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Indianapolis Dairy Technology Club
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Metropolitan Dairy Technology Society
Michigan Association of Dairy and Milk Inspectors
Missouri Association of Milk Sanitarians
New York State Association of Dairy and Milk Inspectors
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A SIZE AND TYPE FOR EVERY STRAINER

RAPID-FLO FILTER DISKS

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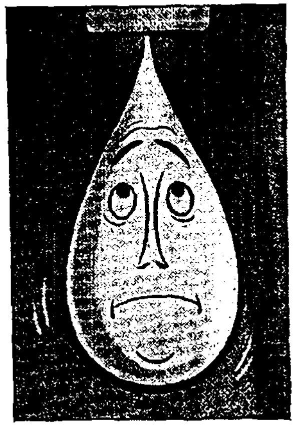
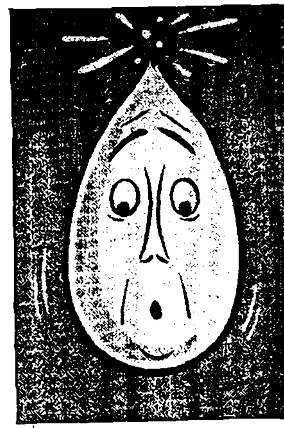
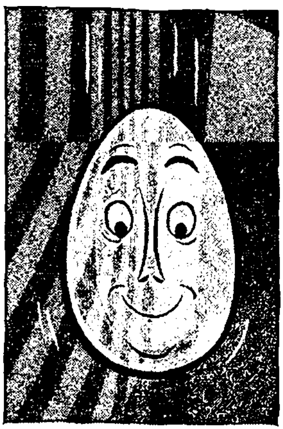
A Drop of Milk . .



filled with foreboding, starts on its journey from filling machine into container.



Looks down to see what kind of a container it's headed for.



Is delighted to discover it's a Canco paper container. Knows that milk is *completely mechanically* filled and sealed in Canco containers, eliminating handling by human hands.[1]

Recalls with pleasure that the number of bacteria in a Canco container is so small as to be insignificant from a public health standpoint.[2]

Serenely awaits its packaging in the Canco paper container, content in the knowledge that there is no safer, cleaner way to package milk.[3] American Can Company, 230 Park Ave., New York, N. Y.

1. Lueck, R.H., Tanner, F.W., Wheaton, E., Observations on Problems Relating to Paper Milk Bottles. Journal of Milk Technology, November, 1938.
2. Sanborn, J.R., Breed, R.S., The Sanitation of Paper Milk Containers. Milk Dealer, April, 1939.
3. Tanner, F. W., Journal of Milk Technology, January, 1939.

THE CANCO PAPER MILK CONTAINER

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International Association of Milk Sanitarians

(Association Organized 1911)

and Other Dairy Products Organizations

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JOURNAL
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Volume 4 May-June, 1941 Number 3

Editorials

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

Disease Outbreaks Traced to Milk

The United States Public Health Service has just published its compilation of disease outbreaks conveyed through milk and milk products in the United States in 1939, as reported by the respective state health authorities. The total figures are as follows:

Total number of cases in communities affected	2509
Total number of deaths	7

These outbreaks involved the following diseases, with the respective number of cases:

Disease	*Number of cases*
Dysentery	324
Food poisoning and Gastro-enteritis	595
Paratyphoid fever	24
Scarlet fever	42
Septic sore throat	1282
Staphylococcus, albus and aureus	154
Typhoid fever	51
Undulant fever	4
Unknown	33
	2509

The classification of scarlet fever and septic sore throat is not sharp, so that the sum total of the cases under both headings is more reliable than the breakdown.

The outbreaks were traced to the following dairy products:

Product	*Number of outbreaks*
Milk: raw	22
pasteurized	5
canned	1
uncertain	2
Cream	3
Ice Cream	8

Cheese	2
Buttermilk	2
Butter	1

(In some instances, two or more of these products were involved in the same outbreak.)

Two epidemics of septic sore throat were traced to raw milk distributed by dealers who received their milk from cows suffering from acute mastitis following teat injury. In both cases, hemolytic streptococci of the human type were isolated from the milk.

The five outbreaks traced to pasteurized milk supplies are of particular interest to sanitarians. The elucidation of the causes are valuable are guides to milk sanitarians in their enforcement procedure.

In one of these outbreaks, the milk was delivered by the dairy in a dirty bottle. Onset of illness occurred after all the milk had been consumed, so no samples were available. Samples at later delivery were all negative.

A very severe outbreak affected one-hundred and sixty cadets at a military institute. The milk was pasteurized, but this milk was clearly the vector. An investigation of the milk supply established the presence of a case of gastroenteritis in a milker at the dairy supplying the milk. This man, on the evening of the day of onset of the illness, had substituted in the pasteurizing plant, filling ten-gallon cans. An inspection of the dairy showed that the milk was subject to the possibility of a contamination by thirty-three individuals beween the time it is pasteurized and its serving to the cadets at meals. The recommendations made following the outbreak were not promptly carried out, with the result that a second outbreak occurred.

A paratyphoid fever outbreak was traced to several bottles of capped milk which had been submerged in the flood water of the storage room. Such a contamination of the pasteurized milk in the closed bottles indicated the possible seepage of the sewage through the caps.

The typhoid fever from infected butter was traced to a carrier who made and sold butter manufactured from unpasteurized cream.

J. H. S.

A New Service Suggested

An interesting suggestion, meriting careful consideration, has come indirectly from Walter Tiedeman of the New York State Department of Health. Noticing that a trade publication devotes some of its space to items in the Spanish language, he calls attention to the frequency of requests for information coming from Spanish-speaking countries to the south of us, concerning activities in our field in North America. A page or two of items and resumes of important articles, printed in Spanish, in each issue of this Journal, he believes, might contribute something to the Pan-American good-will so essential to defense of the western continents, and spread the gospel of milk sanitation, to say nothing of gaining new subscribers for the Journal.

P. B. B.

A Milk-Borne Typhoid Outbreak Traced to Dairy Water Supply

T. R. Meyer, Rosemary Phillips, H. E. Lind, Leonard M. Board
Health Commissioner, Directors of Nursing, Laboratory, and Sanitation Divisions, St. Louis County (Missouri) Health Department, Clayton, Mo.

The value of several frequently criticized principles of milk sanitation was graphically demonstrated by a milk-borne typhoid fever outbreak which occurred in St. Louis County, Missouri, in July, 1940. A small cash and carry raw milk dairy in an unincorporated area was established as the source of the outbreak, resulting in twenty-six cases. There were no deaths.

Distribution of Cases by Sex and Age

Age period years	Total persons	Males	Females
1 to 4	5	3	2
1 to 9	4	1	3
10 to 14	5	4	1
15 to 19	1	0	1
20 to 24	0	0	0
25 to 34	7	3	4
35 to 44	4	2	2
Totals	26	13	13

DISTRIBUTION OF CASES

Age distribution. The 26 cases were evenly divided as to sex. All patients consumed whole raw milk or cream from the dairy in question. Lack of any records of sales prevented the obtaining of number of exposed persons.

Distribution by Families. There were twenty-six cases in ten families in which typhoid fever occurred. Eight of the families lived in the City of St. Louis, two in St. Louis County.

Distribution was as follows:

One case in each of four families
Two cases in one family
Three cases in each of two families
Four cases in each of two families
Six cases in one family

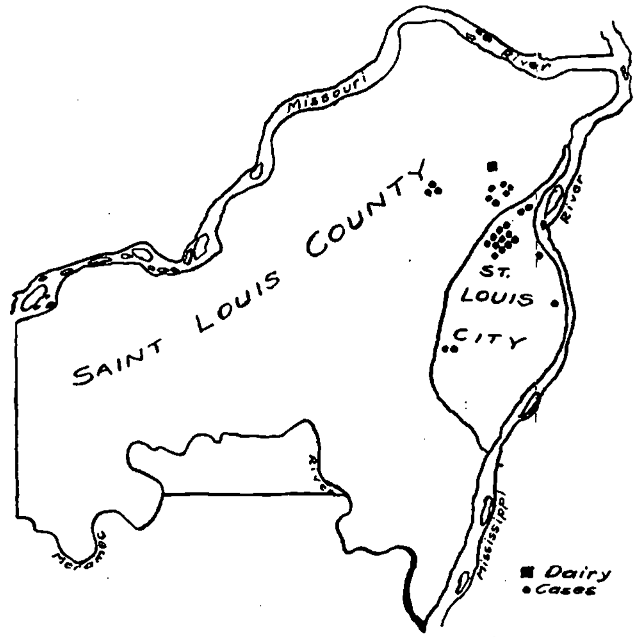
Among the ten families where typhoid occurred, eight (8) families bought milk from the unsupervised dairy. Two patients, a single man and a single woman reported that they had drunk cream in coffee in two separate homes where typhoid fever cases had been traced to the above dairy.

The first cases, four in one family, were reported to the County Health Department on July 20th (Saturday), by the St. Louis City Isolation Hospital.* Epidemiological investigation made the same day disclosed the questionable milk supply and a picnic at a fishing lake in an adjoining county as possible sources calling for further investigation. Three additional cases, from another family, were reported to the County by the City Isolation Hospital on July 23. These cases resided in St. Louis City, but obtained their milk from the same dairy in the County as the first family. Furthermore, peculiarly enough, this latter family had visited the same lake camp ground at the same time as the former family.

DAIRY INVOLVED

Despite the lack of sufficient information to establish definitely the source, steps were taken to close the dairy. No milk was sold after July 23rd, the day the second group of cases was reported. This action was justified by subsequent case reports which indicated the dairy as the only possible source common to all. Furthermore, a sanitary survey of the camp ground visited by eight of the pa-

*Facilities of this hospital are available to county communicable disease patients—(County Hospital isolation facilities are limited.)



Distribution of Cases

tients revealed no likely source other than insanitary privies. No reports have been received of cases among patrons of the camp who did not use milk or cream from the dairy under suspicion.

Reference to the chart indicates that all cases were infected prior to closing of the dairy, with all but three cases having their onset before that date. The fact that a search of previous typhoid case reports failed to disclose a single case where the dairy involved in this outbreak was given as the source of milk supply would seem to support the belief that a combination of circumstances were responsible for the sudden outbreak.

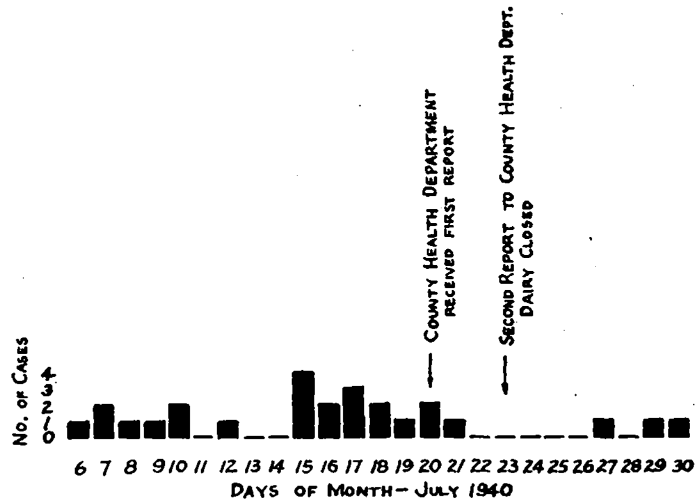
The dairy involved had formerly produced milk for a St. Louis plant, but had failed to comply with Standard Ordinance provisions, and its permit had been revoked by the City Health Department about two years prior to this outbreak. The result was the usual story, a cash and carry raw milk business, with customers furnishing their own containers which received no bactericidal treatment at the dairy. A significant factor was that customers' containers were frequently rinsed in clear water at the milk house.

The entire output of the dairy, about 80-90 gallons daily, was sold to customers at the farm. A majority of the customers were residents of St. Louis City, where the sale of raw milk is prohibited. (See accompanying spot map). Although the County Health Department has an extensive milk sanitation program, enforcing the Standard Milk Ordinance in twelve county municipalities with a combined population of 125,000, it has no jurisdiction in unincorporated areas.

The spot map illustrates the location of cases, with a large majority in the City of St. Louis.

SEARCH FOR CAUSE

Failure to discover a typhoid carrier among the four dairy employees proved an obstacle in establishing the actual source of infection. The owner stated



ONSET OF CASES

positively that no other help had been used and no visitors had been present recently. The water supply, a concrete cistern, had of course been checked and found positive for the coliform group of organisms, but thorough sanitary surveys did not reveal any logical possibility of human fecal contamination.

The finding of *B. typhosis* organisms in the cistern water was a real surprise to the investigators. Efforts to uncover the source of these organisms, however, have not succeeded. There is no residence nearer than one-quarter mile to the cistern. A sanitary pit privy 200 feet from the cistern served the employees. The privy and barnyard area are lower than the ground surface at the cistern and drainage is away from the cistern to a large ditch which is dry during summer months. The cistern top is elevated two or three feet above surrounding ground level, and no floods had reached the cistern for several years. Inspections of the cistern from the inside, after pumping out the water, disclosed only a few hairline cracks, and the nearest ground-water level during dry weather is over 40 feet deep.

Persistent questioning drew an admission that dry weather had recently caused a shortage of water, so that the cistern had been filled several times with water hauled in a cylindrical steel tank on a truck. However, the water for this purpose was obtained from a public water supply hydrant. Actual witnesses confirmed this contention, and there is little reason to doubt it as the distance is less than one-half mile and the charge is nominal. Samples collected from the hydrant and from rinsings of the tank were presumptively negative for the coliform group of organisms. The quality of the public water supply is as near to being above question as present knowledge and methods of treatment and analysis permit. The hauling tank is riveted and constructed with closed ends. It is owned by the dairy operator. No doubt exists of his statement that it is used for no other purpose. He further insists that this tank has been used by no other persons for any purposes whatever.

There is a remote possibility, about the only one not substantially disproved, that milk containers may have been contaminated by a customer who is a carrier. Such contamination may have reached the cistern after the container was rinsed in the milk-house. Back-siphonage from the milk-house wash vats could occur if the pressure system should fail, a leaky check valve exist, and the water faucets be submerged in the water in the vat, probably by use of hose lengths on these faucets for filling vats. The bottom of the suction pipe in the cistern is several feet below the level of the wash vats, and the depleted supply of cistern water would make the above occurrence possible.

As a result of publicity accompanying this outbreak, one city in St. Louis County has already adopted a compulsory pasteurization ordinance and several other cities have similar measures under consideration. Several raw milk dairies have voluntarily decided to install pasteurizing equipment.

The dairy responsible for the outbreak has not resumed the retail business and has tentatively decided to prepare for Grade A pasteurized milk.

Among the many stool and urine examinations made in the St. Louis County Health Department laboratory, the typhoid bacillus was isolated in the stools of three healthy persons with no history of the disease. In one family, residents of the City of St. Louis, the father, Mr. C., was sent to the Isolation Hospital. His wife and two children came to the County during his illness, and were consequently placed under supervision by the St. Louis County Health Department until their return to their homes in St. Louis. Two positive stool specimens, nine days apart, were obtained from Mrs. C. and one positive stool specimen was obtained from her seven-year-old boy. In the family where the six cases were treated at home, one positive stool specimen was obtained from a ten-year-old girl in the family with no history of typhoid or unexplained illness. Several subsequent stool specimens in all three cases have been negative.

Two of the cases treated at Isolation Hospital were discharged as convalescent carriers with positive urine or stool. Both live in the City of St. Louis and will be supervised by the St. Louis Health Department.

Fourteen of the cases treated at the Isolation Hospital were discharged as recovered. On September 21, 1940, four of the cases were still in the hospital.

LABORATORY INVESTIGATIONS

Stool and urine specimens were collected over a period of eight days from the four regular and two occasional dairy employees. The twenty-three stool and eight urine specimens failed to reveal any evidence of the infecting organism, *Eberthella typhosa*. One stool specimen was found positive for *B. paratyphus* "B" organism; however, this finding was believed to be of no significance in this outbreak.*

The presence of *B. coli* in large numbers in two milk samples indicated unusual contamination, in view of the fairly satisfactory milking methods employed.

The eight water samples examined for coliform organisms, qualitatively and quantitatively, included the dairy-farm well and cistern, the public supply used for replenishing the cistern, and the tank truck.

The cistern was regarded with increased suspicion because of the high incidence of *B. coli* organisms—most probable number as high as 180,000 per 100 ml.

Transfers from the positive tubes showing confirmation in the M.P.N. or *B. coli* were made on inhibitory media (Tetrathionate Broth and Shigella-Salmonella Agar). With the inhibition of *B. coli* organisms suspicious colonies isolated from two confirmatory broth tubes were inoculated onto differential media (Russell Double Sugar Agar and Kilgler's Iron Agar). Presumptive positive evidence of typhoid bacilli was confirmed by the routine carbohydrate fermentation and finally completed with the agglutination test against specific anti-typhoid serum.

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*Confirmation of this probably non-pathogenic organism was made at City Hospital No. 1, St. Louis.

CONCLUSIONS

1. A typhoid fever outbreak resulting in twenty-six cases was traced to a small cash-and-carry raw milk dairy.

2. The source of infection was apparently established as the dairy water supply, a cistern, samples of which contained *B. typhosus* organisms. A combination of circumstances was probably responsible for the contamination of the cistern with typhoid organisms.

3. The need for adequate regulation and supervision of dairies in unincorporated areas is again demonstrated.

4. Findings pointing to the dairy water supply as the infecting source, furnish a graphic example of a potential hazard becoming an actuality. Safeguarding the water supply should not be limited to protecting the source, but should include elimination of possible cross-connections and back siphonage.

New York City Milk. Charles E. North. New York State Jour. of Med., **40,** 1320-1327 (Sept. 1, 1940). *Pub. Health Engin. Abs.* xxi, Mi, 11.

There is a direct relationship between medicine and the milk supply of cities. The growth of medical bacteriology in the eighties and the decline of breast feeding compelled attention to the protection of cow's milk for artificially fed infants. Medical bacteriologists proved that clean milk contained very few bacteria while unclean milk contained very many. Their work also proved that a pasteurizer that is properly designed and operated will kill more than 99 percent of the bacteria in milk. These methods and costs were prohibitive as a means of testing the great supply of milk for the city or for the industry. Flash pasteurization was used by the milk industry but was not accepted as reliable by medical men. Through the efforts of the Health Commissioner of New York City in 1902-03, and again in 1910-13, the health department increased its laboratory services and the holding method was developed.

In 1910 the New York Milk Committee organized a program for the production of sanitary milk, interesting dairy farmers by paying premiums for milk found to be within fixed bacterial standards. The N. Y. Dairy Demonstration Company was incorporated to carry on this work. The demonstration was very successful and proved that simple sanitary technic on any dairy farm produced milk with less than 10,000 bacteria.

