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Listed on Page 251

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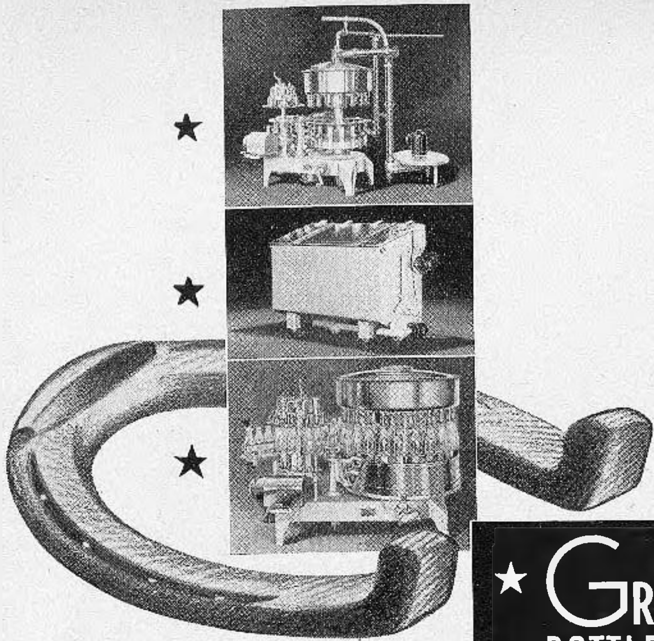

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JOURNAL OF MILK TECHNOLOGY

Official Publication of the

International Association of Milk Sanitarians
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# JOURNAL of MILK TECHNOLOGY

Volume 5 July–August, 1942 Number 4

Editorial

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

Pasteurized vs. Raw Milk in Cuba and Mexico

Before we started on our tour of Cuba and Mexico in the interest of the Inter-American Committee for the Dairy Industries, we studied a circular which described a cruise to the West Indies. Emphasis was placed on the fact that Puerto Rico is as different from Haiti as Haiti is from Curacao, and that the latter is as different from Martinique as Martinique is from Trinidad, and so on through a list of the important islands in the Caribbean area. Thus we were prepared for differences between Cuba and Mexico; but not for what we really found. The two countries are very different from each other.

Cuba has a population of four and a quarter million, one million of whom are negroes or mulattoes. Only a few Indians remain in the eastern end of the Island. The majority of the whites are descendants of the Spanish colonial settlers, but these may have an English, Irish, Scandinavian, or Italian name because of the intermarriage of some ancestor with a Spanish sweetheart.

Mexico, on the other hand, has a population of 20,000,000 persons, 30 percent of whom are of pure Indian descent living under conditions almost as primitive as those found by Cortez and his fellow adventurers in 1519. The ruling class, under present conditions, is composed of the mestizos or mixed blood persons that make up 60 percent of the population. The 10 percent of white persons are largely Spanish with a foreign population of only 160,000 Americans, British, Germans, French, and Italians. Negroes are very few in number.

Among the peons of the country districts of Cuba or among the Indian population of Mexico, milk and dairy products are almost unattainable luxuries. A friend of ours who had lived as a missionary in Mexico for several years in a Zappotec Indian village reported that nobody in the village owned a cow or even a goat. The only dairy products that reached them were a few tins of condensed or evaporated milk. As one Mexican friend expressed it, "Even if an Indian had a milch cow, he would trade the milk for corn and beans as his income is so low that he could not afford to use the milk."

Under these conditions, infant and child mortality is high, especially among the poorer classes of both Cuba and Mexico. Outside of Havana, Mexico City, and similar large cities, milk sanitation, as we know it, does not exist. Fortunately, the peons usually follow the custom introduced by the Spaniards and heat milk to a boil before it is used. While this custom undoubtedly arose in order to keep the milk from souring, it at the same time destroys the germs of infectious diseases.

Few Americans realize that the reason we have a raw milk problem is because our dominant ancestry was British or other northern European countries in which milk was and still is used in fresh unheated condition. The introduction of raw milk into Cuba and Mexico has not been a blessing. Do not think that a milk-shake secured at a soda fountain in Havana is safe just because it comes from a glass bottle with an expensive cover cap. The milk may be raw milk from herds only partially protected from diseases transmissible to man. If you are a tourist in Mexico and are served heavy cream with American food at an American restaurant, just remember that the poorest Mexican who does not use milk until it is heated to a boil really has a safer, though not a cleaner, product for use than you do.

ROBERT S. BREED.

Iowa Enters Journal Family

IT was just not in the stars that the great state of Iowa should continue to go along without an active association of milk sanitarians. So many contributions of value in dairy sanitation and technology have come from that state that we have long wondered why Iowa has lagged behind so many of its sister states in setting up such an organization. The interest of the Iowa men has now found expression in the formation of the Iowa Association of Milk Sanitarians through the enthusiasm and organizational ability of that old-timer in milk sanitation, J. R. Jennings. The great North Central States need just such an organization—and also we need them. Iowa has long been out in front along dairy lines, and is now set to accelerate her pace. Fellow sanitarians, we greet you heartily.

J. H. S.

SANITARIANS—ATTENTION

Thirty-first Annual Meeting

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Headquarters: Hotel Jefferson

St. Louis, Missouri

The Influence of Ammonia on the Development of Rancidity in Milk

C. H. Castell

Department of Bacteriology, Ontario Agricultural College, Guelph, Canada

Among the large and growing list of things that have been shown to influence the activity of lipase in milk, no reference can be found to ammonia. The results of the experiments described in this paper show that ammonia, either added to the milk in the form of an aqueous solution or absorbed by the milk in the form of a gas, has a marked effect on the development of rancidity.

Experimental

The source of the ammonia used in these experiments was a 28 percent solution prepared by Canadian Industries Limited. The quantities used are always designated as the amount of ammonia (NH_3) per volume of milk.

The experiments were all done with winter milk (between January 1 and May 1) from a herd of Jersey, Holstein, and Ayrshire cattle. There were also included two dual purpose Shorthorns. The general procedure was to obtain a composite sample of milk from each cow and place them immediately in an ice box held at 5° C. The activity of the lipase was followed by three different methods. The first was a modification of the method used by Rice and Markley (1): 10 ml. of milk were added to 100 ml. of cream (approximately 25 percent fat), saturated with cane sugar, and this mixture was incubated at 37° C. Increases in acidity were observed by periodically titrating 10 ml. of the mixture in 50 ml. of distilled water against N/10 NaOH with phenophthalein as an indicator. The second method followed the decreases of surface tension of milk when stored at 5° C., using a Cenco-du Nouy tentiometer. Thirdly, the development of rancidity was observed by noting changes in the flavor of the milk. In no instance was milk classified as rancid unless it had a definite and unmistakable butyric-acid-like flavor. Suspicious or slightly rancid flavors were ignored.

These are all preliminary experiments planned to determine whether addition of small amounts of ammonia to milk accelerates the production of rancidity. In this paper no attempt is made to work out a detailed relationship between the amounts of ammonia added and the effects they produce. Nor is any attempt made to determine whether the ammonia activates the lipase or simply changes the physical or chemical condition of certain constituents of the milk in such a way as to favor conditions for lipase activity. For this reason, most of the experimental work deals with the production of a rancid flavor and decreases in surface tension of the milk itself, rather than with the action of lipase on fatty substrates other than milk.

Presentation of Data

The effect of ammonia on the milk from individual cows. The first tests were made with milk from 9 Holstein cows. One of these, No. 7, had a previous history of mastitis; the others were all normal cows. Ten ml. of milk from each cow were added to 100 ml.

of sugar-cream syrup and incubated at 37° C. Two sets of 100 ml. samples of milk from each cow were held at 5° C. To one set, sufficient ammonia was added to give a concentration of 1:5,000. After 4 days, the decreases in surface tension of the milk samples were compared with the increases in titratable acidity in the sugar-cream mixtures, measured in ml. of N/10 NaOH required to neutralize the increased acidity in sugar-cream syrups incubated for the same period at 37° C. The results are shown in Table 1. been noted in periodic tests over a period of three months.

The second series of tests was made with milk from 32 cows. The ammonia was added to give a concentration of 1:3,000. Surface tension readings were taken at 24, 48, and 120 hours. They were also tasted for flavor changes. It should be stated that as well as No. 7, the mastitic cow, there was one other animal producing abnormal milk. Cow No. 79 was a ten year old Jersey at the very end of her lactation period. She had been previously giving milk that very rapidly developed a strongly rancid flavor when held at a low temperature.

TABLE 1

CHANGES IN SURFACE TENSION AND ACIDITY BY ADDITION OF AMMONIA

Cow No.	*Acidity* [1] Ml. N/10 NaOH	*Surface Tension* No NH_3 Added	*Surface Tension* NH_3 Added
11	1.25 [1]	50.0⊠	42.7
33	.85	48.5	45.3
26	.85	49.0	45.7
29	.75	46.0	46.6
14	.75	50.0	46.7
25	.70	48.6	46.9
27	.65	48.7	47.5
17	.65	50.0	48.0
7	.60	50.0	50.0

[1] Increase in acidity over control samples. ⊠ Dynes per cm. at 23° C.

Two things are noticeable in these results:

(1) Some of the milk samples to which ammonia had been added had a much lower surface tension than the corresponding untreated samples; others remained similar to the untreated milk; and in no instance was the addition of ammonia accompanied by an increase in surface tension over that of the normal milk. (2) There is a closer co-relation between the increases in titratable acidity in the sugar-cream mixture and the decrease of surface tension of the milk samples when ammonia had been added. The discrepancy between the increased acidity (in the cream-sugar mixture) and decreased surface tension with the milk from certain individual cows had

The results of the surface tension readings were similar to those of the group previously given. The action of ammonia in lowering the surface tension below that of the untreated milk varied greatly with the samples from different cows. Figure 1 shows 5 examples where this effect was the greatest and 7 examples where the effect was the least for the first period of 24 hours. It is very significant that in the case of Cow No. 79, which had been producing milk with "naturally activated lipase," the results are practically the same with and without added ammonia. At 24 hours the average of surface tension readings of the samples

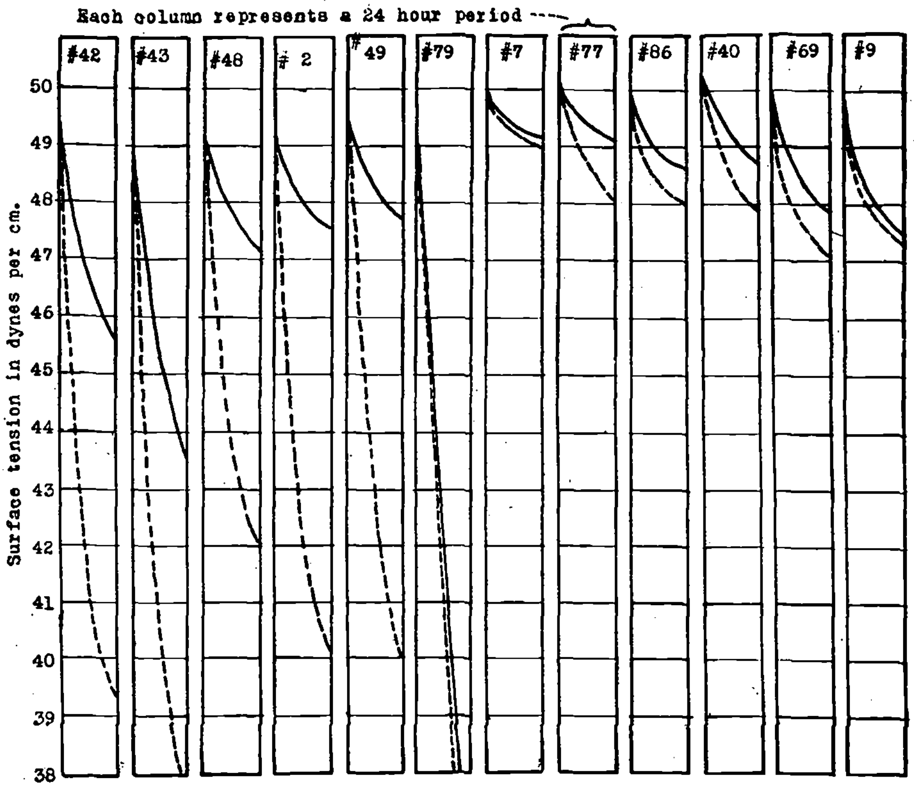

FIGURE 1

Decreases in surface tension during 24 hours storage at 5° C. for milk samples from 12 cows. The unbroken lines indicate untreated milk and the broken lines milk to which 1 part of ammonia had been added to 3,000 parts of milk.

to which ammonia had been added was 2.8 dynes lower than the average of the untreated milks; at 48 hours there was a difference of 3.0 dynes and at 120 hours it had increased to 4.7 dynes. Excluding the two abnormal cows (No. 7 and No. 79), and two Shorthorns, the following gives some idea of the effect of ammonia in lowering the surface tension below that reached by the untreated milk, for the three breeds tested:

	Average Decrease in S.T.* below Untreated Milk Samples		
Breed	At 24 hours	At 48 hours	At 120 hours
Jerseys (6 cows)............	2.43 dynes	1.76 dynes	2.83 dynes
Holsteins (12 cows).........	2.40 "	3.83 "	5.48 "
Ayrshires (10 cows)........	3.90 "	3.99 "	5.42 "

* S.T. = Surface Tension.

That the reduction of surface tension was caused by formation of fatty acids is shown by the fact that such decreases were accompanied by the development of rancidity, as shown by the following:

	Number of Rancid Samples		
Treatment	At 24 hours	At 48 hours	At 120 hours
Plain milk	1 (# 79)	1 (# 79)	4
Ammonia added	6	8	19

It is interesting to note that the milk from the 5 cows which developed a rancid flavor when ammonia was added, at 24 hours (not counting No. 79) were from 4 Ayrshires and 1 Holstein. At 120 hours, where ammonia was added, the rancid samples came from 2 Jerseys, 7 Holsteins and 8 Ayrshires.

Variations in Amounts of Ammonia Used. Milk samples from 8 cows were selected, of which 4 had been found previously to be markedly affected by the addition of ammonia and 4 which were only slightly affected. These samples were divided into 5 sets of 150 ml. each, and ammonia was added so as to give the following concentrations: 1 : 2,800, 1 : 14,000, 1 : 140,000, 1 : 1,400,000, and a control set without added ammonia. They were held at 5° C., and their flavor and surface tension tested at 36 hours, 4 days, and 7 days. Table 2 gives the average surface tensions for each of the groups at the various times when they were tested. These results indicate that ammonia to the strength of 1 part in 14,000 parts of milk is effective in increasing lipolytic activity in milk, but not so effective as 1 part in 2,800; and further, that 1 part in 140,000 is insufficient to bring about any noticeable change.

Absorption of Gaseous Ammonia. In the first of these tests, two glass desiccator jars were used, having a capacity of 2.5 liters. Into each jar were placed 7 duplicate milk samples in small, screw-topped, wide-mouthed bottles, holding 25 ml. each. One out of each pair of duplicate samples had the lid of the bottle tightly screwed down; the other was left uncapped. Into the bottom of the first jar was placed a dish containing 1 ml. of concentrated (28 percent) ammonia solution. Into the other, a similar dish was placed containing 1 ml. of concentrated ammonia that had been diluted 50 times. These were then held at 5° C., and samples were tested at 36, 48, and 110 hours for changes in flavor and surface tension.

In the desiccator jar containing 1 ml. of concentrated solution, so much ammonia was absorbed by the uncapped samples that marked changes occurred in the appearance of the milk. The portion of the milk below the cream layer lost its opaqueness and became almost watery. The samples had a very strong flavor of ammonia and the pH became strongly alkaline. These were discarded. Table 3 gives the results from the milk samples in the jar containing one fiftieth as much ammonia. There was no observable difference in the appearance of the capped and uncapped bottles in this jar. The milk from the first 4 of these cows (Nos. 42, 43, 48, and 53) had been shown in previous tests to undergo a larger additional reduction in surface tension when ammonia has been added than the remaining two (Nos. 76 and 71). These results indicate that ammonia absorbed by milk from the atmosphere is also effective in increasing the lipase activity in milk. In two of these cases the difference between the treated and untreated samples was sufficient to produce a rancid flavor in the former.

TABLE 2

THE EFFECT OF ADDING VARIOUS CONCENTRATIONS OF AMMONIA ON THE AVERAGE SURFACE TENSION READINGS OF TWO GROUPS OF MILK SAMPLES HELD AT 5° C.

Length of Holding Period		*Control* (Nothing added)	*Concentration of Ammonia* 1 : 2,800	1 : 14,000	1 : 140,000	1 : 1,400,000
36 hours	Group I	44.5⊠ (1)	39.1 (3)	40.3 (2)	45.6 (1)	44.6 (1)
	Group II	47.6 (0)	44.7 (0)	46.2 (0)	46.9 (0)	47.9 (0)
4 days	Group I	44.7 (1)	36.5 (3)	42.0 (2)	44.4 (1)	44.7 (1)
	Group II	45.9 (0)	42.7 (1)	44.6 (1)	45.0 (0)	45.1 (0)
7 days	Group I	37.7 (4)	34.5 (4)	37.4 (4)	38.5 (4)	39.3 (4)
	Group II	43.9 (1)	41.8 (1)	44.3 (1)	44.5 (1)	44.6 (1)

⊠ Dynes per cm. at 23° C.

The figures in brackets indicate the number of samples that had a rancid flavor in each group which had a total of 4 samples.

In a second test, where milk was exposed to an atmosphere containing ammonia, the period of exposure was greatly reduced. A glass box (26″ x 23″ x 19″), similar to those used for protecting balances, was used in place of the desiccator jar. Although closely fitted, it was not completely air tight. Two petri dishes, each containing 1 ml. of concentrated ammonia (28 percent) were placed in opposite corners of the glass box. Five hundred ml. of milk were placed in a wide-mouthed glass jar fitted with a syphon delivering into a similar jar below it. It took five minutes for the milk to run from one container to the other, and the milk was left exposed to the ammonia for another 25 minutes. With this treatment it was hoped that an approximation of the most extreme conditions of milking in an atmosphere containing ammonia could be obtained. The milk used was a composite sample from 4 cows.

TABLE 3

CHANGES IN SURFACE TENSION IN CAPPED AND UNCAPPED MILK IN A DESICCATOR JAR CONTAINING 1 ML. OF A 0.56 PERCENT AMMONIA SOLUTION

Cow No.	*Containers*	*36 Hours*	*48 Hours*	*110 Hours*
42	Uncapped	45.5⊠	44.2	39.9 (rancid)
	Capped	45.3	44.5	41.9
43	Uncapped	43.3	41.5	39.2 (rancid)
	Capped	44.2	42.3	43.0
48	Uncapped	48.7	47.1	45.3
	Capped	48.9	48.7	47.2
53	Uncapped	44.3	43.9	41.9
	Capped	46.4	46.7	45.0
76	Uncapped	48.4	45.9	45.6
	Capped	45.4	47.5	45.5
71	Uncapped	46.2	46.2	43.2
	Capped	46.6	46.8	43.8

⊠ Dynes per cm. at 23°C.

