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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in its transactions.

Multiple Inspections — A Tower of Babel

Milk inspectors through their health boards should take steps at once to correct the intolerable condition of multiple inspection by different agencies, each requiring the milk producer to conform to their own requirements. This causes confusion, misunderstanding and disrespect for official control. There is a common ground upon which all may meet, settle their differences and proceed with a united front to the mutual benefit of all. After all the fundamentals of dairy sanitation are simple and easy of application. The farmer and the public are not interested in the whims and personal differences of milk inspectors. They are or should be interested only in producing and consuming clean, wholesome milk.

Some States have taken steps to correct the confusion arising from multiple inspections. The Michigan Dairy and Milk Inspectors Association at their last meeting made plans to correct this condition. A survey revealed that some dairy farms were inspected by no less than five official agencies each with their own ideas. The result was confusion. The farmer lost respect for all of them because he knew that they all couldn't be right. Steps were taken to correct this condition by the appointment of four committees, the chairman of each being a member of a coordinating committee so that their work would be synchronized. The set-up is as follows:

I. Coordinating Committee

(a) Dairy Plant Standards Committee
(b) Dairy Farm Standards Committee
(c) Ice Cream Standards Committee
(d) Creamery Sanitation Standards Committee

It is hoped that in time the Association can recommend an ordinance or rules and regulations which will serve as a model for all, thereby ending the confusion which now exists. Let there be no Tower of Babel in milk sanitation.

F. W. F.

The Pacific Northwest Association of Dairy and Milk Inspectors

The Journal family of associations of milk sanitarians continues to grow. The action of the Pacific Northwest Association of Dairy and Milk Inspectors in designating the Journal of Milk Technology as its official organ raises this number to thirteen—with others pending. Their Secretary-Treasurer, Mr. Frank W. Kehrli, writes that the interesting convention talk given by Professor C. C. Prouty of the State College of Washington on "A Survey of Recent Literature on Milk Sanitation" made reference to so many articles published in the Journal of Milk Technology that an active demand has arisen for back issues. A plan is under development for circulating these earlier numbers among the members particularly interested. We cordially welcome this new group of milk inspectors into the great family. Their contributions to dairy sanitation and technology will be welcomed by the growing number of readers of the Journal here and abroad. We salute the Oregon - Washington milk sanitarians!

J. H. S.

California Association of Dairy and Milk Inspectors

The California Association of Dairy and Milk Inspectors has voted to designate the Journal of Milk Technology as its official organ. This influential group will bring strength to the Journal family of associated organizations. For a long time, California has been a leader in the field of milk sanitation and technology, particularly in that of ice cream. Its contributions to public health and the milk industry have been substantial, and we welcome the opportunities afforded by this new relationship to publicize this work internationally.

J. H. S.

Midwest Regional Conference on Dairy Problems

A conference of legislative and technical representatives of several midwestern dairy states was held at Chicago, Illinois, October 6th and 7th, at the request of the Council on State Governments. It was stated that the exportation of sweet cream to hitherto lucrative markets in the East was being curtailed by restrictions that purported to protect the public health but which instituted unsurmountable barriers to interstate trade in milk and cream. However, the conference held that before any presentations could be made effectively to the East to relieve this situation, it was necessary for them to set their own houses in order by providing uniformity of standards and adequacy of effective supervision.

Committees recommended desirable standards of herd inspection in conformity with those of the Public Health Service Ordinance and Code, January, 1939, insofar as these are available, and drew up a series of qualifications for the training of personnel.

Copies of the proceedings can be secured by writing Mr. Frank Bane, Executive Secretary, Council of State Governments, 1313 East 60th Street, Chicago, Illinois.

Milk Cans and Pails *

H. T. Coates

Purchasing Agent, Dairymen's League Co-operative Association, Inc., New York, N. Y.

The milk can and milk pail are, to many people, including some farmers and milk handlers, simple utensils in daily use, such as tablespoons, pitchforks and shovels. You who are responsible for the sanitation of milk, however, know that they may be a great source of trouble, and that the manner in which they are constructed is very important.

I propose to analyze the construction of these utensils, point out their weaknesses, and show the efforts being made to overcome them. Because I believe that the can is more of a problem than the pail, I expect to devote most of my time to this. In order to explain some of the difficulties, I should remind you briefly of some points in the history of the development of the milk can.

EARLY TYPES OF CANS

The milk can came into existence a good while ago, the approximate date of which is unimportant to this discussion. The wooden churn was, no doubt, the forerunner both for farmer deliveries and for shipping. Cans were made by the local tin smiths and were naturally crude and varied in design. When the stamping companies took up manufacturing cans, they did not at first make whole cans, but furnished stampings for the various parts to be soldered together by the local tin smiths.

Some of these early cans had the breast made in two or more pieces to be fastened together in vertical soldered seams. The lip was pressed as a separate ring, the cylinder riveted together, and various styles of bottoms used. These cans were the possessions of proud owners who took great care of them. When the industry grew to such an extent that there were thousands of these in daily use, individual care could not be exercised and the handling became steadily rougher, especially on the railroads, by men who did not realize the frailties of the can nor the costliness of repairs and replacements. Fortunately, the can has developed to withstand the increasing severity of the service.

By the year 1920, the milk can was fairly standard as to shape, varying somewhat in different localities. I shall confine these remarks to what is known as the New York pattern can.

The can in 1920 was made of 11 pieces: the lip, the wire around the edge of it, single piece breast, cylinder, bottom, two handle clips, two drop handles, breast hoop and bottom hoop, riveted and soldered together. A year or two later, the lip and breast became one piece, but otherwise no change.

The lip at that time was rather large, varying considerably with different makes. In some cans, the edge was rolled, leaving an annular hollow space; in others, a no. 6, or lighter, wire was rolled into it. The method of rolling was not sufficiently accurate to insure the ends of the wire butting together, there being, at times, a gap of 1/8" to 1/4". The bead so formed was not always tightly closed. The breast hoop was held in place by shrinking to the breast and being, to some extent, soldered.

The handle clips were riveted in place, the breast was soldered to the cylinder, the cylinder was rolled from one sheet and riveted together in a vertical seam, the bottom was flanged and held in place

* A paper delivered before a meeting of the New York State Association of Dairy and Milk Inspectors at Syracuse, New York, on September 29, 1939.

by four rivets which held the bottom hoop as well. All joints were soldered. The manner of fastening these parts together was, to say the least, very frail, and it has always been a surprise to me that so many of these cans remained in service for a considerable number of years. It is true that many handle clips came off and were reriveted, many leaks developed and were resoldered, many cracks appeared which did not leak, and the cans remained in service. After all, those that we saw eight or ten years after they had been made were the survivors of thousands that had failed and been discarded.

Improvements were made in riveting and soldering. In a few years, the vertical seam in the cylinder became welded, though even this was not accomplished without many failures, which, however, had a great bearing on future design. When those seams were first welded, it was done with acetylene gas. Cans thus made, often cracked open about ¼" away from the weld due to the unequal stresses set up by the heat treatment and cold working. Furthermore, these acetylene-welded seams were porous, did not take the tin coat well, and most of them rusted in a short time. This was soon overcome, however, by machine-welding. About this time, the handle clips and the breast hoop were spot welded in place, followed a few years later by the sweating of the bottom seam and the welding of the breast seam.

Figure 1 shows at A the construction of the "four piece" can as it was in about the year 1920, exaggerated for clearness. Note particularly the neck lap. B shows the one-piece neck and breast which was a decided improvement. Figure 2 shows the manner in which the can was held together at the seams. Observe what a poor hold the solder has on the steel sheets and remember that the tensile strength of solder is only 6,000 pounds per square inch, one tenth that of steel, only 3,000 pounds at a temperature of 212° and none at 270°, and you will marvel with me that the old can stayed together at all. Some of these joints were better than others. By running the solder down into the joint about ¼", it was much improved, but still left very weak. As can washers were developed, the expansion and contraction due to the tem-

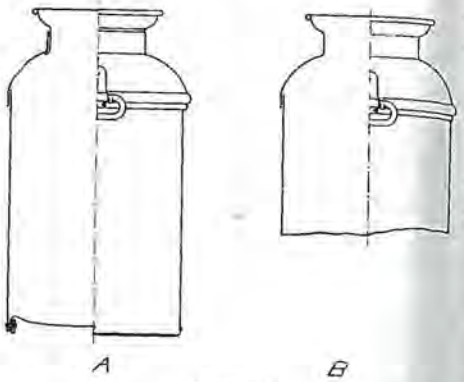


FIGURE 1
"4-piece" and "3-piece" can of 1920

perature changes played havoc with these old soldered seams. Seven or eight years ago when I was examining cans in service throughout the New York milk shed, I noticed a very large percentage with these soldered seams cracked, and inasmuch as the handles were fastened to the breast, more than once these old cans have come apart when lifted with milk in them.

Efforts to overcome this condition were made in two ways. First, by sweating

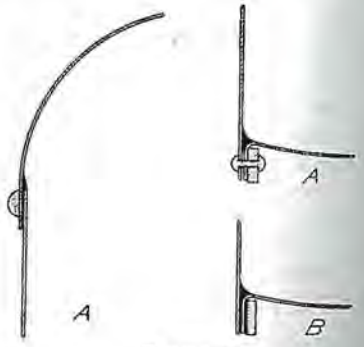


FIGURE 2
Soldered seams

the bottom seam as illustrated at B, and then by welding the breast seam. The welds around the breast seam were quite defective in the early days and some users of cans insisted on the breast seam being sweated with solder instead of welded. Later cans were put out with the bottom seam welded and, as you know, the New York City Board of Health issued an order last year that only cans of the "seamless type" should be purchased.

Before discussing the solderless can, I wish to remind you of certain developments outside of the can which have affected its usefulness and its life. The present day can washer, in producing cleanliness and sterility, has reached a stage that is rather hard on the can, especially when combined with the development in transportation.

TREATMENT OF CANS

Run over in your mind the temperature changes of a milk can on a winter day: When ready to receive the night's milk, its temperature might easily be considerably below freezing. Warm milk is poured into the can, bringing its temperature up to perhaps 95° F. It is then placed in cold water and the temperature lowered to 45 or 50°. In the morning it goes to the plant, is dumped and placed in the can washer, where its temperature rises from 45 to 220° F. in 60 seconds. Leaving the washer at this temperature, it goes into the air which might be well below zero, with perhaps a wind sweeping against one side of the can. Knowing as you do, the way thin sheets of steel expand, contract and squirm under temperature changes, it is easy to picture what great stresses the seams of cans may have to endure.

Now, the can, as you know, is constructed of steel coated with tin. A person would be surprised if he should measure the thickness of the tin coat and observe how thin it is. Tin is also a very soft metal, easily scratched or rubbed away, and when this occurs, the steel underneath rusts in the presence of any dampness. When the hot can comes from the washer, the inside is dry. It is also filled with hot air which is dry, that is, it has a low dew point. If you take a cubic foot of air at ordinary temperature on a rainy day, the dew point is 100, or close to it. In other words, it is holding all the water it can. When you heat that cubic foot of air, you expand its former volume, but it contains just as much moisture. The dew point lowers, because this is a percentage content of moisture based on the temperature and it can absorb more water (which is why hot air can dry things faster than ordinary cold air). This air which is in the can when it leaves the washer was originally the air in the receiving room, which may have had a humidity content of 90 percent or more. By being expanded, it has taken up moisture that was in the can.

Of course, in the operation of blowing air into the can, the content has been changed several times, but the air left in there has probably picked up some moisture, in addition to that which it had originally. As the can cools, this air contracts and would form a partial vacuum if the cover were tight, which it rarely, if ever, is. As it contracts, therefore it draws in air from outside. If it is a rainy day, the air coming in has a humidity content of 100 percent. When the can cools down to atmospheric temperature, it is probably only a quarter full of the original dry air and three-quarters of the wet air that has been drawn in, the combination having a dew point only slightly below atmospheric temperature. Now, if this can is left outdoors in the later afternoon or evening, it cools below the dew point of the air inside it, and this causes condensation on the can walls. The can will remain in a moist condition conducive to rusting until something is done to dry it. Putting it on the drain rack will remove a large part of this water, and consequent air circulation will produce the results if the circulating air itself is not too high in humidity. Many cans are being subjected to rusting atmosphere, and consequently, even a microscopic defect in the tin coating is apt to cause a condition to be condemned as unsanitary.

PRESENT SOLDERLESS TYPE

Solderless cans are of two general designs. In one, the cylinder and bottom are pressed from a single sheet of steel. There is no seam, welded or otherwise, in this. The breast is also pressed from one sheet and the two are welded together. The other type of construction has three welds. The breast is made in one piece, the cylinder rolled out of a sheet and the bottom pressed out of another sheet. These are welded around the breast, down the cylinder and around the bottom, either in an electric welding machine or by acetylene gas flame.

The electric welding machines are of the resistance type, that is, a large volume of current flows into the steel from a copper contact on each side raising the heat to the welding point, and at the same time pressing the sheets together. The early machines were equipped with a device known as an interrupter which broke the circuit very rapidly and produced a series of spot welds which overlapped each other when the machine was running properly. It often occurred that one or more of these spots was skipped. Later, these machines were improved so that they made a continuous or ribbon weld, which usually is about 3/32" wide. This development has taken place in the last few years, and is a big step forward in construction. It is, however, not perfect, and I hope in the next few years, the remaining difficulties will be overcome.

Figure 3 shows the principal difficulty. Either during the welding process or after, the edge of this inner sheet is squeezed out to make a smooth surface. There is a very thin edge which is above the weld. After the can is tinned, this edge is covered and presents a smooth appearance, in most cases not being detected by the eye. When a can is in service, a few heavy bumps on the outside at this point is apt to split this edge away from its position sufficiently to crack the thin film of tin covering it. Then, even though it goes back to its original position, it is attacked by moisture and begins to rust. You frequently see cans with a very thin rust streak around this part, which is due to this condition. It is not possible to weld a thin edge because when the steel is brought to the welding temperature it burns, and once burned, will not weld. Some companies, however, by adroit handling and shaping of these joints have brought the weld up very close to the edge, and I have found some where I could detect no overhanging edge.

FIGURE 3
Early welded seam

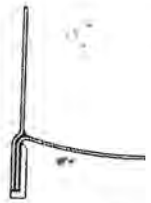


FIGURE 4
Special type soldered bottom.

The solderless can, while very much stronger than the old soldered type, is more vulnerable from this standpoint because in the soldered can all three parts were tinned separately. The joints, therefore, have tin between the sheets which does much to prevent rust. Steel can not be welded satisfactorily after it is coated with tin. Therefore, the solderless can must be made up in the black and then tinned. The process of tinning steel consists of dipping it in the molten metal, then allowing it to cool. When the steel cools to the freezing temperature of the tin, the latter becomes hard. You see, therefore, that the longer the steel remains hot, the more the tendency for the tin to run away, and consequently the thinner the coat. The increased mass of material in the solderless can retains heat longer than the former smaller parts and tin is apt to run thin in one place to accumulate at another one. Because the can's final position was upside down, the coating had a tendency to run thin at the bottom and thick at the neck, whereas we believe that tin thickness does more good in the bottom.

I have recently made some measurements of the thickness of tin coatings on solderless cans and have been agreeably surprised to find that they are now averaging as heavy as the coating on the old soldered can. I think it is also quite uniform.

However, none of these coatings is 100 percent non-porous. All of them have thousands of microscopic holes through the coating. These show up in small rust spots when the can is first used. They are visible to the eye only because the rust color spreads on the surface of the tin. After one of these spots once rusts, it will not rust again because the shell of iron oxide formed is not soluble and the area is so minute that further rust can not take place around the area of the oxide plug. This is what happens when a can becomes "seasoned." Any scratch, however, or disturbing of the tin coating will rust. For this reason, it is not practical to prevent rusting on the outside of the can because this is continually rubbed against concrete curbs, other cans and steel conveyor guides. When a can becomes scratched or rubbed on the outside, the rusty water runs down the surface making the scars appear many times worse. If this is cleaned away, the original luster of the tin shows except right at the scratched or rubbed spot itself.

Many firms manufacturing cans have studied the question of porosity and I am inclined to believe that the present coatings are better in this respect than they were a few years ago.

SPECIAL TYPE OF SOLDERED CAN

There is one other type of can which I would like to mention and I show a section of this in figure 4. This can is welded around the breast and down the side. The bottom is sweated in. The interesting feature of this design is the shape of the bottom part of the cylinder. It is expanded out in such a way that it is resting downward on the flange of the bottom. Any blow, therefore, such as dropping a filled can heavily on the bottom is transmitted directly to the steel so that the solder, with its low tensile strength, does not have to bear this blow. In spite of this not being a solderless can, I believe it has considerable merit and might prove equal to the solderless can in strength. The bottom as one piece and the rest as another, are tinned separately so that here there is no steel surface exposed. This can does not meet the present New York City Board of Health regulations because it is not what could be called a "seamless" type. Nevertheless, I think it might be worthy of consideration.

Referring to the can with the soldered bottom, it is believed that lead should not come in contact with milk, but in this can, the amount of solder exposed is so small that any absorption in the milk would seem to be sufficiently minute to be negligible. As a matter of fact, tin being higher on the electro-chemical scale than lead, the chances are that tin would plate on the lead protecting it from entering solution. I believe there have been some experiments made on evaporated milk in small cans bearing out this theory. It is also true that the bottom of this can can be sweated in with pure tin instead of the mixture of tin and lead composing the ordinary solder. How well this will stand up might be questioned because tin has a melting point lower than lead. It is also somewhat more brittle, and I do not have sufficient data to predict the final results in service.

