not do it. There is no blind side to a cheese buyer, he sees through a box in no time. If you take a lot of those boxes up there and he has reason to suspect a little crooked work, you cannot tell which box he is going to try, so there is not any policy in doing that. That would be worse than foolish.

Adjourned till 9 A. M., January 8, 1903.

SECOND DAY'S SESSION.

Thursday Morning, January 8th, 1903, 9 A. M.
Mr. M. McKinnon in the chair.
The Chairman: The meeting will now be in order. The President is unable to be with us at the present time, but no doubt will take his place soon.

THE BABCOCK TEST AND THE CHEESE MAKER.

Prof. F. W. Woll, Madison, Wis.

The Babcock test was given to the public in July 1890 through bulletin No. 24 of the Wisconsin Experiment Station, entitled, "A New Method for the Estimation of Fat in Milk, Especially Adapted to Creameries and Cheese Factories." Within a few months after the publication of the bulletin the test had been adopted by many progressive dairymen and breeders of dairy cattle for determining the quality of the milk produced by individual cows in their herds. Separator creameries before long followed the example set and based their system of payment of the milk received from their various patrons on the amount of fat which the milk was found to contain by the
Babcock test. In due time gathered-cream factories also adopted the test and paid according to the amount of fat which the test showed to be present in the cream. The adoption of the test in cheese factories came last and aside from a few isolated cases, it took considerable education and argument before any number of these left the old pooling system and paid for the amounts of butter fat actually delivered by their different patrons, instead of so and so much per hundred pounds of milk.

The first cheese factory in this state, and for all I know anywhere, to pay by the test was that owned by Henry Walwoord, of Cedar Grove, Sheboygan County, Wis., who began this system of payment in the spring of 1891. An account of his first season’s work was published in Hoard’s Dairyman for April 15, 1892, and of his first two seasons’ work in the report of the Wisconsin Dairymen’s Association for 1893. To-day your Secretary estimates that 70 per cent. of the cheddar cheese factories of the state pay their patrons for the milk they bring according to the test. So far as is known all creameries in the state, whether run on the separator or cream-gathering plan, now use the Babcock test, except such of the latter kinds that are still using the oil test.

It is not so much to be wondered at that cheese factories were rather slow to adopt the test, so long as the composition of milk and the variations to which the milk components are subject, were not fairly well understood. It is very easy to see that the richer the milk is, the more butter it will make. The amount of butter obtained from a certain quantity of milk is all the butter fat contained in the latter, less what is lost in the skim milk and buttermilk, plus the non-fatty components of butter: water, casein and ash. The increase is more than sufficient to offset the losses in the skim milk and buttermilk and there will therefore ordinarily be an overrun in the process of butter making of from 10 to 16 per cent., that is, the weight of butter obtained from a certain mess of milk will be equal to that of butter fat in the milk increased by, say about 15 per cent. on the average. A hundred pounds of 4 per cent. milk will therefore
yield 4 plus four times .15, equal to 4.6 pounds of butter; 100 pounds of 5 per cent. milk will yield 5.8 pounds, etc.

The matter is not quite so transparent in cheese making. Many farmers and old cheese makers believe, or believed, that there is no definite relation between the amount of fat in the milk and the amount of cheese which can be made from it, that there are “butter” cows and “cheese” cows, or they would say that rich milk, that is, milk high in fat, cannot profitably be made into cheese on account of unavoidable losses in the manufacture of such milk. Definite information had to be furnished on these points before the plan of payment on basis of fat content in the cheese factory could be advocated, and only shortly after the Babcock test had been published, investigations in this line were commenced by different experiment stations. As the years have rolled by, reports of these investigations have accumulated, until now the literature on this point is quite large. Geneva (New York) Experiment Station did pioneer work in regard to these problems during the early part of the nineties, and the results there obtained were corroborated or supplemented by those of investigations in Vermont, Iowa, Minnesota, Ontario (Canada), and at our own Experiment Station.

It is not the purpose of this paper to thresh over old straw, as the question of the relation of the quality of milk to the yield of cheese must now be considered, but only to call attention to the fact that the matter for a series of years has received careful consideration at the hands of the best dairy authorities in this country and in Canada and, if I am not greatly mistaken, American dairy scientists are agreed that payment on basis of the fat content of milk is the most equitable method of valuing milk for cheese making, and that patrons of cheese factories should be paid for their milk according to the test, as is now the general practice in creameries.