A control of the same milk in a tightly stoppered bottle was kept beside the treated sample so as to ensure approximately similar temperature treatment. The milk was held at 5° C. In this, as in all other tests, the glassware had been previously sterilized and every effort was made to keep conditions as aseptic as possible. As indicated by Table 4, even this half-hour exposure was sufficient to bring about

TABLE 4

EFFECT OF AMMONIACAL ATMOSPHERE ON SURFACE TENSION OF MILK

	14 Hours	*24 Hours*	*48 Hours*	*72 Hours*	*120 Hours*
Treated milk	47.4⊠	46.0	45.7	45.0	45.3
Untreated milk	48.9	47.8	47.8	47.6	48.0

⊠ Dynes per cm. at 23° C.

an increased reduction in the surface tension of the milk over that of the untreated sample.

RELATION OF THE EFFECT OF AMMONIA TO OTHER CHARACTERISTICS OF THE MILK

From the college herd 8 cows were selected whose milk was most affected by the addition of ammonia, and these were compared with the 8 which were least affected by the addition of ammonia. After 24 hours at 5° C. the average additional drop in surface tension of the first group when ammonia (1:3,000) was added, was 5.7 dynes per cm.; the corresponding decrease for the second group was 0.6 dyne. The average of the results of these comparisons is as follows:

	Group I	*Group II*
a. Surface tension of untreated milk after 24 hours at 5° C. (dynes per cm.)	46.7	47.7
b. Increased titratable acidity in sugar-cream syrup after 12 days at 37° C. (ml. of $N/_{10}$ NaOH)	1.75	1.77
c. Amount of milk at the milking when these samples were taken (pounds)	23.1	18.9
d. Age of cows (years)	4.1	4.7
e. Length of lactation period (days)	128	85

Although there is insufficient data to make any positive statements regarding these relationships, these results strongly suggest that the "ammonia factor" is independent of the amount of lipase, the volume of milk secreted and the age of the cows, and that it may be related to the changes that occur in milk as the lactation period progresses.

SUMMARY AND DISCUSSION

It has been shown that the addition of ammonia accelerates the production of rancidity in milk, as indicated by the development of a typical butyric-acid-like, rancid flavor, and the reduction of its surface tension when held at 5° C. This effect differs with the milk from different cows, and to a lesser degree with different breeds of animals. It increases as the lactation period progresses.

From the results obtained in these preliminary experiments it seems doubtful, except in very extreme cases, if the concentration of ammonia in the atmosphere of the barn where cows are being milked would ever be a major factor causing rancidity to develop in the milk or cream. However, during the late winter and early spring a strong odor of this gas is not uncommon in many barns, and might very well be a contributing factor to those undesirable flavors in milk and cream which precedes the actual development of butyric-acid-like rancidity. The question also arises as to whether the occasional breakdown in refrigeration units, accompanied by a release of ammonia in the atmosphere, may also accelerate the development of rancidity in unpasteurized milk or cream.

Apart from these practical considerations it seems probable that further study of these findings may shed some more light on the total mechanism of lipase action in milk, in contrast to the action of the enzyme in a less complex substrate.

CONCLUSIONS

It has been shown that small amounts of ammonia added to milk held at low temperatures, accelerates the reduction of surface tension and hastens the development of rancid flavors.

REFERENCE

1. Rice, F. E., and Markley, A. L. *J. Dairy Sci.*, 5, 64–84 (1922).

STUDY CURD STRENGTH OF EVAPORATED MILK

So-called re-made evaporated milk, which is simply evaporated milk to which water has been added, has an exceptionally soft curd according to findings in the dairy laboratory at the State Experiment Station at Geneva. The results of the studies are reported by Prof. J. C. Marquardt in a recent issue of the *Journal of Dairy Science.* The study was conducted to evaluate definitely the curd strength of evaporated milk as commonly used.

During 1941, more than six billion pounds of milk were utilized in the production of 3,165,906,000 pounds of evaporated milk, representing a 50 percent increase over the past five years, according to Professor Marquardt. Because of the increased use of evaporated milk, research was undertaken in the Station dairy laboratory on the curd strength and other properties of the product at the request of the Evaporated Milk Association.

In these studies it was demonstrated that re-made evaporated milk as generally used as a food for infants has a curd strength that complies with the standards set by the American Medical Association for the curd strength for soft curd milk. In fact, re-made evaporated milk was found to have a softer curd than other types of milk designed for infant feeding, such as homogenized milk and so-called special milks.

Re-made evaporated milk will not separate into layers of varying composition upon standing as does whole untreated milk. This is regarded as an important advantage as it insures uniformity when used in the home. Through the cooperation of the Evaporated Milk Association, samples of evaporated milk of comparable composition were obtained from many sections of the United States, thus aiding greatly in the conduct of the experiments.

The "Cream Top" Type Bottle for Laboratory Sampling of Homogenized Milk

Joseph Levine and Rubin H. Feingold

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The increasing consumption of homogenized milk has made necessary the search for suitable methods for the determination of the efficacy of the process of homogenization. This process renders the size of the fat particles very small and also produces a milk without a visible cream line. Variations in the homogenization process affect the size of the fat particles, hence the necessity for some sort of uniformity in the process and the need for suitable means for determining the same.

The United States Public Health Service defines homogenized milk as "milk which has been treated in such manner as to insure break-up of the fat globules to such an extent that after 48 hours storage no visible cream separation occurs on the milk and the fat percentage of the top 100 c.c. of milk in a quart bottle, or of proportionate volumes in containers of other sizes, does not differ by more than 5 percent of itself from the fat percentage of the remaining milk as determined after thorough mixing." [1]

In order to determine conformity with this definition it is necessary to:

(1) Draw off the top 100 ml. of the milk without any agitation of the lower layer.

(2) Analyze the upper and lower layers after the 48 hours of quiescent storage.

In our laboratory we have found it very convenient to use the "cream top" type of milk bottle for the purpose of pouring off the top 100 ml. The milk which is brought into the laboratory for analysis (to determine degree of homogenization) is thoroughly mixed and then transferred to this type of bottle. It is then placed in the ice box and allowed to remain quiescent for 48 hours. At the end of this period the plunger is carefully placed in the bottle so that it forms an effective seal in the neck. (See illustration.) The bottle is then inverted and the upper portion of the milk is poured off. A volume approximating 100 ml. is ob-

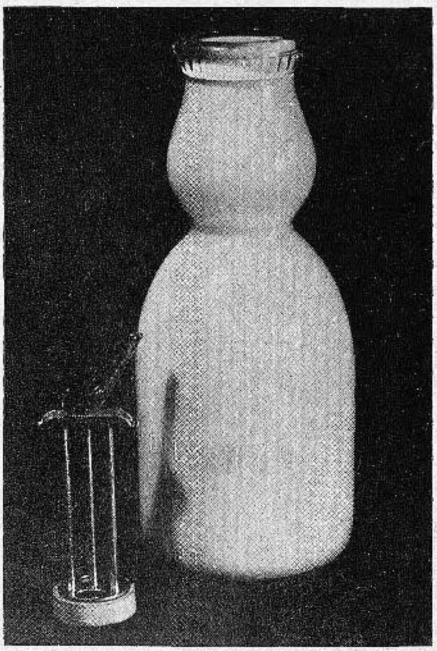

Figure 1

Cream-top Bottle of Milk with Plunger Apparatus

[1] Public Health Bulletin No. 220 (1939 Edition Milk Ordinance and Code).

tained in this portion. It is to be noted, however, that the amount contained in this upper layer is dependent upon the make of the bottle used. There are many types of cream top bottles used, each however, maintaining a similar characteristic design. A representative sample of this upper layer is analyzed. Similarly a representative sample of the lower portion is analyzed.

In making the analysis for the fat content it has been our experience that the Babcock method when applied to homogenized milk may cause an error of as much as 0.3 percent. This is due to the fact that a clear fat column is not obtained.

The New York City Department of Health Requirement for homogenized milk differs from that of the United States Public Health Service, in that the former is concerned with the upper 1/10 portion instead of the top 100 ml. The method described in this article is used in our laboratory in the sampling of homogenized milk just prior to analysis.

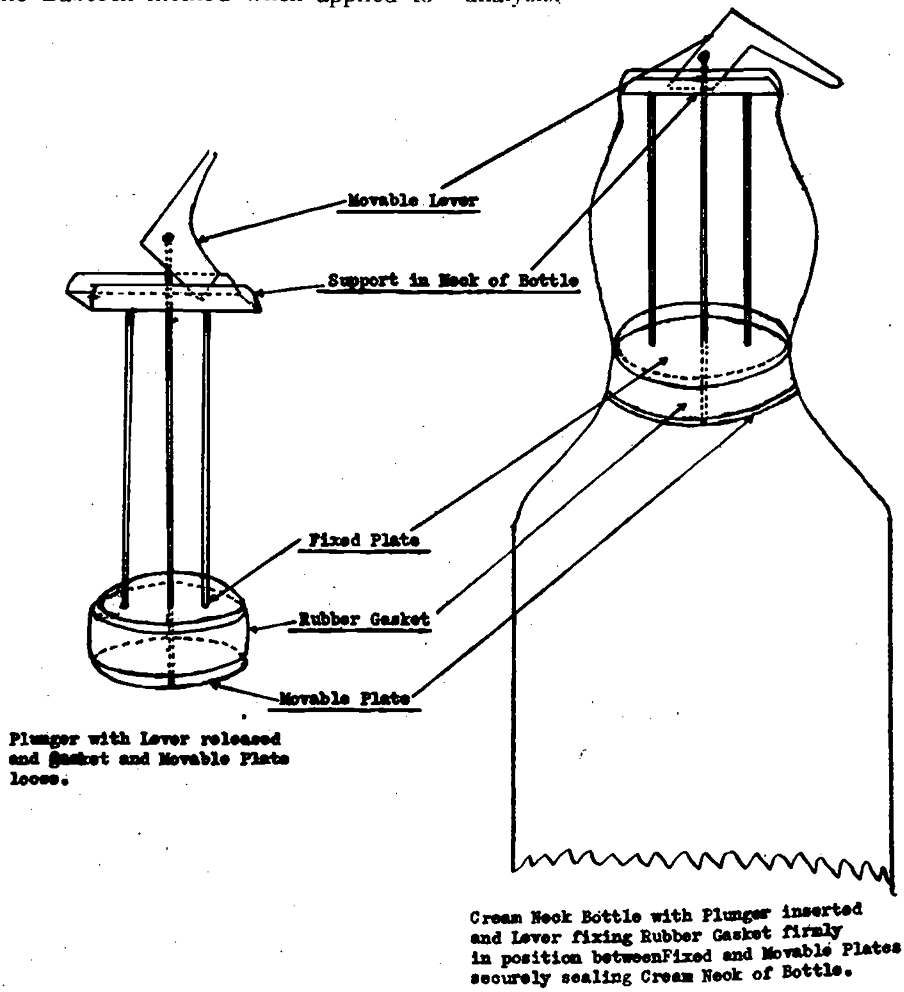

FIGURE 2

Plunger Apparatus and Adjustment in Milk Bottle

New Developments in Milk Plant Equipment*

O. K. Burrows

Cherry-Burrell Corporation, Chicago, Ill.

In the coming months or years of this emergency, many executives of equipment manufacturing houses will face economic conditions which are going to shape our destiny, to a certain extent. Certain developments cannot be carried on to completion because of inability to obtain materials. How serious that is is shown by the fact that William Knudsen, former president of the General Motors Corporation, and now in Washington, recently gave a talk at the Union League Club in Chicago a part of which I want to quote because I don't think it was published in the eastern papers.

If you have heard Mr. Knudsen, you know that he speaks bluntly and from the heart. He says what he means. He said:

"Here is where I have to get quite frank. I think it behooves all of us to wake up. This armament program of ours is the biggest thing ever attempted within the time limits given. It is not up to us that make it to speculate on where the stuff goes or how much better off we would be if we didn't have to do it. It is up to us—and I mean all of us—to get behind the President and our Government to see this job through regardless of what sacrifices we have to make in our own comfortable standard of living to accomplish just that."

This is the statement of a man who sits in a high place in dealing out materials. Then he further said:

"Our services have placed 20,000 contracts of $10,000 or more with a total volume of over 14 billion at the present time. New plants and addition to plants number 27,500."

* Presented at the 15th Annual Conference of the New York State Association of Dairy and Milk Inspectors (now New York State Association of Milk Sanitarians), September 24, 25, and 26, 1941.

These are the people that the dairy industry and the equipment manufacturers are going to have to persuade to get us the materials needed to manufacture some of the equipment to be installed in America in 1942.

Therefore we face two problems: (1) the getting of materials which have been used in the past, and (2) the selection of alternate materials, which is a very big subject.

Primary Materials

On the matter of securing materials, please bear in mind that every dairy equipment manufacturer has tried to be far sighted and has tried to provide inventories to keep serving his customers, keep his men employed, and keep his business functioning. But as time goes along there will be a point somewhere—it is a question of the number of months ahead—where that inventory will be depleted unless new materials can be brought in or the selection of alternate materials is carried to the point where we have acceptable alternates.

Take a look at aluminum. It is practically impossible to get it now, and yet it has been very much used in dairy equipment. Aluminum paint is practically impossible to obtain. Many of us have gone to the store and bought a few cans, just as the housewives did with silk hose. Many industrial concerns did too. So there is a definite shortage of that particular commodity.

Zinc is very difficult to obtain. Yet it is a very necessary metal. Brass is also difficult to get. The same applies to various castings, various sheets, et cetera.

Nickel—pure nickel—is practically impossible to obtain now in either sheet or bar. Copper is not plentiful. Electric motor manufacturers are promising twenty-two to twenty-four weeks delivery for standard current characteristic motors, and some turn you down completely. So there is a definite problem, unless the industry can be given some adequate priority rating.

What that may be we don't know. Already, for your information, order number P22 has been issued, which allows repair parts to be purchased under an A-10 priority rating, and dairy equipment manufacturers can supply repair parts and obtain material for repair parts under that rating.

As yet no blanket priority rating has been given to equipment manufacturers, although certain products being made for use under the Lease-Lend Act, such as evaporated milk, cheese, dry milk, and other products of that kind, are obtaining priority ratings today on needed equipment because of being under the Act. You can tell any of the plant owners whom you serve—I say this advisedly, because I think every inspector's job is to help the people whom he serves to be better business men—that they can get priority ratings for equipment to produce evaporated milk, dried milk, and cheese by writing to the Office of Production Management in Washington.

SUBSTITUTE MATERIALS

The selection of alternate materials is a very interesting subject, and I just want to touch hurriedly on a few points that I think will be of interest to you. In the first place, an alternate material must be as usable as the one that it replaces. And that is quite an order for our engineering and research people!

For example, plastic parts are going to be used in certain apparatus in our industry as they have been used in others. If you look in your new automobile you will probably find more plastic parts than you have ever found before. For instance, in the distributor those parts which have been of steel are now of plastic material. Your cigarettes have been rolled in paper, but they are now going to be made out of North Carolina straw.

Aluminum, brass, and copper are being replaced in many articles. The extent of the saving of these metals is indicated by one concern, the General Electric Company, who estimate that what they will save in aluminum, in the transition over to alternates, would supply enough for 2,000 planes in one year's time.

The supply of wool is going to be short, and already we hear about a synthetic wool being made from milk, and rather successfully, for hats and for other uses such as draperies, fabrics, et cetera.

Graphite is one of the things we need badly for use in machine tools. Other ingredients of the same character for use in lubricants are also getting extremely difficult to obtain.

When on the west coast in February they told me that six million tins of food are going to be placed in glass containers this year rather than in cans. Some of you have perhaps seen some of the foods that you previously bought in tin cans now coming out in glass containers.

In our industry some alternate materials have been selected for insulation. Take a storage tank. The job there is to keep the milk cool. The lower jacket has to support the weight of the tank and milk, therefore you need a good substantial insulator there—cork. And cork we have. But how long we will be getting cork no one knows, so the upper half of the tanks may be taken care of with fibre glass, or insulations of that type very successfully.

We are going to run into all kinds of these difficulties. Enameled utensils instead of aluminum utensils. Much equipment has been painted with aluminum. Now the change-over is to washing-powder-resisting or caustic-resisting enamel paints.

Plastic bases will be used for agitators, or gears, or finishes. We had an interesting one the other day. Rubber tires: you'd think the tire manufacturers would have a sufficient supply of rubber to make rubber tires, but there must be a lot of things moving on rubber tires in this world because you can't get them, and the substitute may be a combination of cotton and phenolic resin, which seemingly makes a very good substitute.

With the shortage of nickel continuing, we may come to the use of straight chrome. When stainless steel first came into being, that metal was straight chrome. There was no nickel present. It was discovered by a man in England. Shortly afterward, however, the Krupps, in Germany, found that the addition of 8 percent of nickel made a stainless steel sheet more workable. It would weld better and handle better; it was easier to heat, easier to roll, et cetera, so the original straight chrome stainless steel was more or less dropped.

We face a nickel shortage, nickel being needed for national defense, and so we are told we must use straight chrome. Here are a couple of pieces of sanitary tubing that look just alike. One is chrome-nickel steel and the other is chrome steel. They polish just as well, just as smooth. They seem to pass the test for corrosion and to weld just as well. You cannot tell the two apart, except in one way: when you put a magnet on one and it is magnetic you know that is the chrome-steel piece. Your chrome-nickel steel, of course, is nonmagnetic. Therefore, you know the difference between the two by this simple test.

Our research department has checked this chrome-steel for corrosion by an accelerated lactic acid immersion test over 24 or 48 hours and finds it quite acceptable. We tried the effect of washing powders, citric acid, et cetera, and find that it stands up very well.

Now the reason chrome-steel was deserted back in '29, '30 and '31 was because at that time in the *"melts"* or *"heats"* in the steel mills they were not able to get the carbon uniformly distributed through the sheets, so there were hard and soft spots. You might have a fracture or crack in the sheet during fabrication. In recent years they have been able to control this factor to such an extent that you have a material which can be drawn in a tube such as this and still be an acceptable alternate material.

In designing dairy equipment, the first consideration is to develop the simplest combination of parts that can be developed and do the job that has to be done in an acceptable manner. It must be economical, as you have pointed out in the discussion this morning, and it must have in it all the known principles of sanitary design which will make it reasonably trouble-proof, and make it possible to keep it clean and sanitary at all times.

SANITARY PRINCIPLES

During the past fifteen years we have seen an accumulation of sanitary principles which have been set down. There is no text book other than perhaps the U. S. Public Health Service code, the state codes, and the city codes. In addition to the codes, we have our various state and local public health officials to guide us in those things which we do wrong.

Too often, there are no two fellows who seem to want the same thing, which is a very difficult situation for the fabricator. But there have been long strides made toward standardization. The pioneering was done by the International Association of Milk Dealers through their Simplified Practice Committee. Their early standardization work was on sanitary fittings to obtain interchangeability because used in practically all dairy plants.

