SWISS CHEESE MAKING.

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Swiss cheese making is the title of the subject assigned to me by your worthy Secretary. A book, perhaps, could be written if we were to go into every particular detail of the manufacturing process of Swiss cheese. I am, however, only going to touch upon some of the effective wants and needs which we are today contemplating, and how these may be overcome.

Let us first consider of what value this foreign cheese industry is to our state. It means that southwestern Wisconsin is chiefly depending upon this industry; its yearly production consists of over $20,000,000 or $2,000,000 worth of foreign cheese. Our cheese finds a constant market, and an Ideal Drum Swiss cheese is desired by the dealers and shows evidence that we are in need of a Fancy Swiss cheese, since there are annually over 85,000 cwt. Fancy Swiss cheese imported.

This cheese is of a fancy brand, but if we were to trace it back to its manufacturing point, we would find a cheese factory with a valuation of from $10,000 to $15,000, equipped with all the modern improvements. It is evident that many of our best cheese makers cannot manage their work in a satisfactory manner, due to the ineffective and poorly constructed buildings. Two years of study and inspection of the foreign cheese section, convinces me of the lack of equipment, and the necessity of putting forth every energy to improve conditions in this line of our industry. It is my desire to impress upon your minds this particular branch of cheesemaking.

The foreign cheese, including Swiss, block, brick and limburger, is known as a sweet curd cheese, entirely depending upon the condition of the milk. The milk for a Swiss cheese dares not exceed over 12 per cent. acidity in order not to destroy that characteristic nature of developing the eye or holes in a Swiss cheese due to breaking down of milk sugar. The milk for brick and limburger cheese may contain a higher per cent. of lactic ferment, but if over ripe milk is used for either Swiss brick or limburger, it will cause, when cured, a pin hole cheese in Swiss, and a sour cheese in brick and limburger, due to the large amount of moisture contained. A gasy milk is be-
yond control for either kind in our present method of manufacturing, yet many of the faults of our cheese may be traced back to poorly equipped factories and factory equipment.

It will be seen, therefore, that the lack of a Fancy Swiss cheese lies greatly in our poorly constructed factories. It has been shown that in the modern constructed factories where skillful methods can be employed, a very rare fancy quality is manufactured.

However, many faults I have observed are due to the maker who has not yet become master of the art. The manufacturer of Swiss cheese requires skill, judgment, yes, years of practical experience, for an ideal Swiss cheese has many details, and is made up very defective under different temperatures in the curing process,—I mean to say it is so under our present conditions; we have no guide to go by as you cheddar cheese makers have. Many of these defects could be overcome by the use of the rennet and acid tests, to determine the ripeness of the milk, thus doing away with the home made rennet which is so uniform in its strength. The application of these tests would aid us in making a more uniform cheese, and if we can determine the point to which our milk should be ripened, a commercial rennet extract can be used.

This particular point of getting ways and means of controlling the ripeness of the milk and strength of the rennet at the time of setting the milk, would undoubtedly be a great aid to us.

The application of scientific tests along these lines has, in the manufacture of cheddar cheese, worked wonders, and I am at a loss to see why the results would not be the same in our branch of manufacturing. But I think I am safe to say that it is evident that the question of ripening the milk for Swiss cheese will, in time, belong to the past. It is evident that we are depending upon lactic ferment; the skilled judgment which is the secret of our makers, to obtain a uniform quality of cheese, will then be overcome. This would be a guide to the beginner and would not require years of practical experience to become master of this particular point. I do not mean that the milk for a Swiss cheese must be ripened to a comparative point as the milk for a cheddar cheese, but it is evident that a large per cent of the Swiss cheese which is made in this state is classed as No. 2 cheese for the very reason that the milk from which these particular cheeses were made did not contain sufficient lactic ferment to produce the proper fermentation necessary to de-
velop the eye, or hole. The milk for a Swiss cheese is hauled two miles, and immediately after drawn from the cows. This will not allow the lactic fermentation to develop to a high point; but it is evident that the ripeness of the milk in a period of six months will be influenced by the temperature of the atmosphere. I earnestly trust that this particular point will be considered by the authority of our station, and an experiment carried out in the regular factory plants, say one factory and location on high land, and one in low lands, where a record of each making should be carried out by the aid of a rennet test and acidity test, whereby each cheese could be compared by the record of manufacturing, and its final results.