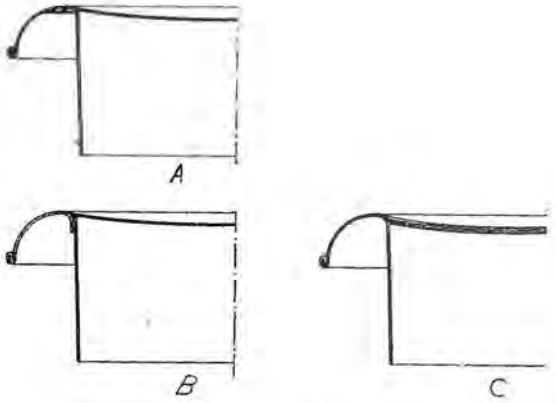


FIGURE 5
Cover designs

STANDARDIZED DIMENSIONS

It is proper here to mention briefly the matter of standardized dimensions, though time will not allow a full discussion of these. To assure the best cover fit and interchangability of covers, it is imperative to have the neck dimensions of the can and cover rim uniform. The International Association of Milk Dealers some years ago issued a standard for the neck, but not for the cover, and set a tolerance too broad in my opinion. Further work is needed on this. I believe the can can be improved by eliminating the lip and developing an outside cover fit.

COVERS

A discourse on the can is not complete without a word about the cover, and I show in Figure 5 sketches of three typical designs. The first one shows the style of cover that has been in most general use for a considerable time. The rim is flanged outwardly and spot welded to the top. The principal disadvantage is that it must be soldered on the inside and this frequently cracks. The next shows the cupped rim and flanged top. The top has an opening in the center and the edges flanged downwardly, the rim being pressed in cup-form and fitted together as shown, being spot welded around the flange of the top. This has no solder inside the cup or underneath the top. The small groove left on the upper side of the top is filled with solder. The third type shown has the cup rim similar to the previous one, but the top is a complete sheet spot welded to the cup, making a double thickness of steel. This requires no solder inside the rim nor on the upper side of the top sheet, but must be soldered underneath the top sheet as shown.

When we received the Board of Health regulations to buy only the "seamless" type, or solderless can, we had bought only comparatively few of them and the ones I had examined carefully did not satisfy me because of the poor welds and the irregular tin coat. However, I am glad to say that in a very few months these conditoins were so much improved that I have felt much relieved.

From what I can see, the solderless can as now manufactured has a life expectancy at least equal to the sweated seam type, and perhaps greater.

CARE IN HANDLING

The life of a milk can depends a great deal on the care of it. It has been accustomed to receiving rather rough treatment. It would simplify our work if we could bring the handlers of milk cans to realize how the life of the can may be extended and sanitation improved by recognizing the short-comings of the can and by treating it accordingly. If it is dropped on the ground, thrown against other cans, bumped against metal railings, given any treatment tending to dent it or even distort it appreciably without making a permanent dent, a crack in the seam may develop, starting rust and leading to early condemnation. If it is allowed to stand with moisture in it or in a moist atmosphere, rust will start, and it will not take a great deal to attract the eye. Even the treatment of the outside coating bears on both the life of the can and its sanitary condition. If it is dragged over the edge of a concrete curb, the sharp particles of sand in the concrete cut through the coating, only about 0.001" thick, and soft, making a scar that rusts and will never disappear.

This is largely a matter of appearance, but it creates a bad impression, and an up-to-date owner would not wish to have a lot of cans coated with rust on the outside even though the inside were perfect. Then there may be some chance of contamination being transferred from the outside into the contents. It is surprising how many farm hands fail to realize what they are doing to a can when they drag it over the concrete curb of a cooling tank, especially one that is four or five years old and made of sharp sand. The owner of a $50 watch will take pride in the luster of the surface. He would not apply coarse sandpaper to it, yet he will give $50 worth of milk cans just as rough treatment or allow his hired man to do so. It is a misunderstanding and needs effort to correct.

Some of the things that tend to make cans unsanitary and shorten their life and can be prevented are dropping off a truck when empty, or setting them down hard when either empty or full; allowing them to stand out in the night air, thereby forming condensation on the inside; sliding them into trucks so that they bang against the other cans; dragging them against concrete cooling tanks and setting them on the floor of cool milk houses instead of on the drain racks. The latter is much accentuated if the milk house is not properly ventilated because the air there is apt to reach a high degree of humidity.

The best can in the world, unless it is stainless steel, can easily be ruined in a few weeks, or even days, by careless treatment, and I am surprised that the average run stand up as well as they do with the rough treatment they get.

PAILS

The pail may be just as important as the can, but I think presents fewer difficulties. The soldered pail had much the same objectionable features as the soldered milk can, and regulations confine us to the welded or seamless drawn type. The welded joints in these have given little difficulty. Making the ears sanitary with the use of as little solder as possible is one of the problems that is being gradually worked out. The question of bottom rim, pouring handle, roughness of tin coating, type of bail, and other features could be discussed profitably at length if space would permit. The fact that the pail remains in the owners' hands assures kinder treatment, and its length of life and sanitary condition depends almost entirely on this.

The Importance of Milk Trucking in Maintaining Sanitary Quality *

F. D. Holford

Borden's Farm Products Division of The Borden Company, New York, N. Y.

Twenty-five or thirty years ago, milk-receiving plants were located in close proximity to each other. A large percentage of milk received at a plant was produced within a five mile radius. Practically the entire supply was delivered to the receiving stations in horse-drawn vehicles. Fifty dairies were about the average number delivering to a single plant. If the milk was not bottled at a country plant, it was shipped to the city in milk cars, in 40-quart cans, partially protected with a few cakes of ice. In those days sour milk was one of the vexing problems. How times have changed —the internal combustion engine has been the principal factor in bringing this about. It not only affected our methods of milk trucking but has been one of the reasons for product improvement and assisting in the maintenance of sanitary quality.

Today most of our receiving plants are known as volume plants and instead of having an average patron list of fifty dairies, we have from one hundred to five hundred dairies per plant. Instead of receiving milk from dairies located in the five mile radius, it is now nearer a twenty mile radius. Tank cars and tank trucks have supplanted the old time milk car and the 40-quart can.

TRUCKING

I will endeavor to confine my discussion in this paper to the use of hired trucks for transporting milk from the farms to the receiving plant, and the return of the clean empty cans to the farmers. In some sections of the country, covered insulated vehicles are being used. Such trucks are now being employed in some of the western states where practically all of the milk is collected at the dairies. In some instances, units have been installed in these trucks which provide refrigeration while in transit to the receiving station. No doubt the covered insulated truck is the ideal method of hauling milk and will some day become necessary in the metropolitan milk shed. However, I question if we are prepared to make such a radical substitution at this time.

If and when the times does come that all milk must be transported in insulated trucks, the job in my opinion should be handled by truckmen who own their own vehicles and who are not milk producers.

A tightly enclosed insulated truck is the most desirable. Second to this would be a tightly enclosed truck with an insulated top. The open type truck is the most common and unless constructed with a tight body gives very little protection to the milk while in transit. Much better results can be obtained when open trucks are used if the platform and four sides of the truck are made tight, and the sides and ends reach at least six inches above the top of the cans. Canvas should be used over the tops of the cans and fastened down by the aid of metal fasteners. When canvas is used, it is advisable to ice the top of the cans, as canvas draws heat and in many instances will tend to raise the temperature of the milk while in transit.

It has been suggested that in cases where morning's milk is being received uncooled, the cooled night's milk should be separated from such product on the truck. Some dealers claim beneficial results are obtained by such a practice while others state very little is accomplished and that the value received is not worth the trouble.

The transportation of cans of milk in a one or two wheel trailer attached to an automobile, especially over a dirt road, is a very poor practice. Under such conditions it is impossible to protect the cans from dust and dirt.

DIRT IN CANS

If the can covers were air tight it would not be necessary to write a paper on this subject. Since they are not, it is doubly essential that the outside of the cans have as much protection as possible.

Ths volume of air within a covered empty can is affected by atmospheric temperatures. At the higher temperatures, air is forced out of the can while at the lower ones air is sucked into the can. This of course is due to expansion and contraction. The same condition prevails in a can just removed from the washer. The approximate temperature of air within a can when it leaves the washer is 170° F. Irrespective of how rapidly the air in such a can cools to the atmospheric temperature, there is bound to be a certain amount of air taken into the can. Dirt, dust, or foreign matter present in the surrounding air, thereby find their way into the can. For this reason it is important that the inside of the truck be kept in a clean condition.

You might be interested to know the amount of air sucked into an empty closed can while the temperature of the air in the can is changing from 170° to 70° F., a drop of 100°. The coefficient of expansion of gases at constant pressure by definition is the change in unit volume per degree centigrade change.

*Constants: Air from 0-100° C. at 760 mm. pressure equals a coefficient of expansion of 0.00367.

Conversion of temperature drop: $5/9 \times 100° F. = 55.6° C.$

(*By:—Wm. Watson, Research Engineer F. W. Edwards Mfg. Co.,—N. Y. C. Manufacturers of cotton goods and filter cloths.)

Calculations: Let 40 qts.=1 unit volume. Therefore $1 \times 0.00367 \times 55.6 = 0.204$ volume decrease, or $40 \times 0.204 = 8.160$ qts. decrease.

Conclusion: Thus 8.16 qts. of air passes into a 40 qt. container when the air in the can cools from 170° F. to 70° F.

Through a recent investigation, a committee appointed by the New York City Department of Health found that in many cases an excessive amount of sediment deposits itself on the shoulders, lips and interior surfaces of milk cans and covers during transit, especially those stored along highways.

Several plants of various dealers were visited and a number of cans were examined, some containing milk and some empty—empty cans being checked along highways and in milkhouses. It was noted that in many cases where milk was being received at the plant, foreign matter would drop into the milk at the time the covers were lifted from the cans. Separate dry, cotton swabs were used on the shoulders, inside lips and necks of cans filled with milk and also on empty cans at roadsides and in milkhouses.

A clean water rinse was used on empty cans. Approximately one gallon of water was filtered through a cotton disc and used to rinse each can. After the cans were thoroughly shaken, the water was then passed through sediment discs which showed varying amounts of sediment—some actually very dirty.

The following objectionable conditions were noted:

1. Cans transported in open trucks not covered.
2. Cans covered with blankets and bags.
3. Dirty truck bodies.
4. Open platforms in trucks.
5. Transporting feed, fertilizers, etc., on top of milk cans.
6. Truck drivers walking on top of cans while on truck.
7. Careless removal of empty cans from truck.
8. Improper unloading of cans along roads and placing in barn yards, etc.

It was recommended by the committee that cans used for transporting milk should be properly protected in transit, either through the use of clean closed vehicles or ample canvas or tarpaulin

* Presented at meeting of the New York State Dairy and Milk Inspectors Association, Hotel Syracuse, Syracuse, N. Y., September 27, 28 and 29, 1939.

covers. When the latter are used same should be free from holes and kept as clean as possible.

Transporting feeds, fertilizers, and other commodities on top of milk cans appears to be another major problem. We have been able to detect on sediment discs taken from milk delivered in the morning, some of the material which was carried on top of the empty cans. In one particular case we followed a truck containing two bags of feed on empty cans which were being returned to the dairyman. The two cans next to those upon which the feed was placed were also the property of this same dairyman. Rinses from all four cans were made and it was found that the two cans next to those upon which the feed rested contained the greater number of particles than the others, although all four cans showed some feed particles.

In another instance practically all the sediment discs taken from milk delivered by a certain truckman were found to be classified as dirty. Upon subsequent investigation it was found that after all the empty cans had been returned to the farmers, the platform of this truck was in a very dirty condition. The truck was then thoroughly cleaned, the sides and ends made tight, and most of the sediment trouble disappeared.

Most truckmen do make some attempt to cover cans of milk on their way to the receiving plant but very little effort is made to replace the canvas over the empty cans.

Careless unloading of empty cans from trucks by drivers is a very common practice. We have all seen empty cans lying along roadways with the covers off. Such cans often remain in this position for quite a long period of time. I have seen sediment tests taken of can rinses from cans unloaded in this manner that would provide sufficient cause for rejecting milk delivered in these cans. In one instance it was noted that two empty cans parked along a railroad at a point where there was considerable switching of cars, were used to deliver milk the next morning. Sediment tests of this milk were taken and both cans of milk were rejected. The sediment on the discs showed the presence of coal dust. I have had dairymen tell me that they find it necessary at times to rinse cans before they fill them with milk.

IMPROVED HANDLING

I believe that much can be accomplished and without too great an expense by improving the bodies of many of the present day trucks. They should be provided with a tight platform as nearly dust proof as possible and where open trucks are used the two sides and ends should be of sufficient height to reach 6 inches above the tops of the cans.

If the sides and ends of the trucks are constructed of wood they should be of matched material (tongue and grooved)

In cases where cans are carried on top of one another (double deck) there should be a platform constructed of the same material as the sides and ends of the truck between the two sets of cans. This platform should be kept clean at all times. In cases of double deck loads, sides and ends of the truck should reach 6 inches above the tops of the second tier cans.

All exposed surfaces of cans should be protected with a clean canvas or tarpaulin so placed as to remain in a protective position.

If it was practical for truckmen to return empty cans on the same day to the locations where the milk was picked up, it would eliminate the practice of leaving them along roads and in other exposed places. A plan might possibly be developed whereby it would be required that truckmen provide a suitable parking place for empty cans. Truckmen could have their choice of delivering the empty cans direct to the dairies on the same day the milk is picked up, or provide them with proper protection while in their possession.

To keep trucks clean it is desirable that the inner surfaces be washed at short intervals, the frequency of such practice being dependent upon road and weather conditions.

Records indicate that approximately 60 percent of the milk is being transported to milk receiving stations in hired trucks. Due to the fact that there is tendency for milk to warm up when being trucked a long distance, it should be important that dairymen use improved methods, especially in refrigeration. From this angle, providing the milk is efficiently protected in transit, long distance hauling will not in itself have a deleterious effect on milk quality.

It is unfortunate that after the methods of can washing and sterilization have reached their present stage of efficiency, so many cans are as poorly protected from possible contamination as they are, before being again filled with milk. The industry has a condition here which can and should be improved.

New Books and Other Publications

Brucellosis in Man and Animals, by I. Forest Huddleson, and Contributing Authors: A. V. Hardy, J. E. Debono, and Ward Giltner. xxi + 339 pages. The Commonwealth Fund, New York, 1939, $3.50.

The present volume by Huddleson and associates replaces his previous one entitled *Brucella Infections in Animals and Man,* published in 1934. It is more than a revision of the earlier text. It reaches out into the detailed discussion of the clinical aspects and epidemiology of the disease, making the book attractive and useful to the medical practitioner as well as to the laboratory worker. It presents clearly the present knowledge concerning the bacteriology of the Brucella genus, the relationships of *Br. melitensis, Br. abortus,* and *Br. suis* to each other and to disease in man and other animals, with case histories, symptoms, diagnostic means, treatment, and epidemiology. A chapter on eradication and control of brucellosis infection is of particular value to milk sanitarians.

The book is well printed on non-glazed paper. The material is well organized, clearly presented, and interestingly written. There are 40 illustrations, several of which are colored plates, and 378 references. Dr. Huddleson has rendered a valuable service to the public health by assembling and interpreting this wealth of information on Bang's disease. In these days of increasing emphasis on the control of this disease in our milking herds, milk sanitarians will find this book to be authoritative, intelligible, and useful.

J. H. S.

ENGINEERING PROBLEMS IN MILK SANITATION

The Government Printing Office has on hand a considerable number of reprints of Leslie C. Frank's paper entitled, "Engineering Problems in Milk Sanitation," published in the March 31st issue of Public Health Reports and also in the March issue of the Journal of Milk Technology. These reprints may be purchased at 5 cents per copy from the Superintendent of Documents, Washington, D. C., cash accompanying order.

This very reasonable price makes this important document widely available. The state departments of health should broadcast this information to every engineering school and public health college in their states. The paper should be on the prescribed course of student reading of every school which teaches sanitary engineering, food technology, municipal sanitation, or public health in general.

J. H. S.

Goat's Milk and its Supervision *

J. C. Marquardt

New York Agricultural Experiment Station, Geneva, N. Y.

No outbreaks of disease traceable to goats are on record in this state. This record should be maintained since from this year on the state and the breeders will share the responsibility for a safe goat's milk supply.

Before persons ridicule the goat industry in this state, they should know of the many persons whose health and economic status is markedly improved because they own a few goats.

It should also be remembered that New York State has some excellent commercial goat dairies. In this state there are five goat societies organized into a strong state organization with more than 400 members. A sizable percentage of the members can easily be classified among our leading citizens.

Utilizing present inspection facilities would result in the supervision of less than 1 percent of the goat's milk produced in the state, due to the scattered and low production per unit.

Before discussing the phases of goat's milk supervision, a brief sketch of goat husbandry is in order. Alpines, Nubians, Saanens, and Toggenbergs are recognized breeds of dairy goats. Rock Alpines were developed in the United States. The "American Alley Goat" is also credited to our country.

PRODUCTION

Goats and dogs are more widely distributed than any of the other domesticated animals. Historians give some credit to the goat in the progress of mankind.