An epidemic of diphtheria broke out in the village of Homer, N. Y., where this demonstration was in progress. Children on three of the dairy farms were infected. As a result of this epidemic and the order to pasteurize all milk, pasteurization became permanent. The value of the milk committee had been proved and resulted in the appointment of a special commission to draft new milk laws. As a result of the work of this commission, the grading of milk was adopted in 1914.

The milk industry installed laboratories for bacterial testing of milk in the country and in the city. A staff of veterinarians was employed to examine cows especially for mastitis. A staff of milk inspectors in the employ of the industry instructed dairy farmers how to install sanitary equipment and practice the sanitary technic. This system quickly eliminated dirt and bacteria from milk of thousands of dairy farms. The volume of this milk grew rapidly from 1914 to 1940.

From the single milk station at Homer in 1911 with 10,000 quarts of milk daily, this Grade A business has grown to 47 stations, producing 918,157 quarts daily. Every mother in the city learned that Grade A was a symbol of clean milk and that this milk was for infants. In May 1940, the board of health adopted a new milk law, abolishing grades and substituting a single grade to be known as "Approved Milk."

D. WEBSTER JONES.

A New Yardstick for Measuring Sewage Pollution. W. L. Mallmann. Sewage Work Journal, Vol. 12, No. 5, September 1940, pp. 875-878. *Pub. Health Engin. Abs.* xx, S, 95.

The use of streptococci instead of coliform bacteria as an index of fecal pollution is advocated because of the tendency of coliform bacteria to multiply under certain conditions. Streptococci are thought to represent more accurately the actual decreases in pathogenic organisms than the coliform group. The use of a modified broth containing a 1:5000 concentration of sodium azide inhibits the growth of gram negative organisms while allowing gram positive bacteria to grow unhampered, giving a practical routine test for the examination of samples for the presence of streptococci.

R. W. Kehr.

High-Temperature, Short-Time Pasteurization and Its Practical Application to the Dairy Industry *

J. L. Hileman and Henry Leber

Dairymen's League Co-operative Association, Inc.
Syracuse, N. Y., Poughkeepsie, N. Y.

ADVANTAGES AND DISADVANTAGES

During recent years the number of installations for pasteurizing milk by the high-temperature–short-time method has increased rapidly. As a result of the development of reliable means for controlling the temperature and time of holding in these continuous-flow pasteurizers and also as a result of the demonstration that pathogenic bacteria are destroyed in milk pasteurized by this method (1, 2, 3, 4, 5, 6, 7), many departments of health have approved this method of pasteurization, and the dairy industry has been quick to follow this approval by plant installations.

Each of the two methods of pasteurization has advantages over the other. Among the advantages of the high-temperature–short-time method may be mentioned the following:

1. Great economy of floor space.
2. Elimination of part of the personal element by the use of automatic controls.
3. Elimination of over-holding of milk.
4. Elimination of the thermophile problem.
5. Elimination of certain chances of contamination of the product because the entire apparatus is a closed system that cannot be opened during operation.

In addition to the above advantages, there are two others that are often mentioned:

1. Economy in the use of heat and refrigeration.
2. Small temperature differential between heating medium and milk, with less danger of cooked flavors and other undesirable effects of overheating.

The first of these advantages is dependent upon the very efficient regenerative heating and cooling obtained with the plate regenerators, and the second on the very efficient heat transfer in the final plate heaters. Both of these advantages can be obtained equally well by the use of plate regenerators and heaters for preheating milk to be pasteurized by the low-temperature–long-time method, so that it is scarcely valid to claim them as exclusive advantages for the high-temperature–short-time method.

The following may be listed as disadvantages of the high-temperature–short-time method of pasteurization.

1. Lack of flexibility, especially in large installations.
2. Smaller absolute margin of safety due to the extremely short holding time.
3. Higher bacteria counts with many milk supplies, with greatly increased cost of laboratory and field work to hold these higher counts down.
4. Not only are total bacteria counts higher, but in at least some milk supplies the percentage of alkali-producing bacteria is higher. Data showing this are available from

* Paper read before the joint meeting of the International Association of Milk Sanitarians and the New York State Association of Dairy and Milk Inspectors, October 18, 1940.

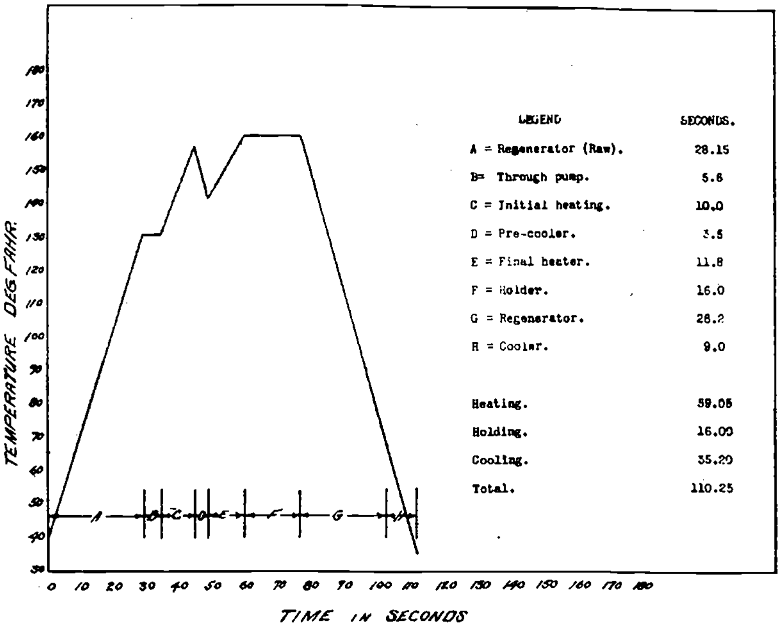

FIGURE 1

Time-Temperature Relationship in the High-Temperature Short-Hold Pasteurizer.

one plant and are being obtained for other plants. These data will probably be published at a later date. Whether or not this preponderance of alkali-producing bacteria is to be considered as a real disadvantage will depend upon further study of the organisms, their growth rates, etc.

References in this paper to commercial apparatus for pasteurizing milk at 161° F. for 16 seconds refers to the so-called duo-short-time machine. Figure 1 shows the time-temperature relationships in this particular method of pasteurization.

Because of its commercial importance, a comparison of cream volumes on milk pasteurized commercially by the two methods is given in Table 1. As can be seen, there is no significant difference in cream volume per one percent of fat when milk is pasteurized by the two methods.

TABLE 1

Comparison of cream volume on milk pasteurized commercially at 143° F. for 30 minutes and at 161° F. for 16 seconds.

	Pasteurized at 143° F. for 30 minutes.			Pasteurized at 161° F. for 16 seconds.		
	Percent of fat in milk	Ml. of cream on 500 ml. of milk	Percent of cream per one percent of fat	Percent of fat in milk	Ml. of cream on 500 ml. of milk	Percent of cream per one percent of fat
	3.8	65	3.42	3.9	68	3.48
	3.7	60	3.25	4.5	75	3.33
	3.6	65	3.61	3.9	65	3.33
	3.6	65	3.61	3.8	68	3.57
	3.7	62	3.35	3.85	69	3.58
	3.7	65	3.51	3.8	68	3.57
	3.7	64	3.45	3.8	72	3.78
Average	3.68	63.71	3.45	3.93	69.28	3.52

Because of the importance attached to the destruction of phosphatase and of colon organisms as criteria of proper pasteurization, Table 2 gives data showing results reported by two department of health laboratories over a period of seven months on the phosphatase test of 66 samples of bottled milk and on the absence of colon organisms from 55 samples of bottled milk, pasteurized at 161° F. for 16 seconds. No positive phosphatase tests were reported, and only 3 (or 5.5 percent) samples contained colon organisms. These data indicate that organisms of the colon group are in no sense thermoduric in milk pasteurized commercially at 161° F. for 16 seconds. The three samples giving positive tests for colon organisms were probably recontaminated in some way during bottling, distribution, or laboratory examination of the milk.

TABLE 2

Summary of reports by two department of health laboratories on colon organisms and on phosphatase in bottled milk pasteurized commercially at 161° F. for 16 seconds. Reports cover a period of seven months.

	Phosphatase	Colon organisms
Number of samples	66	55
Number unsatisfactory	0	3
Percent satisfactory	100	94.5

LABORATORY PASTEURIZATION BY BOTH METHODS

In order to illustrate the differences in count obtained by the high-temperature and low-temperature methods of pasteurization, 125 different lots of raw milk that were to be pasteurized in the commercial plant at 161° F. for 16 seconds were also pasteurized in the laboratory by both high-temperature and low-temperature methods. For laboratory pasteurization at 143° F. for 35 minutes, 5 ml. samples were introduced into sterile, cotton-plugged test tubes. One test-tube contained a thermometer. The test-tubes, held in a rack, were immersed, so as to cover the milk, in a water bath held at 144°-145° F. The samples reached 143° F. in 2 to 4 minutes, and were held 35 minutes. The temperature in the test tubes usually rose to 144° F. in about 5 minutes and remained there. These tubes were then cooled by immersing them in a bath of cold water.

For laboratory pasteurization at 161° F. for 16 seconds, 5 ml. of milk were placed in sterile, 4 dram homeopathic vials on which the aluminum caps were screwed tight. The entire vial was completely immersed in water at 165° F. A thermometer dipped into 5 ml. of milk in a test tube of the same diameter as the vials. The temperature reached 161° F. in about 2 minutes, whereupon the vials were removed and held in the air for 16 seconds, then dipped into cold water, without immersing the caps. The temperature usually rose to about 162° F. and dropped back to about 160° F. during the 16 seconds. Expanding air in the vials prevented water from entering the vials during heating.

The Scharer field phosphatase test showed all samples to be properly pasteurized. Bacteria counts (at a dilution of 1:100) are summarized in Table 3. One important point in this table is that the two methods of laboratory pasteurization gave very similar counts where the counts were low, but the counts differed more and more as they became higher. On the other hand, the counts by the two high-temperature short-hold methods showed (with considerably more consistency) the opposite trend. Where the counts on the samples pasteurized in the laboratory at 161° F. for 16 seconds were under 5,000, the commercial pasteurization gave counts nearly 5 times as high, but, as counts increased, the difference decreased, till the two came together at 45,000. However, the three highest-count groups contained too few samples to establish the exact point of convergence very definitely.

Figure 2 shows graphically how the counts on the samples pasteurized in the laboratory at 161° F. for 16 seconds met those on the samples pasteurized by the other laboratory method when the counts were low, and meets those on the milk pasteurized in the commercial apparatus when the counts were high.

TABLE 3

Comparison of arithmetic averages of counts on milk pasteurized by three methods.

Grouping according to the plate count of the milk pasteurized in the laboratory at 161° F. for 16 seconds	Number of samples	Laboratory pasteurization at 143° F. for 35 minutes	Laboratory pasteurization at 161° F. for 16 seconds	Plant pasteurization at 161° F. for 16 seconds	Ratio of counts on milk pasteurized in the laboratory, 161°/143°	Ratio of counts on milk pasteurized at 161° F., plant/lab.
Up to 5,000	15	4,107	3,640	17,000	0.88	4.67
5,200 to 10,000	37	7,687	7,703	19,897	1.00	2.58
10,200 to 15,000	29	11,028	12,400	25,669	1.11	2.07
15,200 to 20,000	21	15,314	17,819	31,362	1.16	1.76
20,200 to 25,000	10	16,240	21,840	30,560	1.34	1.40
25,200 to 30,000	6	14,600	28,067	36,067	1.92	1.29
35,200 to 40,000	6	24,600	35,833	46,733	1.46	1.30
40,200 to 45,000	1	11,000	45,000	45,000	4.09	1.00
Total and average	125	11,168	13,761	25,932	1.23	1.88

THERMODURIC ORGANISMS

The larger number of bacteria surviving when certain milk supplies are pasteurized by the high-temperature–short-time method probably have no public health significance. If this were not true, our health departments would not have approved this method of pasteurization. However, these same health departments are tending to make their bacterial requirements more and more severe, so that it becomes necessary to eliminate these thermoduric bacteria from the raw supply, which means eliminating them from the milk of each individual producer. This requires a large amount of laboratory work and of field work, all of which adds to the processing cost. An effort has been made to determine the most practical and economical means of detecting what farms bring milk containing excessive numbers of thermoduric bacteria.

The rather extensive literature on thermoduric bacteria in milk refers chiefly to those organisms capable of surviving pasteurization by the low-temperature–long-hold method. A review of this literature has been published in the *Journal of Dairy Science* (8), and for that

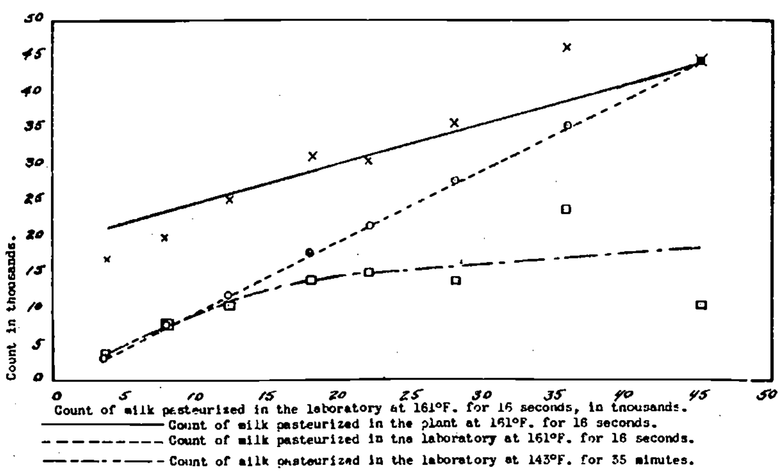

FIGURE 2

Relationship between Counts on Milk Pasteurized in Three Different Ways, as the Counts Increase.

reason, no attempt will be made to review it here.

In studying methods for examining large numbers of samples of milk from individual farms for bacteria surviving commercial pasteurization at 161° F. for 16 seconds, the question arises as to what temperature should be used in laboratory pasteurization of the milk of individual producers. Control of time and temperature is somewhat easier in laboratory pasteurization at 143° F. for 35 minutes than at 161° F. for 16 seconds. However, the latter method is less time-consuming and it seems logical to believe that results might approximate commercial high-temperature pasteurization more nearly if the laboratory pasteurization were by that method also. The data in Table 3 and Figure 2 indicate that this is true in mixed plant milk, especially in those samples where the counts tend to be high. However, it seemed desirable to make a comparison of the two methods of pasteurization on the milk of individual producers, and therefore the data of Table 4 were obtained.

In most of the tables of this paper which show averages of bacteria counts on a number of samples of milk, logarithmic averages have been included for those who may wish to see them. However, in no case have the higher arithmetic averages been omitted, as has been done in much recently-published work.

From the table it will be seen that when plates were incubated at 37° F., counts averaged 41 percent higher on the samples pasteurized at 161° F. for 16 seconds than on the samples pasteurized at 143° F. for 35 minutes.

It is interesting to note that incubation of plates at 32° C. caused a much larger increase in count with the samples pasteurized at 143° F. for 35 minutes than with those pasteurized at the higher temperature, so that the arith-

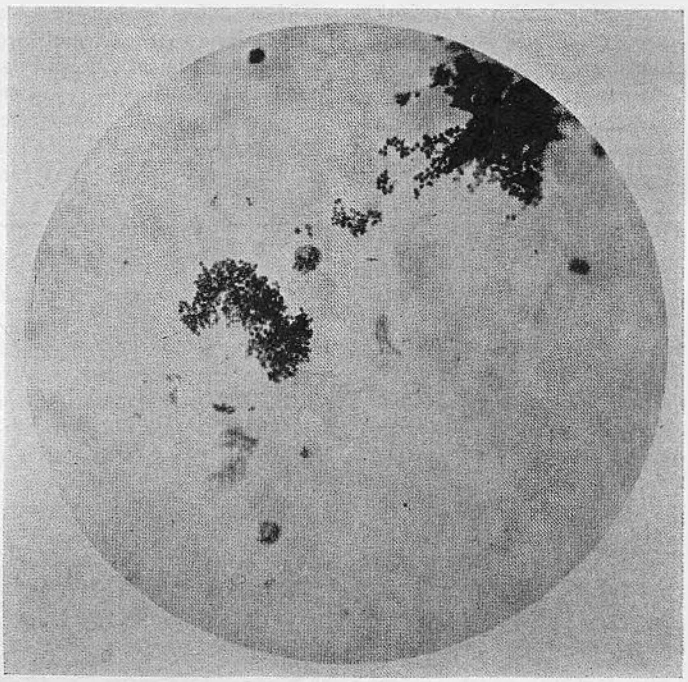

FIGURE 3

Microscopic Appearance of Micrococci. Taken from Bulletin 566 of the New York State Agricultural Experiment Station at Geneva.

TABLE 4

Comparison of plate counts on samples of milk from individual farms, pasteurized in the laboratory at two different temperatures. Dilution was 1:100. Plates were incubated at 37° C. and at 32° C.

Number of samples	Incubation temperature	Pasteurized at 143° F. for 35 minutes: Arithmetic average count	Logarithmic average count	Ratios of counts arith./log.	Pasteurized at 161° F. for 16 seconds: Arithmetic average count	Logarithmic average count	Ratios of counts arith./log.	Ratios of average counts, 161°/143°: Arithmetic averages	Logarithmic averages
105	37° C.	2,801	986	2.84	3,973	1,086	3.65	1.41	1.10
105	32° C.	6,930	1,851	3.74	7,329	1,637	4.47	1.05	0.88
Ratios of average counts, 32°/37°		2.47	1.87	......	1.84	1.50	......	......	......

metic average counts on the two series of samples were nearly identical when the plates were incubated at 32° C.

Because the higher counts obtained on samples pasteurized at 161° F. for 16 seconds agreed more closely with the counts obtained by commercial pasteurization at that temperature and time, the method was adopted for routine control.

Another question that arises in the examination of large numbers of samples for thermoduric bacteria is the feasibility of using 0.1 ml. of pasteurized milk in the plate, thereby avoiding the necessity of using a dilution bottle and a second pipette. Table 5 shows a comparison of counts on 1:10 and 1:100 dilutions for 252 samples pasteurized at 143° F. for 35 minutes and on 351 samples pasteurized at 161° F. for 16 seconds. In both cases the 1:100 dilution gave average counts about 90 percent higher than the 1:10 dilution. Because of the fact that the 1:10 dilution was satisfactory in detecting producers with high thermoduric counts (over 5,000 per ml. was considered to be high), that dilution was adopted for routine control, thereby taking advantage of the smaller amount of sterile equipment required.