The use of the Babcock test in cheese factories is not different from its use in creameries, except that cheese factories do not ordinarily use cream separators and there is, therefore, no skim milk to be tested, while, on the other hand, whey is a by-product in cheese factories and its fat content must occasionally
be checked up. In paying for the milk furnished by different patrons, composite sample jars, one for each patron, are provided and into this is put a small quantity of milk from each lot brought by the patron; the sample is preferably taken by means of a "milk thief" or a Scovell sampling tube, so that each lot of milk delivered will contribute a proportionate part to the composite sample. At the end of the testing period, which may be for a week, or ten or fourteen days, according to mutual agreement, the samples are tested, and the total quantity of milk delivered during the testing period multiplied by the test of the composite sample will give the total number of pounds of fat delivered by each patron. The milk is then paid for according to the net value of a pound of butter fat, the net value being obtained by dividing the gross earnings less the expense of manufacture of the cheese, by the total number of pounds of fat received at the factory during the testing period.

The testers used in the early days of the Babcock test were wooden or tin hand machines, of cheap and poor construction. They have now been entirely superseded by substantially built, easy-running cast-iron machines, like the Facile, Agos and the Twentieth Century testers, and in factories steam turbine testers have been generally introduced. The latter have the advantage over hand testers in point of convenience and durability; it takes less muscle to run them and they require less personal attention. It is important, however, that the turbine testers be kept well oiled and sufficient steam must be on to run them at the required speed. The fact that the bottles can be kept hot until they are read off is a great advantage; the manufacturers of some machines rather overdid this matter up to a couple of years ago, when it was found that tests made in these testers came from .1 to .3 of one per cent. too high, owing to the expansion of the column of butter fat at the high temperature at which the bottles were kept in the tester. I first called attention to this point at the convention of the Wisconsin Dairymen's Association in Feb., 1900, and turbine testers manufactured of late are not subject to this error; the cover of the tester is now generally provided with holes that can be opened and
shut at will, and the upper compartment of the tester is only moderately heated by the steam that drives the revolving wheel of the tester. The temperature at which the tests should be read off has a wide range, viz. 150–120 deg. F. If the temperature goes above 150 deg. the readings will be too high on account of the expansion of the fat, and if it is lower than 120 deg. the column of fat will begin to solidify so that no sharp readings can be taken.

Composite samples should be kept until the result of the test has been compared with earlier tests. In case of apparently abnormal results, the bottles can then be warmed up and read over again, so that it may not be necessary to repeat the test. The tests of milk from the same patrons will vary greatly from week to week at best and the operator should not report a test that looks suspicious until he has satisfied himself as to the correctness of the test by a second reading, or better still, by a retest of the composite sample.

The testing of the whey does not offer any special difficulties. Whey contains only six to seven per cent. solids, of which .2–.3 per cent. is fat and the rest largely milk sugar. The sulphuric acid therefore readily dissolves the non-fatty solids and the fat is forced into the neck of the test bottles on whirling these. A small column of fat is generally formed, extending clear across the surface of the liquid in the neck of the bottles; if there is not enough fat in the whey to do this, it is necessary to use a double-neck skim milk bottle for making the test. As is the case in testing skim milk the readings with these bottles should be increased by .05 of 1 per cent. to correct for the small amount of fat which will always remain suspended in the acid—whey mixture, owing to the minuteness of the fat globules. When tests are made in ordinary Babcock test bottles a similar amount of fat remains in the bulb of the bottles, but a liberal reading is always taken in using these bottles, viz. from the bottom of the column of the fat to the top of the upper meniscus, not to the middle or the bottom of the upper meniscus. Tests of whey, as well as skim milk, are preferably made in hot testers so as to facilitate the separation of the fat. In case of these by-products
a hot test is no disadvantage as the amount of fat separated out is so small that its expansion at a high temperature has no apparent effect on the reading of the tests.

As is well known, cheese can also be tested for its fat content by the Babcock test; it is necessary to procure a small sensitive scale, a so-called cream scale for this purpose, and also some cream bottles, so that a good-sized sample may be weighed out. I shall not here take up time by giving details of the method of procedure in testing cheese, as it can be readily found out from "Testing Milk and Its Products."

It is as important to the cheese maker as to the creamery man to have the confidence and good will of the different patrons and a correct system of testing of the milk will go far towards securing for him this attitude on part of the patrons. A good plan to adopt is to encourage patrons to be present when the testing is done and to freely discuss the results with them. If the accuracy of a test is drawn into doubt, make it over again in duplicate and do not accept the results until both your patron and you are satisfied as to the correctness of the test. Mistakes will happen to the most careful ones;—even Jupiter nods. Errors may come in sampling as well as in testing. It is no disgrace to make an error, but when it does happen we owe it to ourselves and to our business enterprise to see to it that it is rectified.