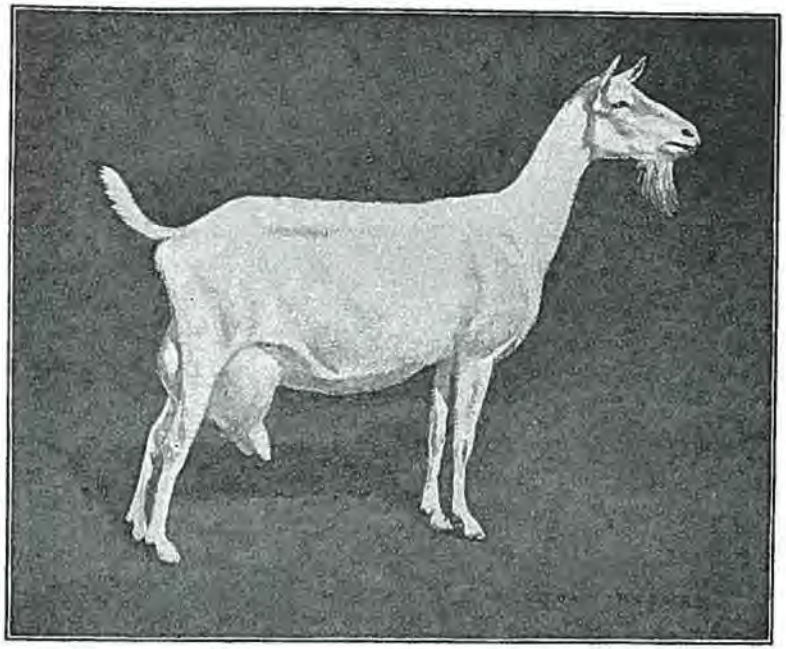
Today less than 10 percent of the world's goats are in North America. South America has a comparable number. More than 30 percent of the goats are equally divided between Europe and Africa. Over 50 percent of the world's goats are in Asia.

There are about 5,000,000 common dairy goats in the United States, with about 500,000 improved goats, and 70,000 good dairy goats. Common goats have a monetary value under $5.00. Improved goats average $20.00, and good goats range up in price from this value. Collectively the dairy goats in the United States are worth about $20,000,000.

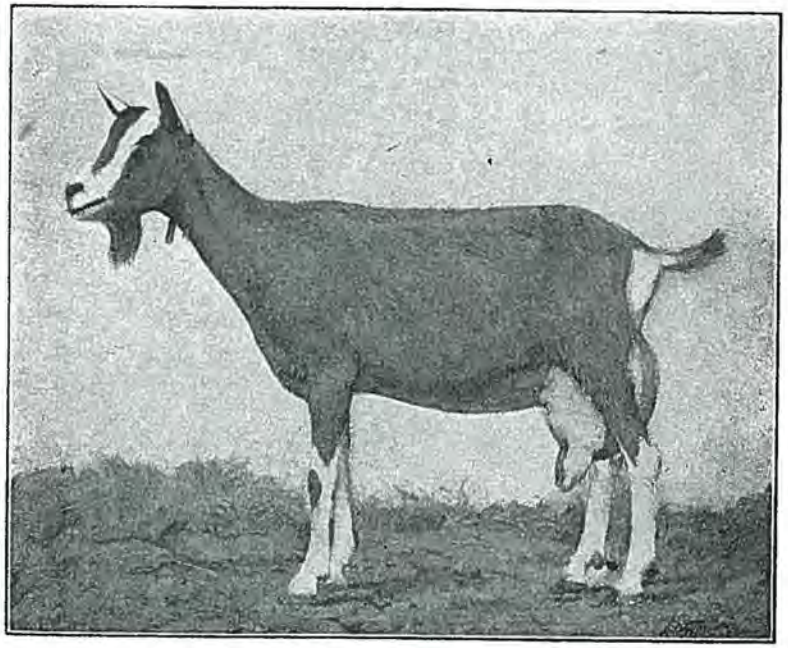
Most of the estimated daily peak production of 15,000,000 pounds of goat's milk is produced for home consumption. It is produced mainly by persons who keep less than 8 goats, the vast majority keeping 1 or 2 milking does. These producers and the operators of 1 cow dairies have common motives. Only in a limited way does their milk enter the retail market. Milk supervision for the small goat herd of this type should be like that given the 1 cow dairy.

Commercial goat dairies are few in number. At least twenty does are needed for a dairy; 80 to 100 is a practical number, some have 100 to 200 does.

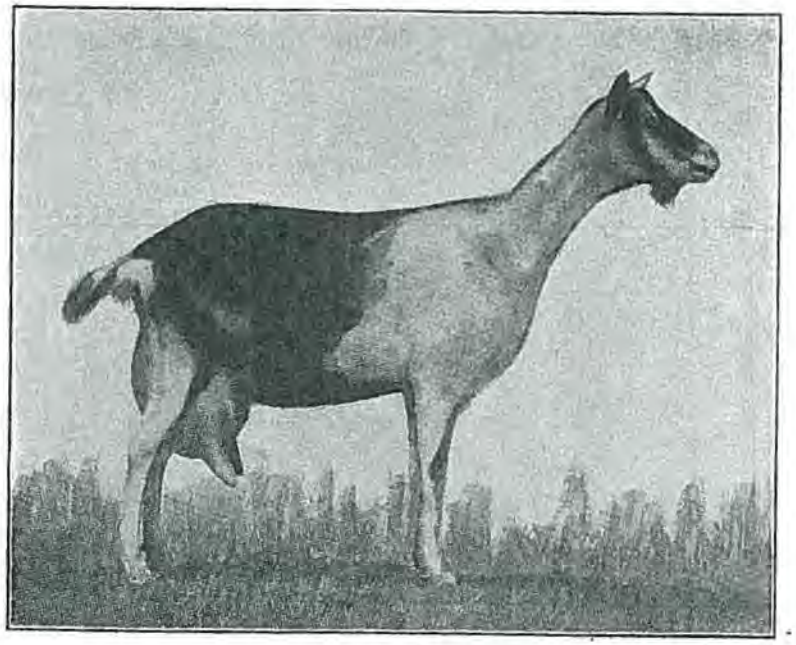
* Presented before the Annual Meeting of the New York State Association of Dairy and Milk Inspectors at Syracuse on Sept. 28, 1939. Approved as Journal Paper Number 342 by the Director of the N. Y. Agr. Exp. Sta., Sept. 23, 1939.



Saanen Doe



Toggenburg Doe



Alpine Doe

Nubian Doe

These dairies are generally supervised by the city in which the milk is sold.

How much milk does a goat produce? Common goats produce less than 500 pounds of milk containing 25 pounds of fat during an average lactation period of 240 days. During a comparable period improved goats will produce 1500 pounds of milk. Goats have produced as high as 4000 pounds of milk in a year. With the use of good pure bred bucks, it is possible to increase 3-fold the production of common does in four generations. One average cow will produce more milk than ten goats. The feed requirements to produce a pound of goat's or cow's milk are comparable. A milker will draw on the average 130 pounds of cow's or 80 pounds of goat's milk per hour. Goats do well on hay and grain with an occasional variation in feeds. Table 1 gives a good idea of what feeds are used for goats.

TABLE 1

*Summary of feeds used by goat breeders**

Feed Used	Percentage of Users
Dairy ration and alfalfa	20.0
Dairy ration and timothy or clover	20.0
Oats and alfalfa	15.0
Dairy ration only	15.0
Dairy ration and timothy and clover	10.0
Alfalfa only	9.0
Special mixtures	8.0
Oats only	3.0

* Taken from a report by J. C. Marquardt in American Goat Society Year Book for 1937.

COMPOSITION

In composition, goat's and cow's milk are somewhat comparable. Mixed goat's milk will contain 3 to 5 percent of fat, and about 12.7 percent of solids. The lactose content is slightly below that of cow's milk; and the minimum values for chlorides in goat's milk are equal to the average for cow's milk.

Normal goat's milk samples will contain more than 0.2 percent of chlorides. This accounts for the salty flavor of certain goat's milk samples. Total ash for goat's and cow's milk are comparable, and both are alkaline in reaction, while normal cow's and goat's milk are acid in reaction. Composition values are given in table 2.

TABLE 2

*Composition of samples received in two National Goat Milk Scoring Contests**

	Fat	Solids	Lactose	Chlorides
Low	3.0	9.75	2.80	0.12
High	7.8	17.8	5.91	0.30
Average	4.1	12.75	3.80	0.21

* Taken from an article by J. C. Marquardt in the British Goat Society year book for 1938.

QUALITY

The flavors of properly produced goat's and cow's milk are frequently similar. Goat's milk deteriorates more rapidly than cow's milk. This may be due to increased lipase activity on the small fat globules, and the presence of saturated fatty acids as capric and caprylic in high percentage. A goaty flavor is common in improperly produced goat's milk. The salty flavor referred to is objectionable.

Observations with samples from a wide area over a period of years have established that 50 percent of the goat's milk produced would qualify as "soft curd milk." Studies with the milk from 20 does over a period of 200 consecutive days have verified this observation. Table 3 gives the percentage distribution of goat's milk curd tension.

TABLE 3

*Goat's milk curd tension distribution and influence on flavor**

Curd Tension**	Percentage Distribution	Av. Flavor Score
0-20	17.9	22.4
21-40	28.6	22.6
41-60	28.6	22.0
61-80	10.7	22.6
81-100	10.7	23.8
101-120	3.5	22.0

* Taken from a report by J. C. Marquardt for the XI World's Dairy Congress, 1937.
** Curd tension is expressed in Hill units.

Sediment in goat's milk is uncommon. This is associated with the size and habits of the does along with the practices of goat husbandry.

The United States Department of Agriculture has decided that 2500 per cc. is a fair bacterial standard for bottled raw goat's milk. At Geneva we have estab-

lished that under rigid supervision goat's milk can be produced with a count under 1500 per cc. Both of these values are supported by abundance of data recorded by cities supervising commercial goat dairies. The count of properly produced goat's milk under rigid supervision is not significantly affected by seasonal high temperature.

Without supervision, goat's milk produced by others than the high type commercial goat dairies will run counts over 1,000,000, with 500,000 as a recognized normal high. A recent survey in our state revealed that over 50 percent of the goat milk supplies examined did not meet the bacterial requirement for Grade B raw milk. These samples did not represent the output of typical supervised commercial goat dairies. The smaller producers of goat's milk whose supply enters the retail field in a limited way were represented. The need of supervision of all goat's milk is obvious.

USE AS BEVERAGE

Goat's and cow's milk as a beverage for average persons give comparable results. Jordan and Smith have reported favorably on goat's milk for infant feeding. Goat's milk is also used by invalids. For these reasons its public health aspect is important.

Selling goat's milk as a cure-all has been about eliminated. There is clinical evidence to show that some of the 4 percent of our infants subject to skin allergies, according to the American Medical Society, have been helped by the use of goat's milk. Contrary to some belief, goat's milk is not a product of "quack medicine." In many localities the high standards of the goat dairies have been stimulated by leaders in the medical profession. It is estimated that 5 percent of the medical men in our state prescribe goat's milk. It is frequently indicated that the assurance of a safe supply throughout the state would greatly stimulate its adoption by the medical men. In one city of our state, information was supplied a few years ago by the public health officer that there was not a demand for goat's milk in the city. A check-up revealed that 8 doctors in the city had ordered goat's milk for their patients and that some of them ordered it regularly, and also that the 8 doctors were rated among the leaders of their profession in the city.

Certain persons like goat's milk as a beverage. It is for this and the previously mentioned reasons that the supervision of goat's milk now provided for in the sanitary code is desirable. The initial surmountable difficulties placed before the goat's milk producers will soon be overcome. Without legal standards the goat milk industry in this state would continue to stagnate.

SUPERVISION

The evils of the family cow and the small goat herd are increased when both units are combined on the same property. A problem in milk supervision is to stop the practice of mixing goat's milk and cow's milk and offering it for sale as either goat's or cow's milk. By the Beyrich method, it is easy to ascertain the addition of amounts of goat's milk as low as 1 percent to cow's milk.

It is essential to check the production of unclean goat's milk, and producers of such milk must be encouraged to improve their supply or refrain from retailing milk. It is also essential to stress proper pasteurization as a factor for a safe milk supply. Goat breeders must be impressed with the fact that typhoid, scarlet, and other fevers and diseases of human origin may be carried in improperly produced milk that is not properly pasteurized. Pathogenic organisms of human or animal origin multiply rapidly in milk. The destruction of food value as a result of pasteurization is so minor and so well understood that its mention here is not necessary. Most persons cannot detect a flavor difference in raw and properly pasteurized milk.

Keeping goats within the city limits is a matter which should be discussed with the local health and police departments before being undertaken. Several cities permit the keeping of goats within the city limits under the public nuisance clause under police supervision.

PUBLIC HEALTH RELATIONSHIP

It is difficult to establish the relative importance of certain diseases in cows and goats. Slaughter inspections do not help. During the years 1936, 1937 and 1938, a total of 30,820,672 slaughtered cattle were inspected with a carcass condemned rate of 6 per 1,000. During the same period 29,489 goats were inspected when slaughtered with a comparable condemned rate of 7 per 1,000. Vital organs were not included in the inspection of goats so that these data have little value in health standard comparisons. It is of more than passing interest to note that 10 percent of the cow livers, the only vital organs reported upon, were condemned.

Cows have single calves with limited exceptions, whereas does have single kids to the extent of 23 percent; twins, 50 percent; triplets, 25 percent; and 4 or 5, 2 percent. Kids weight from 5 to 6 pounds. These incoherent values complicate birth statistics as a relative measure of health.

Pneumonia is a common disease of goats. It generally proves fatal within four days. External and internal parasites annoy goats. They are regarded as a major problem.

Malta fever is one of the diseases that may be transmitted through the milk to man. Malta fever has never been encountered among goats in New York State. Malta fever prevails among the poor herds in the southwest. Breeders bringing animals into the state should require a certificate showing that the goats are free from malta fever. During the past few years 3,460 goats have been blood-tested thruout the United States. All but three suspects gave negative reactions.

Florida breeders have discouraged testing goats for Bang's disease, ruling they were no factor in this disease. Dr. A. J. Durant, Dean of the Veterinary Department at the University of Missouri considers that the Florida action is correct, and he is endeavoring to have this made as an official ruling in Missouri. Both states are among the leading dairy goat states in the United States. Limited evidence indicates that agglutinating bodies may be absent from the blood of infected goats.

Goats have udder disturbances. These are not well understood. The public health aspect of them has never been investigated.

Goats are relatively free from tuberculosis. Since 1936 the yearly number of cows tested in New York for tuberculosis has averaged 1.8 million with an average of 15 reactors per thousand tested. During the same period the average number of cows tested in California was 1.5 million with 29 reactors per thousand tested. These rates for condemned animals are far below the values for the past 20 years. To be specific, during the past 20 years over 20,000,000 cows were tested for tuberculosis in this state with an average of 48 reactors per 1,000 tested. Less than 1 percent of the goats in this country have been tested for tuberculosis. Limited results indicate that 2 reactors per thousand tested is a high estimate.

The animal husbandry department at Cornell and the veterinary college have rendered a real service to the goat industry. A 4-H Club project with goats has been added to the Cornell Extension Service.

Millions of pounds of goat's milk are consumed daily thruout the United States. Its public health aspect is important. The producers who fill the gap between the well organized goat dairies and the hobbyist or pet owners constitute the main problems for the inspectors. Certified pasteurized goat's milk available in our state is rated equal to the best milk produced in the states. Many cities thruout the United States have excellent goat milk supplies. The task for the present is to keep low quality goat's milk off the market; and to inaugurate investigations to obtain more authentic information on some of the health aspects of goat's milk production.

The Training of Pasteurization Plant Operators

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There is a definite trend in the dairy industry to secure technically trained men not only for the positions which require a person capable of supervising operations but for the actual operating jobs. In my twenty years of dairy experience both in the commercial field as well as in teaching, it has been my obesrvation that the market milk industry has been a leader in this respect, and as such should be congratulated in its attempt to secure the best trained men that are available. Our own experience in the placement of dairy manufacturing graduates from the Texas Technological College shows that approximately eighty percent of our graduates during the past ten years are now engaged either in the field of market milk operations or engaged in the field of work covered by the Milk Sanitarians.

In view of this trend, we have made a special study of the requirements that must be met in our particular section of the country, and we have outlined our course work in such a manner that the student has the opportunity to familiarize himself thoroughly with the problems which will confront him after he enters the market milk industry or the milk sanitarian field of work. Two years ago, in cooperation with the Texas State Health Department and the Bureau of Food and Drugs, we instituted a three-day short course for milk sanitarians. This past year we invited the managers and plant operators of market milk plants to sit in on the short course, and we also had several of them appear on the program. Our idea was to bring about a more friendly feeling between the plant operators and the milk sanitarians. We were of the opinion that in discussing the problems of both fields of work, each would have more respect for the other person and his problems. We have been greatly encouraged by the progress that has been made along this line during the past two years.

In making an analysis of the duties of a pasteurization plant operator, we find that it involves a great many duties many of which if properly carried out require a definite fundamental scientific background in the field of dairy manufactures, in which dairy bacteriology, chemistry, and physics form a background for the practical course work.

Methods of handling milk in the early days of civilization were comparatively simple. The producer was close to the consumer, and while the methods of production and distribution, according to our present sanitary standards, were very poor, it was still possible to secure milk in a fairly fresh state. As our cities grew and developed, the producer of milk was forced farther away from the consumer until the time came when he could no longer economically produce and sell direct to the consumer. This economic condition, along with a greater knowledge of the relationship of milk to public health, led to the development of city milk distributing plants and the pasteurization of a large portion of our milk supplies, especially in the larger cities. As we gained further knowledge regarding the benefits to be derived from the pasteurization of milk, the people in the smaller towns and villages began to demand this extra safeguard to their milk supply until now we find at least one pasteurization plant in practically every city of 5,000 persons or above.

TRAINING REQUIREMENTS

It is also true that the large percentage of these plants are doing a fine job in their pasteurization operations insofar as complying with the laws regulating milk pasteurization are concerned. It is the duty of the milk sanitarian to see that the pasteurization plant operator does comply with the milk ordinance under which he is operating. In most instances, the milk sanitarian has recognized the responsibility which is his in insuring the consumer against fraudulent practices. In many cases, he has had to do his duty in the face of much unjust criticism from an uninformed public.

The milk plant pasteurization operator, however, has many other factors to keep in mind besides simply complying with the law. In fact, this should be an easy task. Our present milk regulations take into account only those measures designed: first, to protect the health of the people; second, to insure a sanitary milk supply; and third, to protect the public from fraud.