This problem of thermoduric bacteria in pasteurized milk has been considerably magnified by the adoption of tryptone-glucose-extract-milk agar as standard by the American Public Health Association (9). To illustrate the effect of the change from the old to the new standard agar, Table 6 has been assembled. It is especially significant that the new agar gave *lower* counts on the three Grade A samples, while counts on the other products were much higher with the new agar. In case of a supply such as the Grade B milk pasteurized commercially at 143° F. for 30 minutes, where the new agar gave an average count over twelve times as high as did the old agar, it is usually possible very quickly to bring the count on the new agar down to a satisfactory level by using the informa-

TABLE 5.

Comparison of counts on laboratory-pasteurized samples of producer's milk when plated at dilutions of 1:10 and 1:100.

	Number of samples	Dilution 1:10: Arithmetic average count	Logarithmic average count	Ratio of the two average counts arith./log.	Dilution 1:100: Arithmetic average count	Logarithmic average count	Ratio of the two average counts arith./log.	Ratio of Average counts, 1:100/1:10: Arithmetic average counts	Logarithmic average counts
Pasteurization at 143° F. for 35 minutes	252	1,985	698	2.85	3,801	1,357	2.80	1.91	1.94
Pasteurization at 161° F. for 16 seconds	351	2,282	514	4.43	4,277	979	4.36	1.87	1.90

TABLE 6

Comparison of plate counts made with new and old standard agar on pasteurized milk and cream.

Type of product and method of pasteurization	Number of samples	Count on old standard agar: Arithmetic average	Count on old standard agar: Logarithmic average	Count on new standard agar: Arithmetic average	Count on new standard agar: Logarithmic average	Ratio of counts, new agar/old agar: Arithmetic averages	Ratio of counts, new agar/old agar: Logarithmic averages
Grade A milk, pasteurized commercially at 143° F. for 30 minutes	3	1,866	1,777	866	832	0.46	0.46
Grade B milk, pasteurized commercially at 143° F. for 30 minutes	17	2,870	2,306	35,093	21,523	12.22	9.33
Grade B heavy cream, pasteurized in the laboratory at 143° F. for 30 minutes	20	17,650	9,732	37,300	33,473	2.11	3.43
Grade B milk, pasteurized commercially at 161° F. for 16 seconds	10	17,860	14,048	33,020	29,724	1.84	2.11

tion that is now available on the detection and elimination of thermoduric bacteria. However, the new agar does increase the difficulty of meeting the increasingly severe standards on bacteria counts on all pasteurized products except those with very low counts.

Table 7 shows results of determinations of the number of thermoduric bacteria in the milk of individual producers delivering to plants approved as Grade A by New York City until the recent adoption of a single standard of milk by that city. Samples were pasteurized at 161° F. for 16 seconds and plates were made with 0.1 ml. of milk and tryptone-glucose-extract-milk agar. Incubation was for 48 hours at 35°-37° C. It is interesting to note the very small percentage of counts over 5,000 in this pasteurized Grade A milk. Data in this table as well as in Table 6, indicate that Grade A milk contains few thermoduric bacteria. It is indeed unfortunate that economic and political conditions should require abandonment of a system which has produced a milk supply of the really high quality of that formerly recognized as Grade A by New York City.

CONTROL OF THERMODURICS

There are in the literature many papers showing a connection between large numbers of thermoduric bacteria and dirty farm utensils, especially milking machines. Table 8 shows that this same connection of thermoduric bacteria with milking machines existed at the plant where this work was done. Table 9 shows, however, that nearly half of the

TABLE 7

Thermoduric counts on milk from Grade A Farms.

Plant	Date	Counts under 1,000: Number	Counts under 1,000: Percent	Counts 1,000 to 5,000: Number	Counts 1,000 to 5,000: Percent	Counts over 5,000: Number	Counts over 5,000: Percent	Total: Number	Total: Percent
1	Sept. 1939	39	70.9	14	25.5	2	3.6	55	100.0
	Oct. 1939	42	76.4	6	10.9	7	12.7	55	100.0
	Apr. 1940	54	90.0	4	6.7	2	3.3	60	100.0
2	Feb. 1940	150	92.5	9	5.6	3	1.9	162	100.0
3	Aug. 1939	79	90.8	6	6.9	2	2.3	87	100.0

TABLE 8

Relationship between milking machines and the number of high counts for each producer over a period of eight months. The minimum number of counts for each producer was twelve.

Rating of producer	Number of high counts	Number of producers in group	Number of milking machines	Percent of milking machines
Bad	Over 4	38	27	71.0
Fair	1 to 3	78	17	21.8
Good	None	263	38	14.5
Total	....	379	82	21.6

farms having milking machines at this plant went through a period of 8 months, with 12 counts of thermoduric bacteria, without once giving a count of over 5,000 per ml. Inspection of farms where thermoduric counts were high usually revealed a dirty milking machine or occasionally a dirty pail or strainer.

TABLE 9

Number of high counts over a period of eight months on milk from 82 farms having milking machines. Minimum number of counts for each farm was twelve.

Rating of producer	Number of high counts	Number of producers in group	Percent of milking machine farms in group
Bad	Over 4	27	33.0
Fair	1 to 3	17	20.7
Good	None	38	46.3
Total	....	82	100.0

The pasteurization and making of plate counts on large numbers of samples of milk from individual farms is a rather expensive procedure because of the amount of labor and equipment involved. Therefore, it seemed desirable to devise a simpler method for determining which producers have high thermoduric counts. Early in this work, smears were made on raw samples from individual farms and examined microscopically for comparison with the thermoduric counts on the same samples. It was quickly found that the many reports in the literature that total counts on raw milk bear no relationship to thermoduric counts were correct, so that microscopic examination of the raw milk was worthless as a means of picking out milk with large numbers of thermoduric bacteria.

The second step consisted of incubating the pasteurized samples after the plates had been made, and then examining the milk microscopically. This proved to be more successful than examining the raw milk. Table 10 shows the results of such a procedure at two plants. The samples of milk from individual farms were pasteurized at 161° F. for 16 seconds and plate counts were made. Then the samples were warmed to 37° C. and incubated at that temperature for 7 hours, and smears were made and examined microscopically. Plate counts of 5,000 or over were considered to be poor, and if micrococci were found in the incubated samples, then the smear was called poor. Table 10 shows a comparison of the results, assuming that a plate count of 5,000 or over was always poor. At Plant 1 remarkably accurate grading was obtained with the microscope, 97.78 percent of all samples, and 80.64 percent of the poor samples, being correctly graded by that means. Results at Plant 2 were not quite so good. It is interesting to note that another laboratory in the Dairymen's League organization worked out independently an almost identical procedure for the same purpose. While results are not as yet perfect, it is felt that there is a very good possibility of developing a method for detecting farms bringing milk with high thermoduric counts without the necessity of making a plate count.

Figure 3, reproduced from Bulletin 566 of the New York Agricultural Experiment Station at Geneva, shows the appearance of these micrococci under the microscope. If one of the incubated pasteurized samples contains many of these

TABLE 10

Relationship between the presence of micrococci in pasteurized incubated samples of milk from individual farms and high plate counts on the same samples without incubation, at two plants.

	Plant 1	Plant 2
Total number of samples examined	1,079	227
Percent of good samples. (Plate count under 5,000).	80.65	88.55
Percent of poor samples. (Plate count over 5,000).	19.35	11.45
Percent of total correctly graded on the basis of micrococci in the incubated pasteurized samples.	97.78	91.63
Percent of total incorrectly graded on the basis of micrococci in the incubated pasteurized samples.	2.22	8.37
Percent of good samples correctly graded on the basis of micrococci in the pasteurized incubated samples.	98.82	96.02
Percent of good samples incorrectly graded on the basis of micrococci in the pasteurized incubated samples.	1.18	3.98
Percent of poor samples correctly graded on the basis of micrococci in the pasteurized incubated samples.	80.64	57.69
Percent of poor samples incorrectly graded on the basis of micrococci in the pasteurized incubated samples.	19.36	42.31

large clumps, it almost always has a high plate count immediately after pasteurization.

CLEANING OF PLATES

Another very important and very practical problem in connection with the use of high-temperature–short-time pasteurization is that of washing the equipment. In large installations there are large numbers of plates, sometimes approaching 300. Burning on of a milk film occurs to some extent, and its removal by alkaline cleansers is very difficult, especially because of the indentations made in the plates to promote efficient heat transfer. However, the plates are usually of stainless steel, so that weak acids may be used in cleaning. Immediately after pasteurization is completed, the equipment is thoroughly flushed by pumping cold water through it to cool the plates and prevent more burning on of the milk film. Then one or two quarts of phosphoric acid (containing 20 percent of acid) are mixed with about 90 gallons of water and circulated through the apparatus at a temperature of about 160° F. for 30 to 60 minutes. Smaller systems will need less acid, but the proportion of acid to water given is sufficient. After this, the acid is thoroughly flushed out with cold water. Then one or two pounds of almost any of the mild alkaline cleaners, such as soda ash, trisodium phosphate, or sodium silicate, are dissolved in 90 gallons of fresh water, and this solution is again circulated for 30 to 60 minutes at about 160° F. A special pump should be provided for this cleaning operation, since the cleaning agents will damage the milk pump. The dilute acid (containing only 0.1 percent phosphoric acid) dissolves the lime salts from the milk film, leaving only casein, which is easily dissolved by the mild alkalies. After the alkaline treatment, the apparatus is again flushed with cold water, opened, and each plate is brushed with a brush dipped into dilute alkaline washing powder solution, followed by thorough rinsing. Usually, there is little or no milk residue to be brushed off after the treatment described.

ACKNOWLEDGMENT

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Plastic Acid Dippers

For a long time, the dairy industry has been looking for acid dippers made of other material than glass. Glass used around a dairy plant is a hazard that is tolerated only because there has been nothing else available to replace it. Now, the American Butter Institute has sponsored the development of a plastic acid dipper of the 9-ml. size. The Association now has on file orders from members and non-members totaling more than 11,000. Shipments are expected to be made within a few weeks, and thenafter rapidly. These dippers are clear as glass, are light in weight, and are said to be practically indestructible even under rough usage. The price is 10 cents each, f.o.b., Chicago.

It would be well if a plastic graduate could be made available for measuring flavors in food plants in general.

Restaurant Sanitation. Health News, N. Y. State Department of Health, Vol. 17, No. 31, July 29, 1940, p. 128. *Pub. Health Engin. Abs.* xx, Mi, 63.

At a conference of health officers and public-health nurses, emphasis was made on the washing of eating, drinking, and cooking utensils at a temperature of 120° F., and the use of a good detergent, followed by rinsing at a temperature of not less than 170° F., which would result in not only thorough cleansing, but would also yield without further treatment of disinfection a bacterial count within the limits specified in the N. Y. State Sanitary Code. The code requires a total bacterial count per utensil of not more than 100, free from bacilli of the coliform group. The total bacterial count has been found to be the most adequate index of the cleanliness of utensils, and that the temperature of wash and rinse waters, the detergent used, and method of washing are of major importance. A study is being made of various detergents. Three general methods were enumerated by which satisfactory results can be obtained: The use of single service containers; washing by hand, using a good detergent and rinsing in clean water maintained at 170° F. or more; and washing in any efficient and properly operated machine.

Walter A. Reiman.

Sanitation of Food Markets. Chas. N. Shaw. The Sanitarian, Vol. 3, No. 2, July 1940, pp. 35-36. *Pub. Health Engin. Abs.* xx, Mi, 60.

The public market is a spot where there is visible, as well as intangible and invisible, evidence to the public that the various health services are functioning for its benefit. Following the primary assumption that the markets are clean, it would seem that all filth and disease germs are brought in. To eliminate this possibility, it should be a legal requirement that only healthy individuals with clean hands, clean clothing, and clean habits be allowed to handle and dispense food for human consumption.

The second source of contribution of filth and disease-spreading germs to food is rats. They are not only carriers of bacteria and parasites but also transmitters of a number of their diseases. Ratproofing should be a requirement in all food-handling establishments. Roaches are another problem that should be controlled, as well as street dust, faulty refrigeration, and other faulty means of sanitation. There should be authority to fix responsibility of meeting and maintaining standards of sanitation and cleanliness in order to protect the public health.

M. K. Havens.

Deaeration as a Means of Retarding Oxidized Flavors and Preserving the Vitamin C of Milk *

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We have been working for a number of years on the development of methods for preserving the vitamin C of milk and the prevention of the development of the oxidized flavor. The removal of the dissolved oxygen by deaeration seems to be the most practical method of attaining this end (1).

Ordinarily the amount of vitamin C present in milk is considered to be of minor nutritional significance. Actually there is in the milk obtained each year from the cows of the United States approximately as much vitamin C as is present in our entire citrus crop. If the vitamin C originally present in the milk and milk products which enter human consumption were preserved, it would approximate that in half the citrus crop of the United States. If the vitamin C which is present in fresh milk were preserved, then one quart of milk would be equivalent to the juice of one orange so far as the amount of vitamin C is concerned. When viewed in the light of these figures, the preservation of vitamin C in milk is important from the standpoint of the milk industry and of the nutrition of the nation.

Milk, as freshly drawn, contains, on the average, 22.2 mg. of vitamin C per liter. A quart is only slightly less than a liter. The vitamin C content of 1,502 samples of commercial bottled pasteurized milk obtained in various cities throughout New York state was found to average 2.9 mg. per liter. The milk industry, as it is now operating, is doing a rather poor job of preserving the vitamin C which was originally present and the failure of nutritionists to consider milk as a source of vitamin C in the diet is largely justified. On the other hand, if we preserve the vitamin C which the cows put in the milk, we will raise appreciably the vitamin C nutrition of the nation and milk must then receive consideration as a source of vitamin C.

The question arises as to how much of the vitamin C of the original fresh milk is present at the time the milk is delivered to the milk plant. The answer is 18.9 mg. per liter; the average value for mixed night's and morning's milk. At one plant the night's milk delivered in the morning averaged 18.8 mg. per liter and the morning's milk delivered in the morning about 20.6 mg. per liter. Among various patrons the amount present in the milk ranged from 13 to 28 mg. per liter. The milk decreases in vitamin C content from the 18.9 mg. at the time it is received at the milk plant to about 2.9 at the time it is consumed in the larger cities.

We analyzed milk for vitamin C and oxygen content during the various steps in its passage through a country milk shipping plant, and found only a slight decrease in vitamin C during passage. A summary of the results is given in Table 1. However, when samples taken at the various stages were held cold for five days, the disappearance of vitamin C increased progressively in the samples taken after increased handling in the plant. In general, two factors

* Presented at joint meeting of the International Association of Milk Sanitarians, and the New York State Association of Dairy and Milk Inspectors, New York, October 17-19, 1940. Published in greater detail in the Proceedings of the 33rd Annual Convention of the International Association of Milk Dealers, Laboratory Section. Atlantic City, October 21, 1940.

TABLE 1

Changes in oxygen and vitamin C content on the passage of milk through a country receiving plant.

	Oxygen	Vitamin C content	
		Start	5 days
	mg. per 1.	mg. per 1.	mg. per 1.
Patrons' cans	6.09	18.9	11.6
Weigh tanks	7.05	18.5	9.7
Pump reservoir	7.65	18.4	9.4
Tank truck	9.68	18.3	5.6
Tank cars	9.19	17.7	5.1

would operate under these conditions to accelerate the rate of disappearance of vitamin C. The first could be an increase in the copper content of the milk as a result of copper dissolved from the equipment, and second, an increase in the oxygen content of the milk. The increase in oxygen content of the milk during its passage through the plant is also shown in Table 1. The milk is very nearly saturated with oxygen at the time it is shipped from the plant. Milk in the udder of the cow is practically oxygen-free. If the milk is removed from the cow's udder without contamination with oxygen, it does not develop the oxidized flavor and its vitamin C content does not decrease on holding. Oxygen is introduced into the milk in the process of milking. The cold milk is approximately half saturated with oxygen at the time of delivery to the plant. As the milk passes through the plant the oxygen content is increased due to successive dumpings and pumpings from one vat into another. Leaky pipe unions and pumps also serve as a means of increasing the oxygen content of the milk.

Even though equipment in the up-to-date city pasteurizing plant may be made of stainless steel, yet many of the pasteurizing plants as well as the country shipping plants use tinned copper equipment from which the tinning has worn off, and bronze pumps. Thus the milk arrives at the city with a greatly-increased copper and oxygen content and these two contaminants greatly accelerate the destruction of vitamin C in the milk and the development of the oxidized flavor.

The vitamin C and oxygen content of milk before and after shipment to New York City were determined. Data obtained from a specific shipment are presented in Table 2. This milk was analyzed at the country shipping plant, again after arrival at the New York yards, and after trucking and transferring to the weigh tank in the city pasteurizing plant.

TABLE 2

Shipment by tank car to New York City

	Oxygen mg. per 1.	Vitamin C mg. per 1.
8:50 a. m. loaded ¾ full	9.9	18.6
10:40 p. m. arrived N. Y. yards	9.5	14.4
11:45 p. m. transferred to truck	10.3	13.9
12:40 a. m. weigh tank in plant	11.1	13.9

It will be observed that the oxygen content of the milk increased slightly and that a rather definite decrease in vitamin C content occurred. Check determinations on samples of patrons' milk held in glass make it highly probable that the copper contamination incident to the passage of the milk through this plant was the main cause of the decrease in vitamin C content during the time interval involved in shipment. Samples representing over half a million pounds of milk taken on arrival at New York City had an average vitamin C content of 13.9 mg. per liter with a range of 11.2 to 16.0. The oxygen content averaged 10.3 mg. per liter with a range from 9.3 to 11.7 mg. per liter.

Studies were made of the vitamin C and oxygen content of milk during its passage through several large pasteurizing plants in New York City. Table 3 shows the results which were typical of the samples obtained at various steps in a plant which was pasteurizing by the long-hold method.

It is noteworthy that a considerable amount of oxygen was expelled from the milk as a result of heating to the holding temperature by means of an external tubular heater and that the oxygen lost was regained in the cooling and bottling process. These results do show that the oxygen content was reduced during hold-

TABLE 3

Vitamin C, oxygen content, and oxidized flavor score of milk at various stages of passage through holder Pasteurization in large milk plant.