I am much pleased to state that the condition of our factories are much improved, and strong efforts are being made to overcome that architectural plan of a Swiss cheese factory which was constructed so extravagantly of four posts and a roof. Let it be understood that we are not living in the time of our grandfathers; our circumstances today demands us to keep step with the times. The financial standing of our patrons today are not such that they cannot comply with the state laws in maintaining a sanitary factory that would assure them higher returns for their products.

The map, showing the distribution of creameries and cheese factories will serve to show you that the cheese factories in our section have not only been drilled in one way, but sowed down in full measure. These types of cheese factories are, with a few exceptions, of the poorest construction. It is evident that a critical period is at hand, and in order to bring our conditions up to the State Dairy and Food Laws, the force of the Dairy and Food Commission must be enlarged sufficiently that every factory may be thoroughly inspected by a number of inspectors who are competent to bring modern scientific and practical knowledge to the many who are contrary to our motto "Forward." These inspectors should be clothed with suitable police power should instruction fail to bring about wholesome sanitary conditions. This would undoubtedly improve the condition of our poorly constructed factories and, in general, would secure to all cheese and buttermakers a more suitable establishment. Then we could trust to hope that the advanced methods which are yearly taught to our large dairy class may be accomplished.
DISCUSSION.

Prof. Carson: Mr. Marty states in his paper that there is a marked improvement in the condition of the factories. I would like to know how that improvement was brought about.

Mr. Marty: This improvement was brought about by holding meetings, and where mere suggestions for general improvements failed, they were compelled to do so and it was a case of necessity and it was shown this last season in our cheese section that the closing of a few factories has done wonders down there; it has improved the condition very much and the general opinion today is that the patrons down there, or those interested in dairying, before they go to construct or to rebuild a factory, they apply for plans, and I am getting letters day after day inquiring for plans for new factories.

The Chairman: You find then that just a little enforcement of law now and then is a wonderful aid to education?

Mr. Marty: It certainly is.

Mr. Jones: I would like to ask Mr. Marty what his plan for a curing room for a Swiss cheese factory is.

Mr. Marty: The plan for a curing room for a Swiss cheese factory is a very interesting point, and very often there are mistakes made, as to the curing room for this particular reason, that precautions must be taken that the curing room for a Swiss cheese factory is not laid too deep in the ground in order to get too moist for the cheese. An ideal curing room for a Swiss cheese factory should be about three feet above the level of the ground; that would secure sufficient draught and in case that your curing room should get too dry, with the modern appliances that we have nowadays in the way of steam outfits, we can get steam into the curing room and get moisture as we desire it.

The Chairman: How deep would you run that below the surface of the ground?

Mr. Marty: That should be at least nine or ten feet, that is, the whole depth of the whole cellar.

Mr. Jones: I would like to ask him further at what temperature he found his cheese did the best?

Mr. Marty: That is a point that is pretty hard to answer, except in a general way. The temperature in curing Swiss cheese depends greatly upon the condition of the cheese. If

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the milk has been such that it would hasten the fermentation process (and the fermentation process of the Swiss cheese is for the developing of the holes) a lower temperature would be preferable. The curing room should consist of at least three departments; one department for what we call the curing process, where we aim to hold the temperature rather high if it is needed, all the way from 70° F. to 80° F. Then we have a second room—we do not have it, however, but we should have—there should be a second room so that when a cheese is far enough advanced in its fermentation process it could be taken in there and if that cheese should still go on in its fermentation process, put it way back where there is no heating whatever, at a lower temperature, that will check the fermentation process and this is something that we must have. I think I see a number of foreign cheesemakers in the audience and I would like to get their opinion of this thought that a curing room should consist of three rooms instead of two, or, as many of us have, only one. That the curing process of a Swiss cheese requires skill and much attention must be relied upon.

Mr. Berg: I would like to ask Mr. Marty if by getting moisture into the curing room with the steam outfit that will have a tendency to warm up the curing room?