It is imperative that the person engaged in the pasteurizing of milk be thoroughly familiar with the milk ordinance under which he is working. He should also be thoroughly sold on the necessity for the various requirements of the pasteurization of milk under the ordinance so that he will willingly carry out its provisions without constant supervision. This is an exceedingly important point and basicly sound.

No person should be permitted to operate a pasteurization plant unless he can demonstrate, in addition to a knowledge of the law, that he has a fundamental knowledge of bacteriology and its relationship to milk. Along with this knowledge, he should be able to show that he has a knowledge of what constitutes sanitation. From a physical standpoint, milk when handled can undergo many changes that will not interfere with its healthfulness, but will so alter its general flavor and appearance that the consumer will fail to accept it.

Unfortunately,we find that the prejudice which exists today among many people regarding pasteurized milk is not due so much to the result of not meeting the milk ordinance requirements, as to lack of knowledge by operators of proper methods of handling the milk.

In the training of a pasteurization plant operator, it is first necessary to impress on his mind the necessity of producing a bottle of milk which is uniform in quality and appearance from day to day. In using the word *Quality Milk,* we mean that milk which is produced from disease-free cows, that is free from off-flavors or odors, that has been produced under strict sanitary conditions, and is free from any extraneous organic matter. Contrary to the opinion of some people, pasteurization will not improve the quality of milk as herein defined. It simply adds an additional safeguard, or as we often refer to it, an insurance policy for the consumer that there will be no danger in disease transmission.

In considering the definition, it is assumed that the milk sanitarian had checked the health of cows supplying milk to the plant. However, we find it advisable for the operator to be familiar with the common diseases of cattle which in themselves may not offer any serious public health menace, yet will produce milk having an off-flavor.

Training in the proper methods of feeding to eliminate off-flavors and odors in milk is very important. Naturally, it is necessary that the person be sufficiently trained to recognize the various off-flavors and odors that are commonly present in the raw milk received at the plant. The ability instantly to recognize off-flavors and odors by the sense of taste and smell is the first prerequisite in the selection of milk for pasteurization purposes.

It is very essential that the operator be thoroughly grounded in the approved sanitary precautions that should be used in the production of the raw milk. He should be acquainted with the most acceptable practices and be able to assist the producer in solving his sanitation problems. I recall an instance which actually happened to me several years ago. A producer was having trouble with sweet

curd milk and had brought a sample to our laboratory. Having isolated the causative organism beyond doubt, and while still looking through the microscope I began talking to the man about the condition of his farm and water supply. After some discussion, the dairyman said, "Mister, can you see my farm through that funny looking machine?" Upon assuring him that I could not, he remarked, "Well, you certainly described my conditions exactly and I thought perhaps that was where you got the information." That part was true; the microscope revealed the conditions by making it possible to see the types of bacteria in the sample of milk, and a knowledge of the practical application of what the microscope revealed made it possible actually to determine the cause of his trouble

Training in the laboratory is an essential factor in the market milk industry. The operator should be thoroughly familiar with the latest bacteriological methods in use. He should also be familiar with the different physical and chemical tests which can be used to keep an accurate check on the quality of his product. Not only that, but he should realize their value to the extent that these tests will be used as a matter of routine checking. In addition, he must know the practical application of the various tests and be able to interpret the results in such a manner that he can constantly improve the quality of his product as well as the raw material from which he makes his finished product. He should know what tests to make and how frequently they should be made to insure best results. Ability to make practical application of these tests to commercial conditions cannot be overemphasized.

We have stated previously that the operator should be able to show that he has a definite knowledge of the requirements laid down by the milk ordinance under which he is operating. Due to the differences in many of our city milk ordinances, this is a rather difficult task, other than to give the person an intelligent understanding of fundamental principles. Texas is operating under the Standard Milk Ordinance and Code as are most of the surrounding states, and this uniformity makes it a comparatively simple matter. We simply use the U. S. Public Health Standard Milk Ordinance and Code as a textbook in training our students with respect to that part of the milk plant operation which deals with complying with the regulatory requirements.

The operator should also be trained to use the best methods in selecting equipment which will give the best results, and also in the proper method of handling that equipment. There are all kinds of equipment on the market today, most of which will do a satisfactory job if handled correctly. The proper temperatures at which milk may be pumped without injuring the cream line; the proper placement of valves in the sanitary lines; the types of pumps which are most satisfactory; proper agitation of the milk during the pasteurization and holding period; efficient cooling and speed in bottling the cooled milk to insure proper and uniform cream line are very important items which should receive considerable attention. These are items which are not covered in the ordinary milk ordinance, yet they have a profound effect upon the cream line, which in turn affects the consumer and his acceptance of the finished product.

Proper care of equipment to insure long life is an essential which should not be overlooked. Much milk is wasted by leaky valves and poor pipe connections.

The washing and sterilization of equipment is a very important item and is rather thoroughly covered by most milk ordinances, yet the ordinance cannot go into details regarding the type of chlorine compounds, washing powders, etc., that will give the best results. Water conditions in various parts of the country play a very important part in the effectiveness of general results obtained. In our section of the country, we have very hard water. Many of our commonly accepted washing powders will not do the job without causing the formation of milk stone on the equipment. Also the reaction of some common chlorine compounds used for sterilization of milk bottles seems to have a decided effect on hastening the oxidation flavor in milk.

OUTLINE OF TRAINING COURSE

In summarizing the rather definite training that we feel the pasteurization plant operator should have, it would seem logical to consider carefully the following material:

A. A study of dairy bacteriology

1. A knowledge of the sources of pathogenic organisms in milk; the conditions under which they grow; and the methods of keeping them out or destroying them when they gain entrance to the milk.
2. A knowledge of the bacteria which cause the deterioration and spoilage of milk.
3. The sources through which bacteria gain entrance to milk.
4. The conditions under which bacteria will grow and develop in milk.
5. How to prevent the entrance of bacteria in milk.
6. Methods of eliminating harmful bacteria in milk.
7. A study of desirable types of bacteria in fermented milk products.

B. A study of market milk

1. The production of milk on the farm.
2. Methods of transporting milk to the city.
3. Buying plans.
4. Receiving, grading, and sampling milk.
5. Pasteurization equipment.
6. Care of dairy equipment.
7. Methods of pasteurizing milk.
8. Cooling and bottling milk.
9. Defects in market milk, their cause and remedies.
10. Cleaning and sterilization of market milk equipment.
11. Merchandising of market milk.
12. Laboratory control of market milk.

C. A study of dairy and food inspection

1. The necessity for legal control of market milk supplies.
2. A study of milk ordinances.
3. The value of uniform milk control ordinances.
4. The Standard Milk Ordinance and Code.
5. Qualifications of the milk sanitarian.
6. Methods of inspection.
7. Educational functions of the milk sanitarian.
8. Disposal of dairy wastes.
9. Water supplies.
10. Inspection of other food products*.

D. A study of technical laboratory control of dairy products

1. The various chemical and physical tests that are used in checking the quality of milk.
2. Tests used to determine the effectiveness of sterilization methods.
3. The practical application of the various laboratory control tests.
4. The value of the laboratory tests in checking plant operation methods.

SUMMARY

The above outline indicates very definitely that in order for an operator to do his best work he must have a rather broad training. As has been stated previously, a large number of our market milk plants today have men with this type of training. However, we still have many operators who have not been able to secure the proper training.

As milk sanitarians, you are in a position to assist these men in numerous ways, and especially to point out the value of making an effort to learn more about the business in which they are engaged. This can be done by urging attendance at market milk short courses offered by the various dairy departments of the respective states in which they reside, or by having the operator secure textbooks dealing with this material and encouraging him to study them diligently. If this is done, your relations with the pasteurization plant operator will be much more pleasant and mutually profitable.

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*Quite frequently the milk sanitarian is called upon to inspect food products for the city other than milk, and we feel that training in this type of inspection should be carried out. It also shows the pasteurization plant operator that he is not the only person who is subject to sanitary regulations.

The Relationship between State and Municipal Supervision of Milk Supplies *

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Only occasionally is thought given to the relationship between state and municipal supervision of milk supplies. Attention is directed to the subject usually when state legislation is proposed having some bearing on the status or prerogatives of state or municipal departments or agencies. Even then, it is doubtful if anyone makes a real analysis to develop and present facts which fully reveal the organization, powers, duties, and functioning of the various state and municipal departments and boards with respect to their relation to each other. A study shows that there are many factors and ramifications that have not hitherto been recognized or appreciated.

To some persons supervision seems to mean retention of authority or jurisdiction without exercise or application, while to others it means legislating, defining, and enforcing standards, methods, and conditions for the production, processing, and delivering of milk supplies. Even with the majority in this latter group, activities are restricted mostly to milk and cream destined for domestic purposes, and little or no attention is given to milk and cream for manufacturing purposes. In the several states, there are hundreds of political subdivisions all empowered by law to supervise milk supplies, but only the larger cities have an actual organization of one kind or another for supervision. As cited by Brooks (1): "In the cities in the State (New York State) around 99 percent of the milk is pasteurized but there's so much raw milk in the rural sections it brings it down to 80 percent for the state as a whole. And here's something else: all but one of the milkborne epidemics in eleven years—fifty-nine of 'em—have been in rural sections: towns and villages—and they've come from the 20 percent of the milk that isn't pasteurized. That's something to think about. Of course, New York City doesn't have any of these epidemics; their milk's pasteurized." These figures clearly show results of effective supervision and control as compared with areas without such protection. They also reveal that there is urgent need for public health work by the state and municipalities.

* Presented at the 1939 Annual Meeting of the Pennsylvania Association of Dairy Sanitarians, Harrisburg, Pa., February 10, 1939.

BASIS FOR AUTHORITY

State and municipal authority and prerogatives are secured through the state constitution, acts of the legislature, and municipal charters. The state statutes define milk and cream, and in some instances milk products, together with certain methods and conditions for processing of milk and products. Municipalities and state departments cannot alter or conflict with these specified requirements, but municipalities may by ordinance supplement them, particularly in those items not definitely included in the statutes. Therefore, municipalities are more or less governed or restricted by the state.

Various state agencies have been established by the legislatures. All have rather far-reaching powers and functions, and also direct bearing on the personnel and administration of state and municipal supervision of milk supplies. Such agencies and departments include the Civil Service Commission, State Department of Agriculture, Bureau of Animal Industry, State Department of Health, Agricultural College, State University, and Agricultural Experiment Station. In some states "Milk-Price Control Boards" are also functioning.

NON-HEALTH AGENCIES

The activities of state agencies other than the state health department may first be considered. In some states, the Board of Agriculture is a milk-marketing and publicity agency for dairy farmers, and a dairy-farmer bill-collecting agency under milk-dealer bonding laws. Financial returns to dairymen have a direct influence in attaining compliance with the public health methods and standards. In some states chemical standards for milk and milk products are, through legislation, made the concern of the Bureau of Markets, and the butterfat and total solids contents of milk are thus handled as an economic rather than a public health matter. At least in one instance, a state department of agriculture has established on an optional basis "Official Department of Agriculture Grades" for milk, such action being taken under the general act authorizing the grading of farm products. The administration of the program of supervising and marketing of these grades of milk has been carried on from funds derived from fees charged to the dealers, plus monies obtained from public tax funds. The regulations governing these milks may simulate public health requirements but may not be in strict conformity with them. Under such circumstances, a dealer may have a permit from the State Department of Agriculture which would result in confliction with licenses from local boards of health for distribution of the products in a given municipality. However, under the general health laws, local boards of health for distribution of inspect and regulate milk supplies, and may exclude from the market milks prohibited by ordinance or which fail to meet public health laws.

State bureaus of animal industry carry on programs which have direct relationship to the activities of state and local health departments. As example, the Federal-State Accredited Herd (or Area) System for the eradication of bovine tuberculosis carried on by the federal and state bureaus of animal industry have made it possible for both state and local health departments to promulgate and enforce laws and ordinances requiring that all milk for human consumption be from tuberculin-tested cattle. Without these federal and state agencies, it would be practically impossible for a municipality of any size with a large milk shed, particularly when extending into several states, to enforce readily such a local ordinance. Cooperative programs similar to that for tuberculosis eradication are now in operation by the bureaus of animal industry for the control and eradication of paratuberculosis and Bang's Disease of animals under U. S. B. A. I. Order 367 which prescribes the procedure for payment of indemnities for condemned cattle. These programs cover not only dairy economics but also important public health considerations. A "Summary of Bang's Disease Work in Cooperation with the Various States" issued December 1938 by the U. S. Department of Agriculture, Bureau of Animal Industry, shows that in the United States during December 1938, agglutination blood tests were completed in 52,959 herds with 587,529 cattle. In 6,594 herds with 190,101 cattle, 17,302 reactors were found, while 46,365 herds with 397,428 cattle were negative. The total number of cattle under supervision was 10,280,003 in 1,202,195 herds, and 1,015,544 were the total cattle on the waiting list. These figures show the extent to which this important program has progressed.

Bovine mastitis presents another problem. According to Brooks (2): "Streptococcic infection is not the only infection of the bovine udder with which we are concerned from a public health standpoint. However, it is the most common and, from the standpoint of public health as well as the dairy industry, probably the most important." He reports that ex-

perience has led to several important conclusions: one, "that nearly all extensive milk-borne epidemics of septic sore throat, and many lesser ones, together with many of scarlet fever, are traceable to milk from cows with mastitis", and another, "that whenever a case of mastitis is responsible for such an epidemic, the cow's udder invariably has been infected with Beta-hemolytic streptococci from a human source. Usually it is a milker who has a throat infection or, less frequently, a wound infection." He also points out that "every case must be regarded as potentially dangerous", and "any reduction in the amount of mastitis will improve the quality of our milk supply and increase both its healthfulness and its marketability". Mastitis being an economic as well as a public health problem, the Department of Agriculture, Bureau of Animal Industry, the Agricultural Experiment Station and the state and local health departments are all interested in it, and the work of any one agency has a direct relationship to the program of any of the other agencies.

The agricultural colleges not only educate dairymen in economics and methods of milk production, but also educate individuals who are or will be employed by milk producers, milk processors, and governmental departments. The colleges also conduct dairy research, and include subjects of dairy animal husbandry, dairy science, and dairy products manufacture in the curricula. They also maintain agricultural extension services through which advice and instruction are given to dairymen. The state university also has a direct relationship to both the state and local health deparements for in some states courses in public health, including milk technology, are given.

The agricultural experiment stations in some states license both commercial and public health department milk analysts, and license milk dealers to purchase milk on butterfat content. The stations conduct experiments and research in dairy and milk technology. The results of this work are available to the industry and the health departments. Such information is authoritative basis for regulations. As state departments of health are not usually equipped with funds, facilities, and personnel to conduct research and investigation of current mechanical and technological problems confronting them and local health departments, the experiment stations are in an excellent position to render such service. There should be closer cooperation between the stations and health departments.

Milk price-fixing boards are in some states authorized by statute to license milk dealers, but such licensing is solely for enforcement of prices fixed by the boards. Such legislation is for obvious reasons enacted as temporary "emergency legislation", thus limiting the board's existence. Such statutes provide that the board's license shall not conflict with a board of health license, and shall be issued contingent upon the milk dealer holding a board of health license.

HEALTH DEPARTMENT AGENCIES

Between state and local boards of health, there is a much closer relationship. The duties and functions of both are essentially the same. However, situations may arise relative to the respective jurisdiction and authority of these departments. Attempts may even be made to have legislation enacted to divest one or the other of certain prerogatives and transfer these to the other department. Occasionally, legislation is introduced designed to transfer public health functions in milk supervision to the department of agriculture, but common sense indicates the necessity and importance of retaining such functions in the health departments.

All areas of states do not have adequate milk supervision. Proposed legislation presumed to correct the situation is usually so drafted as to centralize all work and administration in the state agency. Sometimes this may not be wholly intentional but is the result of bill-writing by those not versed in the subject for which the legislation is intended.

If all milk supervision were centralized in the state health department, it is questionable if the work would be executed to an adequate degree or to the standard now attained in some municipalities. For example, it would require very large state appropriations to match the aggregate appropriations, personnel and equipment of the local boards of health.

It is possible to enact legislation whereby both the state and local health departments retain their respective prerogatives. Such a law (3) was enacted in New Jersey in 1932 whereby the State Department of Health exercises jurisdiction over all milk and cream the destination of which is within the state. State permits are required for milk shipped, transported, or imported into the state. However, the act provides that nothing therein contained shall be construed to repeal or modify the acts of the legislature authorizing the licensing and regulating of milk dealers and supplies by local boards of health, and shall not affect the authority granted municipalities under the so-called "Home Rule Act." The law defines milk and milk products and fixes standards.

Included in the act are regulations governing production, processing, handling, and labeling of milk and milk products. Specifications for milk plants, creameries, dairies, equipment, and methods are also included. Requirements for health of milk plant employees and also dairy animals are specified. The law requires that it shall be enforced by the state and each municipality, and the inspections provided in the act shall be made by either the state or local boards of health.

If any municipality is unable for any reason to conduct a thorough and efficient system of inspection and supervision, the governing body of said municipality shall, within sixty days prior to the end of each calendar year, certify by resolution its inability so to do, and shall state in the resolution in detail the reasons for such inability, a certified copy of which shall be forwarded to the State Health Department, which department is authorized to investigate said reasons and determine the sufficiency thereof, and, upon being satisfied that the reasons set forth in said municipal resolution are correct, it shall be the duty of the State Health Department to take over, supersede, and conduct said inspections on behalf of said municipality. Such service shall terminate at the end of the calendar year, but may be renewed in the manner set forth in the law. Local boards of health shall report annually to the State Health Department all sources of milk and cream which are distributed within their municipalities, and which are under inspection by or for the boards of health. By this law, all milk supplies of all areas of the state will be under official board of health supervision, and responsibility is fixed.