That led to the 3A or Three Associations Committee, of which your Secretary has been a very active member, made up of three members of the International Milk Dealers Association, three from the International Association of Milk Sanitarians with which you are affiliated, and three from the

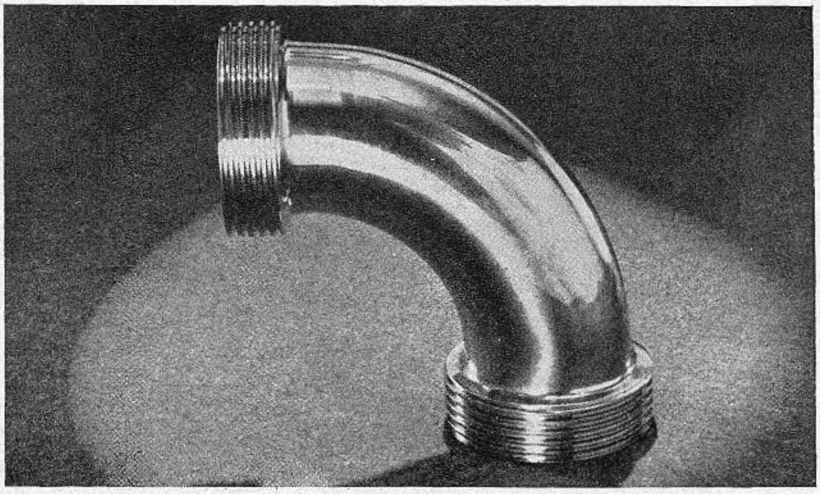

FIGURE 1

"Clear Vision," Recessless, Short Radius Bend, Threaded Both Ends

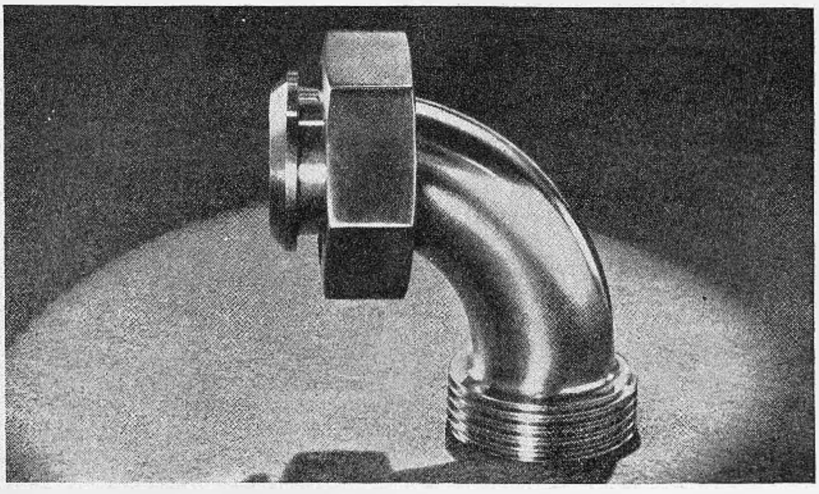

FIGURE 2

"Clear Vision," Recessless, Short Radius Bend, with Plain Ferrule and Hexagon Union Nut on One End

Technical Committee of the Dairy Industry Supplies Association, our machinery group. I understand that the ice cream group is cooperating so we may have to call the accepted items 4A Standards now. This activity started back in 1935, principally with the attempt, at that time, to eliminate soldered fittings. Solderless fittings didn't prove very satisfactory, but brought us to the conception of having all-threaded, recessless fittings. In the organ of the Dairy Industry Supplies Association of May, 1940. there was published the first effort towards the standardization of 10-C valves, 11-C valves, et cetera. (See Figures 1, 2, 3 and 4.)

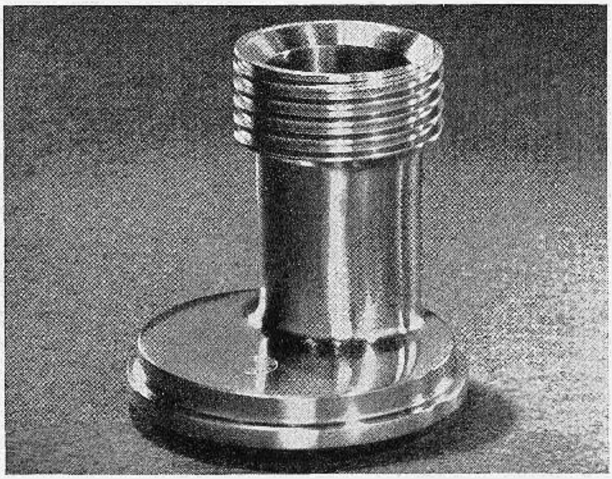

FIGURE 3
Close Coupled, Recessless Reducer, 3-Inch to 1½-Inch, Threaded One End

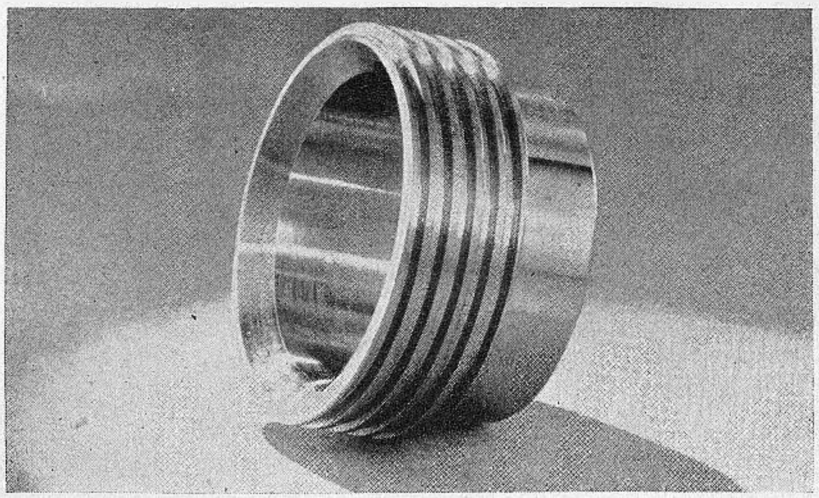

FIGURE 4
1½-Inch Recessless Threaded Ferrule

SANITARY STAINLESS PUMPS

The newer stainless steel casings on pumps are provided with single service paper gaskets. The new impellers are easier to clean than formerly. These new pumps are portable. The discharge port can be arranged in any direction. Practically all the pumps now available are with sanitary rotary seals which is a very forward step.

Some of you have been called to plants where dairy products contained certain off flavors. One plant in St. Louis had a distinct pineapple flavor in their butter. They hunted everywhere for the cause but couldn't get to it. Finally they took the impeller out of an old pump, and there was the pineapple, in thumbnails full. Rotary seals will eliminate that particular kind of thing.

PLATE TYPE HEATERS

Plate type heaters have been thought of too much in the past as only for use in short-time, high-temperature milk pasteurizers. They are equally good for jobs of heating, cooling, or regeneration, singly or all together, and various processes can be put in the one press because the equipment is compact.

The equipment is desirable because it can have accurate control, less cleaning time, greater efficiency. The trend seems to be toward "short-time," particularly for smaller jobs: 2,500 pounds and up, with a three to a four-hour run.

RECORDER-CONTROL

A recorder-control illustrated in Figure 5, is used on batch pasteurizers to get more accurate results. It is a device for recording the temperature of the milk during heating, and is designed to eliminate over- and underheating. An additional feature has been added.

There is a pen arm on the cover which indicates that the instrument is open. It cannot be tampered with, once the device is set. During this period when the green light is on, we would normally have a thirty-and-a-half minute holding period. There can

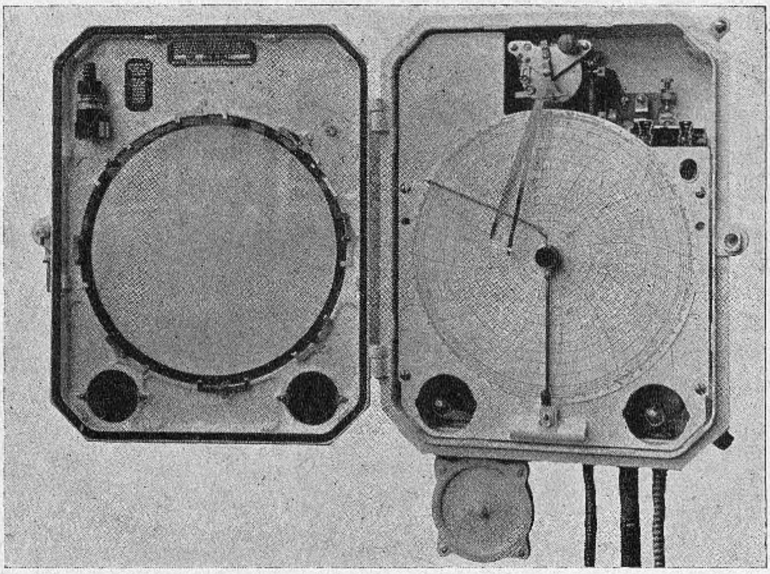

FIGURE 5

Recorder-Controller for Accurate Temperature Control of Batch Pasteurization be no overheating or underheating. thus assuring a normal deep cream layer and natural flavor.

What is new in this device? First, we have the detector pen. The set point for this instrument, which is the

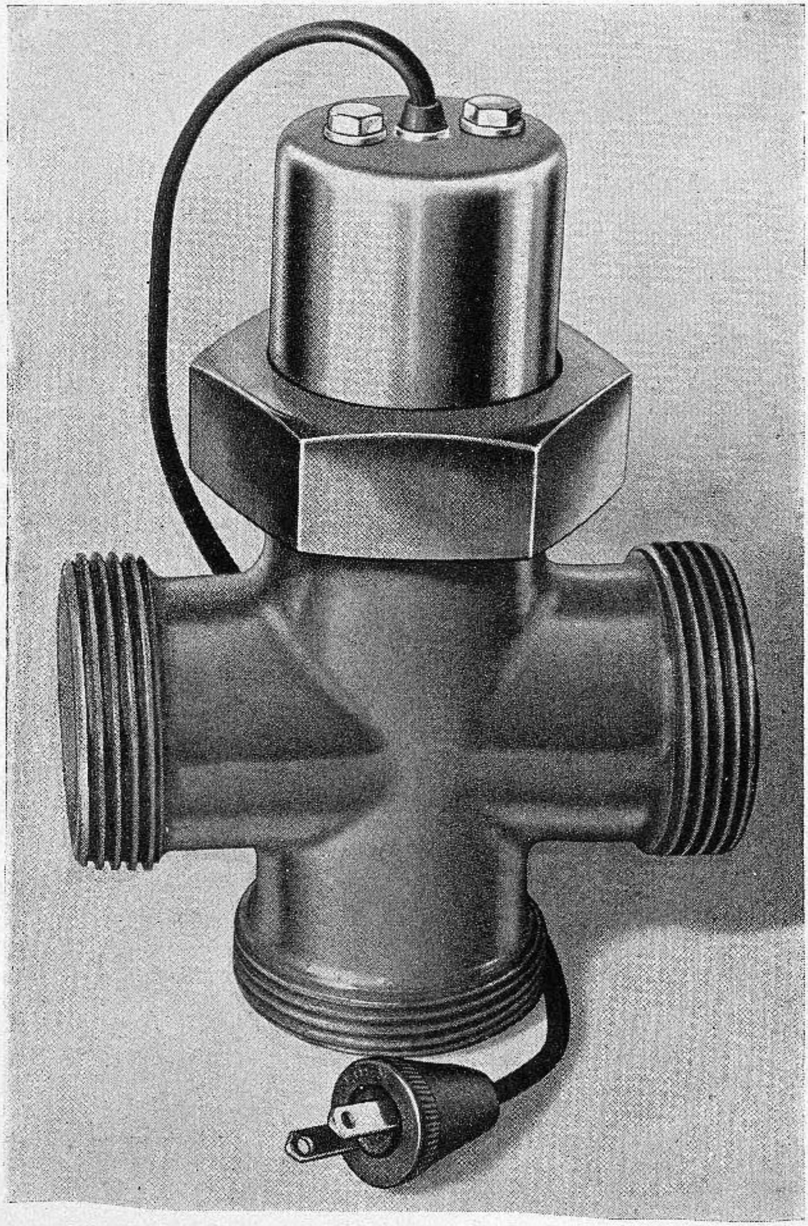

Figure 6
Sanitary Pressure Switch

pasteurization point, can be easily set, and a wire seal can be put through two matching holes and so seal the pen arm so that pasteurization, if it is 143° F., can be set and cannot be changed.

In case of a power failure with Telechron clocks in recording thermometers or these control devices, the chart stopped. The recent U.S.P.H.S. code was changed to demand the use of spring-wound clocks.

We have had some rather interesting service calls because of this particular change. Users wondered what they had to do to make the chart turn. The charts had previously been turned by an electric motor and the minute you energized the outfit you had your chart turning. We had to write and tell them that they'd have to take the key and wind the clock. That was what seemed to be necessary to make the thing function.

Now comes the alarm feature, which has been added to the control so that at the end of the thirty-and-a-half-minute holding period, *and not before,* the alarm goes on and normally stays on for five-and-a-half minutes, unless somebody does something about it.

Incidentally, in case of a very severe condition—let's say a pasteurizer was very close to a cold door on a frigid winter day and a blast of very cold air would touch it—the control instrument automatically would throw hot water into that machine again, bring it up to temperature, and the red light would indicate that the heating was again taking place.

The operator in a pasteurizing plant is a very busy fellow. He has to answer the 'phone, take an order, sell a bottle of milk, et cetera. Here's a device that guarantees the milk has been properly held the full thirty minutes.

The alarm will keep "buzzing" for five and a half minutes, until somebody does something about it, or the "Boss" is going to come down from the front office plenty fast to see that it is turned off.

New Pressure Control Switch

The new pressure control switch (Figure 6) can be put into a sanitary tee or a sanitary line. We know that filter cloths clog up, and we also know that about fifteen-pounds pressure difference between the inlet and outlet is sufficient to tear that cloth.

Putting this device into the line on the pressure "build-up" side automatically will throw off the milk pump switch and stop the milk flow before the filter cloth breaks and allows extraneous matter to go on through.

Let's take a milk cooler, where the milk flow inadvertently is stopped. The brine flow continues to go on, and you're going to have difficulties. So we can have this little device in the milk line. The pressure will act with the starter switch, which shuts off the brine flow. There are innumerable jobs which we think are going to be accomplished by this very simple pressure switch. Incidentally, it is watertight and can be immersed in a wash sink for cleaning.

Cold Milk Thermometer

We hope it will become standard. The graduations on the cold milk thermometer range from 0 to 120 in one degree graduations measuring three sixty-fourths of an inch per degree. There is an expansion chamber on top so it can withstand sterilization.

Inspector's Thermometer

The inspector's thermometer (Figure 7) is described in the U. S. Public Health Service Code. It can be used on high-temperature-short-time apparatus to check the recording or indicating instruments in use. This device takes the place of some of the gadgets you have whittled out—corks, or one thing or another—to get a thermometer in to check a temperature operation. Now this inspector's thermometer can be put into the end of a holder tube in place of the mercury indicating thermometer and actually measure what is going on in that particular instrument.

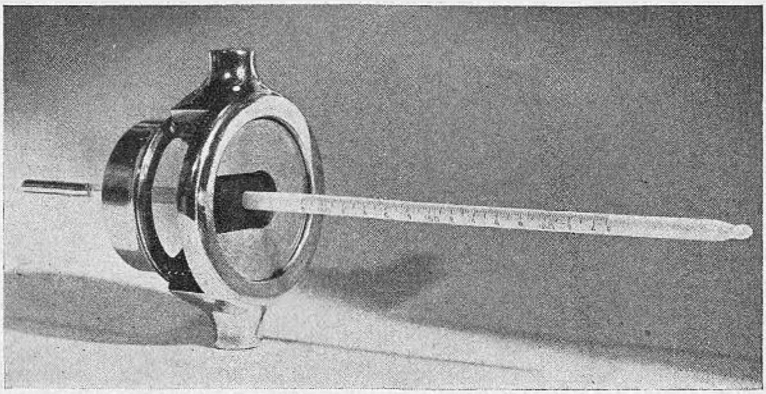

FIGURE 7
U.S.P.H.S. Inspector's Thermometer in a Cutaway Section of a 3A4 Sanitary Fitting

SOAKER-TYPE BOTTLE WASHERS

In soaker-type bottle washers, three things insure a clean bottle: time, temperature, and causticity. The time is fixed. The other two factors can be changed within certain limits from the standpoint of savings in cost to your operators.

Causticity is the factor we should like to reduce. The minimum caustic in a bottle washer, for lubrication purposes, should never be less than 1 percent.

The other variable is temperature. Hence, the answer is to go to higher soak-tank temperatures. There has been a real trend towards higher temperature in washers in order to get the right relationship between these three: time, temperature, and causticity. If causticity is reduced, it can also be assisted greatly by the addition of some of the wetting agents.

Two instruments have been brought out recently, and one is for bottle washers. They have been largely used in the brewery trade. I don't know how many have gone into the dairy industry. This device indicates, to a certain degree, the causticity by a definite indicator.

The other device, or part of it, has been used on can washers to check alkalinity. You will see it advertised with washers.

SWEET WATER COOLERS

Sweet water coolers are coming into use in the air-conditioning field. It has been found that these coolers reduce cost many times by having a very small compressor working on a condenser or an expansion unit which will freeze an ice bank.

One of those units has been worked out for the dairy industry. You store up ice during off-load periods, in order to keep down the cost of electricity.

HOMOGENIZERS

I think you know some of the features which a year ago were adopted—in the stainless steel cylinder blocks which have no internal threads, smooth honed ports, and easily removed parts which can be readily taken apart for cleaning.

A late type of packing has a very much smaller area exposed to the plunger rods for use in modern high-pressure machines. With the advance that is taking place in the use of homogenized milk and other products, the sanitation in this machine must have a great deal of attention.

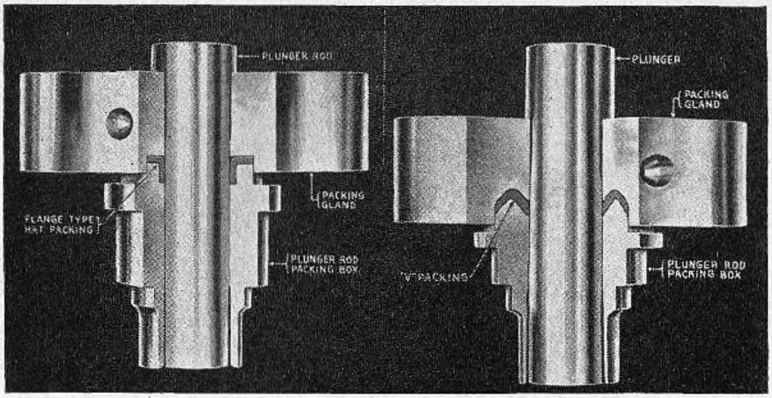

Figure 8

Old Insanitary Homogenizer packing with large area of exposed surface against plunger rod

New V-type Sanitary Homogenizer packing with small surface area exposed to plunger rod

Refrigerated Transport Trucks

Refrigerated transport trucks for milk are equipped with insulated bodies with a corrugated iron bunker on the top, so that flake ice is brought down through a porthole on the top. The ice, as it melts, is ice water, and this corrugated circular container in the truck does a pretty good job of keeping milk cool.

Brushes

In the October 1940 issue of "A–Q" there was an article entitled: "Cinderella Takes a Bow." I thought that was a funny sort of subject, but I read it through and I found it dealt with the hour in which the operators get through and the clean-up starts.

In the dairy industry we go in for brushes as no other industry does, and this article went on to talk about the china bristles, and so on and so forth. And one of the more recent ones is the competition we are having in getting nylon away from the manufacture of ladies' hose for use in brushes. Long-life brushes made of nylon for sanitary tubes are going to make the wild boars of China sort of mad, I guess, because we are going to switch from his product to one of our own making.