The main source of error in sampling comes from insufficient mixing of the composite sample or careless handling of this during the testing period. In the former case the cream formed on the sample is not thoroughly incorporated in the milk through careful pouring from one jar into another, and the sample drawn will not contain the right proportion of cream to milk. In the latter case, the composite samples have been handled roughly as new portions of milk are added, so that by the end of the testing period fine butter granules will on close inspection be found floating in the sample, or the inside of the jar will be covered with patches of dried up cream which cannot again be incorporated in the sample, except with great difficulty. A too low test is the inevitable result of these conditions.
Every time a new portion of milk is added to the composite sample jar, this should be given a gentle horizontal rotary motion, so that the cream formed on the milk may again be evenly mixed with it and will not stick to the sides of the jar. The condition in which the composite samples are kept speak eloquently of the care which the maker gives to his work. Unless proper care is taken in handling and sampling the composite samples, satisfactory tests cannot be obtained; nor can justice be done to the different patrons.

Errors in testing may come from two sources: first, the strength of the acid, or the temperature of the milk or acid is not right, and second, the tester is not run at a sufficiently high speed. The action of acid of different strength on milk is well known to persons who have had some experience with the Babcock test. The proper strength of the sulphuric acid to be used in the Babcock test is 90–92 per cent. Fortunately the commercial acid which is manufactured on an immense scale in this country and abroad, and used for numerous industrial purposes, has this strength as it comes to us in carboys or is bought at drug stores. Acid of this strength has a specific gravity ranging between 1.82–1.83. If the specific gravity falls but slightly below 1.82, it is still possible to obtain a satisfactory test with it by using a cubic centimeter or two more than the usual quality of acid, or by warming the milk to be tested to about 100 deg. F. Acid which is too weak, of a specific gravity below 1.82, will not give clear readings, there being always formed more or less of light curdy or brownish matter either in the column of fat or directly below it, where such acid is used. By warming the test bottles containing the samples of milk, preferably by placing them in some lukewarm water for a few minutes, the action of the acid is intensified and the casein of the milk all dissolved in the sulphuric acid; result, a clear test.

If the test comes out cloudy so that it is difficult or impossible to get an accurate reading, the best plan to follow is to let the bottles cool until the fat solidifies and then heat again; the curdy flocculent deposit will then generally be separated out and a sharp reading obtained. Acid from a recently opened
carboy which is all right at first, may later on become rather weak owing to absorption of moisture from the air. Satisfactory tests can then only be made by using a somewhat larger quantity than prescribed, or by warming the milk samples slightly prior to adding the acid. When anything is the matter with the acid in the factory the trouble is generally that it is too weak. Too strong acid is rarely met with; if a new lot is found rather strong, the difficulty may be easily remedied by using a couple of c. c. less than the normal quantity, and after a while it will absorb enough moisture from the air so as to be of normal strength and make satisfactory tests when the ordinary amount is added. It is much the safer way to weaken a rather strong acid by leaving the bottle uncorked for a time, than by pouring the acid into a little water; water should never be poured into concentrated sulphuric acid, owing to the danger of explosions that may result.

I mentioned before, that the results obtained by the Babcock test may come too low because the tester was not run at a sufficiently high speed. This is of so much the more importance as the results of such tests to all appearances are all right, and the only way to ascertain whether or not the readings are correct is by making another test and running the tester at a higher speed. Unless the operator keeps the tester well oiled and sees to it that there is enough steam on to run it at the required speed, all efforts in other directions to secure a correct test will be in vain. After he has used a tester for a time and becomes familiar with the particular hum it makes when run at the right speed, he will readily discover when it does not run fast enough, by the noise it makes, and will consult the speed indicator which all good turbine testers now on the market are supplied with.

It may seem unnecessary to say that all tests must be read correctly, just as they come, without shading or "doctoring." There is, however, considerable evidence, and still more suspicion, abroad in the land that correct tests are not always given in some factories. Any practice of doctoring tests will be sure to bring its punishment on the guilty party. Competition between different factories in some cases has been responsible for
changing the reading in upward direction, while a lack of competition has in other cases tempted the operator to read tests low. Both practices are, of course, equally reprehensible, and if persisted in, will be ruinous to the good name of the operator and his enterprise. A correct test is a fundamental requirement in paying for the milk delivered by different patrons on basis of the quantities of butter fat contained therein. As Babcock tests become more generally used on dairy farms, as dairy farmers become better educated, and especially better informed as to the quality of the milk produced by their cows, it will be more difficult for the factory operator to sway from the path of righteousness by not giving a patron full credit for the fat content of the milk he delivers, or by giving some more than the credit due them at the expense of other patrons.