LOCAL INSPECTION ASSOCIATIONS

To meet problems of smaller municipalities, the New Jersey Legislature in 1938 enacted a law whereby two or more boards of health are authorized to form an association, known as a "Regional Health Commission", to furnish such boards with public health services. A commission shall consist of two members from each board of health participating therein, except that when more than seven boards of health participate, the commission shall consist of one member from each board. A commission arranges annually with the participating boards of health as to the nature and amount of public health services to be rendered. Such services and the amount to be paid to the Commission by each Board of Health shall be approved by the State Director of Health. A regional health commission functions in the same manner as a local board of health, and its employees are subject to the same qualifications as those of local boards of health. A commission may employ a full-time health officer, and such inspectors, nurses, clerks, and other employees as may be necessary. It will fix the terms of office of its employees and their salaries. Before a commission employee shall act as an agent of the local board of health, he shall be so appointed by such board. A participating board of health may retain persons already in its employ, but the work of such persons, insofar as it relates to matters over which the health officer of the

regional health commission has supervision, shall thereafter be directed by the health officer of the commission. Adjacent communities are enabled voluntarily and legally to pool funds for joint employment of needed public health services. A joint milk supervision program of five municipal boards of health has been successfully carried on since 1934 under a plan similar to that provided in the act outlined above.

SUMMARY

The foregoing demonstrates a direct relationship between not only state and local health departments in the supervision of milk supplies, but also a relationship between them and the numerous other state agencies, colleges, universities, and experiment stations. It is also shown that it is feasible to provide adequate and efficient supervision of milk supplies in all areas of the state, avoid confliction between state and local departments and boards, and to retain to both state and local boards of health authority and jurisdiction in supervision of milk and cream supplies. Closer cooperation and better understanding ought to be encouraged and developed between all agencies.

REFERENCES

(1) "Doctor Jones" Says. *N. Y. State Health News*, **16**, No. 5.

(2) Brooks, Paul B. Streptococcic Mastitis and Public Health. *J. Am. Vet. Med. Assoc*, **94**, N. S. **47**, 1, 11-15 (1939).

(3) New Jersey Revised Statutes, Title 24.

New Method for Recovery of Milk Sugar from Cheese Whey

The Federal Bureau of Dairy Industry has developed a new process for separating whey powder into three valuable products—milk sugar, a protein-rich concentrate, and a solution rich in riboflavin or vitamin G (B_2). On a laboratory scale, about 70 percent of the lactose has been recovered, comparable in quality to the refined milk sugar of commerce.

In this process, the whey powder is wet thoroughly in 95 percent alcohol. The light paste is introduced into more alcohol, agitated, and then filtered as rapidly as possible. The residue is the protein concentrate. The filtrate contains the lactose in a supersaturated solution. It is treated with hydrochloric acid and lactose crystals are introduced to start crystallization. When crystallization is almost complete, the lactose is filtered out and washed in alcohol. The residue is then distilled to recover the alcohol. The vitamin concentrate which is high in riboflavin content is left.

The riboflavin concentrate may be used for poultry feeds, as this vitamin is essential in the growth of young chicks and the hatchability of eggs. Whey and whey concentrates are added to the poultry feeds for the vitamin content. By using the new product the vitamin would be available in concentrated form.

The fact that whey proteins are obtained in soluble form is another feature of the extraction process. By adding water to the protein concentrate, it may be whipped and used to supplement or as a substitute for egg whites. Further investigations into uses of this product will be undertaken by the Bureau.

Two patents have been granted on the process, one for the extraction of the milk sugar and another for the extraction of the protein concentrate. They have been assigned to the Secretary of Agriculture.

The Bureau recently set up pilot-plant equipment in its laboratories to test the process on a larger scale.

J. H. SHRADER.

Milk Tank Sizes and Power Requirements *

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The purpose of this paper is to set forth the arithmetic of the cooling of milk in 10 gallon cans when set in insulated tanks containing water and ice, the cooling being produced by electrically operated refrigerating machines expanding directly into coils of tubing in the tanks.

The facts involved have been prepared for convenient consideration in two tables. Table 1 is devoted to a study of the movement of heat during the first hour of cooling after the milk is put in. In order to avoid the complications of figuring that would otherwise result, it has been here considered that all of the cans have been put into the tank at the same time and that the thermostatic control of the refrigerating machine motor is so arranged that the motor starts to operate immediately upon the loading of the tanks.

Table 2 shows the probable performance of the equipment during a full 24 hours of operation. The figures set down are on the basis of night milk only being cooled, but as will be shown later on, it is a simple matter to determine what the performance would be for cooling twice or even three times during the 24 hours.

The term water-to-milk ratio of tank is used to express the number of gallons of water and ice together outside of the cans for each gallon of milk capacity contained in the cans. It is assumed that when all the cans for one full loading of the tank are in, the water will be 21 inches deep and the cans standing on the floor of the tank.

The temperature difference between the inside and the outside of the tank in hot weather is set at 55° Fahrenheit if the tank has ice on the coils, and at 35° if the tank is operated without ice.

The heat leakage for 24 hours is based on the actual melting of ice in experimental tanks during hot weather. The probable heat leakage into tanks of different sizes is computed on the basis of the outside areas and on the temperature differences between the tank interior and the soil, the milk house wall, and the milk room air. For the 1 hour cooling, the heat leakage would be only 1/24th of the 24 hour leakage; if cooling is done night and morning, the leakage between coolings would be ½ that for 24 hours, while for milking 3 times a day the leakage between coolings would be 1/3rd of the 24 hour amount.

What is termed the useful load is computed first in B. T. U. by the general rule

$$\text{B. T. U.} = \text{Weight} \times \text{specific heat} \times (T_1 - T_2),$$

and then changed to Pounds I. M. E. by the rule.

$$\text{Pounds I. M. E.} = \text{B. T. U.} \div 144$$

This rule is based on the fact that when 1 pound of ice at 32° melts to water at 32°, it absorbs in the process 144 B. T. U. of heat.

For a can of milk, the weight of milk is 85 pounds, the specific heat is 0.935 for 3.5 milk, T_1 may be 95°, and T_2 will be 50°, 45°, or 40° depending on the conditions being considered. For Table 1, T_2 is 50°, while for Table 2 it was taken as 45° as the final temperature of the milk before removal from the tank. The cooling of the milk itself is evidently the only useful load done in cooling but for convenience in this study and in order to separate it from heat leakage there has been included in what is here called the useful load not only the cooling to cool

* Presented at meeting of New York State Association of Dairy and Milk Inspectors, Syracuse, N. Y., September 27-29, 1939.

the milk itself, but also that required to cool the can containing the milk. Cans weigh about 26 pounds each, the specific heat of steel is 0.117, T_1 is the temperature of the can itself when filled and T_2 is the final temperature for the conditions being considered. This part of the useful load is more of academic interest than of practical importance because it is always very small. The entire useful load, then, is the sum of the load for the milk itself and the small load to cool the cans themselves.

The total load is evidently the sum of the entire useful load and the heat leakage. In Table 1, with the heat leakage for an hour only, the increase of load from this source for increasing tank ratios is insignificant, but in Table 2 for 4 cans and a 55° temperature difference the increase of load from 164 for 2:1 ratio to 195 for 5:1 ratio is significant, being a 21 percent increase over the 2:1 ratio load.

It is quite necessary to explain the next item in Table 1 which is "absorbed in 5° rise of water, I. M. E." To see the meaning of this item it must be remembered that Table 1 deals with heat transfers during the first hour of cooling. In order for the water in the tank to cool the milk effectively during this hour the tank water must remain at all times decidedly colder than the milk. The milk is to be 50° at the end of the hour and so the water should not be warmer than 45° at the end of the hour. If the tank water was 40° when the milk was put in and is 45° at the end of the hour, then evidently the water is holding in itself at that time enough of the heat of the milk to have produced a 5° rise in temperature of the water. At the moment this is a satisfactory disposal of that much heat for the time being, and for the purposes of the study in Table 1 no other disposition of this heat needs to be provided for,—it can just stay in the water. Just how much this heat will be depends on the size of the tank; the greater the water-to-milk ratio the greater is the amount absorbed by the water for 5° rise. This is set down in the table.

The next item in Table 1 is simply what is left of the total 1 hour load after the heat absorbed by the water has been subtracted. This heat not absorbed by 5° rise is here less for a 5:1 tank than it is for a 2:1 tank.

If now there is a ¼ horse power unit connected to these jobs which has a refrigerating capacity of 11.5 pounds I. M. E. per hour and if this machine starts running just as soon as the milk is put into the tank then obviously it will reduce the heat not absorbed by the water by this amount of 11.5 pounds I. M. E.

Finally we have a remainder of heat not absorbed by the water for a 5° rise and not removed by the ¼ horse power refrigerating machine in 1 hour of operation. This heat must be gotten away from the cans of milk inside the hour's time if the milk is to be cooled to 50° in that time. Since the water cannot absorb it without getting too warm, and since the machine has not capacity to actually remove it from the tank, then the only way left is to have at the start enough of the water in the form of ice so that in melting it will absorb this remaining heat. How much this is is shown in the table.

The next groups of items in Table 1 show the necessary ice cooling for 1/3 and for ½ horse power refrigerating machines of 15.5 and 26.6 pounds of I. M. E. capacity respectively.

The last 3 lines in Table 1 show how many hours of operation of the machines would be required to cool the milk to 50° if there were no ice on the coils when the milk was put into the tank.

With these detailed explanations completed, we are now ready to consider the practical importance of the figures set down in Table 1. Let us first consider tank sizes for a tank that will receive 4 cans of night milk and have the water-to-milk ratios indicated. A tank of 2:1 ratio is practically 36 inches square, one of 4:1 ratio is about 5 feet long while one of 5:1 ratio is about 6 feet long. Obviously the ordinary farmer would consider a tank 3 feet wide and over 6 feet long as being too big for 4 cans

TABLE 1

Probable performance during the first hour of cooling after milk is put in

No. cans cooled night only	2				4			
Water-to-milk ratio of tank	2:1	3:1	4:1	5:1	2:1	3:1	4:1	5:1
Inside length of 36" tank	19	25	31	37	37	50	62	74
Temp. difference between in and out		55°				55°		
Heat leakage, pounds I. M. E.	1.5	1.7	1.9	2.1	2.1	2.6	3.0	3.4
Useful load, pounds I. M. E.	51.2	51.2	51.2	51.2	102.4	102.4	102.4	102.4
Total 1 Hr. load, pounds I. M. E.	52.7	52.9	53.1	53.3	104.5	105.0	105.4	105.8
Absorbed in 5° rise of water I. M. E.	11.5	17.3	23.1	28.8	23.1	34.6	46.0	57.6
Not absorbed by 5° rise I. M. E.	41.2	35.6	30.0	24.5	81.4	70.4	59.4	48.2
¼ H. P. motor, 1 Hr. pounds I. M. E.	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Necessary ice cooling, lbs. I. M. E.	29.7	24.1	18.5	13.0	69.9	58.9	47.9	36.7
Not absorbed by 5° rise, lbs. I. M. E.	41.2	35.6	30.0	24.5	81.4	70.4	59.4	48.2
1/3 H. P. motor, 1 Hr. lbs. I. M. E.	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Necessary ice cooling, lbs. I. M. E.	25.7	20.1	14.5	9.0	65.9	54.9	43.9	32.7
Not absorbed by 5° rise, lbs. I. M. E.	41.2	35.6	30.0	24.5	81.4	70.4	59.4	48.2
½ H. P. motor 1 Hr. lbs. I. M. E.	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
Necessary ice cooling, lbs. I. M. E.	14.6	9.0	3.4	0	54.8	43.8	32.8	21.6
Not absorbed by 5° rise, lbs. I. M. E.	41.2	35.6	30.0	24.5	81.4	70.4	59.4	48.2
Total Hrs. to cool to 50°. ¼ H. P.	3.6	3.1	2.6	2.1	7.1	6.1	5.2	4.2
Total Hrs. to cool to 50°. 1/3 H. P.	2.7	2.3	2.0	1.7	5.2	4.6	3.8	3.1
Total Hrs. to cool to 50°. ½ H. P.	1.6	1.3	1.1	0.9	3.1	2.7	2.3	1.8

TABLE 2

Probable performance during 24 hours of normal operation in hot weather

No. cans cooled, night only	2					4				
Water-to-milk ratio of tank	2:1	3:1	4:1	5:1	2:1	3:1	4:1	5:1	2:1	3:1	4:1	5:1
Inside length of 36" tank	19	25	31	37	37	50	62	74	37	50	62	74
Temp. difference in and out		55°				55°				35°		
Heat leakage, pounds I. M. E.	35	40	44	49	50	61	71	81	32	39	45	52
Useful load, pounds I. M. E.	57	57	57	57	114	114	114	114	114	114	114	114
Total 24 hrs. load lbs. I. M. E.	92	97	101	106	164	175	185	195	146	153	159	166
¼ H. P. Hrs. of Operation	7.36	7.76	8.08	8.48	13.1	14.0	14.8	15.6	11.7	12.3	12.8	13.3
Kilowatt Hrs.	2.24	2.36	2.46	2.58	4.00	4.26	4.51	4.75	3.56	3.75	3.90	4.05
KW Hrs. p. can	1.12	1.18	1.23	1.29	1.00	1.07	1.13	1.19	0.89	0.94	0.98	1.01
1/3 H. P. Hrs. of operation	4.85	5.11	5.32	5.58	8.64	9.21	9.74	10.27	7.69	8.05	8.37	8.73
Kilowatt Hrs.	2.01	2.12	2.21	2.32	3.59	3.82	4.04	4.26	3.19	3.34	3.48	3.62
KW Hrs. p. can	1.01	1.06	1.11	1.16	0.90	0.96	1.01	1.07	0.80	0.84	0.87	0.91
½ H. P. Hrs. of operation	2.97	3.13	3.26	3.42	5.30	5.65	5.97	6.30	4.71	4.94	5.13	5.36
Kilowatt Hrs.	1.77	1.86	1.94	2.04	3.16	3.36	3.56	3.75	2.80	2.94	3.05	3.19
KW Hrs. p. can	0.89	0.93	0.97	1.02	0.79	0.84	0.89	0.94	0.70	0.74	0.76	0.80

when he cooled night milk only. However, the water in the big tank for 5° rise absorbs over ½ the first hour's heat while that in the smallest tank absorbs less than ¼ of the first hour's heat. The increase in heat leakage for the large tanks during the one hour here considered is so small as to be negligible.

When we consider the size of the refrigerating machine in terms of the horse power of the motor running it, it is obvious that there must be some ice on the coils for cooling in one hour for the 4 can tank regardless of the motor size and the tank size too; thus for the smallest motor and the smallest tank there must be 69.9 pounds of ice at the start of cooling and for the largest motor and the largest tank there must be 21.6 pounds of ice. A ¼ H. P. motor for 4 cans is at the rate of 1/16th H. P. per can, a 1/3 H. P. is 1/12th H. P. per can while a ½ H. P. motor for 4 cans is at the rate of ⅛ H. P. per can. The effects of variation in motor capacity will be much more pronounced when the 24 hour problem is studied in Table 2. In Table 1 these effects are most considerable in the items in the last three lines but these figures refer to a procedure that would not be allowed for a 4 can tank when cooling in 1 hour is required so they will be passed over for the more important aspects of motor size as brought out in Table 2.

Let us now consider the case where 4 cans are cooled at one time once inside of 24 hours and where ice is frozen on the coils. The facts in this case are found in the middle block of Table 2. It will be noticed that the heat leakage for the larger tanks is here a considerable factor, being 81 pounds for 5:1 ratio as opposed to 50 pounds for 2:1 ratio.

The useful load in Table 2 is 114 pounds for 4 cans, instead of 102.4 pounds as in Table 1, because the cooling is now down to 45° instead of only down to 50° as in Table 1. These increases in heat leakage and in useful load serve to make the total loads much greater for the 24 hour cooling than they were for only 1 hour cooling.

Now considering the figures for cooling 4 cans once in 24 hours as shown in the middle block of Table 2, we find that the problem confronting the refrigerating machine is completely to remove from the tank within 24 hours the entire 24 hour load so that the tank water will be cold and the requisite amount of ice built up on the coils well ahead of the time for the next load of warm milk to be put in. If we have a ¼ H. P. unit or 1/16th H. P. per can it must run from 13.1 to 15.6 hours to do this, a 1/3 H. P. unit providing 1/12th H. P. per can must run from 8.64 to 10.27 hours, while a ½ H. P. unit providing ⅛ H. P. per can can do the work in from 5.3 to 6.3 hours.

At this point it is well to note that if we want to see how a 1/3 H. P. unit would work in cooling 4 cans at night and 4 in the morning, we can solve the problem easily as follows:

1. Since one cooling takes place each 12 hours the heat leakage per cooling will be ½ the 24 hour leakage.

2. For each cooling the useful load will be 114 pounds I. M. E. as per the table.

3. The time of operation per cooling is found by dividing the total 12 hour load by the 15.5 pounds I. M. E. per hour capacity of the 1/3 H. P. unit.

The table revised for 12 hour cooling of 4 cans by 1/3 H. P. unit then becomes:—

Ratio	2:1	3:1	4:1	5:1
Heat Leakage	25	31	36	42
Useful Load	114	114	114	114
12 Hr. Load	139	145	150	156
Hrs. Operation	9.00	9.35	9.70	10.01

Since this machine uses power at the rate of about 415 watts, it uses 415 watt hours or 0.415 kilowatt hours for each hour of running and the table becomes

Kw Hours	3.73	3.88	4.02	4.16
Kwh P. can	0.93	0.97	1.00	1.04

From these figures it appears that with a 1/3 H. P. unit it is possible to cool 4 cans at night and 4 cans in the morning

but the machine would run from 9 to 10 hours per cooling or 18 to 20 hours out of the 24. If leaky valves reduced the machine's capacity it might be unable to carry the load even by running all the time. A ½ H. P. machine would be much better for cooling 4 cans each 12 hours.