Portable Refrigeration Units

A three-quarter H.P. compressor can be adapted to the plate-equipped transport vehicles. There was a very interesting article in one of the papers, recently, showing how this type installation changed the cost on that particular item.

Storage Tanks

New, deep-dish heads, with large radius knuckle-bends, make cleaning of tanks easier. In these tanks, 6 percent of the radius of the tank is in this particular portion, a very marked advance step in the construction of large storage tanks as compared with the sharp corner at heads that at one time was as little as a one-half inch radius.

Milk Vending Machines

Wider use of milk vending machines is sweeping this country by storm, and is one of the things, frankly, which health departments have paid too little attention to.

Vending machines need some immediate attention because they are becoming more and more widely used.

SUMMARY

Now, in summing up, during the last several years great progress has been made in the design and construction of co-ordinated equipment for processing milk and its products. In a large measure that has been due to friendly criticism by public health officers and our own dairy products manufacturers.

A kindly spirit has been shown by most folks, and particularly health officers, in allowing an orderly procedure in the suggested changes. When you are in a production operation it is always difficult to change things immediately.

Since there is no last word in anything, there shall continue to be progress, regardless of our present condition. The fact is, it is the belief of most engineers and research men that among these future alternate materials there will be many that will become permanent on our apparatus.

TWO USDA SPECIALISTS TO SURVEY DAIRY INDUSTRY OF CENTRAL AND SOUTH AMERICA

Dr. O. F. Hunziker and Dr. R. E. Hodgson, dairy technologists of the Bureau of Dairy Industry, will leave Washington soon to start a survey of the dairy industries in the Caribbean, Central, and South American countries.

The survey will be made at the request of the Coordinator of Inter-American Affairs. The two specialists will go first to Puerto Rico, where they will visit the Agricultural Experiment Station and study the dairy industry of the Island. From there they will go to the Dominican Republic, Haiti, Cuba, Panama, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Mexico. The second part of the survey will include the South American countries, and probably will begin some time in October.

The specialists will collect factual information about the sanitary production, processing, and distribution of milk and other dairy products, and study the potential possibilities for expansion of dairy farming in the various countries. They also will seek information in each country that will be useful to the Inter-American Institute of the Agricultural Sciences in formulating its contemplated dairy research program.

Expanding the dairy industry in some of these countries would not only aid in developing a better balanced agriculture, but also would improve the nutritional welfare of great numbers of people now contributing their time and energy to the war effort, the Department said.

Thirty-first Annual Meeting

October 30 and 31

Headquarters: Hotel Jefferson

St. Louis, Missouri

Sanitation of Milk Plant Operations Pays Dividends*

JAMES A. TOBEY, DR.P.H., LL.D.

American Institute of Baking, New York, N. Y.

THE production and sale of market milk is a business vested with a public interest. This private enterprise is legally and sociologically a matter of cogent public concern because:

1. Pure milk is an essential article of diet.

2. Milk is a perishable food easily susceptible to dangerous contamination.

3. The production and distribution of clean and safe milk requires technical skill.

Mainly for these reasons the milk business has been, now is, and always will be subject to extensive regulation by the State in the interests of the general welfare. When such regulation is reasonable in scope and application, it is as beneficial to the industry as it is to the people. The production of pure milk which merits and has the confidence of the consumer always is good business.

The dairy industry is not a public utility in the accepted sense of that phrase, according to no less an authority than the Supreme Court of the United States. In a leading decision upholding the New York milk control law, this court declared in 1933 that the production and distribution of milk is a paramount industry of the State, which largely affects the health and prosperity of the people (1). Save the conduct of railroads, said this tribunal, no other business has been so thoroughly regimented and regulated for the benefit of the common good.

Self regulation of milk production by the industry itself is, however, as advantageous and as profitable as is regulation imposed by the State under the very broad authority of its police powers. Mere compliance with official rules may result in an acceptable milk supply, but more rigid voluntary measures will result in an even better supply of this indispensable food. Achievement of the utmost in sanitation in milk plant operations is a relatively inexpensive procedure which pays richly in dividends on the investment. Too many members of the industry fail to realize this axiomatic fact.

PURE MILK IN WAR AND PEACE

Pure milk is the most nearly perfect food at any time, but in time of war this wholesome, nourishing food is even more significant. Milk is prominently featured in the national nutrition program sponsored by the federal government in cooperation with science and industry. More milk and dairy products are being produced today than ever before, for our own benefit and the benefit of our allies.

Although pure milk has been regarded as the best all-around food for young and old, many other valuable protective foods are being properly stressed in the modern nutritional movement. The new enriched white breads, containing vitamins and minerals natural to whole wheat, are receiving well-merited acclaim, and much attention is being given to meats, fruits, eggs, green and yellow vegetables, and fortified margarines, as necessary parts of well-constructed daily dietaries.

* Address at the Service Training Course for Milk Pasteurization Plant Operators, Managers, and Owners, University of Michigan, Ann Arbor, May 12, 1942.

Instead of being in the vanguard of the protective foods, pure milk today is merely one of them. Some of this loss of position is due to short-sightedness among leaders of the dairy industry.

The war has, of course, imposed certain difficulties upon the dairy industry. Although dairying is properly rated as a vital civilian industry, and some degree of priority is given to necessary dairy equipment, there are shortages in many critical materials needed for the proper maintenance of milk plant operations (2). Milk control officials must recognize this fact and must be reasonable and liberal in the enforcement of certain regulations.

Despite the difficulties with equipment and with occasional lack of personnel, any progressive dairyman can easily produce clean and safe milk, or milk that has been obtained in a hygienic manner and then properly pasteurized. The principal factors in the production of such a desirable milk supply may be summarized as follows (3):

1. Clean, healthy, well-fed cattle.
2. Healthy employees using sanitary methods.
3. Proper equipment that is properly cleaned or sterilized after each use.
4. Pasteurization of the milk by standard methods.
5. Adequate cooling of the milk.
6. Proper care in bottling, handling, and delivery of the milk.

THE COSTS OF SANITATION

Sanitation generally represents an extremely small fraction of the cost of production and distribution of market milk. On the farm, the principal cost items in milk production are for feed and labor, which together account for nearly two-thirds of the total cost to the dairyman. The distributor's largest items of expense are his payments to the farmer and his labor charges, These two main items representing about 70 percent of the dealer's total costs.

In a comprehensive study of dairy management in Michigan, made on 499 farms during the years 1932–1936, it was reported that feed represented 41 percent of the annual cost of milk production, labor 21 percent, management 10 percent, buildings and equipment 7 per cent, cow depreciation 5 percent, interest on cow 3 percent, bull expenses 3 percent, and miscellaneous 10 percent (4). Costs of sanitation apparently are included in this 10 percent for miscellaneous items. Elsewhere in this report it is shown that the charges per cow per year for producing market milk were $138.76 in contrast to $137.54 for condensery milk, or a difference of $1.22 per cow per year for the milk having more rigid sanitary standards.

A more recent comparison between the costs of producing fluid market milk and milk for a manufactured market, in this instance evaporated milk, has been published by a large dairy corporation (5). This report shows that the average extra costs for producing fluid milk on 376 farms in eleven markets, which complied with the U. S. Public Health Service Standard Ordinance or with local milk ordinances, amounted to $0.3337 per cwt., of which $0.2426 was for ordinance compliance, and $0.0911 was for extra transportation. The extra costs for producing the fluid milk consisted of increased labor charges, building improvements, depreciation of equipment, extra supplies, and transportation. Labor was the largest single item, amounting to $0.1385 per cwt.

If comparisons were available between the costs of production of fluid market milks of different grades and qualities, instead of between fluid milk and manufactured milk, the added cost of more effective sanitary procedures would be slight. Certified milk may cost considerably more to produce than most other grades, but these costs are due in part to the relatively small volume of production and in part to the large, and often excessive, fees paid to medical milk commissions and to local and national associations of this waning industry.

THE PENALTIES OF POOR SANITATION

The everlasting value of eternal vigilance in the hygienic production of milk is easily demonstrated by the unfortunate experiences of dairymen and dealers who have been negligent in safeguarding their milk supplies. Aside from the possibility of justifiable criminal action for such negligence in the production of an essential food, the offending dairyman or distributor is also liable in civil actions for damages or injuries caused by the consumption of contaminated or unwholesome milk and dairy products (6).

That such litigation is a constant menace to the milk dealer is shown not only by the record of actual court cases, but by the record of annual disease outbreaks caused by insanitary milk. Since 1923 there have been reported an average of 42 epidemics of milk-borne disease in this country. In 1939 there were 41 such outbreaks, with 2,509 cases of disease and 7 deaths, mostly due to contaminated raw milk (7). In that year six epidemics of septic sore throat due to milk caused almost half, or 1,282, of these preventable cases of disease.

Since civil actions in the lower courts are seldom published in the law reports, citations can be given here only to some of the more important decisions which reached state and federal courts of appeals. These decisions by courts of last resort are, however, impressive examples of the penalties of poor milk sanitation.

LIABILITY FOR UNDULANT FEVER

When an article of food, such as milk, is sold for human consumption, the seller is generally presumed at law to warrant that it is sound and wholesome, and fit for consumption. Such an implied warranty of the wholesomeness of food sets up a contractual relationship between the vendor and the vendee, for the breach of which the buyer may sue. But the purchaser of unwholesome food also has another remedy at law. He may bring suit against the seller or producer of the food for negligence, an action which is not predicated upon a contractual relationship, but is due to a legal wrong, or tort (8). If the seller, producer, or manufacturer of the food has violated a law or sanitary regulation, negligence will be presumed.

Early in 1937 an individual living in Everett, Washington, was advised by a member of the healing cult known as sanipractic to give raw milk to his eleven-year-old daughter. He instructed his milk dealer to leave one bottle of raw milk and one bottle of pasteurized milk each morning. With characteristic efficiency, the dealer frequently left only the raw milk, which the customer consumed, and as result of which he became afflicted with undulant fever. For this injury he sued the milk dealer, the dairy company from which the dealer had obtained the raw milk, and the farmer who was thought to have produced it.

In the lower court where the original case was tried, a judgment for damages was awarded to the customer against the milk dealer who delivered the raw milk and the dairy company which furnished the milk to the dealer, but since there was some doubt as to the precise source of this impure milk, the case against the producer was dismissed. On appeal, the judgment of the trial court was upheld in 1940 by the Supreme Court of Washington, which pointed out, among other things, that it is the duty of the seller of the milk to ascertain at his peril the wholesomeness of the food which he sells (9).

Previously, in 1937, a Superior Court in Washington had awarded $1,946.50 in damages against a milk company and a milk producer for a case of undulant fever caused by raw milk. Apparently this case was not appealed (10).

In 1936 a similar case was adjudicated in Virginia (11). In this instance the son of the customer contracted undulant fever as the result of drinking infected milk. In sustaining a judgment for the defendant dairy company in this case, the Supreme Court of Appeals of Virginia pointed out that while the law recognizes an implied warranty for the wholesomeness of milk, there was actually no contractual relationship between the son and the seller of the milk, and the warranty did not apply to subvendees. The milk dealer certainly would have been liable for negligence for the sale of this infected milk, but the customer made the fatal mistake of not instituting suit within one year, as required by the Virginia law for such tort actions. This decision sets forth the same legal principles as does the Washington case, but the plaintiff failed to get relief because of his tardiness, or that of his attorney.

Liability for Impure Milk and Dairy Products

On numerous occasions the courts have upheld judgments for damages in cases of illness or injury due to impure milk and other dairy products (12). In 1918, for example, the New York Court of Appeals ruled in a leading decision that a druggist who sold ice cream for immediate consumption was liable for sickness caused by this food (13). In a recent case the Federal Circuit Court of Appeals for the Seventh Circuit affirmed a judgment for $6,000 for illness due to use of evaporated milk, which was proven to the satisfaction of a lower federal court in Illinois to have contained the body of a mouse (14).

Not all of the decisions have been adverse to the dairyman or milk dealer. In a recent case in Louisiana, where it was alleged that a man and his wife became sick after drinking unwholesome milk, the verdict was for the milk company on the grounds that the customer had failed to prove that his ailment, if any, was due to the milk (15). It was shown by the evidence that the dairy from which the milk was dispensed was a modern plant approved by the state and city boards of health, and conducted in a sanitary manner.

In a recent Missouri case in which it was claimed that an infant was injured by glass splinters in a bottle of fluid milk, the St. Louis Court of Appeals reversed a decision in favor of the customer on the grounds that the trial judge improperly instructed the jury regarding the size of the nipple used on the bottle (16). The court pointed out, however, that if the jury found as a fact that the milk contained glass, which caused the infant's violent illness, that fact would be sufficient to determine liability.

Many of these alleged instances of glass in milk, and many of the other lawsuits brought against milk dealers are, of course, in the racket class, but this fact does not justify or excuse any lack of vigilance by milk producers and dealers in the sanitation of their milk and other dairy products. Proper sanitation and hygiene are potent factors in the defense of such litigation, and may also help to avoid it.

Recent Cases on the Validity of Milk Control

During the past year or two courts of last resort have handed down a number of interesting decisions concerned with various legal aspects of milk control. Thus, city ordinances requiring the pasteurization of all milk were sustained in Arizona (17) and California (18) ; a local board of health regulation to the same effect was upheld as valid in Massachusetts (17) ; and a requirement that pasteurized milk be dispensed only in sealed, sterilized containers was approved by a court in Illinois (20). A state law for the control of Bang's disease has been upheld in Virginia (21), while a regulation of the New York City Board of Health requiring permits for resale of milk by persons not in business prior to June 1, 1939, was upheld, with one justice of the Court of Appeals dissenting with respect to this rather drastic provision (22).

Some of the recent decisions have ruled in favor of the milk industry and against the type of milk control attempted by regulatory authorities. In Chicago a dairy was successful in contesting a prohibition by the board of health against the use of paper milk bottles or single service containers (23). In this case the Federal Circuit Court of Appeals ruled that since such containers were permitted by state law, the local ordinance was void as in direct conflict with it.

An action by a city health commissioner in Washington against a milk dealer who standardized his fluid milk with pasteurized homogenized cream was sanctioned by the trial court, but on appeal was reversed by the Supreme Court of that state (24), which said that such increase in the cream line was not "artificial" and was no violation of existing law.

In Kansas it was held that milk control is vested by the laws of that state in the State Board of Agriculture and not in the State Board of Health (25), so that a criminal action brought against a milk dealer for violation of a regulation of the State Board of Health would have to be dismissed. There was a similar decision in New York, which held that the Department of Health of New York City could not deny a permit for manufacture of ice cream in a sanitary basement, or regulate such manufacture, because that matter was legally the function of the State Department of Agriculture and Markets (26). In New Jersey a local board of health was denied the right to withhold a permit to sell milk merely on the grounds that it lacked funds to inspect the source of supply, which had been inspected and approved by other health departments, including the State Department of Health (27).

In a recent Michigan case it was held that a farmer who sold a few quarts of milk to his neighbors and friends was not selling "to the public," within the meaning of the laws of that state (28).

SUMMARY

The production and sale of market milk is a business vested with a public interest, although the dairy industry is not a public utility.

Under the police powers of the state, the production and distribution of milk may be, and is, extensively regulated.

The reasonable regulation of milk is of value to the industry, as as also self-regulation by the dairy industry itself.

Sanitation generally represents an extremely small, though definite, fraction of the cost of milk production and sale, but it is always a most profitable investment.

The penalties of poor sanitation may be expensive and costly litigation for damages due to illness or injuries caused to consumers by unwholesome or contaminated milk.

On numerous but not all occasions the courts have upheld awards for such damages. A number of such decisions are outlined as examples of the value of sanitary control of milk plant operations.

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Thirty-first Annual Meeting
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Bacteriological Control of Milk Quality*

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DURING the past few years, particularly since the adoption of tryptone glucose extract agar as the standard methods medium for making plate counts on milk, there has been increasing research and interest relative to the bacteria count of pasteurized milk. This has resulted in a more intense interest in the raw milk supplies than has previously been shown, with the introduction of laboratory pasteurization as a means of weeding out raw milks which contain large numbers of thermoduric and thermophilic bacteria.

It has been well established by numerous workers that the thermoduric bacteria found in pasteurized milk originate in dirty utensils, milking machines, and the like on the farm. Hence, a high bacteria count in pasteurized milk resulting from thermoduric bacteria is not a reflection on the pasteurizing plant, as has been commonly supposed in the past, but a direct reflection on the supply of raw milk from which the pasteurized milk was obtained.

Macy (1) found thermoduric bacteria to be the chief source of high counts in pasteurized milk; therefore in order to secure uniformly low counts in pasteurized milk, the raw milk containing excessive numbers of thermoduric bacteria must be detected and eliminated from the supply.

Laboratory pasteurization, or some modification of it has been the only method developed to date for the detection of thermoduric bacteria. While there can be little objection to the laboratory pasteurization test itself, the original technique of making standard methods plates on the laboratory-pasteurized samples is so cumbersome that it is not a practical test for the industry. However, several modifications have been proposed which simplify the procedure considerably.

Maack (2) suggests using a standard loop to transfer 0.001 cc. of the laboratory pasteurized sample to previously poured agar plates and streaking several samples on one plate. Hileman and Leiber (3) suggest incubating the laboratory pasteurized samples over night and examining them under the microscope for the presence of micrococci, which indicate thermoduric bacteria.

Mallmann, Bryan, and Fox (4) developed a modified laboratory pasteurization procedure and microscopic examination to detect thermoduric bacteria. In this procedure, only the living cells are stained and counted under the microscope, and a microscopic count over 40,000 bacteria per ml. is considered excessive.

Myers and Pence (5) developed a method involving an oval tube and standard loop, which embodies all the advantages of the standard plate count, and in addition, may be performed as rapidly as any of the accepted tests for grading raw milk supplies. We obtained very close agreement with their technique and the standard plate count; and were able to pasteurize the samples in the laboratory, make the inoculation on the oval tubes, and count the colonies on the tubes in approximately the same time per test as is required for making methylene blue tests.

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In making this study, we were fortunate in having two supplies of raw milk. The graded milk supply is the regulation raw milk, which upon pasteurization, will meet grade A specifications of the Standard Ordinance proposed by the United States Public Health Service. We also had access to an ungraded milk supply which is used for manufacturing purposes and is produced under no inspection at all, the only requirement being that it be delivered to the plant sweet and free from objectionable flavors and odors.

Weekly samples were taken from our graded and ungraded supply of were read at hourly intervals for 6 hours. Both resazurin and methylene blue samples were incubated overnight and examined the following morning to determine the type of curd formation.

After plating the laboratory-pasteurized samples on oval tubes, the samples were incubated overnight, then examined under the miscroscope to determine the type of flora prevailing.

In this study, 1,200 samples were collected and laboratory pasteurized. Of this number, 957 were samples of graded milk, and the remaining 243 were from the ungraded supply. Table 1 summarizes the results by milk for a period of 14 consecutive months. Three 10 ml. portions were taken from each sample, one each for a methylene blue and resazurin test, and the third was used for laboratory pasteurization. The samples were pasteurized at 143° F. for 30 minutes, then immersed in ice water, and held for 3 hours before plating on oval tubes.