A well-informed, intelligent cheese maker may easily render the patrons of the factory, and thereby the whole community in which he resides, invaluable service by assisting them in agricultural and dairy matters, by acquainting himself with the conditions under which the farmers are working and giving such advice as he may be able to offer, as to the conduct of the dairy in the various phases, of the production of the milk, as to system of feeding the cows, necessity of care in milking them, caring for the milk prior to delivery at the factory, testing the milk from individual cows in the herd, etc. If he is not able to give advice he may be able to refer the patron to somebody who can do so. The various experiment stations and different divisions of the U. S. Department of Agriculture every year send out a large number of publications on dairy topics that are of the greatest value to milk producers. By being on the lookout for such publications and applying in time to the director of the experiment station or the Secretary of Agriculture at Washington he may often secure enough copies of these to supply each of his patrons with the bulletin. A couple of months ago a bulletin was, for instance, published by our experiment station showing the importance of thorough milking and the losses that may be sustained on the farm by not sufficiently careful attention to the work of milking. If the teach-
ings of the bulletin were heeded it would be worth several million dollars every year to the farmers of our state alone. Quite a number of creamery and cheese factory operators have been supplied with copies of this bulletin for their patrons, upon request, and we will gladly send other operators copies for distribution among their patrons, so long as the supply on hand lasts.

The factory operator can well afford to test, free of charge or at cost price, samples of milk from individual cows of the patrons, provided he instructs them properly as to how to take samples of single or several milkings. There is abundant testimony on record showing that an improvement of the herd will result from the testing of the milk produced by single cows therein. It is out of the question for most of the small general farmers, or even most of dairy farmers, to do their own testing. They do not know how, for one thing, and even if they did, the expense of buying even a small tester, the handling of corrosive acid, or the time it takes to make tests, would debar most of the farmers who keep only a small number of cows, say less than a dozen, from finding out anything about the quality of the milk produced by their single cows, unless they can get the testing done at the factory at a normal charge or free of charge. Most of the farmers of this class do not see the need of making tests of the milk from single cows and it is, therefore, necessary for some one to show them the importance of the work, to demonstrate to them, as can be done with but little trouble by weighing and testing the milk, that some of their cows are not worth keeping, as their production of milk and butter fat does not pay for the food they consume, while others will give ample returns for extra feed and attention. The factory operator, if he has studied his business and keeps well informed, can more easily assist in this work of agricultural and dairy education than anyone else, as he stands close to the farmers and has daily opportunities to talk over matters of mutual interest with them. Both he and the patrons are interested to an equal extent in improving on present conditions. By getting more butter and milk from the cows the product of the factory will be increased. More milk means more money to the farmer and more business
to the factory; therefore, higher wages to the operator. But over and above this consideration comes the satisfaction which the operator will have, of having done what he could to make himself useful to the patrons of his factory and thus contributed to advancing the interests of the community where his lot is cast.

**DISCUSSION.**

A Member: I would like to ask whether Prof. Woll considers that the yield is proportionate to the fat?

Prof. Woll: As I said in the paper, the payment by test is, according to the testimony of American dairyists generally, the most equitable method of settling with the patrons. You ask if the yield was proportionate? I am constrained to say that it probably is not quite proportionate with very rich milk, but in ordinary factory practice the range in the fat contents of the milk will not be much over one per cent., say between 3.1 or 3.2 to 4.2, it will be about one per cent., and in those limits the yield is just about in proportion to the per cent. of fat which the milk contains.

Mr. Michels: I would like to ask the Professor what he thinks about the plan I have heard discussed last summer, where they want to add 2 per cent. for instance, to all fat, and then divide that on the whole?

Prof. Woll: That method of payment was suggested seven years ago by Prof. Dean of Canada. So far as I am aware, the method has not received the endorsement of Prof. Robertson, of Canada, or any of the dairy scientists who have studied the matter. I am not aware that the method has increased any in late years. However, Prof. Dean will be here this afternoon and tomorrow, and I think it is only just to him to let him explain that method himself. Personally, I do not believe it does justice to the different patrons, as is done by paying by the test of strength, and this is the opinion that is held by Dr. Babcock, for instance, as you will see by the Poster Bulletin I handed you, and Dr. Van Slyke, of New York, and other Amer-
ican Experiment Station people who have studied this question.

Mr. Michels: It seems to me it is even more than that, it is giving a premium on poor milk for the man who delivers it. I have one factory in particular where the patrons have been talking about it, and I am glad to get this opportunity of talking over these points, so that I can speak to them with some authority.

Prof. Woll: That is the situation at present, as far as I am aware, that method is used to a very limited extent. Mr. Millar of Canada told me this morning that only 5 per cent. of the Canadian factories use the method, and it has not, as I said, been adopted by more factories of late years than it was shortly after it was published, so it seems to me that that speaks eloquently as to the practice of the system, it is not as just a system as paying for it on the fatty strength, in my opinion.