		Analyzed at once		After holding 4 days	
		Oxygen	Vitamin C	Vitamin C	Oxidized flavor score
		mg. per l.	mg. per l.	mg. per l.	
1	Weigh tank	9.85	15.7	2.4	—
2	Storage tank	9.85	14.7	4.1	—
3	Balance tank to pasteurizer	9.9	15.7	3.4	—
4	Start hold	6.05	15.4	5.1	3
5	End hold	5.1	11.1	3.4	3—
6	Top surface cooler after exchange	8.15	9.4	0	2+
7	Bottom surface cooler	8.85	9.1	0	3
8	Surge to bottler	10.36	8.7	0	3—
9	Filler bowl	10.53	8.7	0	3
10	Bottle	10.7	9.1	0	3

ing at the pasteurizing temperature and this may be of some advantage. An appreciable amount of vitamin C disappeared from the milk during the thirty-minutes holding.

The amount which disappeared in these experiments is very much greater than the amount which disappeared in laboratory experiments in which milk uncontaminated with copper was pasteurized in glass bottles. Samples taken at various stages were packed in ice and held for four days. The vitamin C decreased markedly and no vitamin C was found in the samples taken in the later stages. A strong oxidized flavor developed in all samples taken after heating to the pasteurization temperature.

An experiment was performed to determine the amount of oxygen dissolved in milk as a result of the passage of oxygen-free milk over an external tubular surface cooler. The average of the results obtained in several series of experiments is presented in Table 4.

TABLE 4

Increase in oxygen content as a result of passage of oxygen free milk over external tubular cooler.

Top cooler	Bottom cooler	Oxygen content
°F.	°F.	mg. per l.
80	42	4.82
145	42	4.96
162	42	5.26

More oxygen was dissolved in the milk as a result of the passage of hot milk over the surface cooler than was dissolved by the passage of cold milk. This anomaly is to be explained by the fact that the hot milk spread more uniformly over the cooler than did the cold milk.

The vitamin C and oxygen content of milk during the various stages in its passage through a plant using plate heaters and the short-hold high-temperature method were determined. The results of two test runs are given in Table 5. Very little destruction of vitamin C occurred as a result of this method of processing. This is in agreement with previous observations and statements in the literature. The oxygen content of the milk remained constant throughout the processing as would be expected since the processing all took place in a closed system. The samples of hot milk removed for analysis indicated a lower oxygen content but this was due to the escape of air from the hot milk upon removal from the system. Other runs in which the samples were removed through a cooling coil did not show this drop in oxygen content so that these lower values are due to a faulty method of sampling and not because the actual oxygen content was lowered.

Last winter Doctor Hathaway of the Home Economics Department at Cornell University carried out an experiment on

TABLE 5

Vitamin C and oxygen content of milk at various stages in the passage through short hold high temperature Pasteurization in a large milk plant.

	Run 3		Run 4	
	Vitamin C mg. per l.	Oxygen mg. per l.	Vitamin C mg. per l.	Oxygen mg per l.
1 Raw milk to balance tank	15.0	11.9	15.7	10.0
2 Entering exchanger	14.3	11.0	14.3	9.9
3 161° F. beginning hold	14.3	7.1*	14.7	5.9*
4 End of hold	14.3	6.1*	15.0	6.0*
5 Leaving cooler	14.7	10.2	14.3	9.8
6 Bottle	14.3	11.2	14.3	10.4

* Owing to high temperature air was lost from the milk as soon as sample was liberated to air.

the vitamin C requirement of children of preschool age. We supplied the milk which formed a part of the selected diet. This milk was first pasteurized by the vat method (143° F. for thirty minutes). It was then cooled to about 120° F. in the vat and a portion was then removed, deaerated and bottled. A supply sufficient to last a week was prepared at one time. Check and control bottles were retained by us and at the end of three and seven days the vitamin C content was determined and the milk was scored for oxidized flavor. Complete observations were made on seventeen lots of milk. An average of the results obtained is given in Table 6. This table shows that, at the end of holder pasteurization and cooling, the milk contained on an average of 17.8 mg. of ascorbic acid per liter. Practically no decrease in ascorbic acid occurred in the deaerated samples and no single sample at any time possessed a flavor which the judges would call oxidized. The milk at the end of seven days had an average flavor score of slightly over 22. The milk which was not deaerated decreased rapidly in vitamin C content. It was definitely oxidized at the end of three days and practically undrinkable at the end of seven, having a flavor score of 15 to 17, an oxidized flavor score of 3.1 on the scale in which 0 represents no oxidized flavor and 4 represents maximum intensity.

The data presented in Table 6 are in agreement with almost innumerable other comparisons of similar nature made during the past several years. This milk was particularly desirable for Doctor Hathaway's experiment from another standpoint. A knowledge of the vitamin C content of all of the foods which the children consumed was required and one determination made on each lot of milk supplied this information for the milk consumed during the entire week. The vitamin C content of most of the samples fell between the limits of 17 and 19 mg. per liter. This experiment was performed during the school year and consequently the control milk which was not deaerated showed a greater intensity of oxidized flavor than would be found in summer milk. Table 6 shows results that might be expected if mixed night's and morning's milk were delivered in the morning, pasteurized by the long hold

TABLE 6

Average results obtained on 17 lots of holder Pasteurized milk deaerated after Pasteurization.

	Vitamin C			Oxidized flavor score	
	Start mg. per l.	3 days mg. per l.	7 days mg. per l.	3 days	7 days
Deareated	17.8	17.0	17.0	0	0
Not deaerated	17.8	12.3	7.0	2.0	3.1

method with a minimum of copper contamination, deaerated after holder pasteurization as a part of the cooling step, and bottled with the bottom-up type of filler.

The deaeration of milk was discussed before the annual meeting of the New York State Association of Milk Inspectors last year (1). During the past year, in our attempt to develop the commercial deaeration of milk, we have encountered many difficulties with equipment which, though minor in character, have been annoying. It was necessary to overcome these difficulties in order to develop the process to the point where it would work simply and without failure in the hands of ordinary milk plant employees.

Numerous modifications of control valves designed to regulate the flow of milk into the continuous deaerator were tried. Finally, a very simple float control valve, cheap to construct, was designed. This valve involves no additional hole in the deaerator shell. It is operated by gravity alone and therefore does not require electrically- or air-operated valves.

At the time we began our work we could not find a satisfactory pump with which to remove the milk from the deaerator against the vacuum. Pumps which would remove the milk from the deaerator were available but these pumps all incorporated air in the milk at the same time. Finally, a pump was found which would remove the milk from the deaerator without the incorporation of air but the pump was not one of consistent capacity, therefore a metering pump had to be connected in series following this pump in order to enable us to operate at a constant rate. We have now planned a single pump which will accomplish both of these purposes.

We were unable to find a satisfactory check valve which is required to maintain the prime on the pump to install in the horizontal line between the deaerator and the pump. We finally designed one which was extremely simple, involves no additional unions in the lines, and which has worked perfectly.

One of our greatest difficulties has been with leaky pipe fittings. With all the care which we tried to exercise, we found it virtually impossible to make a series of connections which were vacuum-tight, using any of the ordinary types of sanitary fittings. The use of beveled joints was completely out of the question. The conventional joints of the gasket type were not completely satisfactory for two reasons: first, the gasket seat was too small, and, second, the tightening of the nuts of the unions caused the pipe to rotate on the gasket seats. This rotation of the almost invariably scored end of the pipe cut or ruffled the gasket causing it to leak. We contacted several of the manufacturers of sanitary fittings to see if they could suggest ways out of our difficulty or supply us with modifications of fittings which would enable us to run a tight milk line. We got no help from them.

What we needed were unions with larger seats permitting us to use wider gaskets which would lock and thus prevent the rotation of the pipes on the gasket seats. We accomplished this first by constructing wide seats on flat unions with locking parts. We finally devised the so-called angle union. These unions involve the use of a ferrule on each pipe end which bring the ends of the pipes together at an angle of 45°. Thus, in place of the conventional right angle turn consisting of two ferrules, two nuts, two gaskets, and an elbow, this fitting requires only two ferrules, one gasket, and one nut. The same angle union, when turned in the alternate position, enables us to use the same fittings to connect the same pipes in a sraight line. Furthermore, the angle union can be used to construct a T. This T construction involves two ferrules, one nut, and one gasket, in place of the conventional T construction which involves three ferrules, three nuts, three gaskets, and the T part itself. A series of these angle unions fastened together creates essentially a flexible pipe line. On the other hand, when they are lined up in position and the nuts tightened, it is impossible to rotate the fittings on the gasket seats. Thus we have a fitting which solves our problem so far as running vacuum tight lines is concerned.

In addition, the fitting should find a wider application in general use and would save a great deal of time in assembling and taking down lines in a milk plant and in washing. This fitting would permit the elimination of all elbows and some of the T's so that its application is broader than its use in solving our own immediate problem.

We have constructed a surge tank which serves as a reservoir for the deaerated milk. This is installed ahead of the bottler. It is in the form of an upright cylinder with a float resting on the surface of the milk. The clearance between the float and the wall of the cylinder is about 1/4 to 1/8 of an inch. The float rises and falls as the amount of milk in the tank varies and protects the surface of the milk from contamination with oxygen.

We have devised a float of a similar type to rest on the surface of the milk in the filler bowl of the bottler. Rings have been welded to the float which permit the vent tubes and the milk intake pipe to pass through the float. A considerable part of the air which is incorporated in the milk by the conventional bottler is introduced by the foam which rises in the vent tubes and overflows into the reservoir of milk in the filler bowl. This milk is collected on the float and is drawn back into the deaerator again. This float has reduced greatly the amount of air incorporated by the bottler. The complete solution of the problem of bottling deaerated milk, however, is the use of either a true vacuum filler or by the use of a so-called bottom-up type of filler in which a tube is first inserted to the bottom of the bottle and the milk is then allowed to flow into the bottle through this tube, the milk rising in the bottle with an undisturbed surface. Bottlers of this type satisfactory for bottling milk are not now available.

As a last resort, in the bottling of milk with the conventional bottler, we could fill the empty bottles with carbon dioxide just before the empty bottles enter the filler. This solution of the problem does not appeal to us and we consider it more or less as a method of last resort.

In general, the process which we favor for the commercial preparation of deaerated milk is as follows: first, warm the raw milk to about 110° F.; second, deaerate the milk with a continuous deaerator involving a drop in temperature from 7° to 13° F. third, heat the milk to 161° F. by means of plate type heaters; fourth, pass the milk through a holding pipe involving a time of flow of 16 seconds; fifth, cool the milk by means of a plate heat exchanger and sweet water or a brine; sixth, discharge the milk into a surge tank, the surface of which is protected by a float; and seventh, bottle, using bottler designed to prevent as much as possible the reincorporation of air.

Although many other flow systems have been satisfactorily carried out, we prefer this system because the milk is heated in the absence of oxygen and because the deaeration step is performed prior to pasteurization. We prefer the high-temperature short-hold pasteurization because it is continuous and fits in well with the continuous process of deaeration.

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The Angle Sanitary Fitting

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Sanitary fittings designed to meet the requirements of a modern milk plant should possess as many of the following features as possible:

Easy attachment to the tubing.

Attachment should be positive and strong with no cracks or crevices between fitting and tubing.

Contact edge between fitting and tubing should be clearly visible.

Assembled union should be as leakless as possible.

Unions should be easy to take apart and assemble.

Unions should lock so that tightening one leaky union will not loosen others.

Parts should be as few as possible.

Small parts which might be dropped, lost, or washed into drains should be avoided.

Work of cleaning should be reduced to a minimum.

Union seats which always are potential contacts between milk and outside contamination should be as few as possible.

All parts should be open and straight through for better brushing.

Edges and depressions should be slightly rounding.

The fitting should be both strong and light in weight.

Seat surfaces should be protected and broad enough to prevent serious nicking and abrasion.

Costs should be kept low.

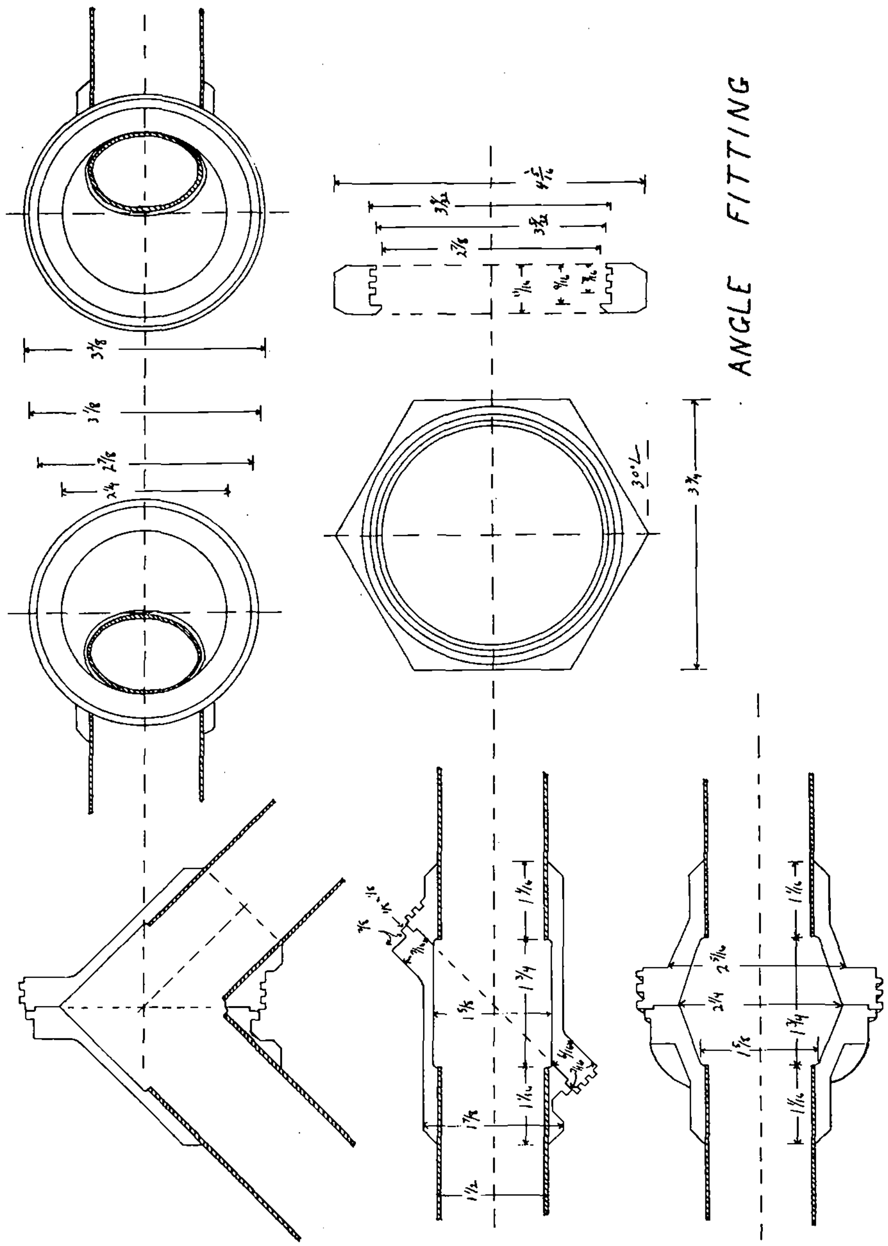
No fitting at the present time meets all of these requirements. We were unsuccessful in our efforts to find leakless sanitary unions. The best we could do with any of the conventional types was to use gasketed fittings. Two paper gaskets, previously soaked in vaseline or other dope, were applied to each seat. This improves matters but we were never sure that our lines would be leakproof when vacuum was applied; in fact, it was more likely that they would leak. We had gaskets made from rubber of suitable physical properties. This was better still but the seat on the conventional fitting is too small to insure tightness, and the rubber gaskets failed frequently.

The rotation of the pipes on the gaskets during the tightening was one cause of leaks. The surfaces were small and unprotected, and soon became nicked. When these nicked parts were rotated, the gasket was abraded or torn, thus allowing leaks. A union was made with a wider gasket seat and with interlocking parts to prevent rotation. This union did not leak.

NEW UNION DESIGNED

After unsuccessful efforts to obtain satisfactory unions from equipment manufacturers, we developed one which we thought would meet our requirements. This union has several features which seem to make it more desirable for general milk plant equipment than the elbows now in use. The uniting of pipes at an angle by means of a coupling has been described (1) but these old forms of the angle union do not meet the requirement of the market milk industry.

The drawing presented gives in detail the construction of an angle fitting of the gasket seat type suitable for 1½ inch tubing. The fitting in one position produces a right angle turn while in the other position it produces a straight line connection. Thus the same fitting is used for turns and straight lines. The attachment between the tubing and the fitting is recessless. The tubing can be attached to the fitting by soldering or by the use of a suitable expander. The pipe is cut



Drawing of Sanitary Angle Fitting

at right angles for the attachment of the fitting.

Care should be taken to attach the fitting to the pipe with the fitting surface in proper angular position in relation to the other pipes and fittings, because this fitting is of a type which makes it impossible to rotate the pipes on the gasket seat when the pipes are held in alignment. This is an advantage of the fitting from the standpoint of preventing leaks and is a basic feature of the design. On the other hand, before the pipes are placed in position, one pipe can be rotated with respect to the other through the angle of 90° to 180°.

Tees can be constructed by introducing two pipes into the fitting at 90° to each other.

ADVANTAGES OF NEW DESIGN

A number of modifications of this type of fitting have been made. The seats may be of the gasket or of the beveled type. The contact seats are broader, thus reducing nicking and permitting the use of larger gaskets. Also, with a slight modification, the tubing can be cut at an angle of 45° and thus the tubing end surfaces can be pressed against each other in the angle fitting.

The angle fitting has numerous advantages such as the elimination of loose elbows and tees, clear view for cleaning, straight open runs for brushing, and decrease in number of contacts between the milk and outside contamination. Time of assembling and taking down of equipment is reduced. There is a great saving in parts to assemble. The angle union used for a right angle turn involves two ferrules, a nut and a gasket, whereas a conventional elbow type of right angle turn involves two ferrules, two nuts, two gaskets and a loose elbow. The angle tee fitting involves two ferrules, one nut and one gasket, whereas the conventional tee involves three ferrules, three nuts, three gaskets and a loose tee. The permanent attachment of one end of conventional elbows and tees to tubing is not permitted by many health inspectors.

The weight of the angle fitting used to connect pipes running in a straight line is considerably greater than the weight of the conventional union. However, in a properly-arranged milk plant, there are very few simple unions. The angle union used in place of an elbow is lighter than the conventional elbow assembly, and when used in place of a tee it is very much lighter.

Manufacture of the angle fittings should not be too expensive. Both the thread ferrule and nut ferrule could be machined from the same blank and the parts are small in comparison with an elbow or tee. For a given size pipe, the nut must be larger than the nuts now in use on the same size of pipe. Thus, the nut can be made thinner and still maintain the same strength in the joint. Because the diameter of the nut is considerably greater in relation to the diameter of the tubing, the threads of the nut are visible for inspection and cleaning.