TABLE 1

MONTHLY SUMMARY OF 1,200 SAMPLES LABORATORY PASTEURIZED

(957 Samples of Graded Milk, and 243 Samples of Ungraded Milk)

	Month—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Graded	Samples tested	196	52	65	119	53	90	62	54	26	52	52	136	957
	% 5,000 to 20,000	15.3	23.0	34.0	15.0	5.7	6.7	6.5	7.4	3.9	13.5	17.3	12.5	13.9
	% over 20,000	12.2	17.3	7.7	6.7	1.9	1.1	1.6	1.9	3.9	0.0	11.5	14.7	8.1
Ungraded	Samples tested	20	20	25	20	54	...	11	18	10	20	20	25	243
	% 5,000 to 20,000	10.0	20.0	4.0	10.0	18.5	...	0.0	22.0	20.0	10.0	20.0	28.0	16.5
	% over 20,000	65.0	70.0	64.0	75.0	65.0	...	64.0	61.0	30.0	90.0	35.0	60.0	63.5

The resazurin test was made by reading the samples at 30 minute intervals for 3 hours, a distinct purple pink end point being considered the end point of reduction. At the end of 3 hours, a smear was made and examined under the microscope to determine the type of bacteria predominating. The methylene blue samples

months. In this table comparing the laboratory-pasteurization results of graded and ungraded milk, the two grades gave approximately the same percentage of tests between 5,000 and 20,000 bacteria per ml.; the exact percentage being 13.9 percent for the graded samples and 16.5 percent for the ungraded samples. The percentage of samples with oval tube counts over 20,000 per ml. however, revealed an unbelievable difference between the two grades of milk. The total for the graded samples being 8.1 percent, while 63.5 percent of the ungraded samples had an oval tube count over 20,000. From the standpoint of laboratory pasteurization, the chief difference in the two grades of milk is the number of samples with oval tube counts over 20,000. Accordingly, the following data will deal with the samples which gave oval tube counts in excess of 20,000 bacteria per ml.

The months of November, December, January, February, March, and April gave relatively high percentages of samples that did not pasteurize to a count below 20,000; while the months of May, June, July, August, September, and October gave an almost insignificant percentage of counts over 20,000. This is the exact reverse of what one would anticipate, since all our quality tests have indicated that our supply of milk is of much higher quality during the winter months.

There is no such trend in the ungraded milk samples, but the entire monthly summary shows that an ungraded supply of milk such as ours would never supply milk which could be pasteurized to a low count at any month of the year. This contradicts the early criticism of pasteurization, that it merely covered up faulty practices on the farm, and did nothing to improve the sanitary quality. Pasteurization may cover up certain faulty practices on the farm, if the plate count is taken as the criterion of quality of pasteurized milk, but the careless handling of utensils and milking machines on the farm shows up in the form of high bacteria counts in the pasteurized product.

In Table 2, we have the microscopic classification of both graded and ungraded milk supplies for the samples which gave oval tube counts over 20,000 per ml. The table for the graded milk supply is based on 47 tests, or 6.3 percent of the total of 742 samples examined. The microscopic examinations were made after 3 hours incubation, and classified according to the method advanced by Lazarus (6). Unclean utensils, external contamination, and poor production accounts for 72.3 percent of the samples containing over 20,000 bacteria per ml. The direct microscopic examination of graded milk samples would have been effective in weeding out samples containing large numbers of thermoduric bacteria were it not for the fact that in 19.2 percent of the samples with oval tube counts in excess of 20,000, no bacteria were found in the ten fields examined. Thus, in many cases, raw milk with a low bacterial content is responsible for high counts after the milk is pasteurized.

TABLE 2

MICROSCOPIC CLASSIFICATION OF SAMPLES CONTAINING OVER 20,000 THERMODURIC BACTERIA PER ML.

Graded Milk Samples						Ungraded Milk Samples					
No Bacteria	Lack of Cooling	Dirty Utensils	External Contamination	Poor Production	Mastitis	No Bacteria	Lack of Cooling	Dirty Utensils	External Contamination	Poor Production	Mastitis
19.2	4.3	17.1	23.4	31.8	4.2	7.5	42.4	4.2	6.7	39.2	0.0

The data for the ungraded milk is based on 189 tests, of which 62.5 percent or 118 samples gave oval tube counts over 20,000 per ml. For this type of milk, the samples giving high oval tube counts which showed no bacteria in the microscopic examination dropped to 7.5 percent. However, in 42.4 per cent of the high counts, lactic acid types of bacteria predominated, according to the microscopic examination. Thus, the microscopic examination did not reveal any unsanitary condition on the farm in approximately 50 percent of the ungraded milk samples which contained excessive numbers of thermoduric bacteria. We noticed that many of the thermoduric micrococci encountered are very similar in appearance to the common types of lactic acid diplococci. Undoubtedly a number of the samples heavily contaminated with thermoduric bacteria were considered to be lactic acid diplococci when viewed under the microscope. There is also the possibility of error due to the large number and variety of bacteria present, since it is more difficult to find the troublesome organisms when the bacterial content is extremely high than when it is lower.

on the fermentation test. For each of the grades of milk, more than 50 percent of the samples with oval tube counts over 20,000 gave a lactic type curd on the fermentation test. We have been able to develop considerable interest among our producers with the fermentation test, and it might be of value in a sanitary program for its visual effects, but it was of no value in detecting milk containing excessive numbers of thermoduric bacteria.

Table 4 shows the methylene blue classification of samples with oval tube counts over 20,000 bacteria per ml. There were 49.0 percent of the graded samples over 20,000 that did not reduce methylene blue in 6 hours, while only 10.7 percent of the ungraded samples with oval tube counts over 20,000 failed to reduce in 6 hours. Although there was more widespread contamination of the ungraded samples with thermoduric bacteria than was present in the graded samples, there was also a much more prevalent contamination of other types of bacteria that reduced methylene blue, whereby most of the samples with high oval tube counts also reduced methylene blue in 6 hours. This would indicate that methylene blue should be a very effective test in starting a quality improvement program, but after definite progress has been made, it is necessary

TABLE 3

FERMENTATION TEST CLASSIFICATION OF SAMPLES CONTAINING OVER 20,000 THERMODURIC BACTERIA PER ML.

Graded Milk Samples				Ungraded Milk Samples			
Not Coagulated	Lactic Type Curd	Gassy Curd	Peptonized Curd	Not Coagulated	Lactic Type Curd	Gassy Curd	Peptonized Curd
8.5	55.4	12.8	23.3	4.2	53.4	19.5	22.9

TABLE 4

RESULTS OF METHYLENE BLUE TEST ON SAMPLES CONTAINING OVER 20,000 THERMODURIC BACTERIA PER ML.

Hours on Methylene Blue —	1	2	3	4	5	6	Over 6
Graded samples (percent)......	6.4	4.2	6.4	8.6	16.9	8.5	49.0
Ungraded samples (percent)...	46.7	12.8	10.9	9.4	6.0	3.5	10.7

Table 3 shows the results of the fermentation test on 47 graded milk samples which gave oval tube counts over 20,000. In using this test, we have presupposed that a digested or peptonized curd indicated the presence of bacteria originating in improperly cleaned and sterilized utensils. Since thermoduric and thermophilic bacteria originate in unclean utensils, we thought this test might be of value in detecing thermoduric bacteria. However, only 23.3 percent of the graded samples with oval tube counts over 20,000 showed peptonization, and only 22.9 per cent of the ungraded samples with oval tube counts over 20,000 bacteria per ml. gave a peptonized curd to supplement it with some other test, such as laboratory pasteurization or some of its modifications.

Table 5 shows the resazurin classification of both graded and ungraded samples over 20,000. There were 38.3 per cent of the graded samples over 20,000 which did not reduce in 3 hours, while 16.9 percent of the ungraded samples failed to reduce. This gave comparable results to those obtained with methylene blue; however resazurin was considerably more effective than methylene blue on the graded samples of milk, and slightly less effective on the ungraded samples. There is not sufficient difference, however, to give it consideration over methylene blue on this type of work, since both methylene blue and resazurin are extremely ineffective in weeding out milk containing thermoduric bacteria.

In our reference to the bacteria surviving pasteurization, we have grouped them all together and classed them as thermoduric. We recognize of course, that this also includes the thermophilic bacteria, if any are present; and since the term thermoduric means any bacteria which is heat resisting but will not grow at pasteurizing temperatures or above, we were interested in obtaining some information on the temperature necessary to reduce the high thermoduric counts to an acceptable number. Accordingly, 54 samples of our ungraded milk supply were prepared in duplicate and one sample pasteurized a 143° for 30 minutes, the other heated to 190° and immersed in ice water immediately. Of the samples pasteurized at 143° for 30 minutes, 16.7 percent had oval tube counts between 5,000 and 20,000; while 50 percent of the samples had oval tube counts over 20,000. Of the samples pasteurized at 190°, however, 14.8 percent had counts between 5,000 and 20,000, and none of the samples were over 20,000. From the commercial viewpoint then, it may be said that the bacteria resisting pasteurization encountered in this study resisted 143° for 30 minutes, yet were killed by 190° momentarily.

TABLE 5

RESULTS OF RESAZURIN TEST ON SAMPLES CONTAINING OVER 20,000 THERMODURIC BACTERIA PER ML.

Hours on Rasazurin —	½	1	1½	2	2½	3	Over 3
Graded samples (percent)	6.4	6.4	8.5	8.5	12.8	19.0	38.3
Ungraded samples (percent)	61.8	5.1	5.1	5.9	4.3	1.8	16.0

SUMMARY

Thermoduric bacteria are prevalent in both graded and ungraded milk supplies. They are of little consequence in graded milk during the summer months, but become of sufficient magnitude during the winter months to make it extremely difficult consistently to obtain low counts on the pasteurized products.

Uninspected and ungraded milk supplies are so thoroughly contaminated with thermoduric bacteria throughout the year that it would be impossible to pasteurize milk of this description so that it would meet the requirements of the standard ordinance from the standpoint of the bacteria count of the finished product.

The microscopic examination of the incubated samples of raw milk failed to detect samples with large numbers of thermoduric bacteria. Even in samples where large numbers of thermoduric bacteria are present in the raw milk, they are so similar to some of the types of lactic acid bacteria that their identification is difficult, if not impossible.

Although the fermentation test is of value in building interest among the producers, it is in no way able to detect samples that are heavily contaminated with thermoduric bacteria.

The methylene blue and resazurin tests are ineffective in weeding out milk with large numbers of thermoduric bacteria. Heat-resisting bacteria as a group are very poorly reducing bacteria, and even when present in extremely large numbers have little effect on either the methylene blue or resazurin test. These tests are successful in grading out milk containing large numbers of thermoduric bacteria only when there is also a high contamination of other bacteria which are capable of reducing the dye. In this connection, they are very effective for the first quality improvement work when the producers are lax from most every standpoint of quality, but as the sanitary practices are improved and the source of large numbers of highly reducing bacteria eliminated, the thermoduric bacterial content is not reflected in the results of the tests.

Laboratory pasteurization alone is not a satisfactory test on which to base the sanitary control of a milk supply, but on the other hand, none of the other present tests have proven satisfactory to be used without some supplementation from other tests. However, the laboratory pasteurization test definitely detects a type of unsanitary condition on the farm that is not detected by any of our present tests. Furthermore, this unsanitary condition perhaps has more direct influence on the plate count of the pasteurized product than all the other sanitary qualities obtained with older tests. Laboratory pasteurization is the one test that provides a carry through in the inspection of both raw and pasteurized milk. With our present method of inspecting and grading raw milk supplies, there is no assurance whatsoever that a graded raw milk supply will give a sufficiently low count after pasteurization to meet the requirements for pasteurized milk. In a well balanced sanitary control of raw milk supplies, it should be assured that raw milk meeting the requirements for its grade would likewise meet all the requirements of its grade after being pasteurized.

The oval tube technique developed by Myers and Pence, which we used in this study, has proven its worth both in connection with the laboratory pasteurization test, and also in the sanitary control work in the plant. We have found it capable of replacing the standard plate count altogether for routine control work with equally satisfactory results, and requiring only a small fraction of the labor, equipment, and space required for the standard plate count.

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Food Requirements Committee

A Food Requirements Committee with control over production and allocation of all civilian and military food supplies was established within the War Production Board under the chairmanship of Secretary of Agriculture Claude R. Wickard.

The new Committee, named by Donald M. Nelson, Chairman of WPB, will determine civilian, military, and foreign food requirements and has authority to step up or limit the domestic production of foods as well as the importation of foods and agricultural materials from which foods are derived.

Administration of food rationing remains in the hands of the Office of Price Administration.

In addition to Secretary Wickard, the Committee will consist of representatives of the State, War, and Navy Departments, Office of Lend-Lease Administration, Board of Economic Warfare, and the WPB Divisions of Industry Operations, Materials, and Civilian Supply.

Decisions of the Food Requirements Committee will be final, subject to the over-all direction and approval of the War Production Board.

The order creating the committee served to clarify and define the respective functions of the Department of Agriculture, State Department, Office of Lend-Lease Administration, Office of Price Administration, Board of Economic Warfare and the WPB as far as they relate to the total wartime picture of food production, supply, allocation, rationing and importing.

Although the order retains final authority in the hands of the Chairman of the WPB, the top agency concerned with the nation's vast problems of production and supply, the Foods Requirements Committee has received broad powers in the food field. These powers and functions, in turn, are given to the Department of Agriculture and other agencies, many of them already familiar with the job.

The Foods Requirements Committee will meet the wartime need for a centralized body which will have power to direct and handle the food problem in close relation to the other complicated problems raised by the war production effort.

In charting its far-reaching decisions affecting the eating habits of every man and woman in the country, the Foods Requirements Committee will receive estimates and programs from agencies representing users of food, such as the Army and Navy and the Division of Civilian Supply of the WPB. The Committee will then balance this information against data supplied by agencies representing food producers, such as the Department of Agriculture.

When all of the facts, programs, and estimates have been assembled and studied, the Foods Requirements Committee will, broadly speaking, make a final decision on how all foods shall be produced and allocated in the light of their availability and of the material and equipment necessary to produce, process, transport, and store them.

To guide the Committee in reaching its decisions, each Government agency concerned with the production or use of food will act as a channel of information. The Department of Agriculture will report regularly on the progress of domestic food production and, after consulting with the State Department and the Board of Economic Warfare, on programs formulated for the importation of foods and agricultural materials from which foods are derived. The War and Navy Department will report on their special wartime requirements for food. The Division of Civilian Supply of the WPB will draw up lists of food supplies considered essential for home civilian consumption. The Division of Industry Operations of WPB will report on available stocks of non-food materials, such as cotton and rubber, which are processed from agricultural materials. And the Board of Economic Warfare and the Office of Lend-Lease Administration, together with the State Department, will estimate the food requirements of our allies.

To carry out the final decisions of the Foods Requirements Committee, the order assigns definite functions to various agencies concerned with the food problem.

The Department of Agriculture will be responsible for:

1. Increasing or limiting domestic agricultural production in accordance with decisions of the Committee.
2. The earlier stages of food production in general.
3. The importation of foods and agricultural materials from which foods are derived. These powers have been delegated to the Commodity Credit Corporation within the Department of Agriculture by the Board of Economic Warfare.
4. The formulation of programs for conservation of critical foods or agricultural materials from which foods are derived.

The Division of Industry Operations of the WPB will be responsible for the later stages of food production in general, such as baking and the manufacture of candy and soft drinks.

The Materials Divisions of the WPB will be responsible in general for the processing of non-foods derived from agricultural materials which are a source of food. Soap would be an example of this.

Members of the Foods Requirements Committee and the agencies they represent are as follows: Chairman, Claude R. Wickard, Secretary of Agriculture; L. S. Stinebower, State Department; Brigadier General Carl A. Hardigg, War Department; Rear Admiral W. B. Young, Navy Department; W. B. Parker, Board of Economic Warfare; Dr. John Orchard, Office of Lend-Lease Administration; Roland S. Vaile, Division of Civilian Supply of the WPB; Douglas C. Townson, Division of Industry Operations of the WPB; and T. L. Daniels, Materials Division of the WPB.

Administrative Public Health Problems in Milk and Milk Products*

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THERE are many problems arising in the public health administration of a municipal milk supply that in these days require considerable thought and study. The lack of uniformity of these administrative practices illustrates the confusion in the minds of administrative officers.

The regulation of a municipal fresh fluid milk supply can, for convenience, be divided into three phases or stages:

The prepasteurization of raw milk.
The pasteurization.
The postpasteurization.

PREPASTEURIZATION

The regulation of the production, handling, and transportation of the raw milk is the most difficult phase of regulation from an administrative standpoint. The dairy farms producing milk are beyond the police jurisdiction of the municipality consuming the milk. The usual procedure is to issue certificates of approval, sanitation, or permits to such producing farms after certain physical requirements have been met. The type of inspection differs on various milk sheds. In many areas, the industry assumes the burden of this inspection under varying degrees of health department supervision. In some instances the entire inspection of dairy farms is done by the health department. Then again, there is a dual inspection service: one maintained by the industry and another by the tax-supported health department.

There are two schools of thought and practice relative to the standards for the quality of a raw milk supply transported into an urban community. One group contends that there are no practical methods of examination that can be used to determine the sanitary quality or public health safety of the raw milk supply; hence the necessity of controlling and regulating milk on the farm when and where it is produced. The other group places greater emphasis on the sanitary quality of the milk after it leaves the farm and before it is pasteurized. This latter group usually enforces environmental sanitation of dairy farms by inspection, but places more emphasis on the examination of the milk supply by the Breed direct microscopic test, methylene blue reductase test, taste and odor of the milk, etc. A combination of these tests is in use in some of our largest milk sheds. When one examines the available records, there does not appear to be any detectable public health advantage enjoyed by the consumers as a result of the use of either of these two procedures for regulating raw milk.

Healthy cows, safe water supply, sanitary disposal of human excreta, properly constructed barns, and milk houses with the physical equipment for the cleaning and disinfecting of utensils and the cooling of milk can be determined by inspection. The daily use of these facilities by the producer is a personal equation and habit factor which cannot be enforced by inspection by the health department. Healthy cows, cleanliness, and proper cooling

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are the underlying factors in farm sanitation.

A careful review of the literature, combined with personal administrative experience, has failed to show an advantage of the present *Standard Methods* of bacterial plate count as a proper index for the sanitary quality of milk. The use of newer media and lower incubation temperature has contributed toward confusion in interpretation of the significance of bacterial plate counts. It should be remembered that bacterial plate counts are only one of the various methods of escertaining the sanitary quality of milk, and likewise it should be kept in mind that this method is subject to considerable variations due to the involved technical procedures. This is the most expensive yardstick we employ in determining the sanitary quality of our milk supply. Its proper place should be only as one of the tests, but alone it can be misleading, particularly unless a large number of samples are repeatedly examined, thereby considerably increasing the costs of regulation.

PASTEURIZATION

The major development in the last decade in milk sanitation has been in improvement in pasteurization. It is true that we have used pasteurization for three decades to aid in safeguarding our milk, but there has been considerable progress made in perfecting the technic and equipment used in the actual pasteurization process. The development of the phosphatase test has given us confidence in the efficiency of these new methods and devices. The pasteurization of milk carried out in modern equipment, with its automatic controlling accessory and safety devices, represents an engineering development that is making this treatment really precise.

POSTPASTEURIZATION

This period of regulation includes the time interval after the milk is pasteurized and until it is delivered in fresh fluid form to the consumer. If we could deliver to the consumer a bottle of milk equal in sanitary and health promoting qualities to the milk that leaves the pasteurizer, some of our health department problems might be solved.

