the trade parchment paper is nearly always used. The cheeses wrapped in tin foil very commonly develop stronger flavors and softer texture than those wrapped in paper. The time of wrapping affects the kind of cheese produced, and the intensity of the flavor can be partly regulated in this way. If a cheese with a strong flavor is desired, the wrapping must be

done when the cheese is only slightly covered with the white mold. The wrapping checks the growth of the latter and promotes a more rapid development of the other mold, *Oidium lactis*. On the other hand, a mild flavor can be obtained by wrapping the cheese after the growth of mold has become luxuriant and has turned blue.

After being wrapped the cheeses are often put in small, round boxes, which they fit tightly and in which they are later shipped to market. These boxes help to maintain the shape of the cheeses, which become quite soft during ripening. At the end of the second week the cheeses are transferred to the second ripening room, where they remain until they are ready for shipment, or, if desired, until they are fully ripe. During the third week the ripening proceeds rapidly, and the cheeses become one-half to two-thirds ripe. On the surface slimy, reddish spots appear, and the cheese begins to give off a characteristic Camembert odor. Between the third and the fourth week the hard curd in the center usually disappears, and the cheese has a creamy, waxlike texture. The delicious flavor found in all Camembert cheeses is now evident. A little hard curd may still be found in the center of the cheese, but this will disappear if given time.

FACTORY METHODS.

In factory practice in France and also where these cheeses are now made in America they are wrapped and put into boxes as soon as the covering of mold is well started. This is when they are about two weeks old. Instead of ripening further in the factory, they commonly are sent to market at once. Further ripening thus becomes a matter for the dealer. Although this is the common practice in France, some factories ripen the cheese quite fully to supply a special trade. In other cases dealers establish cellars, where the cheeses are taken out of the boxes, are unwrapped, and are ripened completely on shelves before selling. Others allow them to ripen as they may in the boxes. It seems desirable to recommend that where domestic factories are supplying our own market, cheeses be ripened far enough to guarantee good results before they are sent out of the factory.

VARIOUS DEFECTS OF CHEESE.

Gassy curd.—In the making of Camembert cheese, as in making any other kind, numerous difficulties are encountered. One of the most common troubles is that arising from gassy curd. (Fig. 10.) In this case the fault generally lies in the milk, being due to gas-producing bacteria. No way has been found in which this difficulty can be absolutely avoided, but it may be partly remedied by increasing the amount of good lactic starter and the development of higher acidity

before setting, which will in time overpower the gas-producing organisms. If the curd is kept at a low temperature after dipping, the growth of these gassy organisms is checked to some extent. The gas can not always be detected in the fresh curd, but sometimes develops later, and if it does the cheese very seldom turns out satisfactorily.

Yeast.—Another difficulty is caused by yeast. The cheeses often become covered with yeast in the making room, although sometimes the yeast makes its appearance after the cheeses have been taken to the ripening room. The surface of such cheeses becomes slimy and