In considering the kilowatt hours required per can for cooling it is interesting to note in Table 2 that the most power is required for the largest tank using the smallest motor while the least power is required for the smallest tank using the largest motor. Expressed another way, with 1/16th horse power per can cooled at any one time, power is wasted because the small compressor and the small motor are relatively inefficient, while with ⅛ or at least 1/12 horse power per can cooled at any one time, power is not wasted because the larger units are relatively more efficient.

CONCLUSION

As final deductions from the facts presented in these tables we conclude (1) that if milk is to be cooled from 95° to 50° in 1 hour in hot weather there must be ice melted from the coils during this hour, (2) to insure rapid melting of the ice the tank water must be mechanically agitated, (3) to get a machine that does not have to run too many hours out of the 24 we should have at least 1/12 horse power per can for cooling once in 24 hours and at least ⅛ horse power per can for cooling twice in 24 hours, and (4) since the larger units use power more efficiently this saving goes toward offsetting the higher first cost, interest and depreciation charges for the larger machines.

Milk cooling is a vitally important job and the equipment provided should operate as economically as possible but above all it should have ample capacity.

Rubber-like Substance from Whey

A process for making a transparent rubber-like substance from lactic acid of milk whey has been devised by scientists in the U. S. Bureau of Dairy Industry. This product, known as polymethylacrylate is a water-white semi-solid material closely related to the so-called organic glass made for highway reflectors. It is softer and more flexible than organic glass, but is very tough and elastic. Laboratory results obtained by Lee T. Smith and H. V. Clahorn in the Bureau's Division of Dairy Research Laboratories indicate that polymethylacrylate can be produced as cheaply from lactic acid by their method as it is now produced from ethylene or alcohol by the cyanhydrin process.

Polyacrylates are already in demand for various purposes. Their transparency, elasticity, toughness, ease of solubility, and stability to sunlight and ultra-violet rays make them especially valuable in the preparation of lacquers, varnishes, inks, impregnating compounds, and cements. The polymethylacrylate has an additional use as a supporting material, as in motor mountings.

All types of fabrics, paper, and other fibrous materials may be coated or impregnated with the polyacrylates to make them resistant to water, oil, and gases. Fabrics with these characteristics are useful in making ship's sails, balloon cloth, and clothing for protection against poison gases. Treated paper finds many uses, especially in the electrical industry.

Unlike the related organic glass material, polymethylacrylate alone is not suitable for making molded objects, but it can be combined with organic glass to make a molding material superior to any of the original compounds.

Lactic acid can be made efficiently from the lactose of whey. More than 6½ billion pounds of whey are produced in the United States annually. Most of it is used inefficiently or actually discarded. More than 5 million pounds of lactic acid was produced in this country last year from all sources.

J. H. SHRADER.

The Coliform Index

David Levowitz

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DEFINITION

The American Public Health Association (1) recommends that "the coliform group be considered as including all aerobic and facultative anaerobic, Gram-negative, non-spore-forming bacteria which ferment lactose with gas formation". It is to be understood that this definition is to apply in this discussion.

SIGNIFICANCE

The literature on the significance of coliform organisms in pasteurized products is aptly summarized in the source referred to above. "4. Pasteurized milk —Organisms of the coliform group are practically eliminated from milk and cream by proper commercial pasteurization procedures. For this reason, where 1 cc. samples of freshly pasteurized milk give positive results from the bottled milk, either improper pasteurization or contamination of the pasteurized product by organisms of the coliform group growing on or in the equipment or in the final container may be suspected."

Since organisms of the coliform group grow in milk products under normal refrigeration practices, the American Public Health Association cautions, "It is likewise impossible to determine the significance of results secured from samples of pasteurized milk which have been stored at temperatures that permit growth."

The adherence to pasteurization times and temperatures can be determined readily by one of the phosphatase tests. The presence of coliform organisms, when demonstrated in a properly pasteurized supply, is a definite indication of the supply's contact with contaminated surfaces or materials, subsequent to pasteurization. This information is sufficient to warrant the inclusion of testing for the coliform group in routine dairy control.

We must not leave this preliminary examination of the significance of coliform organisms in properly pasteurized dairy products without mentioning the variables which may detract considerably from the value of coliform testing in general. Strains of coliform organisms are sometimes encountered which are somewhat heat resistant, and are not destroyed completely by normal pasteurization. Spore formers and Gram-positive organisms which ferment lactose with gas production will yield postive presumptive tests. These are not members of the coliform group. The "Most Probable Number" method of recording coliform concentrations from presumptive tests—most useful in water analysis—has some definite limitations when applied to dairy products. These variables are recognized by the A. P. H. A. The value of the coliform test can be increased pronouncedly by a consideration of these factors, and modifying our procedures to avoid difficulties arising from them.

LABORATORY PROCEDURES AS DEFINED BY A. P. H. A.

The American Public Health Association, in discussing applications of the coliform test, says (page 72): "1. Pasteurized Milk and Cream. Since 10 cc. volumes of properly pasteurized milk or at least 1 cc. volumes of properly pasteurized cream very rarely contain organisms which ferment Brilliant Green Lactose Bile (2 percent) or Formate Ricinoleate Broth, or which produce typical colonies in Violet Red Bile Agar or Desoxycholate Agar, it is recommended that the standard test for coliform group organisms in routine pasteurization control work be limited to the Presumptive Test."

The A. P. H. A. suggests that "the Presumptive Test be also employed when

the coliform group test is applied to raw milk or raw cream control, but that the completed test be used from time to time to confirm the applicability of the Presumptive Test to the samples examined, for some organisms which are not of the coliform group produce gas in the liquid media, or typical colonies in the agar media."

The reason which the A. P. H. A. advances for running completed tests occasionally with raw samples would seem to hold for running them all the time with pasteurized samples. The statement that properly pasteurized products rarely contain members of the coliform group is sound if we apply it to samples taken from the pasteurizer. Only heat resistant coliforms, gas forming Gram-positives, and some spore-formers will give a positive presumptive when the samples are taken directly out of the vat after proper pasteurization. This very circumstance makes it essential to determine whether or not a member of the coliform group is actually present; this identification calls for the complete routine, as elaborated in the "Standard Methods of Water Analysis" (Eighth Edition, pp. 210-217). The statement that "properly pasteurized products rarely contain coliform organisms" is definitely ambitious (at least in my experience) if we refer to packaged products as they reach the consumer. I have found that the sterilization routine followed at most dairy plants at the present time is not rigorous enough to insure a completely sterile system following the pasteurizers. Testing the products from such plants will show the presence of coliforms nearly all, if not all the time—and in the higher dilutions. If a coliform-free product is to be obtained, it is necessary that all equipment following the pasteurizer be hooked up completely, and sterilized in accordance with the true definition of sterility—the complete absence of life; and that all operations be carried on under aseptic precautions. Where such a system is functioning, the need for positive knowledge as to the identity of a gas-former is seen to be essential. The kill of Gram-positive gas-formers, and of spores is not 100 percent, as is that of non-heat-resistant coli, and their presence does not have the same significance.

The A. P. H. A. recommends that 20 ml. of the liquid media be tubed when 10 ml. quantities of dairy products sample are to be used. We have found that this 2 to 1 ratio is not too satisfactory. The coagulation which frequently occurs during a forty-eight hour incubation tends to inhibit the rising of gas, mechanically; and the turbidity imparted to a medium makes it difficult to see whether or not gas has been formed. We have found it advisable to use 40 ml. of medium for 10 ml. inoculations to avoid these difficulties.

"THE MOST PROBABLE NUMBER"

Using the tables for obtaining the "most probable number" of coliform organisms per 100 ml. portions, on the basis of the positive gas formation in fifteen fermentation tubes, is simple. Attempting to correlate the figures in the "Most Probable Number" table with actual experience is difficult. Try explaining to anyone that 5 positive tubes at 0.1 ml. with 0 positives at 10 and 1 ml. is possible; this, by the Most Probable Number table, indicates 9 coliforms per 100 ml., while the same number of tubes at 0.1 ml. with 5 positives in both 10 and 1 ml. tubes indicates 1800 (plus) per 100 ml. The most important question—how can you get negatives in 10 and 1 ml. tubes if your 0.1's are positive—is frequently answered by the reply that the method has limitations. I cannot blame dairy manufacturers who then remark, "Why don't you get a better method?"

THE "COLIFORM INDEX"

Coliform group results can be expressed more readily by using the principle of the "indicated number" method outlined in Standard Methods of Water Analysis (Eighth Edition, p. 222, 1936). We know we have at least one organism in every tube which shows gas formation. If we have gas formation in 4 out of 5 tubes inoculated with 1 ml. portions, and

no gas in 5 tubes inoculated with 0.1 ml. portions, why not be honest and take the result we find—4 in 5 ml. Under most probable number listings, this same result would yield from 7.5 organisms per 100 ml. to 130 organisms per 100 ml.

The A. P. H. A. recognizes that the selective, direct-plating presumptive media are more reliable than fermentation tubes for determining the concentration of coliform organisms when many are present in a sample. Tubes are preferable, however, for obtaining portions of sample for the confirmatory test. A system which we have used as routine for some time, and which we have found to be eminently satisfactory, consists of inoculating five tubes with 10 ml., 1.0 ml., and 0.1 ml. portions, and seeding 2 plates with 1 ml. portions and 2 plates with 0.01 ml. portions. The selective media plates, requiring a comparatively short incubation time, tell us whether or not the sample contains many coliform organisms on presumptive test, or may pass a specification of none in 1 ml. portions. The tubes give us the presumptive indication in larger units—50 ml., 5 ml., and 0.5 ml. The 0.5 ml. is converted to 1.0 ml. We refer to these presumptive results as the "Coliform Index". The lowest tube inoculation level to show is the index level utilized. Thus, 5 positive tubes at 10 ml., 4 at 1 ml., and 1 at 0.1 ml. merely yields an index of 1/.5=2 per ml. Our selective 1 ml. plate results should have given us a value readily correlatable. A confirmatory medium plate is streaked with portions removed from at least one positive tube to determine the presence of typical colonies, and to yield material for the completed test.

USE OF THE "COLIFORM INDEX"

Many control agencies avoid the difficulties occasioned by the use of the "Most Probable Number" table by merely reporting "coliform group present or absent" in 1 ml. portions. Sometimes there is no sample volume designated at all. The value of the test will be made much greater if the actual level of the coliform concentration is reported. Plants which have instituted coliform control systems can equate the plant efficiency on the basis of the coliform index. We have found no plant in which a coliform index of 0/10 (equivalent to 0 per 50 ml. portion) has been maintained in all batches for all products indefinitely. We consider a plant is doing a good job if its index never gets below 3/1 (equivalent to 3 per 5 ml.)

Although our experiences with the use of the coliform index may not be applicable to every one, I would like to indicate some of our own recommendations for coliform control, and our interpretations of the index.

Recommendations on Milk Plant Sanitation:

1. Chlorine sterilization of all equipment after its complete assembly in plants subject to thermophilic or thermoduric problems, followed by

2. Hot water sterilization 180° - 190° F. for a full ten minute contact.

3. During operation of equipment, no lines are to be broken at all, if possible. If lines must be broken, aseptic precautions must be taken in their reassembly.

4. Handling of bottler valves during operation must be avoided. (Bottler valves must be assembled for hot water sterilization.) Where bottler valves have been touched, bottler must be stopped and valves sterilized. Cut or cracked rubbers on valves must be replaced immediately.

5. Cappers must be adjusted perfectly; handling other than the bottom cap in the cap tube must be guarded against. Bottom caps are to be discarded after the cap tube has been inserted.

6. Temperatures and strengths of bottle washer solutions (alkali, water, and chlorine) are to be checked at very frequent intervals. Empty bottles taken out of line to the filler at various stages during processing are examined for presence of coliforms.

Recommendations for Ice Cream Plant Sanitation:

1. Pump chlorine solution through entire processing line from pasteurizer. See that homogenizer head nuts (on old style machines) are loosened. See that packings are in good shape.

2. Follow with 180°–190° F. hot water for full 10 minute contact with all surfaces.

3. Freezing and packaging equipment must be given similar treatment. Principle of closed line from storage tanks to freezing equipment must be observed as far as possible.

4. Avoid contamination at the freezer by attention to sanitation of flavors, colors, fruits, and nuts.

Butter, cheese, and cultured products are rarely examined for the presence of coliform organisms. You will be surprised at the results if you examine these products. Just a tip—run controls for heat resistant coliforms and use high dilutions as well as low; you may need them.

INTERPRETATION OF THE COLIFORM INDEX

The plant which is working under a coliform control system will frequently show perfect results; it will sometimes produce samples which will possess some organisms in the lower dilutions. To those people who say that it is always possible to obtain coliform-free products, I say that I should like to see them do it under modern plant conditions.

The coliform group is not pathogenic; we consider their presence as proof that not all the possible precautions have been observed religiously. For that reason, we should certainly differentiate between the plant yielding ten thousand per ml., and that showing two per fifty ml. We know that the latter plant is trying to do a good job, and succeeding as far as is humanly possible.

1. *Standard Methods for the Examination of Dairy Products 7th edition*, p. 71 (1939).

Method for Making a Milk Bottle Cream Volume Gage

T. H. Butterworth

Chief Milk Sanitarian, Health Department, San Antonio, Texas.

In the quality control of bottled milk, the modern creamery laboratory uses among other tests the measurement of cream volume, both to determine the uniformity of its own product and as a comparative test on competitors' milk. Used to supplement the fat test, it indicates fraudulent cream lines effected by the addition of viscolized cream to skimmed or partially skimmed milk. In any case, the test is most easily carried out by use of a gage. It is necessary to have a gage to match every size and shape of bottle likely to be encountered. In many markets this means a multiplicity of gages, especially for the quart sized bottle where designing ingenuity runs rampant in an effort to produce apparently generous cream lines.

These gages often must be made to order, usually by the laboratory technician. This may tax his inventive ability. The best gage from the standpoint of durability is made from light sheet metal which calls for the preparation of a paper or cardboard pattern first. There are several ways to make this. One is to cut out the bottle curves free-hand with a pair of shears. While quickest, this calls for an artistic eye. A more practical method is to cast the shadow of the bottle onto a card by means of lights, and trace the outline. But distortion, magnification, or other optical phenomena are apt to interfere. The usual method followed is the snip-and-fit, or trial-and-error method, but it is time- and patience-consuming.

The following method has proved its worth.

Take a handful of plastercene or modeling clay, and warm it up by working well in the hands. Make a strip ¼ inch in thickness and a little longer than the overall length of the required gage. Smooth and flatten the sides by pressing on a flat surface. Take the bottle for which the gage is to be made and grease the upper part well with lard or similar substance to prevent the clay from sticking. Fit the strip of clay edgeways to the neck of the bottle, working a small piece well over the lip to form a sort of hook at the top, and keeping the edges neat and trim with a wooden tool or the fingernail. When the strip of clay conforms satisfactorily to the bottle neck representing the curved edge of the finished gage, the bottle with the clay should be put in the refrigerator for a short time to allow the clay to harden. This will make subsequent handling easier.

When sufficiently stiff to be handled without losing shape, the clay strip should be loosened from the bottle and placed carefully on its side on a piece of paper. The outline of the bottle neck and lip can then be easily and accurately traced onto the paper with a sharp pencil. The rest of the gage can be designed to suit the fancy and the pattern cut out. The clay can be used repeatedly. The procedure is shown in Fig. 1.

Any metal worker will be able to cut out a metal gage from the paper pattern and punch a small hole so it can be hung up. There then remains the job of calibration. This is done by determining the liquid volume of the bottle exactly, and computing 1 percent of this volume. The bottle can then be filled from a burette with any desired percent of fluid. The level of the fluid is marked on the gage with a sharp tool, the gage being held firmly in place on the bottle neck. Water is convenient to use in calibration, and if

FIGURE 1.

A The strip of clay ready for use.
B The strip of clay fitted to the bottle neck.
C Cardboard pattern made from the clay model. To be used in cutting out the final metal gage.

to it is added a little dark dye such as gentian violet, the exact level of the water in the bottle is more readily determined. Also, the eye must be on the same level as the surface of the water when calibrating or reading the gage, so that the thickness of the glass in the bottle wall will not introduce an appreciable error.

Gages covering 0 to 40 percent of the upper volume of a bottle are usually adequate in range for ordinary purposes. To calibrate such a gage, first determine the total volume of the bottle. Then compute 60 percent of the volume, and add that much water to the bottle from a burette. The level of the water will constitute the lower or 40 percent mark on the gage. Fill the bottle in 10 percent stages, marking each 10 percent water level. There will be four such marks, the last one constituting the full or zero mark on the gage.

Starting over again, begin with 60 percent, and add water in 5 percent amounts, marking each water level and making sure that the alternate marks coincide with the 10 percent marks previously registered. Finally, repeat the process a third time, marking the level after the addition of 1 percent quantities of water. This triple calibration gives a check on your work, and prevents the cumulative error which is otherwise apt to creep in especially at the lower end of the gage where the 1 percent graduations are closest together.

When all the marks from 1 to 40 have been recorded, the lines can be evened and extended with the aid of a rule. Varying lengths can be given to the 5 and 10 percent lines which may be further identified by written figures as in any scale.

Comparative Digestibility of Some Soft Curd Milk In-Vitro

In a recently issued bulletin from the Pennsylvania State College, Doan and Flora sought to obtain information relative to the accuracy of curd tension measurements as an index of the digestibility of various types of soft curd milk, as compared with data obtained on the ease of digestion of evaporated milk, acidified milk, or boiled milk, all known to be well tolerated by most infants.