The bacteriological control of milk before and after pasteurization presents different problems. The raw or prepasteurized milk contains a variety of bacteria: some come from the udder of the cow, some from the environment of the barn, and many are derived from utensils, milking machines, and various pieces of equipment that may not have been cleaned properly. The latter group is usually thermoduric and survive killing temperatures for disease-producing bacteria. The postpasteurization bacterial flora of milk have more to do with keeping qualities of the milk than with the public health significance of the bacterial flora as determined by refinements of established technical procedures. We do not have practical methods nor do we attempt to apply quantitative bacteriological procedures to determine disease-producing bacteria in a milk supply. Our methods at present consist of determining all of the bacteria that may grow in a milk sample under strict and standardized procedures of media composition and incubation temperature. The media and temperature are more concerned with determining the keeping qualities of the milk than with the public health significance of the milk sample. Every administrative officer should separate the commercial advantages of increasing keeping qualities versus the protection of the health of the public.

The total qualitative bacterial count of milk after pasteurization is not as significant (as now practiced) from a general sanitary standpoint as before pasteurization. When milk is bottled in small retail containers, the opportunity for contamination by human bacteria are enhanced. When a 10,000 gallon tank of milk is brought to the pasteurizer and then broken up into 40,000 to 50,000 individual units, each handled several times by different hands, the opportunity or probability of contamination is increased in proportion to the surface exposure of the retail package. This necessitates protection of the milk from contamination also after pasteurization and bottling. Hood closures that will be as effective in protecting the contents of the bottle as the pasteurization equipment is effective in destroying harmful bacteria, are certainly essential for a safe milk supply.

A total bacterial count of a quart of pasteurized milk may be 10,000 bacteria per ml. immediately after filling and cooling, and 15,000 when delivered to the consumer. If this is due to contamination of bacteria of human origin, such as salivary or fecal bacteria, then such a milk is unsafe for human consumption. But if the increase is due to lack of cooling or refrigeration, then there should be little apprehension as to the public health significance of the fifty percent increase in the bacterial count. The significant factor in postpasteurized milk is the types of bacteria present in the milk—are they survivals of the prepasteurized flora or are they added to the milk after it was pasteurized due to human contact?

Discussion

There are many unanswered questions concerning administrative problems in controlling and regulating a municipal milk supply. Suppose a raw milk has a bacterial plate count of 100,000 or 1,000,000 per cubic centimeter and is properly and effectively pasteurized. Has the postpasteurized product, if efficiently protected from extraneous contamination, any different nutritive properties in these two samples? There is nothing in the literature to show any differences upon the health of the consumers of these two hypothetical samples. All of the observations bearing on this question were made before we had effective pasteurization equipment and chemical methods of checking and verifying the efficiency of the process.

The public health regulations governing and controlling milk should be for the purpose of insuring a wholesome and nutritious milk, free of disease-producing bacteria and irritating substances. If these regulations are extended beyond this field, they may become a burden to the industry and the consumer.

The death rates for typhoid fever serve as an index of sanitation in a community. The death rates per 100,000 *rural* population in 1900 was 45.8, in 1910 it was 23.3, in 1920 it was 9.6, in 1930 it was 6.6 and in 1939 it was 1.8. This indicates that our rural population has approximately equally sanitary safeguards as the urban population. Table 1 shows the typhoid death rates for the total population, urban and rural, in the United States Registration Area from 1910 to 1939. We can no longer regard the rural areas as typhoid reservoirs. As the sanitary environment of our rural areas improves, the hazards of contamination from this source decrease in the same proportion.

TABLE 1

United States Registration Area
Typhoid Death Rates

Year	Total	Urban	Rural
1900	35.4	19.7	45.8
1910	22.8	22.4	23.3
1920	7.6	5.5	9.6
1930	4.8	2.8	6.6
1935	2.8	2.2	3.6
1939	1.6	1.4	1.8

Public health practice and procedures change with the advancement of knowledge, and the regulations are adjusted to meet the situations as they exist. A Committee on Administrative Practice in regard to communicable diseases of this Association frequently makes reports embodying its recommendations relative to methods, procedures, etc. to reduce the incidence, morbidity and mortality of certain diseases or groups of diseases. Some of these recommendations have involved radical departures from the usual quarantine and placarding practices. These have, as a whole, been favorably accepted by the public health administrative officials. Why cannot the same practice and policies be carried out by the divisions of the health departments concerned with milk control as is and has been in vogue in respect to communicable disease control?

We began our farm sanitary regulations governing milk production when the rural areas were reservoirs for enteric diseases. The last two decades show a marked improvement in rural sanitation; in fact, the incidence of typhoid fever is the same as in urban communities. The first handler of the dairy farm's milk, the receiving station, can now be used as the testing area to determine if utensils are clean and disinfected, if the milk has been kept cool, etc. We can now shift our administrative control with a reasonable degree of assurance from the broad shed to the bottlenecks where we can regulate and examine the product in a practical manner. The facilities for proper milk production can be ascertained by farm inspection which can be made less frequently than when we attempt to control the sanitary quality of the milk on the farm.

We should continue the present regulations regarding pasteurization. These rules are rigid and capable of being supervised and checked by various recording devices during operation, and by chemical tests to determine if all of the milk has been properly pasteurized.

We need to place more emphasis on the postpasteurization handling of milk. Better packaging of the pasteurized milk is desirable. The human contact with the final consumer's bottle of milk requires more study in order to make this phase equal in efficiency to the prepasteurization and pasteurization phases. The cleansing and disinfection of the bottle can be carried out with modern equipment if the operation is supervised comparable to the scrutiny given to pasteurization equipment and its proper operation. The milk must then be protected against contamination and adulteration until consumed. Better methods of determining effective closures of bottles need to be developed. If water, moisture, etc. can get from the outside into the milk in the bottle, a definite health hazard will exist. The frequent hand contact will deposit bacteria of salivary or fecal origin on the external surface adjacent to the cap or hood and these bacteria will be transferred to the milk with any liquid that may gain entrance. The total bacterial count may not increase but a few bacteria per cubic centimeter but the significance of these few hundred human strains in the postpasteurized quart of milk have definite public health hazards.

There is an undeniable tendency in the public health administration of milk to retain all existing rules and add new ones from time to time. There is a tendency to pyramid regulatory measures. The bottom of the structure may be its weakest part because it is the oldest and has not been altered or revised based upon accumulation of knowledge and experience. The less inspection and regulation we can do to insure a wholesome, sanitary, and drinkable milk, the better off we are in the long run. Many of us recognize the pitfalls of over-inspection and excessive regulations. We defeat our objective when we do so. We hamstring the industry, we overload the taxpayer, and the consumers pay for a fictitious quality of product.

Problems Incident to the Production and Use of Homogenized Milk*

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While homogenized milk has been readily accepted by the consumer almost beyond comprehension, the processing and distribution of homogenized milk has not been without its problems. These problems, troublesome as they may seem at times, are not without solution. It should be emphasized, however, that homogenized milk is not alone in respect to problems. In fact, any product has its own peculiar problems incident to production, processing, and distribution.

Too often we think of the process of homogenization only as one reducing the size of the fat globules to the extent that they no longer rise to form a cream layer and that that is all which does occur as a result of the process. The very fact that the fat globules are rendered much smaller in size thus creating new and increased surface area and dispersing the fat uniformly throughout the milk, results in a product which no longer behaves in many respects as milk normally does. These problems may be roughly classified as follows:

1. Processing
2. Packaging
3. Distribution
4. Laboratory control
5. Cooking
6. Utilization of returns

Processing

In the field of processing there are at least five problems to which the attention of the production manager should be called. These are:

1. Rancidity
2. Sedimentation
3. Increased bacterial counts
4. Inefficient homogenization relative to standards
5. Cream line

Fortunately, practically all the problems incident to the production and processing of homogenized milk may be readily solved. However, if the plant manager is not aware of the problem, difficulty may be encountered. Probably the chief problem in homogenizing milk is that of the development of rancidity. Unless the milk is processed at a temperature sufficiently high to inactivate the enzyme lipase causing lipolysis, all homogenized milk soon becomes so rancid, bitter, and soapy, that it cannot be used for edible purposes. Thus, if milk is to be homogenized, it must be pasteurized prior to homogenization or immediately following the process. Furthermore, homogenized, pasteurized milk must not be contaminated with raw non-homogenized milk. The introduction of a small percentage of raw milk to the homogenized product induces lipolysis, or fat splitting, about as rapidly as though the milk had been homogenized raw. This problem has been successfully solved by recognizing the behavior of raw milk resulting from homogenization and heat-treating the milk accordingly.

Another problem in processing milk of quite some concern, which is not entirely eliminated in the homogenized milk industry today, is that of sedimentation. Despite the fact that the milk may have been filtered, the

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homogenized product may show a flocculent, smudgy precipitate in the bottom of the bottle after 24 hours standing regardless of the pressure used. Particularly at some seasons of the year is sedimentation in homogenized milk troublesome. An analysis of this sediment shows it to be composed largely of milk cells, milk solids, colloidal dirt, and some milk fat. In other words, it compares quite favorably with that of separator slime. Sedimentation of homogenized milk has been successfully eliminated by subjecting the milk to centrifugal force as in clarification. While clarification may be more efficient following homogenization, experiments have been demonstrated that sedimentation of homogenized milk may be overcome by clarifying the milk prior to homogenization. If sedimentation is to be overcome in part without submitting the milk to clarification, then special attention must be made to securing a clean milk supply and to processing the milk through a scrupulously clean machine.

Increased bacterial counts have been a matter of some concern to those distributing homogenized milk. Actually, increased bacterial counts in homogenized milk over the same milk non-homogenized is largely a matter of fancy rather than one of reality. True, the homogenizing process breaks up the clumps of bacteria so that in plate-counting the milk, higher counts may be obtained. However, such higher counts are apparent rather than real. It must not be overlooked that the modern homogenizer which is completely demountable may be as readily sanitized as any piece of equipment with which the milk comes in contact. Furthermore, the increased temperature above that of pasteurization resulting from the pressure of homogenization may be a factor responsible for further destruction of the bacteria of the milk, thereby tending to keep down the bacterial count of the homogenized product. The very fact that homogenized milk is put on the market today by many plants with no higher bacterial count than experienced in pasteurized milk shows conclusively that this problem is apparent rather than real.

At the present time much concern is being felt over homogenized milk not meeting the standards set up for the product. Some evidence is available showing that some commercial milk thus processed is not quite meeting the standards for homogenized milk. Apparently, either the standards for the product are too stringent or else it may be necessary to subject the milk to somewhat higher operating pressures. Generally, at least 2,500 pounds pressure per square inch are necessary if homogenized milk is to meet the standards for the product.

Another problem in processing which occurs from time to time is that of cream line or a cream plug. Such a problem would seem never to be associated with homogenized milk, yet the problem occasionally manifests itself. Two causes may be mentioned. Either the milk is insufficiently homogenized or else the homogenized milk is contaminated with non-homogenized milk. In the latter case the homogenized milk may have been put through the bottler after non-homogenized milk had been bottled without previously having washed the equipment. In some cases a dead-end pipe filled with non-homogenized milk may feed such milk into the line later on during bottling of homogenized milk, thus giving a cream line or a cream plug to the homogenized milk. As long as the entire lot of milk is properly homogenized and bottled without subsequent contamination with non-homogenized milk the trouble with cream plug should not exist.

PACKAGING

In the packaging of homogenized milk one major problem exists. This problem is that of foaming so that difficulty is experienced in properly filled bottles. This problem has not been successfully solved to the satisfaction of all. To our present knowledge the best procedure is to carry a high head of milk in the cooler trough and the bottling supply tank, making certain that no air leaks are in the line and that the bottler is operated at slow speed. Probably vacuum filling of bottles at a comparatively high temperature offers some remedy. Also homogenization prior to pasteurization in the lipase-active zone may overcome foam in part. However, this is a dangerous procedure to follow in most cases.

DISTRIBUTION

In the field of distribution three problems manifest themselves: First, an unattractive appearing bottle due to seepage, particularly in the summer months when the bottles are not properly refrigerated enroute; second, seepage of the homogenized milk either around the cap seat or through the staple holes of the cap itself; and third, a watery appearance resulting from partial freezing of the milk in the northern climates during the winter months.

The unattractive bottle occurring sometimes during the summer months may be overcome by controlling the seepage. In overcoming seepage the 56 mm. cap milk bottle may be filled to one-quarter inch of the cap seat. This fill allows sufficient volume for expansion that seepage does not occur. The real solution to seepage of homogenized milk is adequate refrigeration from the plant to the consumer's refrigerator. Also during the winter months bottles of homogenized milk may be unattractive. When homogenized milk freezes it does not force up the cap as it does in non-homogenized milk. Instead of the frozen homogenized milk gradually pushing the cap up, the milk is first forced out from under the cap seat where it runs down over the sides of the bottle forming a candle-drip appearance.

When frozen homogenized milk is defrosted, the upper portion of milk appears quite watery as though it had actually been diluted with water. Strange as it may seem the fat does not rise to the surface in frozen homogenized milk to form a cream layer, but actually settles out to a greater or less extent, depending largely upon the rate of defrosting.

LABORATORY CONTROL

The plant or health laboratory frequently has encountered difficulties in laboratory control of homogenized milk. These laboratories are chiefly concerned with the legality of the fat test of the milk and whether the milk attains the standard set for homogenized milk. Many experiments have shown conclusively that homogenized milk may be readily tested by the Babcock procedure, provided some modifications are made. The use of sulphuric acid having a specific gravity of 1.815 to 1.820 is to be recommended in making the fat test of homogenized milk. Precaution should be taken to know that the temperatures of both the milk and of the acid are about 70° F. Also the acid-milk mixture should be rotated gently at first and then agitated longer before the test bottles are placed in the centrifuge. Despite some little difficulty at times in making a clear fat test of homogenized milk, data show that homogenized milk may be tested readily with the results checking within 0.1 percent of that obtained on non-homogenized milk. This variation is within the tolerance provided for the fat percent of non-homogenized milk as specified by the American Dairy Science Association.

In checking the efficiency of homogenization, the upper 100 ml. are tested for fat and compared with the fat test of the remainder after the 100 ml. has been removed. The definition for homogenized milk given by the U. S.

Public Health Service is used as a standard. This definition is as follows:

"Homogenized milk is milk which has been treated in such manner as to insure breakup of the fat globules to such an extent after 48 hours storage no visible cream separation occurs on the milk and the fat percentage of the top 100 c.c. of milk in a quart bottle, or of proportionate volumes in containers of other sizes, does differ by more than five percent of itself from the fat percentage of the remaining milk as determined after thorough mixing."

Unfortunately, variations in the manner of securing the 100 ml. portion of milk results in wide variations in the test of that portion. Generally, methods involving the siphoning off of the upper layer without disturbing the under layer comes nearer giving a true picture of fat migration in the homogenized milk than do methods in which the underlayers are disturbed. Microscopic examination is very frequently employed also in checking the efficiency of homogenization. It is generally recognized that in properly homogenized milk the fat globules should not exceed two microns in diameter.

COOKING

In view of the fact that within a decade homogenized milk has become a standard food item in many homes, it seems strange that a problem should arise relative to its use in the home. However, its use in cookery particularly, has given rise to some problems. The problems are chiefly concerned with the curdling of the milk. Apparently homogenized milk is more sensitive to heat, especially when the milk is used in cookery involving relatively high calcium values. On the other hand, this curdling of homogenized milk in cooking may be of distinct advantage in several types of cookery, custard for example, rather than a disadvantage. However, the problem should be recognized and our customers educated to it.

UTILIZATION OF RETURNS

When homogenized milk was first introduced to the public the matter of the utilization of returns was of very vital concern. However, at the present time little is heard of this particular problem. In the first place, the amount of milk homogenized above that of the route demands is kept at a minimum. Studies have shown that that which is returned may be successfully utilized in making of buttermilk and cottage cheese. Separation of the returned homogenized milk would seem to be a questionable procedure to follow, particularly when the milk met the public health standards as to fat dispersion.

CONCLUSION

While homogenized milk apparently gives rise to numerous problems, these problems fortunately may be solved. Let it be recognized that problems exist in the processing and distribution of any product and homogenized milk is no exception. The general acceptance of homogenized milk indicates that the problems are not insurmountable.

Thirty-first Annual Meeting

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Headquarters: Hotel Jefferson

St. Louis, Missouri

Thermoduric Organisms in Relation to High-Temperature Short-Time Pasteurization*

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INTRODUCTION

FROM the standpoint of temperature relationships, there are different kinds of bacteria: some that can live and grow at very low, some at very high, and some at temperatures in between. The bacteriologist classifies these three groups as follows:

	Temperature Range		
Name	Minimum	Optimum	Maximum
Cryophilic bacteria	32°F	59°F	86°F
Mesophilic bacteria	59°F	98.6°F	113°F
Thermophilic bacteria	113°F	131°F	158°F

The term "thermoduric" is not included in this classification. The reason is that it is a specialized term. Thermoduric in dairy bacteriology is used to designate a group of bacteria which will withstand the temperature of milk pasteurization, 140 to 145° F. for 30 minutes or 160–161° F. for 15 to 16 seconds, but will not grow at this temperature. *It is a matter of heat tolerance or resistance and not growth.* In contradistinction to this, the term *thermophilic* means *heat loving and growth only in the presence of heat.*

It, therefore, is evident that we should expect to find more thermophilic bacteria in milk pasteurized at 142 to 145° F. for 30 minutes than in milk pasteurized at 160 to 161° F. for 15 to 16 seconds since the pasteurizing temperature is within the growth range of thermophilic bacteria and there is sufficient time for them to grow, especially since milk may remain in the pasteurizing vat longer than the 30 minute interval. Conversely we should expect to find more thermoduric bacteria in the high temperature, short-time pasteurized milk than in the low-temperature, long-time pasteurized milk since they are heat resistant but are not able to grow at 142 to 145° F. but the longer time at this temperature is unfavorable to them. Thus, it becomes evident that the farm presents a greater possibility of thermoduric contamination in milk while for thermophilic bacteria, the holding type of pasteurizer is the chief source of contamination. In short, thermoduric bacteria are a problem of the producer, and thermophilic bacteria of the dealer.

EXAMPLES OF THERMODURIC BACTERIA

Keeping in mind that the term thermoduric refers to a group of bacteria and not any one species or even genus of bacteria, let us see the kind of bacteria that are able to withstand pasteurizing temperatures. Most investigators (7, 11, 21, and 26) agree that the micrococci predominate. Here are the names of some of the more common ones that survive pasteurization: *Micrococcus albus, Micrococcus aureus, Micrococcus candidus, Micrococcus conglomeratus, Micrococcus epidermidis, Micrococcus luteus,* and *Micrococcus varians.* The next most commonly found group are the streptococci such as *Streptococcus thermophilus, Streptococcus liquefaciens, Streptococcus bovis, Streptococcus*

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glycerinaceous, Streptococcus inulinaceus, Streptococcus fecalis, and *Streptococcus zymogenes.*

After the streptococci, sarcinae are most prevalent such as *Sarcina lutea* and *Sarcina rosea.* Next come the rod shaped bacteria mostly of the sporogenic type such as *Bacillus cereus* and *Bacillus subtilis.* Some idea of the relative numbers of each of these four groups of bacteria which survive pasteurization in milk is given by the data of Hileman *et al.* (7). They found in the laboratory pasteurization of 484 samples of milk from 49 producers that the surviving bacteria were composed of 79.3 percent micrococci, 7.4 percent streptococci, 8.1 percent sarcinae and 5.2 percent rods.