The angle sanitary fitting was developed in connection with the designing of equipment for the deaeration of market milk where some of the unions are subjected to vacuum, and these unions must not leak.

Angle unions possessing the above listed features are not on the market but since they appear to possess certain advantages it would seem that they should be given a trial in a few plants to determine their merits under operating conditions.

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An Inventory of Some Methods of Milk Control

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Methods for the improvement of milk supplies are subjects of continuing review. Outbreaks of milk-borne disease in this country occur, chiefly in small communities, at the rate of three or four a month. Decreased incidence of diseases traced to dairy products has followed the increase in pasteurization and the improvement of systems of sanitary control.

INSPECTION METHODS

The increased use of milk which is carefully produced, pasteurized, and protected from subsequent contamination, and better coordination of inspection services are goals of health authorities. Newer methods to facilitate supervision, coupled with the responsibilities for instruction of workers and for approval of designs of pasteurizers and checks of complicated equipment have emphasized the need for inspection personnel equipped by experience, personality and training to cope with modern problems.

The administrative plan of milk supervision on a district basis, such as that employed in the Oranges in New Jersey, is practical. Unfortunately, in many localities, there is duplication of inspection and much confusion because the several communities, state departments and dairy companies maintain individual inspection services and employ varying standards. Uniformity of methods, economy of supervision, and better understanding of procedures, by both producers and inspectors, should be encouraged. Agreement upon major items of equipment and operation and occasional joint inspections to eliminate differences of interpretation are helpful. Vigorous efforts should be made through joint planning and service to reduce the unnecessary confusion, waste, and duplication in milk inspection activities of various departments interested in the same milkshed.

LABORATORY CONTROL

Laboratory control is an important factor in the increasing safety of our milk supplies. While the standard plate count has contributed much to the improvement of milk supplies and has long maintained a position of dominance among the tests for the control of milk sanitation, many limitations have been noted. Among the supplementary aids to field control is a combination of such tests as: the Breed smear for bacteriological quality—the phosphatase test for degree of pasteurization and the coliform test for recontamination.

NON-CHECKING BACTERIAL COUNTS

In a study of laboratory methods, 142 routine samples of fairly low count raw and pasteurized milk were submitted to the four above mentioned tests. Eighty-four of the samples were also subjected to standard plate count tests by a second laboratory. The duplicate samples were kept cool and most of them were plated within an hour of each other. The mean of all agar plate counts was 20,000 colonies per cc.; excluding sixteen pairs of counts outside a 1.5 ratio range, the mean was 12,000. The mean of the absolute difference between paired counts on the eighty-four pairs was 22,000, but excluding sixteen pairs outside a 1:5 ratio range*, the mean was 8,000. Calculation of the percentage average *differences* among the pairs of counts indicated that in a large proportion of cases the difference between the counts of any given pair of plates was a little larger than the mean of the same two counts. Even if several of the most variable pairs were excluded from consideration, there was still much variation. These observations, in keeping with the findings of other investigators, suggest an important lack of precision in results from the standard plate count.

Another way to visualize the variation among the paired samples is to note how many samples would comply with state regulations governing bacteria in milk by the count on one plate but fail to do so on the basis of the duplicate count. In this group, showing such variations, for example, are two samples of certified milk, one sample of grade A raw milk, two of grade A and four of grade B pasteurized milk. Thus, some ten percent of the samples from one health department would be either within or without the Connecticut regulations if only one plate were made. Problems related to methods of interpretation and of recording of very small colonies, pin points, and spreaders sometimes vary among different workers. As a barometer of safety or as an indicator of a problem at the milk plant, the plate counts taken during this study would have been of limited usefulness.

Duplicate Breed counts made by the same person were analyzed in a manner similar to that for the paired plate counts. The mean of 142 pairs of counts was 858,000, while the percentage average difference was 20; in the majority of cases the difference between the two counts of given pairs was only about one-fifth of that of the mean of the same two counts. These percentage average differences were considerably smaller than those for paired plate counts for the samples studied, but one hesitates to draw conclusions from this observation without more extensive study. The necessity of counting more fields in low count smears than in high count smears, if the same degree of accuracy is desired, was suggested by analysis of the percentage average differences. This figure for those counts whose mean was over 100,000 clumps per cc. was only one-eighth of that for the samples with counts with a mean between zero and 100,000 clumps per cc.

Plate counts were compared with Breed counts (average of the two duplicates) made on the same samples at the same time, as shown in Table 1.

The ratio of the mean of the Breed counts to the mean of the plate counts expressed in percent is over 600 for all the samples, but is four times as large for the 91 samples of pasteurized milk. The low ratio for the raw milk may be due to the fact that most of the bacteria are alive and are counted by both methods. In the pasteurized milk, only a small proportion of the bacteria are alive to show up on the plate count although large numbers are revealed by the Breed count. The ratio of dead bacteria to live bacteria in the cream samples is not as large as in the case of pasteurized milk. This same phenomenon may also be partially explained on the basis of the presence of thermophiles and other living bacteria that do not grow on agar plates. Milk with a flora predominantly thermophilic in morphology gave a high ratio in contrast with milk with a flora containing a preponderance of other morphological forms. Identification on the basis of morphology only, however, is uncertain. The size of clumps was usually somewhat larger in high count milk than in low count milk. But the clumps found in pasteurized milk were as a rule smaller than those found in raw milk.

The Breed count showed not only more samples with high counts, but also en-

* Tiedeman[1], in a study of variations in bacteria counts on identical milk samples, calculated the percent of counts falling within an arbitrary 1:5 ratio range divided into two equal parts by the mean of all the counts made on the sample under consideration. He found that this ratio range included only 82 percent of the counts on identical samples examined by a standard method in different laboratories. In the present study, 16 of the 84 pairs of counts gave a ratio greater than 1:5.

TABLE 1

*Results of Breed Counts and Plate Counts**

	Number of Plate of counts	Mean of Plate counts	Mean of Breed counts
Total	142	128	858
Pasteurized			
Fresh	91	26	640
Old	2	600	5,343
Raw	25	67	50
Cream	24	542	2,141

* Counts are expressed in thousands per cc.

abled one to conclude that some milk had high counts due to improper methods of handling or to thermophiles. One sample of mixed pasteurized milk showing only 285,000 body cells and 45,000 Breed clumps revealed 2,625,000 individuals, most of which were tangled masses of long chain streptococci (mastitis) associated with engulfing polynuclear phagocytes.

PHOSPHATASE TESTS

The phosphatase tests made in this study were based on the technic of Kay and Graham (2). The method of reading the results involved the use of a colorimeter previously described in this Journal (3). These tests were conducted in both the study laboratory and the local health department laboratory, while many of the samples were also tested in a laboratory of one of the large milk plants. In general, the results obtained by the different laboratories were satisfactory for comparative purposes. Controls were run on all tests in the study laboratory to demonstrate that the phenol measured was the product of specific enzymatic hydrolysis. Five instances of the sale of underpasteurized milk or of pasteurized milk contaminated with raw milk were detected*. These plants were inspected and a close correlation of laboratory findings and plant conditions was found. Faulty practices, inaccurate thermometers or other inadequate equipment were responsible for the unsatisfactory results detected early by these tests and confirmed by subsequent inspections.

COLIFORM TESTS

The presence of large numbers of coliform organisms in water has been so successfuly used as an index of contamination that many attempts have been made to apply the same principle to milk. The significance of the presence of coliform organisms in milk is obviously different than in water. Most samples of raw milk contain many coliform organisms; so their presence may indicate no unusual conditions except possibly in very high grade milk. But since they are commonly present in raw milk and are generally destroyed by pasteurization, the presence of large numbers of these organisms in "pasteurized" milk may indicate either underpasteurization or recontamination. Now that the phosphatase test, or some modification of the test, is available for the determination of proper pasteurization, the presence of coliform organisms in the pasteurized product is sometimes used for the determination of recontamination after pasteurization (4).

In routine coliform tests of raw and pasteurized milk and cream, the technic presented in *Standard Methods for the Examination of Dairy Products* was followed. The presence of any amount of gas in the tubes after 48 hours of incubation was the criterion used for the presence of coliform organisms. The 25 raw milk samples showed considerable variation in their content of coliform

* One sample gave duplicate readings—>0.15; two samples gave duplicate readings 0.08; two samples gave readings similar to the very dark blue ++++ for raw milk.

TABLE 2

Effect of Laboratory Pasteurization at 145° F. on Plate Counts and Breed Counts.

Time of holding in minutes	Plate counts*	Breed counts*	
		Clump	Individual
0	880	930	2910
5	328	660	3690
10	256	450	3930
15	105	360	2520
20	84	540	2850
25	42	570	3690
30	39	660	3810
35	36	780	4230
40	32	510	2340
60	38	630	3480

* Results expressed in thousands per cc.

organisms, depending somewhat upon the quality of the milk. Three of the six samples showing negative results were of certified grade. Nine cream samples contained larger numbers of coliform organisms than did the raw milk samples, although fifteen gave negative results. The significance of results may be greater when the test is applied to fresh samples. The 91 samples of pasteurized fresh milk showed less variation and fewer coliform organisms, only six percent showing the presence of coliform organisms in 1 cc. or smaller portions. The assumption that the presence of coliform organisms in 10 percent of the 1 cc. portions examined indicates underpasteurization or recontamination (5) would seem to be reasonably lenient.

COMPARATIVE TESTS

In order to study the relation of Breed counts to plate counts, to test the thermal resistance of coliform organisms, and to calibrate and appraise the sensitivity and soundness of the phosphatase test, all four tests were applied to 90 samples of known history, that is, samples pasteurized in the laboratory under known conditions. For this purpose a large "drip" sample was obtained, representing the milk from 2,000 cows, chosen in order to insure the presence of a "normal" amount of phosphatase and a "normal" bacterial flora. Portions of the sample were pasteurized in the study laboratory at nine different temperatures varying from 130 to 150 degrees F. Ten samples were taken on each portion pasteurized, the first as soon as the milk was thoroughly mixed in the pasteurizer. Smears were made immediately after pasteurization. The data in Table 2 show results of pasteurization at the temperature of 145° F., selected for illustration purposes.

Coliform tests gave clear results; all samples unheated showed positive results in 0.1 cc. and larger amounts, but no sample receiving as much heat treatment as 140 degrees F. for 30 minutes gave a positive coliform test.

The results of the calibration of the phosphatase tests were consistent. The duplicate readings checked closely, and the phenol values obtained for each series of samples showed a regular progressive decrease with increases in the time of holding. At temperatures below 140 degrees F. the test was quite insensitive to heat treatment because too little phosphatase was destroyed, while above 145 degrees F. the same was true because too much was destroyed. Within this important range, variations in heat treatment as small as one degree F. or five minutes of holding may be distinguished. The addition of 0.05 percent raw milk to milk pasteurized at 145 degrees for 30 minutes may be detected. Studies of the effect of deviations from standard technic indicate that the average laboratory worker should be able to follow the technic closely enough to obtain accurate results.

OTHER TESTS

These tests are only a few of the tools of workers in this broad field; new methods and modifications of old methods are being developed. Their general use follows an exciting period of experimental application. The early detection of bovine mastitis by an electrometric method (6) and the more accurate estimation of milk quality by a modified resazurin test (7) illustrate recent contributions of importance. The trend toward higher standards, as indicated, for example, by those suggested for the M. B. reduction test, (8) is promising. Continued research, health education, and constant vigilance are necessary for effective supervision, especially in view of the nutritional value and the quantity consumed of milk and milk products.

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Musca Domestica, a Vector of Bovine Mastitis (Preliminary Report). D. A. Sanders (Fla. Expt. Sta.). Jour. Amer. Vet. Med. Assoc., 97 (1940), No. 761, pp. 120-123) Expt. Sta. Rec., **83**, 679 (Nov. 1940). *Pub. Health Engin.* Abs. xxi, Mi. 7.

"Report is made of observations of the habit of the housefly of crawling over the surface of teats of cattle in the milking line to feed at the external teat orifices and then flying to the udder of other cattle in the same milking line. The flies were noted to crawl or fly alternately from one teat orifice to another of the same and of different individual cows in the corrals and milking sheds. Experiments conducted, a description of which is presented, have shown conclusively that the housefly is a natural vector of bovine mastitis."

R.A.C.

Tubercule Bacilli of the Bovine Type in Skin Lesions. Am. J. Pub. Health, 30:551-552. 1940, Jour. of Dairy Sci., **23**, A224 (Dec. 1940). M. W. Y. *Pub. Health Engin. Abs.* xxi, Mi, 7.

"This editorial discusses an article by an investigator in Western Poland who finds that the bovine type is more frequent in skin tuberculosis than in any other organ of the body. Lupus vulgaria is the most frequent form of skin tuberculosis in Poland and it is estimated that there are some 25,000 cases of lupus in that country. The cattle in Poland have a rather high percent of tuberculosis and in Warsaw 50 percent of the market milk is contaminated with the tubercle bacillus."

R.A.C.

A Four-Year College Course for the Training of Sanitarians. Victor Burke and Howard Lundy. The Sanitarian, Vol. 3, No. 2, July 1940, pp. 37-38. *Pub. Health Engin. Abs.* PHA, 21.

Sanitary inspection is of value to the public in proportion to the skill of the sanitarian and the enforcement of his judgment. The required knowledge is both extensive and specialized. It should be sufficiently adequate to justify the responsibilities associated with the position. Until a formal college course becomes available and is required for the sanitarian, there will not be an adequate supply of qualified personnel. Although minimum requirements for such personnel may be obtained in less time than 4 years, if sanitarians are to receive a professional status comparable to that in other professions of no greater importance to the public welfare, it is necessary for them to have specialized training leading to a degree. Furthermore, the salaries justify 4 years in college.

Recognizing this situation, the State College of Washington in 1938 introduced a 4-year college course for the training of sanitarians. The training given is sufficiently broad and thorough to enable a graduate to master quickly any problem that may arise within the broad scope of a sanitarian's duties. It includes sanitary building construction, milk sanitation, water supplies, sewage disposal, food inspection, epidemiology, medical bacteriology, public-health administration and public-health education, psychology, advertising, and public speaking.

M. K. Havens.

The Control of Mastitis *

L. E. Bober

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EXTENT OF PROBLEM

As an interested spectator in the progress of disease control during the past twenty-five years, I have seen the advance in the eradication of tuberculosis until it is no longer a great factor, the Texas fever tick checked by dipping, though in many cases it involved the aid of the sheriff, and a workable plan for Bang's disease eradication developed and adopted in many sections of the country. Through all of these years, mastitis has been taking its toll in loss of the best producing dairy cattle—the farmers' income, and lowered quality milk—and not very much has been done about it.

In the past year, I have made a survey of mastitis conditions in the eastern and mid-western states, and in Eastern Canada.

Based on streptococcic infection alone in some sections, and both streptococci and staphylococci in others, the microscopic test shows the rate of infection in the fluid milk areas averages 25 percent, or infection at the rate of *one cow in every four*. It is well to note in this connection that while most authorities agree that many types of bacteria may be involved in mastitis infection, most researchers in this field agree that the evidence to date points to, *Streptococci agalactiae* as the dominant factor. This list includes such prominent names as Plastridge of Storrs, Bryan of Michigan, Miller of the U. S. Department of Agriculture, Little of the Rockefeller Institute, and Schalm of California.

Everywhere there is a noticeably increased interest in mastitis control in local and state health departments. The health officer, looking at the problem in an impersonal way, may feel that mastitis control is not his problem. However, he may stay within the narrow border of the law, which defines milk as "the normal lacteal secretion from healthy cows", and, as was the case during the early days of tuberculosis eradication, must and is enlisting his intelligent co-operation. For such cooperation to be most effective, a uniform plan of approach based on all available knowledge of the disease is urgently needed.

Mastitis today is responsible for greater loss to the dairy industry than any other single factor. These losses are greater than the combined losses from tuberculosis, and Bang's disease. In cold cash, it is estimated that the annual loss in dairy cattle, milk and milk products, labor and useless treatment, is responsible for a $200,000,000 annual seepage.

The wide-awake dairyman knows what it can mean in friction between himself, the local health officers, and the dairy buying his milk. He knows that it is difficult, and sometimes almost impossible, to maintain a breeding program because of constant crippling and loss of his best cows.

There are many others, unfortunately, who think of it only as a temporary phase of bad luck, or bad weather. They remind me of the story of Farmer Jed.

Farmer Jed was sitting on his porch steps moodily regarding the ravages of a cloud burst. A neighbor pulled up in a wagon. "Say Jed" he yelled, "your hogs was all washed down the creek and they're all dead."

"How about Kelley's hogs?" asked Jed. "They're gone too." "And Larson's?" "All washed away," "Huh!" exclaimed Jed, cheer-up. " 'Tain't as bad as I thought."

I do not wish to imply that the disease has gone unnoticed in the past by dairy

* Read at the Joint meeting of the International Association of Milk Sanitarians, and the New York State Association of Dairy and Milk Inspectors, New York City, October 17-19, 1940.

farmers. I do wish to point out that with the exception of a relatively small percentage of dairymen who were fortunate in securing helpful information on the subject and have followed it intelligently, the larger percentage, lacking definite information, have followed the practice popular in each community or the one handed down from generation to generation.

For example, in Eastern Pennsylvania, I was told in serious tone, the trouble was due to "hexing"; other suspected causes throughout the country ranged from inherited tendencies, milking machines, too much protein, injury, slow milking, mouldy silage, and a hundred other suspicions that blamed everything except religion and politics.

In each case almost every dairyman had his own idea of a cure. The cures ranged from doses of medicine from beautifully labeled bottles, the juice of poke weed, salt petre and purgatives, carefully prepared vaccines, subcutaneous injections of weak solutions of brilliant green, and in recent years sulfanilamide, diathermy and electro-magnetic waves.

The term mastitis as it is used today in the dairy field and by scientific investigators is so broad that its discussion in many cases is attended by confusion of thought.

CAUSATIVE FACTOR

That there is a great deal of speculation on the causative factor in mastitis in the dairy field is not surprising.

Those who use indirect tests alone, such as brom-thymol-blue, chlorine or catalase tests, often overlook the fact that these tests prove only that milk reacting positive to them may be abnormal—but not necessarily that a diseased condition of the udder was responsible. Such reactions may be due to non-specific causes.

To determine that such abnormal milk is due to bacterial invasion or infection of the mammary gland, bacteriological tests must show evidence of the causative germ.

There is need for a cleaner-cut definition and more universal use of standardized tests by health officers, dairies, and research workers to draw a more distinct line between mastitis that is infectious and that which is of a non-specific nature.