The laboratory in-vitro method that they devised depended on the following general procedure: Three ml. of an acid-rennin-pepsin solution were placed in each of several 50 ml. Florence flasks, to which were added 20 ml. each of the sample of milk. After standing for 15 minutes at 100° F. to coagulate, 4 ml. of pepsin solution were layered onto the coagula in each flask, and all were placed in a rocker agitating device in an incubator at 100° F. The pH value was lowered every half hour to approximately 3.5 in 2½ hours by the addition of 0.3 ml. of tempered normal hydrochloric acid. Peptic digestion was measured by making nitrogen determinations on the material which passed through a 12-mesh screen. At the beginning of the fourth hour, the contents of the flasks were adjusted to a pH value of 7, and 4 ml. of a trypsin solution added. At the

end of the fourth hour, the pH value was elevated to about 8.1, and the tryptic digestion was determined at hourly intervals by removing a flask, treating with trichloracetic acid (to precipitate the natural proteins), filtering, and determining the nitrogen of the filtrate.

The results of the in-vitro technic were checked against in-vivo methods. Rats were fed approximately 6 grams of milk, and then after various intervals of 1½ to 3½ hours were chloroformed so that post-mortem examinations could be made to ascertain the condition of the milk in their intestines. The results of the two methods agreed reasonably well, certainly far better than when the curd tension technic was used as a measure of digestibility.

The in-vitro technic, while not above criticism, did produce results which compared favorably with the findings obtained by feeding rats and examining the progress of digestion in their alimentary tracts. It indicated superior digestion properties for acidified milk, evaporated milk, and to a lesser degree for boiled milk, all of which were confirmed by the in-vivo method.

Curd tension measurements were not a reliable index of the digestibility of all types of milk, particularly for homogenized milk, and to a lesser extent for trypsin-treated milk, acidified milk, and base-exchange milk.

Homogenization lowers curd tension considerably but apparently does not improve digestibility at all. Sonized milk and rotary homogenized milk seem to react similarly to milk homogenized at low pressure with a piston machine, indicating that such processed milk is no more digestible than regular pasteurized milk.

The digestion properties of trypsin-treated milk appear to be somewhat better than would be anticipated from the curd tension value.

Base-exchange milk digests more readily than untreated milk. Evaporated milk and acidified milk digest most readily of any of the milk types analyzed in this study, showing particularly high initial digestion in the peptic period.

Curd particle size would seem to be a more accurate index of the digestibility of milk and its suitability for use by infants than is curd tension.—**Comparative Digestibility of Soft Curd Milks in Vitro** by F. J. Doan and C. C. Flora. *Pennsylvania Agri. Exp. Sta. Bul.* 380, 1939.

(Editor.—An excellent review of the subject of soft curd milk has been published by F. J. Doan in the Journal of Dairy Science, November 1938, vol. XXI, No. 11, pages 739-756.)

A Simple Device for Sampling Air-Borne Bacteria *

A. Hollaender and J. M. DallaValle

National Institute of Health, Washington, D. C.

For air-borne bacteria studies, an easily constructed and operated device has been designed for accurately measuring the volume of air and counting the number of microorganisms suspended in it. The air is delivered and measured by an ordinary impinger pump (Leiman type) in series with a flowmeter. The number of organisms is determined by impinging them onto culture media in standard Petri dishes and counting the developed colonies after incubation.

The equipment is arranged as shown in figure 1. A cylindrical brass container with removable bottom is fitted with an inverted 60°, 3-inch glass funnel which is suspended (at a distance of about a centimeter) over a standard type Petri dish on the container floor. The latter may be screwed onto the body of the container tightly against a washer. Before use, the Petri dish (containing the culture medium) is placed on this bottom, the funnel and rim are swabbed with alcohol, and the cylinder (with the inverted funnel suspended within) is screwed onto the bottom. The air passes through the funnel stem so that the organisms and dust are impinged upon the agar in the Petri dish. Reproducibility is readily obtained as shown by the check results from parallel runs, and completeness of recovery of the air-borne microbic load is achieved by drawing the air through three funnels in series, obtaining about 80 percent in the first funnel device, about 15 percent in the second, and the remainder, about 5 percent, in the third.

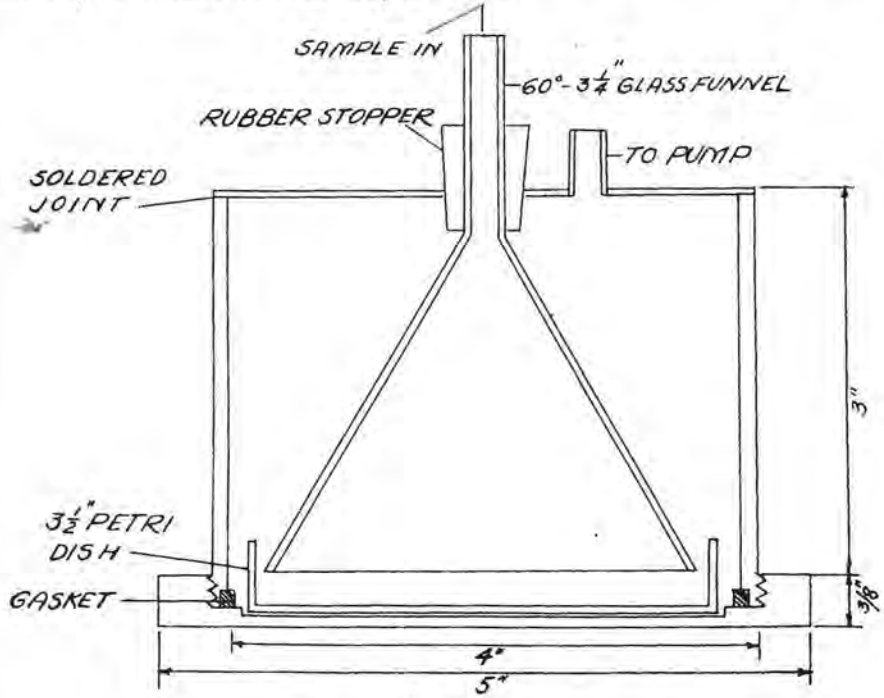

FIGURE 1
Funnel device for sampling air-borne bacteria

* Digest from *Pub. Health Repts.* 54, 574 (1939).

New Shipping Case Simplifies Milk Testing Program

A light weight milk sample shipping case has been developed by the Bureau of Milk Sanitation, New York State Department of Health, for shipping 14 milk samples under proper conditions to stationed mobile laboratories. The container maintains samples at a temperature below 40° F. for 24 hours, and costs $4.30 when bought in quantity lots. It is illustrated in Figure 1.

The outer, corrugated cardboard case measures 11⅝ x 11⅝ x 13⅝ inches. Insulated by about 3 inches of crinkled aluminum foil, a tin cannister, 5½ inches outside diameter and 7 inches high, in the center of the case holds a smaller tin container, 3½ inches outside diameter and 5 inches high. This smaller container is imbedded in ice, and holds 14 vials of 20 cc. capacity each, arranged in two tiers, with a circle of strawboard at the bottom, one between the tiers, and one at the top. Both cannisters are closed with tight-fitting covers, extending ½ inch down the side, and sealed water-tight with wide rubber bands.

Further details of price, specification, and names of supply houses can be secured by writing to the New York State Department of Health at Albany.

Health News, N. Y. State Dept. of Health, Sept. 11, 1939.

Mechanical Milk Cooling on Farms

Mechanical refrigeration for cooling and storing milk on farms has increased rapidly in recent years. There are now on the market many small refrigeration machines suitable for use where electric power is available. Refrigeration units may be powered by gasoline or kerosine motors. These machines can be obtained, with or without the storage unit, in sizes suitable to any dairy farm.

The arrangement and operation, power consumption, cost of equipment and repairs, and relative efficiency of different types of coolers were studied on 44 dairy farms, ranging in amount of milk handled from 15 to 200 gallons per day per farm. The results obtained have already been published in Circular 336, "Cooling Milk on the Farm with Small Mechanical Outfits". The use of water and ice for cooling milk on dairy farms is discussed in Farmers' Bulletin 976, "Cooling Milk and Cream on the Farm."

Either wet-tank or dry-box storage can be operated economically with mechanical units. The average amount of electric power used to cool 1 gallon of milk 1° F. on 27 farms having wet tanks was 4.6 watt- hours, and on 7 farms having dry boxes it was 5.8 watt-hours. The refrigerating machines observed were compression machines, all driven by electric or gasoline motors. All of them cooled by alternately vaporizing and compressing certain refrigerants (ammonia, sulphur dioxide, methyl chloride, and others). These evaporate at ordinary room temperatures when not under pressure, thereby absorbing heat from the surrounding water or air. When they are compressed, they condense to liquids, and are cooled back to room temperatures by the air or by water which circulates around the condensing coils. These outfits complete cost on an average $15.14 per cubic foot of storage capacity; without the tank or box, $13.30. Repairs over a period of from three months to nine years was $3.60 per year, and were mostly confined to regulation of the temperature control, replacing belts, repairing leaks, and adding new refrigerant to replace that lost by leakage.

Inasmuch as most of the machines are air-cooled, they circulate dust. Their operation generates some heat, which may raise the temperature of the room as much as 6° F. Moreover, they may leak oil. All of these considerations require that the machines be installed in a well-lighted, well-ventilated room, separate from the milk-handling or storage room.

Directions are given for calculating the capacity of the compressor for any size installation. A table lists the capacity of any compressor and the size of the electric motors needed. Examples are given to show how these calculations are made. Detailed instructions are printed for proper installation and operation.

Cooling is facilitated by agitation of the water in the cooling tanks. Various methods and hookups are discussed and illustrated.

Detailed information is given on the construction of different kinds of wet-tank and dry-box storage, together with instructions for the most efficient operation.

Farmers writing to manufacturers for information regarding the selection of the proper size refrigerating unit should give the following data: The maximum quantity of milk to be cooled and stored per 24 hours at any season; the range of temperature through which the milk is cooled (for example, from 95° to 40° F.); the temperature of the well water if this is used; and the thickness and kind of insulation on the tank.

The above information is published in Farmers' Bulletin 1818, U. S. Department of Agriculture, Washington, D. C. Copies may be obtained without charge from the Office of Information as long as the supply lasts, and thereafter may be purchased from the Superintendent of Documents, Washington, D. C., price 5 cents.

J. H. SHRADER.

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Treasurer, G. Ulvin.....Chicago, Ill.
Secretary, P. H. Tracy, Dairy Department, University of Illinois, Urbana, Ill.

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1st Vice-President, I. R. Vail.....Bristol, Conn.
2nd Vice-President, B. E. Bowen, Waterbury, Conn.
3rd Vice-President, H. Clark, Colchester, Conn.
Secretary-Treasurer, H. C. Goslee, State Office Building, Hartford, Conn.

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Secretary-Treasurer, R. E. Bemis, 24A City Hall, Cambridge, Mass.

METROPOLITAN DAIRY TECHNOLOGY SOCIETY

President, C. H. Kimberly....New York, N. Y.
Secretary-Treasurer, O. F. Garrett, Rutgers University, New Brunswick, N. J.

MICHIGAN ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, L. B. Chamberlain, Charlotte, Mich.
1st Vice-President, G. J. Turney, Lansing, Mich.
2nd Vice-President, L. M. Lamont, West Branch, Mich.
Secretary-Treasurer, H. J. Barnum, Health Department, Ann Arbor, Mich.

MILK SECTION OF TEXAS PUBLIC HEALTH ASSOCIATION

President, M. Pierson.....Austin, Texas
Vice-President, M. B. Starnes.....Dallas, Texas
Secretary-Treasurer, W. E. Roberts, State Health Department, Austin, Texas.

MISSOURI ASSOCIATION OF MILK SANITARIANS

President, J. Moffatt.....Sedalia, Mo.
Vice-President, J. W. Burns.....Nevada, Mo.
Secretary-Treasurer, G. M. Young, State Board of Health, Jefferson City, Mo.

NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, E. E. Brosnan.....Binghamton, N. Y.
Vice-President, J. F. Jansen.....Oneonta, N. Y.
Secretary-Treasurer, W. D. Tiedeman, State Office Building, Albany, N. Y.

PACIFIC NORTHWEST ASSOCIATION OF DAIRY AND MILK INSPECTORS

President, F. L. Herrington....Vancouver, Wash.
1st Vice-President, R. M. Wiley, Seattle, Wash.
2nd Vice-President, J. C. Austell, Spokane, Wash.
Secretary-Treasurer, F. W. Kehrli, Bureau of Health, Portland, Ore.

PENNSYLVANIA ASSOCIATION OF DAIRY SANITARIANS

President, J. A. Haag.....Pittsburg, Pa.
1st Vice-President, M. E. Dauer, St. Mary's Pa.
2nd Vice-President, R. P. Lienhardt, Wayne, Pa.
Secretary-Treasurer, G. C. Morris P. O. Box 141, Troy, Pa.

WEST VIRGINIA ASSOCIATION OF MILK SANITARIANS

President, W. P. Gainor.....Fairmont, W. Va.
1st Vice-President, J. E. Weber, Charleston, W. Va.
2nd Vice-President, S. W. Frame, Martinsburg, W. Va.
Secretary-Treasurer, H. E. Eagan, City Building, Huntington, W. Va.

Association News

Chicago Dairy Technology Society

The November meeting of the Chicago Dairy Technology Society was held at the Sherman Hotel, Tuesday, the 7th. Officers for 1940 were nominated to be voted on at the December meeting. Professor E. H. Parfitt of Purdue University spoke on the application of the phosphatase test to butter manufacture. The December meeting will be held Tuesday, the 12th.

P. H. TRACY, *Secretary.*

Connecticut Association of Dairy and Milk Inspectors

The fourteenth annual meeting will be held in Hartford on Tuesday, January 9th. The morning session will be devoted to talks by different authorities on milk subjects, and the afternoon session will be given over to a question box program, in which everyone is invited to participate.

At the annual business meeting, an amendment to the by-laws, reducing the number of vice-presidents from three to one, will be presented, and another amendment providing for a Board of Directors, consisting of six members, in addition to the present Executive Committee, will be offered.

H. C. GOSLEE, *Secretary-Treasurer.*

Massachusetts Milk Inspectors Association

The fall meeting of the Association was held at the Massachusetts State College on October 18, with about 150 persons in attendance. Members of the faculty presented papers on the following subjects:

The new milk media; homogenized milk and its future; suggested standards for chocolate milk; milk as a public utility.

The Electropure pasteurization process was demonstrated. Fifty-five persons enjoyed the dinner at Wiggin's Tavern, Northampton, Mass. President H. P. Baker of the State College welcomed the Association. Professor J. A. Gamble of the Bureau of Markets, U. S. Dept. Agr., and former milk inspector of Springfield, Mass., twenty-five years ago, talked on "The Early Days of the Association." Mr. E. J. O'Connell, President of the Association, acted as toastmaster.

The success of the meeting was largely credited to Professor J. H. Frandsen, head of the Dairy Department of the college.

Officers were nominated for election at the annual meeting to be held at Worcester, on January 3rd and 4th.

R. E. BEMIS, *Secreary-Treasurer.*

Metropolitan Dairy Technology Society

A symposium on milk bottle closures was the subject discussed at the meeting of the Metropolitan Dairy Technology Society on October 24. Mr. Abraham of the New York City Board of Health presented the point of view of health authorities relative to the development of more efficient closures and closures that more completely protect the pouring lip and the contents of the bottle.

Mr. F. M. Scales, Sheffield Farms, Inc. and Mr. A. J. Powers, Borden's, presented the point of view of the processor-distributor and told of the efforts which were being made in a practical way to develop a method for testing the efficiency of closures.

Dr. D. Levowitz, New Jersey Laboratories, summed up the information which has been made available by research workers and described a method which he has devised for testing the efficiency of closures and hoods in preventing contamination. His method consists essentially of using a chromogenic organism not commonly found in milk, freezing a suspension of this organism in ice, icing the bottles with the contaminated ice and, after a definite routine, looking for the organism on the pouring lip and in the contents of the bottle by making a streak culture.

Dr. J. A. Keenan, Whiting Dairies, Boston, Massachusetts, told of the cooperative efforts of the health authorities and dairy companies in that city to improve the closures of bottle.

The next meeting of the M. D. T. S. will be held on November 21, 1939, at University House, 106 East 52nd Street, New York City. Announcement of the speaker will be made later.

O. F. GARRETT, *Secretary.*

Missouri Association of Milk Sanitarians

New Dairy Husbandry Building at University of Missouri

The dedication of Eckles Hall, the new Dairy Husbandry Building at the University of Missouri, Columbia, Missouri, will take place at one-thirty Friday, November third.

The new dairy building includes a pasteurization plant, constructed in compliance with the requirements of the Public Health Service and State Board of Health Milk Ordinance and Code, and contains equipment for the proper pasteurization and handling of milk and other dairy products. Laboratory facilities and lecture rooms are available, and may be used in connection with milk control short courses and the annual meetings of the Missouri Association of Milk Sanitarians.

Through the excellent cooperation of the Dairy Department of the University of Missouri, an unusual opportunity is offered to milk sanitarians, in the state, to receive information concerning problems relative to the dairy industry. The new dairy building and new pasteurization equipment will further increase these opportunities.

Milk Sanitation Seminar To Be Held At St. Louis November 13-17

In compliance with a resolution adopted at the Seventh Annual business meeting of the Missouri Association of Milk Sanitarians held in Columbia, Missouri, on May 3, 1939, the State Board of Health and the St. Louis City Health Department have made arrangements with the U. S. Public Health Service to conduct a milk sanitation seminar in St. Louis on November 13-17, 1939.

This is the ninth seminar for state and local milk sanitarians to be held as a result of a recommendation of the committee on milk of the Conference of State and Provincial Health Authorities, and will be attended by milk sanitarians from Missouri and surrounding states.

Official announcements concerning the meeting have been sent to all members of the State Association and others interested in milk control work.