THE SOURCE OF THERMODURIC BACTERIA

There is evidence to indicate that one of the principal sources of thermoduric bacteria is the udder of the cow. Harding and Wilson (6) isolated 71 groups of organisms from 900 samples of milk drawn aseptically from the udders of cows. They found no spore formers and about 75 percent micrococci. Later Alice Breed (1) studied the micrococci present in the normal udder. Of the micrococci isolated from the udder by these investigators, more than 40 percent were thermoduric.

A second source of thermoduric bacteria in market milk are the farm utensils such as the milk pails, cans, and the milking machines. Robertson (24, 25, 30) has shown that they will survive the concentrations of chlorine and salt brines as used to sterilize milk cans and pails on farms. Utensils not properly drained and cleaned will contain sufficient nutrients for prolific growth of bacteria, many of which may be thermoduric types (24, 25, 31). When it comes to milking machines, there is ample evidence (3, 12, 14, 20, 23, 28) to show that they may be a prolific source of not only thermoduric but a great many other types of bacteria.

All evidence indicates that many of the thermoduric bacteria especially the micrococci found in milk originate in the udder and are carried by the milk to the pails, cans, and milking machines. If these farm utensils are not cared for properly, they may be a rich source of thermoduric bacteria. This of course does not exclude other sources of contamination such as soil, feed, etc.

That there are many bacteria with different degrees of sensitivity to heat is evidenced by the fact that there seems to be little relationship between bacterial counts of milk before and after pasteurization either by the holding or the high-temperature, short-time methods (20).

SANITARY SIGNIFICANCE OF THERMODURIC BACTERIA

There is no evidence to indicate that the thermoduric bacteria cause disease. From what has been said so far, it should be clear that the presence of excessive bacterial counts in milk due to thermoduric organsms would indicate improper care of milking utensils such as milk pails, cans, and milking machines. This type of carelessness is not good sanitation and should not be condoned.

METHODS OF PASTEURIZING MILK

There are in use in this country today two commonly used methods of pasteurizing milk: (1) The holding method which consists in heating the milk to 142 to 145° F., and holding it for 30 minutes. (2) The high-temperature, short-time method which consists in heating the milk to 160–161° F. for 15 to 16 seconds. A third method, the so-called "High-Pasteurization" method should be mentioned since it is widely used in continental Europe. In this method the milk is heated to 176 to 185° F. and held momentarily. However, we shall confine our remarks to the first two methods since they are in general use in America today. Each of the first two methods has its adherents and each has advantages and disadvantages. These may be found elsewhere in the literature (8, 22).

One of the first questions that should interest you is, Do both methods kill pathogenic bacteria? The answer is yes. There is no question about the holding method since it has been used successfully for years. Whenever there is a question of this nature raised, it is in connection with the short-time, high-temperature method of pasteurization. Why should there be any doubt about this method? The real reason, I believe, is to be found in the history of pasteurization in this country.

One of the first methods of pasteurization used for market milk was the so-called "flash pasteurization" one, starting about 1890. It was used extensively in the United States from about 1900 to 1914. As practiced at that time, flash pasteurization consisted in rapidly heating the milk to 160° F. and immediately cooling. There were no automatic temperature controls such as we have today. Naturally with such an uncontrolled method there were slips and inefficient pasteurization. As a result, there were disease epidemics traced to flash pasteurized milk. Consequently this method came into disrepute. It is the memory of these early experiences which still lingers in the minds of many of the older milk control officials and this has built up the prejudice which still exists in their minds against high-temperature short-time pasteurization.

WHAT ARE THE FACTS?

About 1925 an electrical method of high-temperature short-time pasteurization of milk was introduced, and in 1927, it was tested and accepted by the Pennsylvania State Health Department (5) and put into large scale commercial use in Pittsburgh. In 1928, the New York State Health Department (29) tested this type of pasteurization. It was accepted by them, as well as the U. S. Public Health Service, Massachusetts State Health Department, and many cities, especially those operating under the U. S. Public Health Service Milk Ordinance. By 1935 according to Irwin (13), there were 76 plants in the United States using either the electric or hot water type of high-temperature, short-time pasteurizing equipment. I have seen no figures available on the number of installations of this type since Irwin's, but every one familiar with the facts knows that a very great many units have been installed not only in the United States but also in Canada and the British Isles.

Why has high-temperature short-time pasteurization again come into favor after being in the "dog-house" for a decade or so? The first reason is because of the mechanical changes which have been made in the equipment so as to make it reliable and foolproof. When the milk is in contact with the pasteurizing temperature only a few seconds, usually 15 to 16, there must be no slips and no guess work. The machines must deliver the goods and they have been designed to do just that.

The second reason which is really based on the first is that numerous investigators (5, 10, 16, 17, 19, 29) have shown that the temperatures and times used did and would actually kill pathogenic bacteria under commercial conditions. And finally a third reason, predicated on the second, is the large number of units of high-temperature short-time pasteurizers which have been operated successfully since 1927 without a single epidemic of disease having been traced to them. Of course there are other reasons, economic and engineering, which should be considered in a full discussion of the subject but we are interested only in the bacteriology of the subject.

ADVANTAGES AND DISADVANTAGES BACTERIOLOGICALLY

Dahlberg (2), taking the data of North and Park (19) and plotting them on semilog graph paper, has shown that, accepting 142° F. for 30 minutes as the proper pasteurization standard, a series of standards could be calculated which were comparable from the standpoint of margins of safety in protecting the public against disease germs in milk. He found that "while the total time variation became less with increased temperatures of pasteurization, the time required to destroy the tubercle bacillus was exceeded at each temperature variation by the same percentage of the total variation. Pasteurization at 142° F. permitted a maximum time variation of 20 minutes while 160° F. gave a safety period of five seconds." From the standpoint of temperature variation, "if the holding time was exactly 30 minutes, the maximum temperature variation was from 136° to 144° F. but at exactly 16 seconds holding, the temperature variation was from 159° to 161.25° F." The 5-second safety period at 160° F. means, when translated into practical terms, that if milk is held 11 seconds instead of 16 seconds or if the temperature is allowed to drop below 159° F. when the holding period is actually 16 seconds, then infected milk may result.

A second disadvantage of the high-temperature, short-time method of pasteurization is the higher bacterial counts obtained with many milk supplies when this method is used (3, 8, 20, 23). Comparisons made with the same milk pasteurized by the holding and the high-temperature, short-time method showed this to be the case. This has increased the cost of laboratory and field work to hold the counts down to within legal limits. From what has been said previously it is evident that a part of the increased count is directly attributable to thermoduric organisms which are better able to withstand the higher temperatures and shorter pasteurization times than they are at the lower temperature and longer pasteurization times.

Another factor which is also responsible not only for the higher total counts in raw and pasteurized milk but for relatively larger percentages of thermoduric bacteria in raw milk is the change to a more nutritious official medium and an optional lower incubation temperature (9).

The phosphatase test is of value as a control and an additional means of checking adequate pasteurization since Mattick and Hiscox (17) found that tubercle bacilli in the numbers in which they occur in naturally infected milk were killed at 158° F. in 11.5 seconds, after being in the regenerating and heating sections, at a temperature culminating at 158.5° F. for about 16 seconds. The phosphatase test remains positive at holding temperatures below 160° F. for 11.5 seconds. They concluded that 162° F. for 15 seconds afforded a sufficient margin of safety, and any significant departure from this time and temperature would be revealed by the phosphatase test which is still positive at temperatures and times at which the tubercle bacilli are unable to survive.

METHODS OF DETECTING THERMODURIC BACTERIA

There are several methods for determining the individual farms that are contributing excessive numbers of thermoduric bacteria to a milk supply. One commonly used method, first suggested by Taylor (28), is to pasteurize samples of milk from individual producers in the laboratory and then plate them. This is expensive and time consuming. To cut down the expense, Myers and Pence (18) inoculated a standard loopful, 0.001 or 0.01 ml. of laboratory pasteurized milk into an oval test tube containing melted standard milk agar, mixed well, and incubated at 37° C. for 48 hours. Their data show very good agreement between the standard plate count and this less expensive method.

Another method (8) is to pasteurize the samples in the laboratory at 161° F. for 16 seconds, then incubate them for seven hours at 37° C., after which they are examined microscopically. Mallmann *et al.* (15) incubated the raw milk for two hours at 58° to 60° C. after which a microscopic examination was made. They claim that the viable thermoduric bacteria present in raw milk may be determined in this manner since all the non-thermoduric bacteria have been destroyed and will dissolve during the two hour incubation period. They propose a standard of not more than 40,000 thermoduric bacteria in raw milk as determined by this method. Most investigators (20, 23, 31) find that laboratory pasteurization tends to give lower bacterial counts than commercial pasteurization, irrespective of the time and temperature used.

It is also interesting to note that Parfit (20) found that methylene blue tests were not an accurate index of thermoduric bacteria. Thus, shippers' milk might pass a satisfactory methylene blue test and yet be the source of thermoduric bacteria in the milk supply.

SUMMARY

Thermoduric bacteria are a group of bacteria which are able to withstand pasteurizing temperatures but are not able to multiply at these temperatures. Four groups of thermoduric bacteria are commonly found in milk, viz., micrococci, streptococci, sarcinae and bacilli. Of these four groups, the micrococci are by far the most common. One of the principal sources of thermoduric bacteria is the cow's udder since milk drawn aseptically from the udder predominates in micrococci. Many species of these have been demonstrated to be the same as the thermoduric bacteria found in milk. Other sources of thermoduric bacteria are poorly cleaned and improperly sterilized milk pails, cans, and milking machines contaminated with milk from the udder and from other sources.

There are three methods of pasteurizing milk, viz., the low-temperature, long-time method, commonly known as the holding method; the high-temperature short-time method; and the high-temperature method. The first two methods are in common use in the United States while the latter method is used mostly in continental Europe.

From a bacteriological standpoint, the high-temperature, short-time method of pasteurization is effective in killing all pathogens commonly found in milk as the numerous experiments carried out on a commercial scale have proven. Additional and more convincing evidence is the absence of disease epidemics caused by milk pasteurized in this type of pasteurizer. Such milk has been sold to and consumed by thousands of people every day for the past decade or more. However, it is quite generally agreed that the high-temperature, short-time pasteurization gives higher bacterial counts with many milk supplies than the holding method. A part of the increase in count is due to thermoduric bacteria. There seems to be little relationship between counts on raw milk and the counts on milk pasteurized by either method.

There are three different methods of determining the presence of thermoduric bacteria in milk, viz., laboratory pasteurization, then plating; laboratory pasteurization and incubating 7 hours at 37° C., then examining microscopically; and incubating raw milk 2 hours at 58° to 60° C., then examining mcroscopically. Laboratory pasteurized milk tends to give lower counts than commercial pasteurization, irrespective of the time and temperature used.

The control of thermoduric bacteria is a producers' problem while the control of thermophilic bacteria is a dealers' problem.

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An Emergency Method For Estimating Bacterial Populations

(A Preliminary Report)

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IF the surface of a suitable solid medium is flooded with a liquid such as milk containing dispersed micro-organisms, and the liquid then poured off, there will remain adhering to the surface a film of the liquid in which the dispersed organisms are retained. If such cultures, prepared in suitable dilutions, are incubated, discrete colonies will develop on the surface and may then be counted.

The area of the surface and the thickness of the film are the two factors determining the total amount of liquid adhering to the surface of the medium and consequently the number of organisms so entrapped. The surface area may be fixed by preparing the medium in containers of determined size. The thickness of the film depends upon the conditions under which the last traces of the liquid are removed: conditions which affect its viscosity such as temperature, the time allowed for draining, and of course the position of the slab. By controlling these conditions it is possible to obtain reproducible colony counts apparently within the limits affected by random distribution, over-crowding, etc. Then, by comparison of such colony counts with actual plate counts, the relationship between them may be noted and perhaps expressed as a factor for future use under like conditions.

For example, we have found that the relationship noted when using milk at room temperatures for the liquid vehicle carrying the organisms and Standard Agar slabs (2 percent agar) at the same temperatures, having surface-areas of about 20.5 square centimeters, is surprisingly like the factor used in reporting counts from a 1 to 100 dilution. From one sample of pasteurized milk two duplicate plates developed 5 colonies and 2 colonies from a 1 to 100 dilution, while three agar slabs flooded with the undiluted milk developed 1, 3, and 4 colonies respectively. A pasteurized, homogenized milk with a single plate developing 113 colonies from a 1 to 100 dilution, developed on the agar slabs 116, 123, and 129 colonies respectively. A pasteurized skim milk, plated in two 1 to 100 dilutions, developed in one plate 329 colonies and in a second plate 419 colonies, while using this same skim milk to flood the agar slabs in three bottles, 280 colonies developed in the first, 368 in the second, and 218 in the third with several spreading colonies. Using a raw mixed milk but agar slabs with slightly larger surfaces (about 23.5 square centimeters) two plates from a 1 to 100 dilution developing 55 and 64 colonies, the flooded slabs developed 68, 66, and 56 colonies respectively. A sample of milk from a single cow in 1 to 100 dilution developed in plates 24 and 30 colonies. Agar slabs flooded by this milk at different temperatures, produced colonies as follows: at 40° F., 22 colonies; at 70° F., 28 colonies; at 85° F., 16 colonies; at 100° F., 17 colonies; cooled from 100° F. to room temperature and warmed again to 85°, 24 colonies.

An orange staphylococcus culture from a milk sample was plated out from water dilutions and compared with slabs where the dilutions used for flooding were made in recently boiled milk, with results as shown in Table 1.

Sterile skim milk is recommended for making dilutions.

Since samples for the first flooding must be shaken very violently to break up clumps, it is necessary that these bottles be only partially filled.

TABLE 1

Dilution	*Colonies in Plate* (from water dilutions)	*Colonies on Slab* (from milk dilutions)
1 to 1,000	*13,624	....
1 to 10,000	1,442	1,014 (24 hour count)
1 to 100,000	158	128 (24 hour count)
1 to 1,000,000	14	8 and 1 Spreader

* Estimated from the average counts of several representative areas.

Considerable difficulty with spreaders has been encountered. Since surface colonies grow so rapidly, perhaps 24-hour counts will to some extent obviate this difficulty, and still be sufficiently accurate. The advantages of such earlier information will appeal to many engaged in practical control work. Possibly some growth accelerants may be added to the medium or to the milk which will further shorten the time which must elapse before counts can be made. For many purposes, such as roughly grading milk, checking sterility of equipment, etc., accurate counts are often unimportant although both time and labor-consuming. A glance will determine whether few or many organisms are present.

This work has been done using 10 milliliters of agar media (2 percent agar) sterilized in 2 oz. square-bottomed, flint glass bottles fitted with molded bakelite caps. To avoid injury to the cap-liners, caps should not be screwed down tightly until after sterilization. While the agar is still melted the bottles are laid on their sides until the media has hardened.

The counting of colonies is facilitated by the use of a magnifying glass, by spotting with a pen, or by marking the bottle into suitable squares with a red pencil. It is recommended that the bottle be held toward a light with the bottom of the agar slab nearer to the eye.

This report is presented with some hesitancy because of insufficient experimental material and the uncompleted study of the principles involved, as well as the most satisfactory methods for their application. The urgent needs of workers in the laboratories of the Armed Services, Public Health, Milk Plants, etc.—even of Producing Dairymen themselves—for methods requiring a minimum of time, skilled labor and laboratory facilities, is offered in extenuation. It is sincerely hoped that others will develop the possibilities and limitations of this method as quickly as possible for use in the national emergency. It may be particularly suitable for traveling and field laboratories.

SUMMARY

(1) It has been found that reproducible colony counts within the usual limits may be obtained by flooding, draining and incubating slabs of solid nutrient media with a suspension of bacteria in a vehicle such as milk or skim milk if constant conditions of the area of the slab and the drainage of the vehicle are maintained.

(2) These quantitative results may be correlated with an actual plate count, and a factor expressing the relationship may be obtained for future use under like conditions.

(3) A report has been made of the,

results of several experiments utilizing the adherent film of the vehicle in lieu of formal measurements and dilutions, and correlating these results with actual plate counts.

(Note: Dr. R. V. Stone, Department of Health, Los Angeles, California, points out that the usefulness of the method does not necessitate a comparison of the counts obtained with those by standard methods. The sterile medium surfaces can be stored for ready use in the event of, say, bombing, requiring immediate action on milk and water supplies even though normal facilities for conducting laboratory work have been interrupted. The counts on these bottles can be compared against each other, and serve as a "screening" procedure to determine whether or not the samples are relatively good, fair, or potentially unsafe.—*Editor.*)

CADMIUM POISONING *

There has been a pronounced increase in the use of cadmium in electroplating materials and alloys. It is important that the plating industry, in its search for substitutes for tin and other valuable war materials, be cautioned that cadmium is not a suitable substitute for the plating of utensils for food. Prior to 1941 there have been reported in the literature 20 cases of cadmium poisoning due to the ingestion of cadmium. Since January, 1941, there have been reported 315 cases definitely caused by this metal.

Owing to the greatly increased technical use of cadmium in the manufacture or repair of various types of containers used for food, several instances have occurred from this cause. It is also possible that cases of cadmium poisoning have been mistaken for food poisoning owing to the similarity of the symptomatology of cadmium poisoning to ordinary so-called "food poisoning."

* Cadmium Poisoning, *Pub. Health Repts.* 57, 601 (1942).

FOOD SERVICE EQUIPMENT *

In February, 1941, a proposed simplified practice recommendation covering sizes, dimensions, and details of construction of cooking and serving equipment used by hotels, restaurants, cafeterias, hospitals, etc., was submitted to those concerned for consideration and acceptance as standard practice. This proposal, which was developed by a committee of the Food Service Equipment Industry, Inc., was modified by the manufacturers and users, and then promulgated through the National Bureau of Standards, U. S. Department of Commerce.

* Food Service Equipment. Simplified Practice Recommendation R182-41, October 1, 1941.

Milk In The Army*

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THE Army, like the American people as a whole, is paying more and more attention to proper nutrition both from the standpoint of energy value of the food provided and the balance of the soldier's diet.

That milk and milk products are highly regarded by the Army is shown by the fact that on a milk equivalent basis approximately 20 percent of the foods issued troops in this area is made up of fluid milk, cheese, ice cream, and dry skim milk. In addition to these products, 35–45 grams of butter are served every man every day.

The Army is well aware of the fact that close inspection must be maintained over the fluid milk it provides the soldiers. This work is under the direction of the Camp Veterinarian and his assistants. The Veterinary Corps officers maintain inspection of the milk all the way from the farms through the milk plants, and regularly submit samples of milk picked up from various shipments to the camp, to the laboratory at Station Hospital for analysis.

The laboratory is modern, well equipped, and staffed with personnel that are top notch in their special fields. Here the milk is routinely analyzed for milk fat, the standard for which is 3.25 percent; and for bacteria the standard plate count allowance being not more than 30,000 per cubic centimeter. Occasionally, further tests are run to determine sanitary quality and food values of milk and ice cream.