Mr. Marty: It certainly has, that is what we apply steam for. But as I have previously stated, it would only have a tendency to heat up that certain room that we want the steam and heat in. When that cheese is beyond that fermentation we sometimes, as I have mentioned in this paper, find that the condition of the cheese is such that an unskilful manufacturer of Swiss cheese cannot tell what the ripeness of the milk was for this reason, we have no appliance, no test whatever, it is only his judgment that the fast working of the curd will indicate to a maker that it is apparent by his work that his milk has been somewhat overripe. This will also hasten the fermentation process. Now, that cheese could perhaps, if the milk was overripe, be cured at the lower temperature and be cured to a good cheese, but we have occasionally had the difficulty that at the time of the setting there was not enough fermentation in the milk, that is what I want to get over, and that cheese will fall short in a curing process, it will not develop unless we can force it, we have to force that cheese with high temperature. Now, if we were to apply high, dry heat, it would certainly have a tendency to check the rind of the cheese, there-
fore, we must have steam to moisten the atmosphere of the room.

The Chairman: The only time you need to apply steam is when the air is warm, because that is the only time it is too dry, is it not?

Mr. Marty: Yes.

Mr. Torney: I would like to ask how you could ripen that milk to prevent glass cheese?

Mr. Marty: We mean by "glass" cheese a cheese similar to a cheddar cheese. There are checks in a cheddar cheese, or, in other words, seams; instead of the cheese going into fermentation, there are seams going through the body of the cheese instead of holes. Now, it is my belief, as I have stated, that we are much dependent upon lactic ferment. That is a point I want to bring out, and I wish it would be thoroughly discussed; if any of you think differently, I wish you would come out with your ideas, but it has been the general belief that in the manufacture of Swiss cheese there is no starter used, it is today the general belief of many of the makers that there is no starter used in the manufacture of Swiss cheese, and I say there is; the home made rennet which we use and have been using contains a large per cent of lactic acid. Now, if I were to say to a cheesemaker, "I would not use home made rennet, I would use commercial rennet extract," he would tell me, "I cannot get that fermentation in my cheese by using commercial rennet extract, I have got to have something in my milk to start it."

So I say it is a starter and I think a "glass" cheese is largely due to the lack of lactic ferment, that the milk has not become sufficiently ripe to produce the proper fermentation necessary. I would like to get some opinions of the others here as to whether you think that the cheese will go into fermentation, and the cheese being made of such a sweet—I cannot explain the nature of the milk any other way—the milk being so sweet that the cheese will become very tender and very soft in texture and in body, a weak body, causing that cheese to remain blind, that is, closebodied for about three or four weeks; and if the cheese maker will go to work and force that cheese in the fermentation process, when it is in normal condition, he is going to hurt that cheese, he will force the fermentation in that cheese, he will warm the texture of the cheese; that will have a tendency to check that cheese in body and therefore, instead of forming the holes, it will crack and form into seams.

Mr. Monrad: I would like to ask Mr. Marty, if you had
just the Swiss cheese how much acid would you have in your milk?

Mr. Marty: That is a very difficult problem for me to answer, for this reason. I was trying to make experiments on behalf of the state for the last three or four years, but I have not been able to receive any milk at that establishment with less than .12 of acidity, therefore it was already beyond the point of producing those eyes, so I was not able to determine what degree of ripeness it should be, although I know it should not exceed .12 per cent.

Mr. Carson: I understand you to say that Swiss cheese making depends largely upon the lactic fermentation?

Mr. Marty: Yes.

Mr. Carson: You have also used commercial rennet?

Mr. Marty: Yes.

Mr. Carson: I understand there are some rennets that contain as high as 14 per cent, while others contain only 10 per cent. Now, would your results that you got be due to the acidity of the rennet, or was it due to something else?

Mr. Marty: That is a pretty hard point to determine, but I can explain in this way that we have obtained good results at the factory by using commercial rennet extract; however, no test was ever made as to the per cent of acidity in the rennets. Now, this is a point which would certainly have to be taken into consideration, yet I dare to say this much, that the small amount of rennet which would be applied to a large amount of milk would not have the tendency to materially hasten that fermentation in the milk.

Prof. Emery: Well, when that acid is not lactic acid, it is hydrochloric acid, and some other element, and I understand hydrochloric acid has the same effect in cheesemaking as lactic acid.