Hastings and Beach of Wisconsin report that thirty-nine herds containing 711 animals were examined with the following results:

	Percent
Normal milk	61
Abnormal milk with streptococci	27
Abnormal milk with no streptococci	12

They did not state whether staphylococci or coliform organisms were present. However, if the 27 percent is due to streptococci infection, what is the cause of the 12 percent? And what is its economic significance to the farmer and consumer?

In experiments carried on by Dr. Petersen to determine the effect of osmotic pressure on the rate and character of milk secretion by infusing udders with lactose, saline, and Ringers solution, he found changes in the milk character similar to that observed in non-specific mastitis. In discussing this, Dr. Petersen said:

"Mastitis milk is due to a change toward equilibrium between the blood and the milk, which involves tissue permeability. When the cells are so disturbed as to lose their ability to select those ingredients which make for a normal milk, we see a change in pH, chlorine, or catalase, and call it mastitis. While I am certain that certain virulent types of organisms are capable of being the only etiological factor in the production of some cases of mastitis, it is not improbable that physiological disturbances due to certain chills, overheating, digestive disturbances ,and a number of conceivable metabolic disturbances may also cause changes in milk that will be interpreted as mastitic in character".

That such conditions are the results of overfeeding, mechanical injuries to the udder, forced production, etc. has been the belief of most dairymen.

While I do not wish to appear to minimize the importance of the annoyance and loss to the farmer from non-specific mastitis, it is not a great economic factor, since such conditions are: 1st, usually temporary; 2nd, it presents no problem of spreading infection; 3rd, under common sense management it does not involve loss of cows or quarters, except in cases of severe injury; 4th, while it may in severe cases involve taste and nutritive value to some degree, it does not involve the safety of public health.

This type of mastitis certainly can be better controlled, but it will always be with us. Clean, comfortable stalls, removal of obstacles, remembering that cows are not race horses, and walking–not running–cows, particularly those with full or pendant udders, will help considerably.

No cow's mammary system is ever as perfect as it is in her first lactation period. Constant work takes its toll. Therefore, light, tonic and mildly laxative feeding before freshening, and allowing a month to six weeks to reach normal capacity in production will prevent abnormal milk which so often results from damage to fine blood vessels due to excessive pressure in a complex organ not ready to stand the strain.

Three times milking of high producing cows, especially those producing fifty or more pounds of milk a day, is to be recommended.

Yet with the best care and management, accidents will occur and udders will be injured. In normal healthy cows, scar tissue will rebuild the injured tissue where bacterial infection is not involved. Scar tissue, however, cannot replace the function of secreting cells.

ACUTE AND CHRONIC MASTITIS

Acute and chronic mastitis in dairy cattle was recognized as an infectious disease as early as 1885. According to most investigators, the disease-producing bacteria reach the interior of the udder by way of the teat canal—pass up to the milk cistern where they become firmly imbedded.

From this point, the infection spreads to other parts of the quarter, through the milk ducts and passages. The rate of spread is not uniform, depending on physiology and resistance. These germs may be in the udder for long periods of time without doing apparent injury. Under normal conditions, strong inhibiting factors in the teat canal and gland tissue usually keep these germs inactive until some predisposing factor upsets the normal physiological condition of the cow—resistance is lowered, and the door is opened to a virulent attack.

Although numerous other types of bacteria are also thought to be capable of causing mastitis, those most commonly associated with it are:

Streptococcus agalactiae
Streptococcus dysgalactiae
Streptococcus uberis
Staphylococci
Corynebacterium pyogenes
Escherichia coli

CONTROL

Since most prominent investigators in this field have found that *Streptococcus agalactiae* is responsible for 90 percent of all acute and chronic mastitis, and it appears that this germ is a strict parasite of the udder, not able to carry on a saprophytic existence for any great period of time in the environment of the dairy farm, a program of control must be based on certain fundamental rules, such as:

(1) Detection of infected cows by chemical, physical, and bacteriological tests. The brom-thymol-blue test is but relatively accurate. Occasionally, abnormal milk reacting to such a test may be due to some physiological disturbance as well as to a diseased udder, therefore, reaction to such a test should label the cow only suspicious, not positive. Retesting in this case is imperative.

Physical examination by a competent veterinarian should detect the badly indurated udders. However, evidence of mastitis germs in the milk as determined by microscopic and cultural tests should be the clinching evidence.

(2) Segregation, isolation or sale of infected cows, depending on economic factors.

In this connection I am not at all optimistic about the ability to prevent spread of infection by segregating infected cows in the same barn. Hospital conditions cannot be maintained in a cow barn. I have seen segregation tried in hundreds of barns. Cows are not kept segregated for long, nor is a hygienic plan adhered to when the boss is not present or the rush of the season's work is on.

(3) Prevention of injury, strict hygienic care in milking and barn conditions, and a feeding program to foster the highest degree of health and resistance.

(4) Test all new additions to the milking herd before placing them in the herd.

Do not expose calves to possible infection by allowing other calves to suck their teats. This removes the wax seal to the teat canal through which bacteria may enter, even long before the first lactation period.

That there is hope in such a program has been demonstrated by Dr. W. N. Plastridge of Storr's Experiment Station at Storrs, Connecticut, Dr. Dahlberg of Geneva Experiment Station, Dr. C. S. Bryan, Michigan Agricultural College, Dr. Little of the Rockefeller Institute, and Dr. O. W. Schalm, University of California.

In 1932, of a total of 40 cows, Dr. Plastridge shows 17 shed *Str. agalactiae;* in 1934, only 3. During these three years, the positive cows were isolated for retest and were gradually eliminated until 21 cows shedding *Str. agalactiae* were disposed of. During the following 5 year period from 1935 to 1940, the milking herd averaged 47 head. Samples were taken every 3 months from each quarter, making a total of over 3,000 tests, all negative to *Str. agalactiae.*

It is interesting to note that during this period, positive reactions to bromthymol-blue dropped from 40 percent in 1932 to 2.1 percent in 1939.

As the direct result of a septic sore throat scare in the Lansing, Michigan, area in 1933, Dr. Bryan cooperated with the local health department in a streptococcus mastitis investigation of twenty raw milk dairies. A mastitis control program was developed in which fourteen of the original twenty dairies have cooperated up to date.

In April, 1935, the fourteen herds, with a total of 256 cows, showed 112 cows or 44 percent positive to streptococcus. Thirteen of the 14 dairymen eliminated all streptococcus-positive cows, replacing some of these with tested stock. The fourteenth dairyman decided to segregate the positive cows in the same barn and started pasteurizing. Up until August 1940, the 13 herds had one cow in one herd develop streptococcus infection due to a teat injury, and another herd had two streptococcus infections, apparently from human source, a total of 1½ percent positive to streptococcus, as compared to 44 percent in 1935. The 14th herd, using segregation only, had four streptococci shedders in August 1940 and had sold three others, during this period.

At this stage, the point may be raised: "These dairies no doubt had the benefit of close technical supervision during these many years, but can a good dairyman follow through with such a plan, without the personal supervision of laboratory technicians?"

As an example, and I have seen many others, I would like to cite this case.

Last year, Haven Hills Garcia, a beautiful 3-year-old registered Guernsey, was featured at the New York World's Fair as a part of the Borden exhibit. She had a record of 661 pounds of milk fat and 13,162 pounds of milk, and during the term of her exhibit was also the highest producing Guernsey in the Borden show. She was consigned by Haven Hills Farms, Albion, Michigan.

To meet the requirements for entry to this exhibit, she had to be free from tuberculosis, Bang's disease, and mastitis. Not only was she free, but the entire herd at Haven Hills Farms have had a mastitis-free record as judged by tests for *Str. agalactiae* from 1939 and 1940 to date, and a 99 percent record for the past seven years. This was not the case, however, for the years previous to 1933.

I visited this farm in September to see the herd and get the story.

Mr. Glen Fox, manager, stated that from 1929 to 1933, mastitis was more than a mere incident on this farm. Losses due to abnormal milk, loss of quarters, and production was so serious that there was a question of continuing as a dairy farm. Through the cooperation of Dr. Carlson and Dr. Bryan, a control program was agreed upon, which is still in force today. Separate samples were taken from each quarter and the incubated samples tested by microscopic test. Each cow was also physically examined by palpating the udder, and all badly infected cows were shipped for slaughter.

The suspected cows were isolated in a separate barn for retest. Upon removal of such cows from the milking line, their stalls were thoroughly cleaned and disinfected. Replacement cows were all purchased subject to test, and in each case were isolated until a second test again proved them negative.

Heifer calves being raised were protected against other calves sucking their teats during and after feeding time, by tying the loose calves for a period of thirty minutes after feeding.

Comfortable, clean, well bedded stalls were provided for all stock, and, of course, the barn is always kept in a sanitary condition. Before each milking, each cow's udder is wiped clean, with an individual cloth moistened with chlorine solution. These cloths are washed and sterilized each day. The milkers wash their hands in chlorine solution before milking each cow. Milkers with running sores on their hands, or infected throats are not permitted to milk cows. The fore milk is milked into a strip cup and later discarded. Any suspicious cow is milked last.

From 1933 to 1940 the herd grew from 31 head to a total of 175 head including young stock, of which 75 to 90 are milked. Although over 10,000 samples have been tested during this period, only 6 samples have shown presence of streptococci. The history of the 6 positive samples shows infection due to: one udder badly gored by another cow, a two-year-old infected through amputation of two extra teats, two cows' teats badly mashed by being stepped on, and two cows infected by barbed wire cuts. Other than these, the record is clean. During the entire 7-year-period, there were no other quarter losses, and no swollen udders. The average bacteria count on the raw milk has been about 5,000 per ml., with only one count over 17,000. The production average has increased from 351 pounds of milk fat in 1933 to 420 pounds per cow.

Here is a farm where they are proud to show visitors every cow. What's more if you are interested, you are welcome to take a sample from any cow in the herd. The record to date has shown they are mastitis-free. This on a farm where in 1932 90 percent of the herd was infected.

Mr. Fox is a capable, experienced, and intelligent dairyman. His farm help is made up of hard working, conscientious farm boys who know their job depends on their ability to follow instructions to the letter. The point I want to stress is that control is a matter of intelligent sincere effort rather than type of labor.

What was the actual added cost of this program as compared to the usual method of caring for a dairy herd?

Based on original investment in condemned cows, the first cost was heavy. But for the balance of the cost,—an average per cow of 7c a year for cloths (made from flour sacks), 50c per year for chlorine, 1½ minutes extra labor daily in stripping foremilk and wiping udders, etc., plus $1.60 for laboratory testing of milk samples.

It is obvious that the price of insurance against mastitis infection is the elimination of the source of infection, good dairy husbandry, and strict hygienic care in dairy management. The problem is not much different in some respects than the elimination of Bang's disease and tuberculosis, as far as the control of the infection goes; the difference is that infection can only take place via the teat canal.

Thousands of dollars have been spent annually by farmers on various medicines and drugs, which gave only false hope.

Vaccines and bacterines employed in the treatment of thousands of cows under farm and experimental conditions proved of so little value that practically all authorities agree that to date they have offered no hope, either as cures or as a means for developing immunity against the disease.

Sulfanilamide, the miracle drug which has worked magic in certain human streptococcus infections, has not lived up to its reputation when used in the treatment of mastitis. It will often help a cow over the critical period, and temporarily the cow and udder is saved, but 9 times out of 10 not undamaged. I say temporarily because streptococci usually are still present and will attack again when any one of many predisposing factors lowers the resistance of the cow.

In the study of the effects of large doses of sulfanilamide on cows shedding streptococci, Dr. Miller has shown that dosing with sulfanilamide up to 5400 grains a day may temporarily suppress the shedding of streptococci during the dosing period, but almost invariably within 48 hours after the dosing was discontinued, streptococci seem to come out of hiding, and are just as numerous as they were before treatment started.

Dr. Schalm of California has reported some favorable results obtained by udder infusion with certain acridine derivatives, but little direct experience has been had in the mid-west and east with such methods—with the exception of Dr. Udall who has used acriflavians experimentally, but when last visited felt it was too early to pass an opinion as to their possible value.

To sum this up, an ounce of prevention is still better than a pound of cure. I have been impressed with the vast amount of research that has been done in this field.

There is a great need to coordinate the findings of all research branches working with the bacteriological, pathological, and physiological aspects of mastitis, for the benefit of the layman, and a way must be found to put this information in the hands of the dairymen who are so badly in need of it.

Food Poisoning from Cream-Filled Cup Cakes. Health News, N. Y. State Dept. of Health, 17, 188 (Nov. 18, 1940). *Pub. Health Engin. Abs.* xxi, Mi, 8.

The small outbreak of food poisoning involved seven persons in two related households. Investigation by county health authorities showed that cupcakes approximately 55 hours old were held without refrigeration and at room temperature for that period. Other cream-filled pastries using the same cream filling were sold within 8 to 12 hours after production and showed no apparent ill effects.

A physical examination of bakery employees showed no evidence of infection or any histories of illnesses. Laboratory examinations showed the presence of *Staphylococcus aureus* in large numbers in the filling of one cupcake. Examination of fecal specimens of three patients failed to show the presence of any organisms of the enteric disease group.

L. A. MORLEY.

Food Poisoning. British Medical Journal, No. 4143, June 1, 1940, pp. 896-897. *Pub. Health Engin. Abs.* xx, Mi, 24.

Food poisoning is of high importance in time of war. Outlines problem in general. Discusses Salmonella group and different methods of detecting and isolating the bacilli. Food poisoning may be regarded as an infection with bacilli which produce toxin in the intestine, or as an intoxication with food containing toxin formed at room temperature. Botulism and staphylococcal poisoning belong to the latter group; the position of the Salmonellas is not quite clear. Outbreaks of Flexner dysentery may be indistinguishable clinically and epidemiologically from Salmonella infections. Botulism is rare in England. The danger from milk calls for careful supervision of cows and justifies a demand for compulsory pasteurization of all milk. Reports of some food-poisoning outbreaks are summarized.

Paul F. Krueger.

How Can the Small Milk Producer Meet Pasteurization Requirements?

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In recent years there has been a distinct trend by states, cities, and towns to make more stringent laws and ordinances pertaining to the sale of raw milk, and during this time many additional towns and communities have adopted pasteurization requirements for their milk supply. According to the 1938 annual report of the Public Health Department of the State of Massachusetts, pasteurization laws or ordinances have been put into effect in a total of 46 cities and towns in the state This represents an increase of ten cities and towns over that reported in the previous year. It represents 67 percent of the population of the state. In addition to this, it is estimated that an additional 20 percent of the population voluntarily use pasteurized milk. This additional interest in the pasteurization of milk has created a rather serious problem for the small milk producer, and in some instances has made it very difficult for these small producers or milk dealers to meet pasteurizing requirements. In fact, it appears that much of the objections that one hears to pasteurization of milk comes from these small dealers who believe that their business will be ruined when and if pasteurization is required.

The problem then arises—how can the farmer with a small herd distributing direct continue his business without such sacrifices as will make it impossible for him to carry on profitably. Fortunately it is not necessary for the farmer to go out of the dairy business just because a pasteurization ordinance confronts him. There are several ways in which he can meet the pasteurization requirements.

(1) In the first place, he can purchase a complete pasteurizing unit, but the investment in such standard equipment is likely to be so large that for the small dairy farmer without hope for substantial expansion, such an investment is hardly practical. *Some farmers have found, however, that pasteurization and good advertising increased their business far beyond their fondest expectations and thus justified the installation of standard equipment.*

(2) The farmer, now selling his milk, may sell it direct to a dealer already equipped for pasteurization, but this of course means that he surrenders his retail business and can expect only such profit as there is in wholesaling his milk, which from his point of view likely is not nearly as remunerative.

(3) In the third place, the small producer may arrange to take his milk to a pasteurizing plant and receive back an equivalent amount of pasteurized milk, simply paying the dealer for the pasteurizing and bottling of it. The objection to this plan is that he is not getting back his own milk, which of course is not satisfactory if he is advertising a specially produced milk.

(4) In the fourth place, there is the possibility of encouraging some manufacturer to put on the market a special small-type pasteurizing outfit, small enough to meet the needs of these producers with limited milk production. Certain manufacturers indicate that this small equipment will soon be available. Detailed information regarding these outfits can be furnished by most reliable dealers in dairy equipment or by the Massachusetts State College Dairy Indus-

try Department A few manufacturers have now placed on the market 20-gallon units and some of these have indicated a willingness to place on the market a 15-gallon unit, complete with necessary indicating and recording thermometers. Most of them are of the vat type, and in most cases the heating, the holding, and the cooling are done in sequence without the removal of the milk from the vat. Some manufacturers have even gone so far that not only the pre-cooling of the milk, the pasteurizing, and the cooling of the milk are done with the same machine, but also the bottling and capping. A sample of this machine is on display in Flint Laboratory at the present time. A unit of this type has been installed by the O'Toole Goat Dairy near Chicopee Falls, Mass. As an interesting sidelight, it may be mentioned that to supply heat for this pasteurizer Mr. O'Toole has connected the pasteurizing equipment with the hot water heater of his home, thus saving the expense of a separate water boiler.

Based on present prices, one of these small type pasteurizers, complete with indicating thermometer, recording thermometer, cooler, and boiler, could be purchased and installed complete for $1,000 - $1,600, depending on the equipment already in use.

(5) Another way of meeting this pasteurizing problem, and a relatively new idea in most sections, is that of pasteurizing the milk in bottles with especially provided metal caps. (The metal caps necessary are more expensive than ordinary caps.) This arrangement consists simply of a tightly-made wooden box large enough to hold as many cases of milk as the farmer wishes to pasteurize at one time. The box, when filled with cases of milk, is immersed in water. A long-stemmed recording thermometer is inserted in a dummy bottle in the bottom of the case for recording the temperature. The water is then brought to the desired pasteurizing temperature and held for the required length of time, after which it is cooled. This arrangement has the advantage of being suitable to any size desired and does not require the expensive flush-type valve and expensive sanitary piping. There are a few such plants in New England. Addresses will be furnished any one requesting same.