Mr. Aderhold: On this question of adding to the actual per cent. of fat, I saw an article in one of the dairy papers by Mr. Monrad, who took up that question, and he figured out, I do not remember the figures, but he showed plainly that if there was anything added to the test, a man by watering his milk would get paid for part of the water that he put in. That is one thing that we ought to consider in this connection.

Mr. Michels: In other words, the operator is offering a premium for poor milk, the patron will get pay for the watered milk, whereas by the straight test they do not get anything for the water that might be in it.

Mr. Anderson: As I understand the situation at present, it is not many that claim a proportion on the yield to the butter fat in milk in cheese making. It was said that we lose in proportion of that yield from rich milk. But now comes the trouble, we do not get any more for this cheese that is made from 4 per cent. milk than we get for cheese made from 3 per cent. milk, and in fact there may be as good cheese made from 3 per cent. milk as from 4 per cent. milk.

(Cries of No, no, no, no.)

Mr. Anderson: Well, now, I know anyway there has been cheese sent to the Wisconsin State Fair made from 3 per cent.
milk which scored 97, and I call that good cheese. Now to pay straight by the test in cheese making, that means like this, one patron may get a dollar per hundred for his milk, another gets 75 cents for his, and there is no such difference in the yield. I know that by my own experience and by the reports on milk at the dairy schools; these reports are usually good text books. There is the report of about 350 dairy students; the yield of cheese through the whole season, according to the tests, of one pound of butter fat in 3 per cent. milk was 2.95 lbs. of cheese; and in 4 per cent. milk 2.50, and the average yield for the season was 2.63 pounds of cheese to one pound of fat. That shows plainly that we did not get yield in proportion to the butter fat in the milk. That is what I meant, but that will be all right if we would get extra pay for the cheese made at the extra expense, but if we do not do that, I think the right way is to use the Babcock test, that is all right, but use that as a basis to figure out the yield. It is just as fair to pay the yield in cheese making as it is to pay by the yield in the creamery. Now I think it is impossible to get yield in proportion, because I think there is just as much caseine in 3 per cent. milk as there is in 5 per cent. milk.

Prof. Woll: There is some rich milk that has 5 per cent. fat.

Mr. Anderson: Now I saw some figures given by a doctor in New York state; he said his figures represented results from 140,000 analyses of milk, and he gave the per cent. of solids and water in the milk from different regions, he gave the average per cent. of Jersey milk to be 5.21, in Holstein he gave the average per cent. of fat 2.88, and those extremes contained exactly the same amount of protein; he did not give the caseine separate.

Prof. Woll: I believe the gentleman is mistaken in regard to the interpretation of Prof. Jordan's figures. It is certainly a fact that the richer milks have a higher per cent. of solid not fat and a higher per cent. of caseine. I have here a compilation of about all the analyses of milk from pure bred stock that I could lay my hands on. This was published in the last annual report from our experiment station, and the average of
nearly 500 samples of Jersey milk gave the fat at 4.98, the solids not fat at 9.55; now take the Holstein,—679 samples gave 3.28 fat, and 8.61 solids not fat. I need not give you any other figures on this. It shows that the milk high in fat has a high per cent. of solids not fat, and that is certainly the result of our analytical work along that line. There is one point that we want to bear in mind in discussing the question of yield of milk of different richness, and that is this, that the experiments that have been made, as shown by the poster bulletin and card I have handed out, I made my skim milk one per cent. milk, then 3, 4, 5, and 6 per cent. milk and the yields from those. Now that is the theoretical question. The practical question is this, Does the herd milk as it comes to the factory vary, and how much does that vary, and what are the yields of cheese from milk of that character, and as I said before, the variations between milk delivered at different factories by different patrons rarely exceed one per cent., so that the question comes, does the yield increase in the same ratio within that limit, and I then on that proposition maintain, as I said before, that the yield is very nearly up to the proportion shown by the fat.

Mr. Aderhold: I have a little bone to pick with the gentleman; he referred to something that came from Prof. Decker, I believe, as to the yield of cheese from rich milk and poor milk, 2.95 from 3 per cent. milk, and 2.50 from 4 per cent. milk. Those are the figures he gives in his book on “Cheddar Cheese Making.” Now, I have noticed those figures and the way Prof. Decker got at that was, he took it from the reports that the students had been sending in, and it covered probably many thousand reports from the different factories, and it furnished the basis of material for demonstrating what the yield of cheese is per pound of fat in factories, but I considered that Prof. Decker’s construction was fallacious or unpractical, because the poorer milk, the 3 per cent. milk, was a little better than 3 per cent.; we get it in the spring of the year only, our factories shut down in the winter, the cows are all fresh in the spring, and that is the time when we make what we call the “hurry-up” cheese. We are not working that milk normally as we do in the summer.
We are not trying to make a cheese that has got the body to it that a good cheese ought to have. We are making a cheese that has got an abnormal yield, an illegitimate yield, and that is why he gets those figures, that is why the yield shows up to the better with poor milk than it would show up if we tried to make as good cheese as we make later on, and for that reason that construction was not practical. I just wanted to explain this, that that is an illegitimate yield; then again, when we have the richest milk, which is in the fall of the year, milk will run in Sheboygan County 4 per cent. fat. The fat will average up in Manitowoc and counties around there, as high as 4.5 and 4.6; farther north in the newer county it will be higher than that. Now, there again, the construction is unpractical; that is the time when we hold milk over, we make it up every other day, sometimes twice a week only. Now, you all know that old milk will not yield quite as good as it would if it were made up every day. The construction all through on those tests is unpractical and really needs explaining.