Mr. Marty: Yes. Now, do you believe that by using—perhaps at the rate at which we would use, under normal conditions, we would use a higher quantity of rennet for the manufacture of our cheese,—now, do you believe by using, I would not say at the rate of four ounces per thousand, but if we had 2,000 pounds of milk, that eight ounces per thousand would have any great influence upon the ripeness of the milk?

Mr. Carson: Well, I am not clear on that point, and I am seeking information, understand. Dr. Babeck has done some experimental work in using diluted acids instead of rennets and can produce a first class cheese from that. Now, then, the
question is, whether the acid that is in the rennet has any effect on the cheesemaking, that is what I am trying to get at.

Mr. Marty: It certainly has.

The Chairman: That would not be a ferment.

Mr. Marty: But the point I want to get at is, I want to ripen the milk, by means of the commercial starter instead of getting the fermentation in the rennet, I want to ripen the milk; that is the point that I want to get at.

Mr. Carswell: I would like to ask Mr. Marty if he considers it absolutely necessary to have a copper kettle for the manufacture of Swiss cheese? Or can it be manufactured in tin vats, if the vats are properly constructed for the dipping of the curd. It used to be thought that a Swiss cheese could not be made unless a copper kettle was used.

Mr. Marty: That is a very interesting point, and it is a point that has been experimented upon at the state dairy school by Dr. Babcock and myself, but as I have previously mentioned, we were not able to keep track of the results of the cheese as to fermentation or developing between the eyes or the holes, but I believe as to the block cheese, it could be manufactured in the vat if the lump of curd could be dipped at one time. I think if we were to dip the curd by the methods which are applied in dipping curds from a vat as in brick cheese dipping, that is dipping the curd from the vat over into the molds, it would lower the temperature of the curd, which would certainly cause an uneven distribution of the development of the eyes, or else they would not form to the large sizes which are wanted, they would be more numerous and small.

Mr. Monrad: Could not you dip it in the square vat just the same way, by changing the band? Now, you use a steel band that you bend in the shape of the round kettle; supposing you had a steel band bent to fit exactly the square vat and that two men with that ran along on either side, just as you do now, don't you think you could dip out of the square vat in lump just as well as out of the round one?

Mr. Marty: I think we could, but this difficult problem would have to be overcome then,—you understand that in the manufacturing of block or Swiss cheese the curd is not left to ferment at all, it is kept in continual motion and every curd particle is supposed to be free for itself, therefore it is necessary for us that we get a curd agitator that will assure us that we can keep those curd particles separate under a high forming temperature.
Mr. Monrad: Is not the round vat more important on account of the advantage in enabling you to keep up that stir?

Mr. Marty: Yes.

Mr. Monrad: Keeping it stirred while it is being heated, and after it is heated, keep that up for nearly an hour on an average.

Mr. Marty: Yes.

Mr. Monrad: Well, now, then and there is the trouble, that it is pretty hard to keep it moving in a square vat, to keep it stirred as well as in a round kettle. I always thought that was why the Swiss people stuck to the round kettle so persistently.

The Chairman: Mr. McKinnon, do you think there is any way of keeping that in motion in a square vat?

Mr. McKinnon: We who are interested in agitators believe that an agitator can assist in any make of cheese, that is about all the information I can give you today. It is not a question that we have taken under consideration, but we have found this, and I believe there are many men right in this hall that will bear me out in asserting that an agitator can stir the curd far better than two or three men can stir the curd in a vat. It stirs every particle of the vat. If the fans are not rightly constructed at the present time for stirring the curd that you want to make into a Swiss cheese, why, that undoubtedly can be altered. I apprehend that there will be no difficulty in that direction, that it can be overcome by mechanical power just as well as many other difficulties are being overcome by mechanical power at the present day.

BRICK CHEESE MAKING.

CHRIST SCHENK, Stitzer, Wis.

Brick cheese making is a subject which has perhaps never been discussed very much, but I really believe that the manufacturing of brick cheese requires attention at several particular points and very often it is manufactured with altogether too much moisture remaining in the cheese.

For the manufacturing of brick cheese it is necessary to have sweet milk perfectly free from all bad odors. The making of this cheese is very similar to the manufacturing of limburger.