(6) A distinctly new plan now in operation in Fitchburg, Mass., has much to commend it to the farmer of limited production who still desires to retain the identity of his milk and personally to market it. This arrangement is known as the cooperative pasteurizing plan. While this plan has much to commend it, it should not be encouraged in a community unless the people are almost 100 percent cooperative-minded and of the type that would have faith in each other. This Fitchburg plant (one of the very few of its kind in the country and well worth seeing) is known as the Tri-City Dairymen's Cooperative Association. There are 26 cooperating members, and it is interesting to note that the group has among its membership, Americans, Germans, Frenchmen, Italians, and Finns. All reports indicate that they get along quite harmoniously. The plant is housed in a well-constructed cement-block building about 45 feet x 35 feet. The unique feature of this cooperative pasteurizing plant is that instead of having the usual large-size pasteurizing units, it has three 50-gallon pasteurizers and two 100-gallon pasteurizers, and all the plant equipment is so arranged that each farmer's milk can conveniently be pasteurized and bottled separately. For this service each member of the association pays 1½ cents per quart. Non-members pay 2 cents per quart for the same service. To start with, a 5 percent shrinkage was charged. They now report that with increased business this shrinkage charge is omitted. The total cost of the cooperative plant is estimated at $15,000—the building costing about $10,700 and the dairy equipment $4,300. Reports indicate a substantial growth in the association

At the time the compulsory milk pasteurization law was enacted in the Fitchburg community, 33 percent of the city's milk was sold as unpasteurized milk. The raw milk dealers were steadily losing business to dealers in the pasteurized product. Many physicians were recommending pasteurized milk for the children, particularly for new-born babies. The late Mr. Ernest Viewig, then president of the Worcester County Farm Bureau and himself a prominent dairyman, was intensely interested. It was thought that with proper cooperative spirit a cooperative plant could be made to work. It required enough small pasteurizers to handle in a reasonably short time all the milk of all the members. The distinctive features were that each farmer's milk was pasteurized, bottled, and capped separately.

This plan will not work in all communities. As Mr. Oksanen, the efficient manager, says, "There must be a real need for such a plant for there is nothing like necessity for promoting success." There must be a good leader and manager, and all the help should be versed in the principles of cooperation and trained for their respective jobs. The manager must understand farmers and have more than the ordinary amount of common sense and diplomacy, and be willing to work long hours.

Any persons interested in this plant would find it well worth their while to arrange for a visit to it in Fitchburg, Mass.

Disease Outbreaks Resulting From Faulty Environmental Sanitation. Leslie C. Frank. Public Health Reports, Vol. 55, No. 31, August 2, 1940, pp. 1373-1383. *Pub. Health Engin Abs.* xx, Mi, 64.

Heretofore we have not been well informed as to the number of outbreaks of disease resulting from faulty sanitation because of:

(A) Incomplete reports.
(B) Inadequate epidemiological studies.
(C) Failure to report.
(D) No systematic publication by any national agency.

Last year, the U. S. Public Health Service inaugurated the first Nation-wide survey.

It was found in 1938 that there were 48 outbreaks reported due to water, 42 to milk and milk products, 70 from other foods, and 8 by unidentified vehicles, making a total of 168 outbreaks which involved 36,507 cases and 72 deaths. The data indicate the necessity of more intensive sanitary control of ground-water supplies, and the inadequacy of control of surface-water supplies. Only 2 of the water-borne outbreaks occurred in communities of more than 10,000 population, but one of these involved 29,250 persons.

Thirty-seven outbreaks were reported due to raw milk and one to pasteurized milk in which case the pasteurizer "broke down." Typhoid fever caused most outbreaks and deaths, but in the case of water, gastroenteritis caused most cases. Only 5 of the 42 outbreaks were in communities of over 10,000.

Food-borne outbreaks traced to pies and pastry were most numerous and those traced to pork and pork products were second, with fowl, salads, and home-canned vegetables third. Gastroenteritis caused most outbreaks and cases. An intensive study of food sanitation is needed.

Previous known incidence of water, milk, and food-borne outbreaks are reported. It is estimated that there are probably 5 to 10 times as many outbreaks, cases, and deaths as reported. The discussion takes no account of typhus fever, undulant fever, and malaria with several hundred thousand cases and several thousand deaths per year, all the result of faulty environmental sanitation.

Paul F. Krueger.

We Look At Milk Inspection*

J. H. Shrader

Editor, Journal of Milk Technology

DEVELOPMENT OF MILK INSPECTION

Milk inspection has not always been with us. Its present state of development has been brought about in a large way since the turn of the century, although some work was done before that.

Trained medical men were the first to give milk control serious attention. Even now, the milk inspection work in the United States Army is under the direction of the Medical Department, and the inspection of food products is made by the Veterinary Corps, sometimes by the Quartermaster Department when officers of the former group are not available.

If I may be allowed a digression at this early stage of my talk, may I say that this situation is an anachronism, to say the least. There are no provisions in the conventional education of either physicians or veterinarians for training in milk supervision. Neither the American Medical Association nor the American Veterinary Medical Association have sections devoted to these subjects nor are they particularly interested. The Army does give some degree of training in this field, but it is very elementary. We all here present know that an efficient milk inspector cannot be made overnight. The unfortunate experiences of our CCC camps bear witness of the kinds of difficulties encountered when food inspection is not taken seriously.

Now to get back to our main theme, soon the chemical laboratory became the center of milk control work. Milk was examined for the detection of added water, the removal of milk fat, and the addition of harmful preservatives—in those days formaldehyde.

Then came the day for the bacteriologists. The discovery of the role of milk in the dissemination of disease, and the frequency with which milk became involved as the vehicle turned the attention of health officers to the direct importance of the bacterial quality of the milk as more vitally connected with disease than chemical adulteration. This led to a great development in the study of methods for determining the number of bacteria in milk, eventuating in the appearance in 1910 of the first edition of *Standard Methods of Milk Analysis,* published by the American Public Health Association. Overenthusiastic officials released to the news press the bacteria counts of milk samples, thus leading to much misinterpretation by the public and an inordinate race among dealers to lower their counts by one means or another, some not so good. This program made the public as well as the dealers bacteria-conscious, although neither group always understood what it was all about.

In the meantime, the veterinarians had achieved an important place in milk inspection. They diagnosed tuberculous cattle, and endeavored to improve milk quality by eliminating unfit cows. However, proof that most milk-borne disease (except bovine tuberculosis) was traced to human contamination after the milk was produced directed attention to the handling of the milk itself. These findings laid the foundation for the development of our present inspection system.

Then, along in the early 1920's, the mechanical engineers took over. They showed that our pasteurization practice was faulty by reason of poorly designed

* Address delivered before the joint annual meetings of the Pennsylvania Association of Dairy Sanitarians and Milk Dealers, Harrisburg, April 3, and 4, 1941.

equipment. A great improvement in plant design and operation was worked out, and detailed specifications were drawn up for equipment design and operation.

Finally, the discovery in 1933 of the usefulness of the phosphatase test as a measure of the effectiveness of milk pasteurization turned the emphasis back to chemical control, thereby greatly strengthening the position of the inspector by providing him with a field testing kit.

Before leaving this phase of our considerations, may I state that during the waning of the influence of bacteriology as our main control instrument, the development of the direct microscopic technique for the examination of dairy products has been so useful that this procedure bids fair to remain with us permanently.

PRESENT STATUS OF PUBLIC ACCEPTANCE

What has been the result of all this inspection and control? In the first place, the sanitary condition of the milk industry has been improved to a really amazing degree. In the early days of milk inspection, no one would have dreamed that the general level of milk production all over a municipal milk shed would compare very well with the level of sanitation in the production of certified milk in its early days. Formerly, the attainments of the brewing industry in their excellent microbiological control had been the envy of the milk industry. Now, the situation is reversed: the brewing industry extols the dairy industry as the standard of microbiological technology.

Considered in the abstract, the production of milk does not present a very attractive picture. The very conditions under which a cow is milked, and the social and industrial level of the milkers as a class are not such as would lead a person to expect a clean product. And yet in spite of these conditions, sanitary technology places milk among our cleanest foods. The public knows this.

No other branch of the food industry has the unanimous, enthusiastic, and vigorous kind of support that is given the milk industry by physicians, health officers, inspectors, school officials, and educators. All unite in extolling the virtues of milk. What wouldn't any other industry give for such publicity and support! This is the reward of effective milk inspection and supervision.

Milk inspection is a publicly recognized necessity. The imposition of rules and regulations in general are often resented by the already regulation-burdened community—except in matters of health. Here, the public is willing to support a rational program.

PRESENT TENDENCY IN MILK CONTROL

At present, there is a tendency to impose too much detail in milk control work. There are times when this is necessary. We must insist on the dependability of our tuberculosis eradication records. We do have to insist on exact specification of time and temperature for proper pasteurization. However, we are continually tightening our requirements by adopting new rules and regulations. We raise the question: Is it possible to go too far? Is it possible that we may run afoul of the law of diminishing returns? As a matter of fact, there is no epidemiological support for most of the newer requirements enacted in the last ten years or so. We stopped the occurrence of milk-borne disease outbreaks when the level of milk supervision reached the development obtaining back there. We defend our newly adopted, increasingly stringent regulations by saying that if so and so might happen, then we might have a disease outbreak. Yes, maybe there would be one chance in a million. Compliance with regulations costs money, and usually the more meticulous they are, the more it costs. There must be a limit that the public is willing to pay for its health insurance. Our margin of safety in milk control is already so great that we are free from milk-borne outbreaks where there is any real enforcement. This health record attests the effectiveness of our protective measures. Why should we continue to exact even more stringent requirements!

Let us look at another phase of our work. A conscientious inspector (and most of them are) may be disturbed by the more or less inefficient work (as he considers it) of inspectors on adjoining milk sheds. In such instances he must face the question: Will I do more harm to the public by refusing to recognize the work of this inspector (who is in good and regular standing with his officials and his community) or shall I temporarily overlook relatively minor points of non-compliance for the greater good of all concerned? What is this greater good? It is the educational effect on the person that is regulated, and the respect of the community whether the latter be producers, dealers, consumers or fellow-inspectors. We must develop good-will to insure that proper practices that are really important are followed when our backs are turned. We are passing from the period of the policeman in milk inspection. A "holier-than-thou" attitude does not sit any better on a milk inspector than on a Pharisee. Most milk supplies that are under any regular inspection at all are so much better than they probably formerly were that no great harm will ensue if minor requirements are waived. For example, if one shed requires a covered milk pail and the adjoining shed prohibits it, then in the interest of our own self respect and public confidence, let's ignore the issue. Just don't see it for the time being. A price is paid for ignoring such a consideration.

Then there is the misuse of bacteria counts. We all laugh at the misdirected zeal of the dairyman who boasted that his milk contained more of these bacteria things than that of his competitor. Really now, does any intelligent milk worker believe that, other things being equal, a milk showing a bacteria count of 5,000 colonies is less sanitary than one showing 4,500, or a raw supply of 750,000 colonies as superior to one showing 1,000,000? We keep tightening our bacterial standards and we find ourselves introducing a new difficulty: cappy milk. Which is worse: letting the industry operate under, say, a count of 25,000 colonies, or demanding a 5,000 count and curtailing consumption? I do not mean that these actual figures represent these respective conditions. I do emphatically mean that experience, EXPERIENCE, shows that under such conditions as have been prevailing under normal milk control, there were no epidemics or demonstrated milk-borne disease, and milk tasted right, whereas now, with extremely more stringent requirements, we have no less disease and yet have off-flavor milk. If the public knew this, what do we think they would say about it! What would you say if you were just a consumer!

RESULTS OF PRESENT PRACTICES

As a result of our constant pressure to keep raising the requirement, we have thrown a burden on the industry which is difficult to justify. It costs money to equip a dairy farm. It costs money, for example, to test every producer's milk. How often shall we test it? Some regulations prescribe the number of samples a year, regardless of whether the samples need such testing. Instead of confining our control to the product itself, we set up expensive requirements for plant and equipment, often out of all proportion to their effect on milk quality.

In enacting these increasingly stringent requirements, we defend them by citing possibilities of disseminating disease. This scares the industry into accepting them. They don't dare express any doubt of this possibility for fear of losing face or of being classed as a defender of faulty practices—so they go along. As industry complies, then new regulations are imposed, and so on. As a grand result, industry has acquired a fear complex regarding the possibilities of milk for transmitting disease. Even the public has gotten this fear. How do we know! Look at the advertising. In some quarters, more is said about *protection* than about nutrition. Whereas some firms would educate the public to consider milk in a positive way and to think of it as a premium food, others weaken this by talking about protection, about fending off disease, by appealing to the fear complex.

There is a great difference in the consumer appeal between the phase "Our milk is your most nutritious and most economical food" versus the one "Our milk will not hurt you."

And so the milk industry is spending more money to make milk "safe" than it is to make it more nutritious and to taste better. It is spending great sums of money to make show places out of dairy plants, to appeal to the public's misdirected idea of safety, to cater to the glitter.

NEEDS OF THE SITUATION

The present freedom from milk-borne outbreaks in all reasonably-well supervised communities warrants us to go slow in imposing new and more stringent regulations. We now have no reason for harping on the possibilities of disease from milk (in such communities). Our efforts should better be directed toward introducing milk inspection (including other foods as well) in those communities where there is no inspection. We should seek to dispel the fear complex on the part of the public. We must relieve the industry of its tendency to spend vast sums on control procedure and shining plants. No normally-minded person wants to think of a hospital every time he looks at a milk plant.

Rather, we should encourage the industry to invest in improvements in the nutritive quality of the milk itself. This is what the baking industry is doing now—at no extra charge to the public. The dairy industry charges from ten to twenty-five times the cost of the addition of vitamin D to milk. Why the difference between the two industries? There are many: one is that the baking industry is seeking to regain its lost position as providing "The staff of life" (which they essay at the expense of the milk industry to a large extent), and another is that the baking industry is not crowded by an increasing regulatory burden. Therefore, its vast energies and resources can be directed entirely to improvement in product and to constructive education of the public.

Moreover, we should want the public to respond to our preachments that more milk should be consumed. Is the public responding? What has been the degree of change in milk consumption per capita within the past few years, in spite of continually tightening requirements? Disease from milk is not measurably less nor is the per capita consumption of fluid milk materially different from what may be called a flat average over the past ten years or so—and yet regulation is increasing to a very great degree.

We need liberality in enforcement—and this does not excuse laxity. Liberality means intelligent tolerance when no subversive principle is involved, whereas laxity connotes careless disregard of any principle.

We need more knowledge of the bacteriology of milk. We have gone farther in quantitative determination of total numbers than in elucidating what these numbers mean. We know too little of their qualitative significance. The need is for more fundamental bacteriological research.

What is milk. Until we know its composition exactly and reasonably completely, we do not know it properly as a merchantable commodity. We don't know it as the automotive industry knows it cars, as the rubber industry knows its products, as the electric industry knows its machines—and these industries are progressing. They improve their products because they know them so well.

I am not pleading for a lowering of the level of present milk sanitation, of plant construction or of equipment performance. I want it to be as high as practicable. Most certainly I am pleading for a better product. I think that we can get this when we go after it. We cannot do this very effectively, if at all, when our aims are defensive, so to speak. The army that remains on the defensive is not the one that is going places. "You cannot discover continents in the harbor."

As applied to milk inspection, I plead for more and better trained inspectors. I plead for men so well trained technologically that they do not have to be provided with increasingly intricate rules and regulations—men so able to adjudge the needs of a situation that they can prescribe the corrective measures without having to pull out their measuring tape to see if the dairy house is within the prescribed fifty feet from the milking barn. Maybe there is a more effective provision seventy-five feet away, say, a mechanically refrigerated dairy plant where the producer may store his milk regularly (an actual case where the regulations were literally violated but a better product obtained).

Inspectors who are dairy technologists should lead the industry into a more healthy state of mind, away from emphasis on protection to promotion of improved nutrition, away from frozen investment in glittering plants to productive enterprise by an expanded business, away from white tile to research laboratories, away from just good milk to nature's best food.

We need to double the per capita consumption of milk. Who will lead the way? Can our present inspection policy do it? Will we encourage industry to do it? If so, then by all means let's first expand our own mental and spiritual horizons. Let's get a perspective on the triangle—the milk control system, the milk industry itself, and the nutritive needs of the public. "Where there is no vision the people perish." Dairy inspectors, let's go forward.

Rural Water Supplies and Sewage Disposal

Farmers and other rural dwellers who may be planning improvements to their water supply and sewage disposal facilities will find a wealth of practical suggestions in *Farm Water Supply and Sewage Disposal* published by the Portland Cement Association.

Attractively illustrated, this booklet not only describes several approved methods of providing an abundant supply of clean pure water but also tells how to safeguard it against possible contamination. The protective measures outlined are adapted from suggestions of state health departments, the United States Department of Agriculture and the United States Public Health Service. Complete information is given for each step in the planning and development of the water supply from preliminary estimates of the total requirements for household and livestock purposes to directions for construction which are illustrated in detail in numerous diagrams. Equally complete instructions are given for the installation of farm sewage disposal systems which will provide safe, convenient and inexpensive disposal of sewage from the home and help protect the water supply against pollution.

The Portland Cement Association, 347 Madison Avenue, New York City, will be glad to send *Farm Water Supply and Sewage Disposal* to anyone requesting it. *The State Department of Health does not have copies of this booklet for distribution.* Persons who are interested should communicate direct with the Association.

From *Health News*, State Department of Health, Albany, N. Y.

Scientists Start Search For New Food Values In Dairy Products

Discovery of new and now unknown food values in dairy products is anticipated from a new, comprehensive research program being developed by the National Dairy Council for the American Dairy Association. The National Dairy Council's experience of a quarter of a century in research and educational promotion is recognized by the American Dairy Association as qualifying the organization to supervise the research project it is sponsoring.

Leading scientists who are taking part met recently to discuss plans for what Milton Hult, President of the National Dairy Council says is the "most important research project for the dairy industry since that which led to the discovery of the famed fat-soluble vitamin A in milk. Coming at a time when America is launching its defense program, this research will be of particular significance. Medical rejections of prospective soldiers, reported upwards of 40 per cent in some areas, emphasizes the need for greater knowledge of food values as well as most accurate facts regarding bodily needs."

Noted research and nutrition authorities present were: Dr. George O. Burr, Department of Physiology, The Medical School, University of Minnesota; Prof. E. B. Hart, Department of Biochemistry, University of Wisconsin; Dr. George E. Holm, Senior Chemist, Bureau of Dairy Industry, U. S. Department of Agriculture; Dr. E. V. McCollum, Department of Biochemistry, School of Hygiene and Public Health, Johns Hopkins University; Dr. Lydia Roberts, Chairman of Department of Home Economics, The University of Chicago; Dr. Isaac Schour, Department of Histology, College of Dentistry, University of Illinois; Dr. Russell M. Wilder, Professor of Medicine, Mayo Clinic, and Chairman, Committee on Food and Nutrition, National Research Council.

Others who took part include: Dr. C. A. Elvehjem, Department of Biochemistry, University of Wisconsin. Dr. T. W. Gullickson, Division of Dairy Husbandry, University of Minnesota; Dr. P. C. Jeans, Department of Pediatrics, University Hospitals, The State University of Iowa; Dr. W. E. Kraus, Department of Dairy Industry, Ohio Agricultural Experiment Station; Dr. Herbert E. Longenecker, Department of Chemistry, The University of Pittsburgh; Dr. Grace MacLeod, Professor of Nutrition, Teachers College, Columbia University.