Prof. Short: They say that nothing will lie like statistics, and when a man has figures he always tries to show something by them. Now, Mr. Anderson is right in some respects and Mr. Aderhold is right in other respects. But the point comes in there, when you say how many pounds of cheese you are going to get from a certain per cent. of milk, you are introducing a decided fallacy. You carry that out to a legitimate conclusion, to say that a 4 per cent. milk will yield ten pounds of cheese per hundred, you begin to run your fat down, and you get a skim milk cheese, and the minute you do that and you find out that your relation of fat to cheese is high and for every per cent. you add to that you increase wonderfully the amount of cheese and you decrease the fat, you add wonderfully to the amount of cheese per pound of fat. If you run up the other way, you run it up richer still until you get to a point where you simply have no cheese at all, no yield at all to the amount of butter fat, therefore you cannot always say that a pound of butter fat will give so much cheese. I think you go to extremes, and the same fact is apparent from the figures quoted, your fat
increases a great deal more rapidly than your caseine, and the relation of percentages between the two cannot be established.

Mr. Luchsinger: The Professor's paper seems to demonstrate to a practical man two things, that if we have the conditions, the temperature proper, the acid is strong enough and the motion of the test is just right, the Babeck test is a reliable test for testing the amount of butter fat in the milk, but if those conditions are not just right, it is a very unreliable test, and that accounts for the great number of complaints that are made in cheese factories by patrons who cannot understand that at one time their milk will test so much and perhaps in two or three days or a week afterwards, it does not test near that much, so I think the practical application of the Professor's paper is this, that every one using a test of that kind should see to it that the conditions are just right. If the temperature is too high, as the Professor's paper says, the readings are higher, the butter fat expands, just as almost any other substance expands, by the heat, and the factoryman or the creameryman is deprived, is wronged, he has to pay for more butter fat than there actually is. If it is too cold, then the patron is wronged, unintentionally. It has demonstrated those things to my satisfaction. Now, as to the question of paying at the cheese factory according to the test, I am inclined to doubt whether it is the proper way, according to the butter fat test. There have been instances in which prosecutions were brought for watering milk brought to cheese factories, and the Babeck test showed that there were 3 per cent. and perhaps a little more of butter fat, and the person who brought the milk escaped punishment. Now, if the milk originally tested 5 per cent., and the man put enough water in to bring the test down to 3 per cent., he would comply with the present law, and yet the cheese maker would be defrauded, he would not get the amount of solids other than fats that he should have in the milk and therefore I think that in addition to the Babeck test, the lactometer is a necessary instrument to have in a cheese factory, and a knowledge to use it in any way you can to demonstrate and prove the amount of solids contained in your milk other than fats. That question
to test milk by the Babcock test alone in the cheese factory is unfair, is not the proper test, is not a correct test, and the factoryman is very liable to be defrauded in the way that I have indicated. Where a man's cows test high, he can water his milk and still escape punishment and detection.

Mr. Noyes: I have in mind at present a test made by Dr. Van Slyke of fifty different herds of cattle. I studied that thing a little, so that I remember it, and the range of fat was from 3 per cent. to 4 1/2 per cent., and in those tests he found that when butter fat went up one fourth per cent., the caseine went up one tenth per cent. right straight. Now, it seems to me that is a pretty good demonstration, and they were a mixed herd of stock, such as we have at our factories, there were not any full-blooded herds in that test if I remember, and while we have got to have some proper, correct method in the factories, a man has got to weigh his fat just as well as to run the Babcock test right, in order to have it right, and I think the Babcock test is the nearest right, while it is not absolutely correct, I think it is the nearest test we have had yet. I will say this further, we have not one factory in our section, but what tests by the Babcock test. I had the pleasure of looking over the figures of those factories for six months, and we found the man who paid off by the test on an average paid his patrons fifteen cents a hundred more than he had done paying per pound of milk. Now, that demonstrates that there was something wrong in that factory, the patron did not get as much as he should have, and it is the general thing, wherever the tests have been put in, we get better yield right along, we have in all of our factories, than we did before. While it is not just exactly right, I think it is the nearest right of anything we have ever had.