G. M. YOUNG, *Secretary-Treasurer.*

New York State Association of Dairy and Milk Inspectors

Reported by Dr. Paul B. Brooks

The Seventeenth Annual Meeting of the New York State Association of Dairy and Milk Inspectors was held at Syracuse, September 27, 28 and 29, 1939. The attendance was 412.

OFFICERS

President: Dr. E. E. Brosnan, City Health Department, Binghamton.

Vice-President: Dr. J. F. Jansen, Sheffield Farms Company, Oneonta.

Secretary-Treasurer (re-elected), W. D. Tiedeman, Albany.

New Member Executive Committee, Mr. Samuel Abraham, New York City Health Department.

Following a discussion of the inadequacy and relative ineffectiveness of efforts in the direction of mastitis control and the loss to the dairy industry as a result, a resolution was adopted authorizing the president to appoint a committee to confer with appropriate authorities of Cornell University and, if acceptable to them, to convey to the State legislature the association's urgent recommendation that a sufficient appropriation be made available to the University to permit a thorough and adequate study of the problem.

At a *preliminary* business meeting at the opening session on the 27th, the by-

laws were amended to permit members of the association, by payment of an additional dollar in annual dues, to become associate members of the *International Association of Milk Sanitarians* and receive the JOURNAL OF MILK TECHNOLOGY. This was made possible by a recent amendment of the Constitution of the International Association. Local members able to qualify and wishing to become active members of the International organization, it was pointed out, could do so on payment (to the latter) of an additional dollar.

A few gleanings from the program (not necessarily the major points brought out by papers or discussions).

The program opened with an address of Welcome by Dr. H. Burton Doust, health commissioner of Syracuse who called attention to the fact that it was at a meeting in Syracuse seventeen years ago that the State association was first organized. He commended the organization for its influence in improving standards in milk sanitation and, particularly, in promoting the spread of pasteurization. Syracuse, he said, was the first city in the State to officially require the pasteurization of all milk sold in the city.

Dr. F. W. Graves, of the department, reported the results of a survey to ascertain the relative effectiveness of laboratory methods and veterinary examination and combinations of the two, in elimination of mastitis from milking herds. In company with local veterinarians he had examined a large number of cows in herds subject to the various measures, noting the percentages of cows with mastitis. Except for the certified dairies examined, which showed a relatively low percentage of diseased animals, and for individual herds producing "premium" milk, his figures revealed that the results obtained by the different methods did not differ materially. It was his general conclusion that the results in elimination of infected animals depended less on the selection of methods than on the thoroughness and skill with which the measures were applied. A member of the state health department staff, in discussion, said, it was "rather disappointing" to note that the percentage of diseased animals found in herds producing Special A Raw milk, subject to standards which the department had been describing as "comparable with those for Certified" was not materially lower than those for herds producing milk sold as Grade A and Grade B pasteurized.

Dr. George J. Hucker, of the Geneva experiment station, discussing "The Relation of the Elimination Program to the Control of Mastitis" reported the results of a study of a large number of reports and records from health departments and other control agencies in this and other states. His studies indicated that the control measures, as they have been applied in the past, have not reduced the general incidence of mastitis. In discussion the view was expressed that a large share of responsibility for the failure rested on cattle dealers who bought "condemned" animals and later sold them to other unsuspecting dairymen.

Papers of special interest to laboratory workers were presented by Dr. Ralph B. Little, of the Rockefeller Institute for Medical Research, Princeton, N. J., on The International Classification of the Streptococci of Bovine Mastitis; Mr. C. E. Safford of the State Department of Agriculture and Markets, on Grade A Milk Control Laboratories (Bacteriological); Mr. Harrey Scharer, of the New York City department of health, on "New Tests for Available Chlorine," and Mr. F. W. Gilcreas of the New York State Laboratory on "Precision in Reading Results of the Phosphatase Test."

Dr. F. D. Holford, in discussing the relation between "Milk trucking" and sanitary quality, brought out the fact that if milk cans are exposed to dust, when milk is cooling, dust will be sucked into the cans in appreciable quantities, even though the cans are covered. Road dust had been found in empty cans arriving at farms on return from plants. When empty cans had been unloaded near a railroad track and left exposed, they were found to contain coal dust. When bags of feed had been carried on the top of loads of closed milk cans, feed dust had been found in adjacent cans, he said.

Discussion of a paper by Dr. F. W. Fabian of Michigan State College on "New Developments in Sanitary Control of Ice Cream" brought out the fact the epidemics traced to ice cream in New York State have been due to use of unpasteurized milk and cream in home-made ice cream. Careless handling of ice cream after delivery to stores and restaurants was emphasized as a potential source of danger.

Modern Fly Control in dairies was the subject of a practical paper by W. A. Pohlman, of New York City, discussed by Dr. O. D. Chapman, of Syracuse University. Systematic efforts to prevent fly breeding, both speakers emphasized, were more likely to be effective than efforts to exclude flies from plants. When deprived of "preferential" breeding places, they would go to "the next best place". They will breed in soil or even in cracks in floors and walls, where there is organic material, moisture, and warmth without direct exposure to the sun. Where flies are numerous around plants, Mr. Pohlman said, they congregated on screen doors and were "pushed in" when the doors were opened. He advocated electrification of screens.

Speakers from outside the State, besides Dr. Little and Dr. Fabian, were Ralph E. Irwin, of the Pennsylvania State health department, who discussed the "Approved Inspector System"; Dr. Leslie A. Chambers, University of Pennsylvania School of Medicine, on "Digestibility of Processed Milks;" Dr. E. H. Parfitt, Purdue University, Indiana, on "Bacteriological Problems in High-temperature, Short-time Pasteurization"; and Mr. C. J. Babcock, United States Department of Agriculture, who spoke on "Flavors and Odors in Milk". Dr. Parfitt's paper was discussed by Dr. T. W. Workman of Yale University.

Cornell University was represented on the program by Dr. G. F. Hucker and Professors P. F. Sharp, D. B. Hand, E. S. Guthrie, H. W. Riley and H. J. Brueckner.

Report of the Secretary-Treasurer, International Association of Milk Sanitarians, Inc., October 26, 1939

At the last annual meeting of the Association, action was taken which made it mandatory that a vote be taken upon two proposed amendments to the Constitution. This vote, by mail, was taken in accordance with the provisions of the Constitution. The amendments voted upon were as follows:

3. Cancel present article entitled "Object" and substitute therefor the following:

Article II. Object

"The object of this Association shall be to develop uniform and proper supervision and inspection of dairy farms, milk and milk products establishments, and milk and milk products; to encourage the improvement in quality of dairy products and the technological development of dairy equipment and supplies; and to disseminate useful information regarding dairy sanitation, technology, inspection, and administration."

4. Cancel present article entitled "Membership" and substitute therefor the following:

Article III. Membership

Paragraph 1. There shall be two classes of membership in this Association: Active and Associate.

Paragraph 2. The professional and experiential qualifications of the Active members, in addition to the dis-

tinctions specified in the following two paragraphs, shall be:
(A) an undergraduate degree or its equivalent; (B) actual experience of at least three (3) years in dairy inspection, supervision, teaching, or technology; provided, however, that all persons who at the time of the adoption of this amendment are members of the Association shall retain their present status.

Paragraph 3. The Active membership shall be composed of persons who are officially engaged in dairy or milk inspection, or the laboratory control of, or the administration of such function for any country or any subdivision thereof, and of persons who are officially engaged in research or educational work related to dairy or milk inspection for any country or subdivision thereof, and who possess the qualifications described in Paragraph 2 of this Article.

Paragraph 4. The Associate membership shall be composed of any persons, not eligible for Active membership, who are interested in the promotion of dairy sanitation and technology. Associate members shall not be eligible to vote, serve as officers, hold the chairmanship of any committee, serve on the Resolutions Committee, or serve as majority members of any committee of this Association.

Paragraph 5. Any person may make application for Active or Associate membership to the Secretary-Treasurer, and if application is accepted by the Membership Committee, said applicant may become an Active or Associate member, as the case may be, upon payment of the annual membership dues of three dollars ($3) for Active Membership, or two dollars ($2) for Associate membership.

The result of the vote is as follows:
Amendment No. 3: For: 92. Against: 0. (92 voting).

Amendment No. 4: For: 89. Against: 3.

These amendments become effective upon the reading of this report at this annual meeting.

The Executive Board has been empowered to publish the Journal of Milk Technology. This Journal has been issued bi-monthly since the first issue, October, 1937. The report of the Managing Editor, Mr. Wm. B. Palmer, has been submitted to the Executive Board, and with your permission Mr. Palmer will present his report to the Association. The magnitude of the work entailed in editing and publishing a bi-monthly publication requires exceptional ability and unabated effort to assure success. The Association, through this report, expresses to Mr. Palmer, Managing Editor, and Dr. Shrader, Editor, its appreciation for their efficient and successful work. It can not be expected, nor is it desired, that the managing editor and editor continue their work without remuneration for services rendered by themselves and for capable clerical assistance. By virtue of authority given to the Executive Board, action will be taken to compensate the Journal management.

It is gratifying to announce that the following organizations have designated "The Journal of Milk Technology" as their official publication:

New York State Association of Dairy and Milk Inspectors.

Massachusetts Milk Inspectors' Association.

Central States Milk Sanitarians.

Michigan Association of Dairy and Milk Inspectors.

West Virginia Association of Milk Sanitarians.

Milk Section of Texas Public Health Association.

Connecticut Association of Dairy and Milk Inspectors.

Missouri Association of Milk Sanitarians.

The Pennsylvania Association of Dairy Sanitarians.

Metropolitan Dairy Technology Society.

Chicago Dairy Technology Society.

Indianapolis Dairy Technology Club.

Pacific Northwest Association of Dairy and Milk Inspectors.

Plans are under way for the formation of similar associations in areas which now have no such organizations.

The accomplishments of the Committee on Sanitary Procedure should not be passed over without comment. The work of this committee, cooperating with similar committees of the International Association of Milk Dealers and the Dairy Industries Supply Association, is exerting a significant influence in the standardization of dairy equipment. Very appreciative comments through editorials in some of the publications of the industry indicate the value of what has already been accomplished. It is strongly recommended that this Association make every effort to further the work of this committee.

The report of the Committee on Dairy Farm Methods received widespread publicity in Canada, it having been reprinted in toto and distributed to thousands of dairy farmers in that country. This was done by a manufacturer of dairy equipment, with permission.

Although other committee reports have not received the publicity given the aforementioned ones, communications reaching the Secretary's office indicate that they have served a very useful purpose for many persons interested in sanitation.

Since our last meeting, 89 new members have joined the Association, 44 Active and 45 Associate, making a total membership of 400—233 Active and 167 Associate. (The United States, Canada, Ireland, Cuba, India, Mexico, Puerto Rico). (Last year 328 members.)

The Membership Committee has before it approximately 300 applications for membership, most of which are the result of action taken by the New York State Association of Dairy and Milk Inspectors at its 1939 annual meeting. The by-laws of that Association were amended to provide that upon payment of $3 per year by eligible members, such members would receive:

1. membership in the State Association.
2. (if elected) membership in the International Association.
3. subscription to The Journal of Milk Technology.

If membership in the International Association is not desired by any member of the State Association, the annual dues to the State Association will be $2.00. In brief, this action by the State Association lowers the local Association dues $1.00 per year if a dual membership is taken out. Of those registering at the State meeting, approximately 80 percent applied for membership in the International Association.

Such action by local association should stimulate and coordinate milk control work with mutual benefits to both the local and International associations and their members, because the purposes and ideals of each organization are the same.

In looking ahead, your Secretary visions a steady and perhaps a rapid growth in the Association, but more especially in the work which the Association is undertaking. Such growth will bring real and lasting benefits to all milk control officials, to the industry as represented by producers, manufacturers, and dealers, and the results will be reflected in better milk for more people.

To all who have helped in preparing the program and carrying it to its completion, to the Executive Board, to the Management of the Journal of Milk Technology, to the many members who have given of their time and thought to Association problems and activities, your Secretary expresses his grateful appreciation. It has been a real pleasure to work with President Ehlers, who has given unstintingly of his time and energy to the duties of his office. Due to his promptness in handling Association matters the distance which separated the two offices was no real handicap.

Respectfully submitted,

C. SIDNEY LEETE,
Secretary-Treasurer.

FINANCIAL STATEMENT OF THE SECRETARY-TREASURER

TO OCTOBER 20, 1939

Receipts

Cash on hand Oct. 15, 1938	$ 635.38
Sale of annual reports	20.63
Annual dues	1,640.65*
Refund from Dr. Shrader on expenses to Cleveland meeting	3.40
Total	$2,300.06

Disbursements

Printing: including committee lists, programs, notices, paper, envelopes, etc.	$ 108.80
Postage and telegrams	42.00
Stenotype services at Cleveland meeting	23.87
Badges—Bastian Bros.	31.84
Managing Editor of Journal of Milk Technology—for clerical help and expenses of Journal management	699.00
Expenses of Secretary-Treasurer attending annual meeting at Cleveland and one Executive Board meeting in New York City	44.99
Expenses of T. S. Sutton attending Cleveland meeting as speaker	13.50
Expenses of Dr. Shrader attending Cleveland meeting	64.00
Secretarial services for Association during year	200.00
Services of printing clerk	25.00
Services of stock clerk storing and handling reports and other Association material	10.00
Fee for filing annual report of Association	1.00
Refund of annual dues to Arthur Lipson	5.00
Refund to Dr. Shrader for overpayment**	1.00
Subscription to 1938 Journal for Dr. Hodges (sent to Mr. Palmer)	5.00
Premium on Bond for Mr. Palmer	10.00
Premium on Bond for Mr. Leete	5.00
Cash on hand October 20, 1939	1,010.06
Total	$2,300.06

* Exchange fee—Ireland.

** His check noted under "Receipts" should have been for $2.40 instead of $3.40.

New Developments Proposed for the International Association of Milk Sanitarians

Through resolutions adopted at the annual business meeting of the International Association of Milk Sanitarians, the Executive Board is to inaugurate the following activities:

REGIONAL CHAPTERS AND AFFILIATIONS

The formation of local or regional chapters of the International Association of Milk Sanitarians, which may consist of formally organized local or regional associations of milk sanitarians or technologists, provided that the constitution and/or by-laws of the local chapters do not conflict with those of the International Association of Milk Sanitarians, and furthermore, that the members of such chapters have the status of Associate Members of the International Association of Milk Sanitarians, and further provided that any such Association Member is eligible to become an Active Member upon compliance with the requirements therefor, and that any such local chapter may publicly declare its affiliated relationship when it has received written permission from the Executive Board of this Association to use the statement: "Affiliated with the International Association of Milk Sanitarians", or its equivalent as the said Board may permit.

AWARD

The establishment of an award, granted at the Annual Meeting, in recognition of the important services rendered to milk sanitation or technology by anyone deemed worthy by the Executive Board of receiving such honor, and that the award will consist of an engrossed medal or certificate, publicly presented and accompanied by such monetary honorarium as may be contributed by a public-spirited person, organization, or business, subject to the approval of the Executive Board.

EDUCATION

Collaboration with the Dairy Industries Supply Association in affording sanitarians and a limited number of selected students opportunity to study the exhibits at the Dairy Exposition, and in conducting related lectures and conferences on public relations, dairy sanitation, and dairy technology, providing that selection of the students be made on a competitive basis and that these privileges granted sanitarians be extended to members as well as non-members of this Association.

Establishment of desirable curricula for the instruction of milk sanitarians, and for the accreditation of institutions offering adequately administered and constructed courses.

CHOCOLATED MILK

Appointment of a committee of five to study the subject of chocolate milk including necessary standards and requirements, and report at the next Annual Meeting.

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"Doctor Jones" Says —

"Maybe it hasn't got much to do with health—and then again maybe it has—but I was thinking what a lot of inconsistencies there are in this business of age limits on jobs. Years ago a friend of mine worked for a concern that made hammers that were known all over the world, practically, as the best that could be bought. They used to pride 'emselves, this company did, on the length of time their employees had worked for 'em: thirty, forty, fifty years, some of 'em. A defective hammer'd have just about as good a chance of getting by one of 'em as a baseball fan'd have climbing over the fence to the World Series. And other industries that turned out high-class stuff—they used to look at it the same way: after they'd spent twenty or thirty years breaking a man in, they figured it was his duty to stay on for another twenty or so and give 'em the benefit of his experience. It seemed they went in for quality rather'n quantity.

"Then the situation sort of changed. I don't know whether it was the war or the boom coming on or automobiles or what but speed got to be the watchword, as you might say. We began hearing that it was an 'age of young men.' Maybe compensation insurance and pension systems had something to do with it. By the time the boom busted anybody over forty—they began running 'em on a siding and pulling up the track. All they were good for was junk.

"But the other side of it—it's kind of funny. Back here awhile ago when a man forty years old was appointed on the United States Supreme Court, they wondered whether he was old enough for the job; the way one New York editor put it—whether he had the 'ripeness of judgment and experience' the position called for. They decided he might get along all right, seeing there was another man got to be Chief Justice that was only forty-six when he was appointed. By the way, they used to have an age limit on health officers but they took it off. Maybe they decided being able to use their heads was more important than being able to stand on 'em. I've got sort of a hunch some more age limits are coming off pretty soon, too.

"About the size of it, the way it looks to me, a working organization is some like a kite: it's got to have plenty of lifting power but, the same time, it needs a tail to keep it right side up and a string to keep it from blowing away. The high-speed stuff—that's where the youngsters shine but they need the older one to watch the signs and slow 'em down around the sharp curves.

"I see the committee the Secretary of Labor appointed—with six heads of big industries on it—they reported there's no sound basis for the prejudice against older workers. It sort o' looked, there one while, as if we were wasting our time, us health officers, making folks live longer but maybe there's something in the 'Fathers' Day' idea, after all."

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