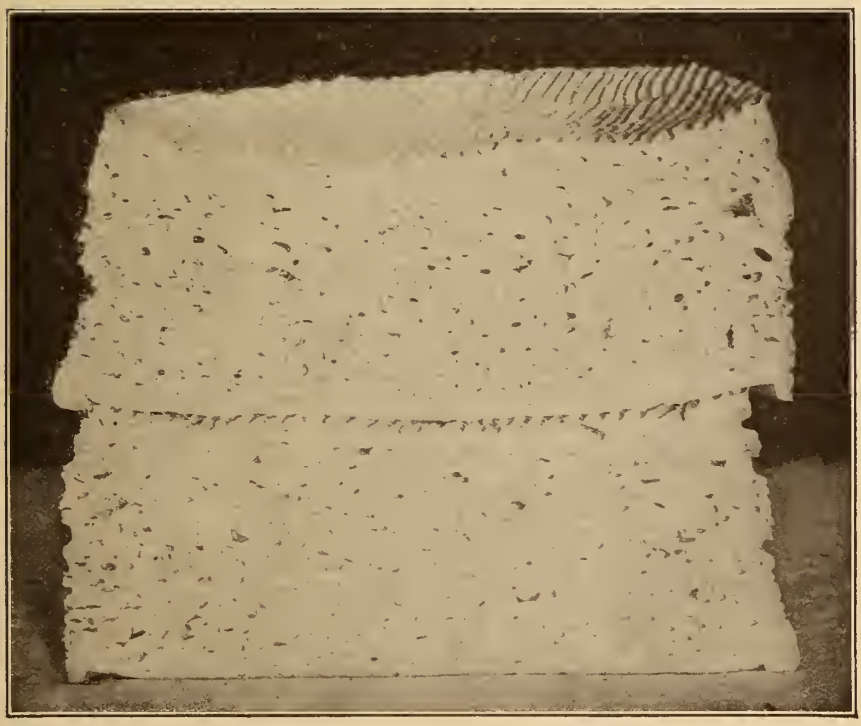

FIG. 10.—Gassy curd.

sticky, causing the cheeses to stick to the boards, so that when they are turned a thin skin is torn off. In such cases it is difficult to obtain a good growth of mold, for the latter is pulled off with the thin film of yeast, the cheese does not ripen properly, and it often has a strong, bad flavor.

Molds.—Contamination from the other varieties of mold causes considerable trouble. If the cheeses contain spots of green or brown mold, or if a long, fuzzy mold, sometimes with black tops (Mucors), appears, the Camembert mold can not grow properly, and the result

is often a bitter cheese or one with other undesirable flavors. The Camembert mold will sometimes grow over and cover the green and other molds, but this does not prevent them from producing an objectionable flavor.

When such infection from foreign molds occurs, the whole equipment should be sterilized, and if possible the walls and floors of the making as well as the ripening rooms should be cleaned and whitewashed.

Dry cheese.—The drying out of cheese is caused by lack of moisture in the ripening rooms, or by too rapid draining of the curd. Such cheeses can often be saved, if the drying out has not proceeded too far, by wrapping them tightly in tin foil.

Wet cheese.—A defect just the opposite of the last is found in wet cheeses. It is caused by too low a temperature of the making room, as well as by too low a degree of acidity of the milk, both of which retard the draining of the cheese. It may also be caused by too high a degree of moisture in the ripening rooms.

The ripening of such cheeses is more in the nature of a liquefaction, and the interior becomes so soft that it would run out if the cheese were not kept in a box. There is no hope for such cheeses, as the flavor and texture will never be satisfactory.

Mites.—Serious damage is done to cheeses by the cheese mite, a small insect scarcely visible to the naked eye. These mites crawl all over the cheese and eat up or destroy the mold, so that the cheese will not ripen properly and is practically ruined. The only remedy in such cases is the thorough disinfection of the whole plant.

Skippers.—Another enemy of the cheese is the cheese skipper—the larva of a small fly. The flies lay their eggs on the cheese, and these hatch out in a short time. The skippers remain on the surface and can be scraped off, but not without spoiling the appearance of the cheese and possibly leaving unhatched eggs. Such cheeses can not be sold and are practically lost.

ESTIMATED EQUIPMENT FOR A FACTORY.

The estimated equipment for a factory using about 1,000 pounds of milk per day is indicated below. Before building such a plant, however, it is always desirable to visit some dairy establishment where the essential equipment would be as nearly comparable to that needed as possible. This need not necessarily be a Camembert-cheese factory. Any properly equipped dairy establishment will give ideas as to the arrangement of steam and water pipes, vats, etc.

In addition to this ordinary creamery equipment a Camembert-cheese factory requires its own special apparatus.

Calculated for 1,000 pounds of milk, which will produce 250 cheeses, this will require for the making room:

250 high hoops.
500 low hoops.
150 draining boards (if used in making room only).
150 mats.
Draining table to accommodate 250 cheeses (42 square feet of surface).
Shelf room enough to accommodate 250 cheeses on the second day of draining.

Vats and draining tables should be so arranged as to minimize the labor of dipping. The two ripening rooms must be large enough to accommodate the entire output for about twenty days, i. e., 5,000 cheeses. If the cheeses are kept on boards such as are used in the making room, this would require about 500 boards in constant use. These would occupy 700 running feet of shelving. The shelves should be about 5 inches apart. A rough calculation will show that a total curing space of 14 by 14 by 8 feet would be large enough to accommodate all the cheeses. The arrangement of shelving is a matter of economical utilization of all the available space. Aisles between the shelves should be at least 3 feet wide to give sufficient room to do the necessary work. It probably would require a maker and one helper to run such a factory.

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