Mr. Michels: I would like to ask Mr. Luchsinger where he thinks the patron is going to gain by adding water to milk, because it will decrease the solid not fat as well as the the fat. I do not see his point, he only gets more weight, that is all I can see.

Mr. Luchsinger: This was the case where the milk was
bought by the weight. If the patrons sell the milk by weight, they get paid for so much more water.

Mr. Michels: Yes, but the test will be so much lower on the solid not fat.

Mr. Luchsinger: If he comes within the law, if he can keep his milk at 3 per cent., a 'trifle over, he escapes punishment, and he gets paid for so much water, and the cheese maker does not get as much cheese out of the milk as he should.

Mr. Michels: That is a good argument for paying by the test, is it not?

Mr. Luchsinger: A good argument for paying by the test, and most of the cheese factories do not pay by the test; creameries do, but cheese factories pay by the pound.

Mr. Michels: I would like to ask Professor Woll what the tests on cheese are for butter fat between, sa, 3.2 and 4 per cent., or, say, 3½ or 4 per cent. What are the differences in the contents of the cheese as to fat?

Prof. Woll: I do not know that I can give you definite figures about that. Full cream cheese will contain considerably more fat than cheese made from milk that has been partially skimmed, but I have not now the figures in my mind. There is quite a rapid decrease in the per cent. of cheese made from milk with decreasing fat contents and corresponding to the decrease in the fat contents from increasing the water contents.

Mr. Michels: The question comes up right there that they can sell cheese that is made from milk containing 3½ per cent. of fat, and it will bring as much upon the market as 4 or 4½ per cent. of fat. That is the question I am trying to get at, and it seems to me that there could never be much difference in the amount of 100 pounds of cheese made from such fat.

Prof. Woll: There is quite a difference, the yield is in proportion to the fat contents.

Mr. Michels: Mr. Anderson brought out the question that he could sell his 3 per cent. cheese for as much money as his 4 per cent. cheese. I think the gentleman may be all right, and if it is true what you told us, that the cheese yield was nearly
in proportion to the amount of butter fat in it, why, then the 3 per cent. cheese would have nearly as much fat in it as the 4 per cent. would, and it ought to test as about as good a cheese.

Mr. Aderhold: I would like to ask Mr. Anderson about that. Was that cheese exhibited at the State Fair made from 3 per cent. milk?

Mr. Anderson: It came from two factories that generally have 3 per cent. milk. It was made in the summer.

Mr. Aderhold: Probably July or August. I do not believe they would get a 3 per cent. milk in July or August. I know something about how milk runs in the factory.

Mr. Noyes: I know that cheese made from different per cent. milks sell exactly the same, and I will say now, we ought to work together with the cheese buyers on this question. The cheese buyers ought to tell their opinion in regard to the quality that the cheese ought to have. If they can pay more for rich cheese, it is all right, but if they cannot, then I would say it is an injustice to the low test man to pay straight by the test. Of course if we can get higher prices, it is all right. But I do not think the buyer can do it, because the making of the cheese costs more than can be made up for by the higher test.

Mr. Arnold: I want to ask Prof. Woll a question on the strength of acid, I want to know whether the acid is always satisfactory for testing, that is, as regards strength, if the specific gravity is right and the acid is clean otherwise.

Prof. Woll: I should say yes; I have had no occasion to doubt that that is so. We have always had good tests with acids that had the correct specific gravity. I may say in regard to the matter that was brought up by Mr. Luchsinger in regard to 5 per cent. milk and reducing it to 3 per cent. milk. A patron that would do that would be within the law as the fat itself is concerned. The law specifies that the milk shall be delivered to the factory as produced by the cow, and if the cow produces 5 per cent. milk, he has to bring it to the factory as 5 per cent. milk, and he cannot add water to reduce it to 3 per cent. The law covers that point perfectly, and the Dairy and Food Commission in their work of testing milk at factories al-
ways take into consideration the yield from the cow as well as the per cent. of fat in the milk, and there will be no difficulty in establishing the adulteration of 5 per cent. milk in bringing it down to 3 per cent. by the addition of water.

Mr. Luchsinger: The Professor is perfectly right, the law provides that milk be brought unadulterated and undiluted to the factory; a man is liable to punishment if he is detected. Now, the point is, how shall we detect it? You cannot do it with the Babcock test alone, in my opinion, you must have a lactometer also to detect the amount of solids other than fats, and I think the point I tried to make was that the Babcock test alone is not sufficient in a cheese factory where the milk is bought by the weight and not by the test.