At the present time all the fluid milk consumed in camp is produced and pasteurized in the Jacksonville area, and comes under the highly efficient supervision of the Health Department of that city. This milk has been of extremely high sanitary quality, the bacterial counts rarely exceeding a few hundred per cubic centimeter. Analyses show the fat content to be well over 4.0 percent. The fluid milk is served in half-pint bottles with protective hoods. It is delivered fresh daily, and is properly refrigerated prior to serving.

Evaporated milk is consumed in large quantities in cooking as well as in coffee. Ice cream is the favorite dessert of practically all soldiers, and is provided regularly. Dry skim milk is being used in large quantities in Quartermaster bread, and a few of the more progressive messes are using it in cooking and baking. Cheese, especially natural American Cheddar, is served a few times weekly.

The Quartermaster cold storage warehouses are modern in every detail and insure the best possible conditions for storing perishable foods, including butter and cheese, prior to issuing to the various mess halls throughout camp.

Milk and milk products play a very important rôle in the diet of soldiers. And producers, manufacturers, health inspectors, the Quartermaster, Veterinary Corps, and the laboratory, all coöperate to provide them with sanitary products of high quality and uphold the reputation that the U. S. Army is the best fed Army in the world.

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* Excerpts from a letter written by our fellow-member, Lieutenant D. I. Thompson, Station Hospital, Camp Blanding, Fla.

FOOD HEADQUARTERS FOR THE UNITED NATIONS *

(Farming in Wartime)

During the past few days there have been two developments here in Washington that have an important bearing on the use of our food supplies. Those two steps are part of the over-all war strategy of the United Nations; they also mean a lot to every farmer, every handler of food products, and every consumer in this country.

The first of those two developments is the creation of a Foods Requirements Committee for this country. That committee held its first meeting on June 11 at the Department of Agriculture. The second development is establishment of the Combined Food Board which was set up jointly by the governments of the United States and Great Britain.

The Foods Requirements Committee is part of the War Production Board. The Secretary of Agriculture is chairman of that committee. The eight members represent other branches of government which have a direct interest in the food requirements of our fighting men and our civilians and our allies. The agencies responsible for the materials used in producing and processing food also are represented.

This means that now all phases of our food supply problem are under one tent. It is the best way I know of for doing our wartime job effectively. When the Foods Requirements Committee has decided just where we stand and what we need to do, those decisions will be carried out by the different branches of government best fitted for each particular job. The Department of Agriculture, for instance, will still be responsible for getting the necessary farm production, and also will be responsible for some stages of processing and for importing any supplementary food supplies that we may need.

The first task of the committee is to estimate how much food and what kinds of food we will need for our own use or to send to our allies. After that, the Committee will decide on the best ways of getting that food produced, processed, and transported to the people who need it.

Now, the Combined Food Board goes a step further. The governments of this country and Great Britain realize that food is one of the basic war materials of the United Nations. The Food Board has one representative for the United States and one for Great Britain, and we plan to consult with representatives of other allies on any of the food supply problems which concern them. The whole aim of the Combined Board is to work together in making the best use of our food resources. One of our main problems will be to see that as much food as possible is obtained in the area where it is going to be used, so that we can save on shipping space.

The main reason why both the Foods Requirements Committee and the Combined Food Board are so important is that this country more and more is becoming the food headquarters for the United Nations. Our responsibilities are tremendous. We can meet them and still have plenty for our own people, but we will have to make every ounce of our effort count. Farmers will have to concentrate on raising the things that are needed most,

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* A radio talk by Claude R. Wickard, Secretary of Agriculture, broadcast Friday, June 12, 1942, in the Department of Agriculture period, National Farm and Home Hour.

and there must not be any waste or misdirection in processing and distribution after the food has left the farm. We now have a means of handling all parts of the food supply problem as a single job.

All of us know how big that job is. Just think of what it means to supply our own fighting men. The average American soldier eats about a quarter again as much as he did when he was a civilian. When you consider the millions of men in our Army already, those larger appetites mean an increase in our total food requirements even though the men did eat three meals a day before they joined the service.

The shipments to our men overseas, just like the lend-lease shipments, have to be foods that keep well and don't take up a lot of shipping space. That means lots of canned meats and dehydrated vegetables and dried milk. It's interesting to know that the Army is making a point of giving our boys overseas the good American dishes that they are used to. Beef stew is always a great favorite, and apple pie is still their first choice for dessert. We send them the makings of the pie by shipping dehydrated apple cubes, dried milk, and enriched flour.

Our allies need plenty of nourishing American food, too. I got one of my clearest ideas of what lend-lease food means from a set of pictures which came from Great Britain soon after our food began arriving there in large quantities. These pictures showed British school children getting American bacon and eggs for lunch, and a baby in a hospital drinking dry milk which had been reconstituted with water. There were pictures of workmen in a blast furnace munching American cheese for lunch and people in a bombed area making their lunch on our food. I hope that all of you have seen some of these pictures in newspapers or magazines, for sometimes it is easy to lose track of the food we have raised after we have sold it off the farm.

Also American food is helping keep British soldiers fit both in their own country and on fighting fronts in other parts of the world. It is helping Russian armies and civilians in the same way. That is why we have to keep on producing food right up to the limit, even in the face of all the difficulties that are in the way.

There are lots of those difficulties—shortages of labor and equipment. But this year, in spite of all those handicaps, farmers are off to a flying start. We already have plentiful supplies of most farm products and if the weather is normal we will have another year of record-breaking farm production. The June Crop Report shows that. I want to say right here that I am proud of the way farmers are responding to the needs for greater war production.

The difficulties will increase as time goes on and this is bound to be a long and hard war. So you see why we need to keep right on top of the whole food job and make the best use of our resources.

The Foods Requirements Committee and the Combined Food Board will help a lot. But of course we also will need the cooperation of everyone here at home—farmers, and members of the food trade, and consumers. With that kind of teamwork I believe we can have plenty of Food for Freedom with a minimum of hardship and inconvenience.

New Books and Other Publications

What Are the Vitamins?, by Walter H. Eddy. Published by the Reinhold Publishing Corporation, New York, N. Y., 1941. 247 pages. $2.50.

"What are the vitamins? What do they do? Which ones do I need. How much of each do I need? How can I determine my own particular need? Where and how can I get them? . . . The present text is the author's personal expression of what seems to him pertinent and reliable information."

After telling what the vitamins are and what they do, the author goes on to describe in some detail their properties. Chemical structural formulas and the free use of physiological and medical terms requires that the reader possess a considerable understanding in these fields in order to appreciate the author's discussions. The book is very readable, and makes the subject interesting and clear. The use of large print, frequent paragraphs, and numerous sectional headings relieve reading fatigue, and enhances the value of the book to those well-prepared persons who want to be brought up to date quickly and comfortably.

Dairy Engineering, by Arthur W. Farrall. John Wiley & Sons, Inc., New York. 1942. 405 pages. 84 tables. 190 figures. Illustrated. $4.00.

A large amount of practical data has been assembled and presented in a concise and simple manner, understandable by the practical plant operator as well as the student who has not had technical engineering training. After a general chapter on the properties of milk, there follows six chapters on simple mechanical principles, power transmission, electric power and equipment, hydraulics and pumping, heat measurement and transfer, steam production and uses; then two chapters on principles of refrigeration and insulation; nine chapters on special types of dairy plant equipment; equipment maintenance; fittings; and finally dairy plant design and utilization.

The principles of power production and utilization are illustrated with mathematical examples easily followed and solved with an elementary knowledge of mathematics. Extensive tables are presented for use in applying the principles to various operations. Line drawings, flow diagrams, cross-sections of machines, and half-tones profusely illustrate the text.

In producing a book of this type, the author evidently found difficulty in deciding how much to omit and what to emphasize. We wonder why he included the involved formulae for turbulent flow of gases inside pipes (on page 68) with no further reference or use. Often important subjects are barely mentioned. However, in a book of this size, such handling is unavoidable.

Other branches of the food industry can find much information of value to their operators because many practical aspects of food technology are found in this book but nowhere else in the conveniently available food literature.

The book is well arranged for teaching in classes. Lists of questions, problems, and references follow practically every chapter.

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Auditor, L. J. Manus........Morgantown, W. Va.
Secretary-Treasurer, J. B. Baker, Department of Health, Charleston, W. Va.

Association News

Connecticut Association of Dairy and Milk Inspectors

The Honorable John R. Sweeney of Bozrah, Connecticut, has been appointed Dairy and Food Commissioner for a term of four years beginning May 4, 1942. Mr. Sweeney comes with some experience, having been an inspector with this Commission several years ago, and has operated a dairy farm for some time.

The Milk Administrator for the State has just issued an order establishing alternate day delivery of milk to consumers for the duration. This step was necessitated particularly by the shortage of rubber tires. On the average, dealers could continue to deliver daily for only about six months. Changeover to horse-drawn vehicles was not feasible because of unavailable wagons and harnesses, and also the great length of many routes since the advent of trucks. Many milk routes average about 30 miles. Health officials testified that in their opinion there would be no particularly harmful effects especially if the milk were pasteurized. According to the census of 1940, probably more than 95 percent of the families of the State have some form of refrigeration. The remaining families could make the necessary adjustments without great difficulty. It was thought that properly refrigerated milk of the quality usually distributed in the State may safely be held for much more than 48 hours. In fact, it was considered probable that this was the only measure that could insure a continuance of home delivery at all.

H. C. Goslee,
Secretary-Treasurer.

Iowa Association of Milk Sanitarians

Whereas, the Iowa Association of Milk Sanitarians was organized for the purpose of coordinating milk control effort and the dissemination of knowledge pertaining to milk control among its members, and

Whereas, the Journal of Milk Technology is the official organ of the International Association of Milk Sanitarians, and

Whereas, the Journal of Milk Technology is dedicated to the dissemination of knowledge to those engaged in the field of milk technology;

Therefore, be it resolved: That the Iowa Association of Milk Sanitarians designate the Journal of Milk Technology as its official organ and that a copy of this resolution be sent to the Secretary of the International Association of Milk Sanitarians for acceptance by the officers.

J. R. Jennings,
Secretary-Treasurer.

Kansas Association of Milk Sanitarians

The thirteenth annual meeting of the Kansas Association of Milk Sanitarians will be held at Kansas State College, Manhattan, Kansas, on November 19 and 20, 1942. Arrangements for the program are being made by the officers and directors of the Association at this time.

Mr. Leon Bauman, Chief of Milk Sanitation for the Kansas State Board of Health, has obtained a leave of absence from this position to complete the work necessary for his degree in the Medical School at Kansas University. Mr. Tom Larsen, who has been associated with the Milk Control Division of the Kansas State Board of Health for the past several years, has been appointed as Mr. Bauman's successor.

W. J. Caulfield,
Secretary-Treasurer.

Michigan Association of Dairy and Milk Inspectors

The summer session of the Association was held with the American Dairy Science Association at Michigan State College on June 23 and 24.

Charles E. Gotta, who for the past two years has been Milk Sanitarian for the Bay City Health Department, has been appointed Milk Sanitarian for the Michigan State Health Department. He began his duties on June 16.

H. S. Adams, Director of the Bureau of Sanitation of the Flint Health Department, is teaching sanitation at the summer session of the University of Minnesota. Herbert Dunsmore, Sanitary Engineer for the Calhoun County Health Department, is similarly engaged at the University of of Oklahoma.

H. J. BARNUM,
Secretary-Treasurer.

Philadelphia Dairy Technology Society

At the regular annual meeting of the Philadelphia Dairy Technology Society, held at Houston Hall, University of Pennsylvania, May 12, the new officers for the ensuing year were elected.

At the June 9th meeting Dr. Bernard Shaw, one of our own members, spoke on soft curd milk, and explained the "Curd Number Test." The talk was illustrated with slides.

W. S. HOLMES,
Secretary-Treasurer.

New York State Association of Milk Sanitarians

The next meeting of the New York State Association of Milk Sanitarians will be held at Albany, September 23, 24 and 25, 1942. The local committees on arrangements are as follows:

Women's

Mrs. W. D. Tiedeman, *Chairman*
Mrs. Samuel Abraham
Mrs. E. R. Albee
Mrs. F. W. Graves
Mrs. G. D. Harmon
Mrs. J. F. Jansen
Mrs. C. S. Leete
Mrs. Iver Mikkelsen
Mrs. G. W. Molyneux
Mrs. D. F. Taylor
Mrs. P. O. Wood

Men's

Paul O. Wood, *Chairman*
J. B. Badgley
P. B. Brooks
F. W. Gilcreas
G. D. Harmon
L. J. Kinaman, Jr.
G. J. LaBarge
A. H. Robertson
F. L. Schacht
D. F. Taylor
C. W. Weber

Willett M. Alley has been promoted temporarily to Assistant Milk Sanitarian and assigned to the Jamestown district office. His position in charge of the state milk laboratory at Buffalo has been filled temporarily by the appointment of Abraham Millanky.

W. D. TIEDEMAN,
Secretary-Treasurer.

M. E. Parker Appointed Dairy Advisor

Mr. Milton E. Parker, Manager of Production of the Beatrice Creamery Co., and a long-time active member of the International Association of Milk Sanitarians, has been appointed advisor to the Resources Board of the Office of Quartermaster General in Washington, D. C., in connection with quality control and production of dairy products.

AMERICAN CAN APPOINTS NEW RESEARCH HEAD

MR. F. C. BASELT
Manager of Research, Atlantic Division, American Can Company, New York City

Mr. F. C. Baselt has been appointed Manager of Research, Atlantic Division, of the American Can Company, with headquarters at 230 Park Avenue, it was announced at the Company offices recently. Mr. Baselt has been with the Company for seventeen years having joined with them shortly after his graduation from Princeton with degrees of C.E. and E.E. He is a member of the Phi Beta Kappa.

Mr. Baselt is one of the industry's leading authorities on heat penetration in the processing of canned foods. He was also largely responsible for the research development of the linings for beer cans. Mr. Baselt has been in the New York office for the past six years. During this period he spent most of his time on the problems affecting the brewing industry in relation to the manufacture of their product. Mr. Baselt is a graduate of the Wahl-Henius Institute being a graduate brewmaster. Previous to 1936 he was in the Research Department at Maywood, Illinois, for eight years, interrupting the term for a three year period with the research branch of the Company at San Francisco, California. Mr. Baselt began his work with the Company in the Sales Department of Shonk Works, Chicago, Illinois.

Mr. Baselt is a member of the American Society of Brewery Chemists, International Association of Milk Sanitarians, and the Institute of Food Technologists.

Thirty-first Annual Meeting

October 30 and 31

Headquarters: Hotel Jefferson

St. Louis, Missouri

New Members

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

ACTIVE

Hauver, P. A., Field Representative and Quality Control, Deerfield Creamery Co., Deerfield, Wis.

Hunter, Alexander G., Jr., Chief Milk Inspector, Department of Health, Nashville, Tenn.

Maynard, Thomas G., Assistant Milk Sanitarian, Illinois Department of Public Health, Capitol Building, Springfield, Ill.

Miller, Albert C., Assistant Director, Michigan Bureau of Dairying, 306 S. Foster St., Lansing, Mich.

Stauff, Paul V., City Chemist, Eveleth, Minn.

ASSOCIATE

Adams, C. M., District Sales Manager, DeLaval Separator Co., 427 Randolph St., Chicago, Ill.

Adams, J. V., Chemist and Bacteriologist, Indiana State Board of Health, 711 N. Water St., Salem, Indiana.

Ahl, Martin V., Production Manager and Laboratory Director, Bridgeman-Russell Co., Duluth, Minn.

Alger, Harry B., Sealtest Supervisor, 13505 Griggs Ave., Detroit, Mich.

Bellin, Walter P., Thiensville, Wisconsin.

Domke, L. C., Bacteriologist and Chemist, Waukegan Water Works No. 2, 1942 North Ave., Waukegan, Ill.

Lawrence, George J., J. B. Ford Sales Co., 412 Plymouth Drive, Syracuse, N. Y.

Murdock, Ralph J., Field Representative, Wilson Cabinet Co., Bloomville, N. Y.

Nickerson, William F., Chief Chemist, Magnuson Products Corp., 135 Prospect Park West, Brooklyn, N. Y.

Oldenburg, W. J., Bacteriologist, Arden Farms Co., P. O. Box 3067, Seattle, Wash.

Poston, L. M., Milk Sanitarian, City Health Department, City Hall, Borger, Tex.

Robinson, Harry L., Jr., General Delivery Service Corp., Box 352, Saratoga Springs, N. Y.

Sattell, Irving, Senior Dairy Chemist, Sunshine Farms, Inc., 40 Stuyvesant St., New York, N. Y.

Sammet, Mrs. Anita R., Laboratory Director and Bacteriologist, Brock-Hall Dairy Co., Hamden, Conn.

Son Succeeds Father as **President of Walker-Gordon Co. (Plainsboro)**

Henry William Jeffers has retired as President of the Walker-Gordon Laboratory Company at Plainsboro, N. J., and is being succeeded by his son, Henry W. Jeffers, Jr. Mr. Jeffers, Sr., will become Chairman of the Board. Both are members of the International Association of Milk Sanitarians.

Henry Jeffers, Jr., 38 years old, has been vice-president for twelve years. His father, 70 years of age, was a junior at Cornell University when he joined the young firm of Walker-Gordon. Completing requirements for his degree on leave of absence, Jeffers went to Plainsboro and built a 100-acre farm into a 3,000-acre establishment, with 1,500 milch cows.

"Dr. Jones" Says—*

WELL, milk *will* come up now and then—as the baby said. This new emergency milk law—I noticed the headline in the paper: "State Can Compel Milk Pasteurization." I guess they just read that into it. It certainly wasn't the intent of it.

The sort of thing that law is supposed to take care of—something that happened awhile back is a good illustration. A certain village—their only pasteurizing plant burned down one night. In a nearby town there was a good-sized plant pasteurizing milk for New York City. This plant was willing to pasteurize their milk for 'em but they didn't dare take it because the New York City regulations said they couldn't take in any milk that the inspecting and so on hadn't been done by their men. The City Health Department finally waived this regulation in the emergency but the negotiations took time. If they'd had this law then the State Health Department could've authorized 'em right away to handle the milk. The size of it is: if there's an emergency—an accident or sabotage or what not—and something happens to a milk supply, the Health Department can take whatever action is necessary to see't they're supplied with safe milk until things can be fixed up. They won't have to wait for some board or somebody to call a meeting and change their regulations.

Another thing is this every-other-day delivery. The milk dealers—they aren't giving 'em any priorities on tires and they've told 'em—the Government has—that they've got to cut down their mileage on deliveries and so on. That's one way of doing it. It ain't exactly ideal but this tire situation—well, as General Grant or somebody said: we're faced with a condition and not a theory. It's better that way than no milk at all.

The way they figure it: the dealer divides his territory in two sections and delivers his whole supply to one of 'em each day. The customers are supposed to take twice as much. So it's fresh milk each delivery (at least as fresh as it would've been anyway) and the main problem is storage and refrigeration in the home. Good, clean milk'll keep sweet for several days *if* it's kept cold. The homes where they don't have refrigeration—that's where the problem'll be. They're the ones we've got to keep an eye on.

This war emergency—the number of things we've got to "keep an eye on"—we're liable to have some cross-eyed health officials before we get through.

PAUL B. BROOKS, M.D.

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* *Health News*, New York State Department of Health, Albany, June 8, 1942.

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