Mr. McKinnon: One difficulty in paying by the test up in our section of the country is that a large per cent. of our cheese makers are not qualified to manipulate the test. It requires some skill, it requires good eyes and good judgment to manipulate that Babcock test and get it to work thoroughly. Now, we have been discussing up in our section of the country the advisability of having some persons appointed, elected or chosen in some manner that are qualified to make the Babcock test and go around as these cheese instructors are going around from factory to factory to make those tests. Perhaps we could get better satisfaction in that way. In paying straight by the test, we have not been able to reach the results that it appears you have reached in other parts of the state. A few years ago I undertook to pay straight by the Babcock test, and I ran that way for two years, but it was quite unsatisfactory, and, in fact, I was losing my patronage, consequently, when I heard about this idea of adding two per cent. to the milk and testing in that way, I concluded that I would adopt that system, and I adopted that some three years ago and it has given entire satisfaction.

Mr. Michels: I would say to Mr. McKinnon that I have been paying by the straight Babcock test for the last eleven years, and it has given entire satisfaction.

Mr. Noyes: I put in the test and ran it for a few years, and it will be impossible to pay in any other way now.
Mr. Michels: I think if Mr. McKinnon had kept on one year longer, it would have been all right.

Mr. McKinnon: I would not have had anything to test.

Mr. Hort: What class of patrons did your complaints come from, those that brought the high class milk, or the low?

Mr. McKinnon: When one man is receiving a dollar a hundred for his milk, and his next neighbor is only receiving seventy-five cents, as a matter of course the man that is receiving seventy-five cents is the one that makes the complaint.

Mr. Noyes: Is it right for that seventy-five-cent man to take part of the other fellow’s money?

Mr. McKinnon: No, but it is right that that man should receive pay for every ounce of cheese that his 3 per cent. milk makes. It is also right that that man should receive every cent that is due him out of four per cent. milk, but he should not receive any more. Now, we are all aware of the fact that there is no such difference as twenty-five cents on a hundred pounds of milk made up into the average cheese at the present time.

Mr. Noyes: I beg to differ. Take those figures right there, that is cheese made from patrons’ milk; take the price of cheese and the yield and it will make more than that, it will make thirty-five cents per hundred, right in the manufacture of patrons’ milk just as they deliver it to the factory and made into cheese. How do you account for that?

Mr. McKinnon: We do not find in our section of the country that as milk increases in richness the cheese increases in yield. I am not very well posted on these different figures, I think I am posted on general results, and the 3 per cent. milk will give you perhaps nine pounds of cheese out of one hundred pounds of milk. If it ran on until you get four per cent. milk you get about ten pounds of cheese out of one hundred pounds of milk. That is about the way they run, and there is no such difference as twenty-five cents per hundred pounds. Do you claim, Mr. Noyes, that you are going to get two pounds out of the difference between 2 per cent. and 4 per cent. milk?

Mr. Noyes: Well, 2 per cent., yes.

Mr. McKinnon: You do not know whether you do or not.
We do not so find it. There may be difference in localities, but we do not find that the yield varies so much on that as they do in other parts of the state, and while we are perfectly willing that you in that section of the state should adopt this Babcock test and pay straight by the test, we in our section of the country must consult our own interests and pay by the Babcock test, with 2 per cent. added, or we will pay on some other plan that we deem to be strictly in accordance with justice with us.

The Chairman: Yesterday it was with pleasure that we sent a fraternal greeting to our brethren in Ottawa, Canada, who are holding their annual convention, and this is their reply:

Ottawa, Ont., January 7, 1903.
W. C. Dickson, Esq., Prest. Wis. Cheese Makers Ass’n., Milwaukee.

Eastern Ontario Dairymen in Annual Convention assembled at Ottawa, desire to reciprocate your kind greetings and best wishes for a successful and instructive meeting.

D. Derbyshire, Prest.

The President then introduced to the convention Mr. A. J. Decker of Fond du Lac, who extended a cordial invitation to all the members to attend the annual meeting of the State Dairymen’s Association, to be held at Fond du Lac February 11-13, 1903.

Secretary Baer: Mr. President, I have a letter of greeting from Congressman S. A. Cook of Neenah, Wis., who is at present at Alexandria, Ind., on business, also a telegram from Mr. D. W. Willson, editor of the Elgin Dairy Report, Elgin, Ill. They read as follows:

Alexandria, Ind., Jan. 8, 1903.
Mr. U. S. Baer, Secretary Cheese Makers’ Association, Milwaukee, Wis.

My Dear Sir: I wish that I could have the pleasure of dropping in at your annual gathering this week in Milwaukee, where much information can be obtained and much good accomplished for the cause for which the Association labors. Busi-