Dr. C. M. McCay, Laboratory of Animal Nutrition, Cornell University, Agricultural Experiment Station; Dr. Irvine McQuarrie, Department of Pediatrics, The Medical School, University of Minnesota; Dr. H. W. Mitchell, Professor Animal Nutrition, University of Illinois; Dr. P. Mabel Nelson, Head of Department of Foods and Nutrition, Iowa State College; Dr. Julia Outhouse, Professor of Nutrition, Department of Home Economics, University of Illinois.

Dr. Rudolf Schoenheimer, Department of Biochemistry, College of Physicians and Surgeons, Columbia University; Dr. W. H. Sebrell, Chief, Division of Chemotherapy, National Institute of Health, U. S. Public Health Service; Dr. H. C. Sherman, Department of Chemistry, Columbia University.

It has long been known that dairy products possess nutritive qualities other than those already recognized. With financing made possible by the American Dairy Association it is hoped that these new qualities will be revealed, thus providing even stronger scientific background for the use of adequate amounts of dairy products in improving the American diet. As a part of this new research project, studies on the nutritive value of butter fat are already under way at the University of Minnesota and the University of Wisconsin.

Legal Aspects

UNGRADED PASTEURIZED MILK

Under amendments to Chapter III of the New York State Sanitary Code, only one grade of pasteurized milk other than "Certified-Pasteurized" will be sold in upstate New York after April 1, 1941. This will be known as Grade A Pasteurized.

In adopting the amendments including the designation "Grade A Pasteurized," the Public Health Council indicated that it is moving toward what it considers the desirable objective of requiring all milk for human consumption to be pasteurized and to eliminate grade designations which have little real meaning in terms of preventing disease being spread through milk. Further steps in this direction will probably be taken by the Council during the coming year, the first of which will likely be the elimination of grade designations for both pasteurized and raw milk.

Much milk that has been produced for Grade B Pasteurized met the former Grade A bacterial requirements and will meet the new Grade A requirements. The bacterial and temperature standards for the new Grade A Pasteurized milk and cream, as delivered to consumers, are the same as heretofore. The temperature to which milk must be cooled at the farm, however, has been changed from 50 to 60 degrees Fahrenheit. The bacteria count limit before pasteurization for the new milk is 200,000 at the receiving station or 400,000 at the city plant if shipped by rail or tank truck. For cream the limit is 250,000 at the place of separation and 500,000 at the pasteurizing plant. Physical examinations of cows are required once a year.

Standards for the Grade A Pasteurized milk to be sold upstate after April 1 are the same, with a few minor exceptions, as those for the "N. Y. C. Dept. of Health Approved Pasteurized" grade now being sold in New York City.* Two of these exceptions which may be of particular interest are: (1) The bacterial count limit before pasteurization upstate will be 200,000 as compared with 150,000 in New York City. and (2) cover caps will not be required upstate for bottles containing Grade A Pasteurized milk whereas such caps are required in New York City.

The new standards for Grade A Pasteurized are such as to insure safety and quality and at the same time, it is believed, will make it possible for dealers to sell this grade at the present price of Grade B Pasteurized milk.

"ENRICHED" FLOURS

Proposed definitions and standards of identity for flour and 15 related wheat products, including "enriched" flours, have been announced by the Acting Federal Security Administrator Wayne Coy. "Enriched" flours would be required to contain thiamine (vitamin B1), nicotinic acid, ribo-flavin, and iron. Comments are invited from those interested before final standards are issued.

Contrary to the opinion which seems to have been implanted in the minds of both manufacturers and the public, the production of "enriched" flours will not be compulsory under the requirements of the Federal Food, Drug, and Cosmetic Act. Millers are at liberty to continue as heretofore to market flours other than those which are "enriched."

In the administration of the Federal Food, Drug, and Cosmetic Act, the interest of the Federal Security Agency in the composition of these products is limited to its obligation of insuring, as soon as

* See this Journal, 4, 38 (1941).

the final standards become effective, that each of the products conforms to the requirements of the applicable standard. "Enriched" flours will be required to contain the specified amounts of the vitamins and minerals provided for in the standards.

The proposed standards are published in the Federal Register of April 1, 1941. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

Model Uniform Food Bill

The Association of Food and Drug Officials of the United States has drawn up a Uniform State Food, Drug, and Cosmetic Bill, which was accepted and endorsed by the Association at its meeting in New Orleans, Louisiana, October 1940. It should be helpful as a guide to state officials in seeking new legislation to bring state food control practice in harmony with the federal program, and thereby minimize, at least, some of the difficulties pointed out in the last issue of this Journal, page 111.

Copies of the bill may be obtained from the Secretary of the Association, Mr. George H. Marsh, 515 Dexter Avenue, Montgomery, Alabama, price 10 cents each.

Influence of Sunlight on Flavor and Ascorbic-Acid Content of Milk Exposed in Three Different Types of Paper Containers. J. L. Henderson, D. C. Foord, and C. L. Roadhouse. (Food Res., 5 (1940), No. 2, pp. 153-159.) Experiment Station Record, Vol. 83, No. 4, October 1940, p. 539. *Pub. Health Engin. Abs.* xx, Mi, 60.

"Paper containers fabricated from (1) a thin white bleached paper, (2) a cream-colored paper of intermediate thickness, and (3) a relatively thick paper with the inner plies unbleached and light brown in color, were compared in this study. Milk samples in clear glass bottles and in each of the three types of paper containers were exposed to midday sun for varying periods, placed in cold storage, and scored for flavor at 2 and 20 hrs. after exposure. The ascorbic acid content of the samples was also determined. The paper containers, while varying in protective capacity, all exhibited greater protection from the effects of sunlight than clear glass. The thick unbleached paper gave complete protection against flavor defect and nearly complete protection against ascorbic acid destruction during 2 hours' exposure to sunlight. The degree of ascorbic acid destruction proved to be a useful index of the effect of sunlight on milk flavor."

R. A. C.

The Treatment of Dairy Wastes. Sylvan D. Montagna. Sewage Works Journal, Vol. 12, No. 1, January 1940, 108-111. *Pub. Health Engin. Abs.* xx, S, 100.

A producer of milk and manufactured milk products has successfully treated dairy wastes by the activated-sludge process. It treats an average of 50,000 gallons of waste daily. The essential units of this plant are a lime tank, the receiving chamber or wet well, mixing chamber, primary settling basin, aeration and final settling basins.

Lime solution, added in the mixing chamber, serves to neutralize the lactic acid and precipitate the suspended caseins in the raw waste to form a sludge, and to prevent septic conditions in the primary settling basin. Agiation is by means of diffused air. Part of the sludge from the primary settling basin is returned to the mixing chamber for recirculation. Sludge removed from the primary settling basin (400 to 500 gallons daily, 50 percent settleable solids) is conveyed by tank truck to an adjacent field.

The lactic-acid-forming bacteria in the aeration basin convert the milk sugars to lactic acid, thereby reducing the pH to between 7.6 and 7.8, the most favorable reaction for this type of bacteria. A further decomposition of the milk sugars occurs simultaneously to form carbon dioxide and water. Sufficient aeration is maintained to keep the dissolved oxygen above 2 parts per million. Sludge from the final settling basin is returned to the aeration tank for recirculation and seeding. The final effluent of the plant in discharged into a small stream.

The analyses of samples indicate a B. O. D. range of 260 to 1,800 (average 545) p.p.m. for the raw wastes; 98.4 per cent B. O. D. reduction is effected by the treatment.

R. S. Shaw.

New Books and Other Publications

The Chemical Composition of Foods, by R. A. McCance and E. M. Widdowson. Chemical Publishing Co., Inc., New York. 150 pages. 1940. $2.50.

The authors state that pioneering investigations into food chemistry were made in Germany and the United States of America, but that after the war of 1914-18, England played a leading part, especially on vitamins.

The present work is a collection of analyses over fourteen years of almost all the foods commonly eaten in Great Britain. The method of approach has been somewhat different from that of previous workers in the same field; for the foods have been analyzed, not only in the raw state, but also as prepared for the table, and studies have been made of the losses introduced by cooking. The investigations also record data on the availability of constituents by digestion in the alimentary tract or their loss by elimination. The information in this book supplies fundamental information of the chemical composition of foods, essential in the dietary treatment of disease or in any quantitative study of human nutrition.

J. H. S.

Judging Dairy Cattle. Text by Edwin S. Harrison, Photographs by Henry A. Strohmeyer, Jr. and John T. Carpenter, Jr. John Wiley and Sons, Inc., New York. 1940. 132 pages. 193 figures. $2.75.

This book is an excellent compilation of photographs of the most famous animals in the various dairy breeds. Comparisons illustrate real judging problems, and the text discusses these comparisons from the standpoint of developing a showing of the relation of desirable points to the usefulness of the dairy cow. The purpose of the manual is to present by pictures, supported by text, a complete study of dairy types.

Pumps: Types, Selection, Installation, Operation, and Maintenance. By Frank A. Kristal and F. A. Annett. McGraw-Hill Book Company, Inc., New York. 1940. 339 pages. $3.50.

The purpose of the authors has been to produce a book that would be interesting to everyone interested in pumping operations. To this end, considerable space has been given to a description of the types and designs of pumps available, and in a general way to the applications for which they are suited. The general field of pumping equipment has been completely covered but no attempt has been made to include every type of special pump available. Extensive treatment has been given to the selection of pumps and service limitations, together with emphasis on pump installation, operation, and supervision, also pump troubles and remedies. All through the work, the authors have tried to present the subject from the practical man's viewpoint.

The Merck Index: An Encyclopedia for the Chemist, Pharmacist, Physician, Dentist, and Veterinarian. Fifth edition. Compiled and published by Merck and Company, Inc., Rahway, New Jersey. 1060 pages. $3.00.

This fifth edition is nearly twice the size of the previous one, containing 5,900 descriptions of various substances. An important new feature is the section, "Chemical, Clinico-Chemical Reactions, Tests, and Reagents by the Author's Name," carrying 4,500 items. Another new section contains formulas for the preparation of culture media, fixatives, and staining solutions, comprising a total of 212 formulas and methods of preparation.

This manual is well printed to lie flat on the desk for reference use. The atomic weights are those of 1939.

JOURNAL OF MILK TECHNOLOGY

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Association News

Chicago Dairy Technology Society

A new state grade A milk law is being introduced at the present session of the legislature. It is not expected to meet any great opposition. Only grade A milk is permitted to be sold in Champaign beginning April 1. The ordinance was passed some time ago but was not placed into active enforcement until this spring. Urbana has not passed the ordinance as yet. Rantoul, located 12 miles north of Urbana, the site of the government aviation school for mechanics, has adopted the grade A ordinance as part of the government's program to permit the consumption of only Grade A milk at army posts.

The University of Illinois has adopted standards for the production and distribution of milk and milk products that satisfy the local requirements for grade A milk in Champaign. Mr. H. L. White, sanitary engineer for the University, is the enforcement officer. All milk, ice cream, butter, cheese, etc., served in University buildings must be of grade A quality and must be processed in the University Creamery. All people connected with the preparation or serving of foods on the campus must pass food handler's examinations and all premises where food is prepared and dispensed must comply with sanitary standards adopted by University health officials.

A recent conference of field men held at the University of Wisconsin was pronounced very successful. An overflow crowd indicated that there is considerable need for this type of a program in some sections of the country at least. The field man's importance in the picture of high quality milk and cream production is coming to be better appreciated by all agencies concerned in this problem. More educational conferences for dairy field men are likely to be given in the near future.

One of the topics to be discussed at the meeting of the American Dairy Science Association sub-committee on milk quality at Burlington, Vermont, in June will be the problem of the establishment of uniform standards and regulations for the procedure to be followed in the production of milk to be used for market milk purposes. It seems that existing differences of opinion in regard to this problem on the part of regulatory officials and other enforcement agencies make for considerable confusion in the minds of the producer, distributor and consumer, and in some cases have resulted in the establishment of trade barriers. It is hoped that this effort on the part of the American Dairy Science Association committee members will eventually bring about more uniform requirements.

P. H. TRACY,
Secretary-Treasurer.

International Association of Milk Sanitarians

A list of the committees for the current year is published on page 176. The Committee on Awards is a special committee that will report direct to the Executive Board.

Massachusetts Milk Inspectors' Association

The Legislative Committee of the Massachusetts Milk Inspectors' Association has been active in watching the bills pertaining to milk legislation. Several of great local importance have been before the Legislature.

The spring meeting of the Association was held in Boston on April 2. Mr. W. D. Tiedeman, New York State Department of Health, Albany, spoke on "Milk Plant Equipment." Dr. G. L. Gately, Commissioner of Health of Boston, and Dr. L. J. Smith, Commissioner of Health of Springfield, were guest speakers. Dinner was served to eighty-five members and guests.

The summer meeting will be held at Cherry Hill Farms of H. P. Hood & Sons, North Beverly, Mass., on July 16. This meeting is in the form of an outing.

Milk inspection procedure in this area of greater Boston is undergoing changes. The milk from each individual farmer is examined at the receiving station. These data indicate the farms to be checked up. This change allows more time to be placed upon the inspection of those dairies requiring more attention.

ROBERT E. BEMIS,
Secretary-Treasurer.

Michigan Association of Dairy and Milk Inspectors

The date of the annual summer conference at Michigan State College has been set for July 17-19. The following constitute the Program Committee: Frank Holiday, Chairman; Peter Stevenson, Charles Gotta, and J. M. Jensen.

H. J. BARNUM,
Secretary-Treasurer.

New York State Association of Dairy and Milk Inspectors

The Executive Committee of this association has acted to direct the secretary to submit for action of the members at the Annual Meeting in Buffalo on September 24, 25 and 26, an amendment to the constitution changing the name of the association to New York State Association of Milk Sanitarians.

W. D. TIEDEMAN,
Secretary-Treasurer.

Pennsylvania Association of Milk Sanitarians

The Seventeenth Annual Convention of the Pennsylvania Association of Milk Sanitarians was held in conjunction with the Tenth Annual Convention of the Pennsylvania Association of Milk Dealers, at Harrisburg, April 3 and 4, 1941. More than 500 sanitarians and milk dealers registered during the convention.

Among the subjects of more direct interest to sanitarians in general were the following: Mr. J. George Binnig, Dairy Council, Pittsburgh, stated that multiple inspection regulations are "foremost in the news" among milk producers, and urged that uniformity, simplification, and producer-education be the objectives in milk control. Mr. Paul W. Soderberg, Wyandotte, Mich., stressed the necessity for considering each of the numerous washing operations of a dairy plant as separate and specific problems. Dr. F. J. Doan, Pennsylvania State College, stated that the readings of the phosphatase test are not affected by enrichment with vitamin D by irradiation or the addition of concentrate, nor by the addition of pancreatic extract or trypsin for reducing curd tension or preventing oxidized flavors, nor by contamination of milk with copper, nickel, iron, aluminum, or tin in quantitites up to 10 ppm, nor by the development of oxidized flavor. Mr. George W. Putnam reported that the original AAA Joint Committee on Sanitary Procedure, consisting of the International Association of Milk Dealers, the Dairy Industries Supply Association, and the International Association of Milk Sanitarians, has now been joined by the International Association of Ice Cream Manufacturers. At the banquet session, Dr. J. H. Shrader, Wollaston, Mass., urged the curbing of tendencies to keep imposing new milk control regulations when the needs of public health protection really did not warrant such and stressed the need for abandoning the fear appeal in dairy advertising as now so generally used and adopting a positive emphasis on the nutritive and economical value of milk, thereby increasing the per capita consumption of milk which has remained fairly static over the past ten years.

West Virginia Association of Milk Sanitarians

During the past year, a Milk Advisory Board has been organized to study the Public Health Council's milk regulations and enforcement methods, and make such recommendations for changes as considered advisable by the Council. The members of the Board are appointed as representatives of their respective organizations or departments, as follows: West Virginia Dairymen's Association (representing the producer-distributors), West Virginia Dairymen's Association (representing producers for plants), Department of Dairy Husbandry, West Virginia University, West Virginia Dairy Products and Ice Cream Manufacturers' Association (representing the dairy plants), and a member from the West Virginia Department of Agriculture and the West Virginia Department of Health.

J. B. BAKER.
Secretary-Treasurer.

Restaurant Sanitation Film in One-Reel Form

A one-reel popular version of the Department's sound motion picture *'Twixt the Cup and the Lip* is being released for bookings in theaters throughout the State of New York.

'Twixt the Cup and the Lip was produced by the Division of Public Health Education, cooperating with the Bureau of Milk Sanitation of the Division of Sanitation, in the interests of promoting higher standards of restaurant sanitation. It has been available heretofore only in two-reel form, and its distribution has been limited to health officers for showing before restaurant operators, food handlers, and agencies interested in restaurant sanitation. The new one-reel version has been especially adapted for the general public.

The film will be available for lending for group showings, subject to the usual conditions without charge, only after theatrical bookings have been completed in any territory. It will be available in 16 and 35 mm. sizes, sound only, in both the theatrical and long versions, running time about thirteen and twenty-two minutes respectively. Health workers who are interested in having this picture shown in local motion picture theatres may communicate with the Division of Public Health Education, New York State Department of Health, Albany.

Health News, March 3, 1941, published by New York State Department of Health.

Association Membership List

The membership list of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, corrected to February 1, 1941, has just been published . It contains more than eleven hundred names, asterisked to distinguish the Active and Associate members. Only three years ago, the membership was less than two hundred and fifty. This great increase in membership does bespeak the approval of milk sanitarians of the progressive policies of the Association's leaders, and encourages them to develop further the potentialities of the Association in the interest of the public health and in milk technology. Copies may be secured from Mr. C. Sidney Leete, Secretary-Treasurer, State Office Building, Albany, N. Y.

New members to be added to list of members, which was published February 1, 1941

*Adams, Albert S., Laboratory Director, St. Lawrence Dairy Co., 215 South Ninth St., Reading, Pa.

*Anderson, Olen, Laboratory, Consolidated Badger Coop., Shawano, Wis.

*Atkinson, Amelia M., Laboratory Technician, Abbotts Dairies, Inc., 1411 Baltic Ave., Atlantic City, N. J.

Barnhart, John Love, Asst. Prof. of Dairy Manufactures, Oklahoma A & M College, Stillwater, Okla.

*Brooks, Paul L., Dairy Serviceman, Dairymen's League, Wolcott, N. Y.

*Brown, L. Wayne, Bacteriologist, Dairy & Food Control Lab., State Dept. of Agriculture, 421 Chemistry Bldg., Madison, Wis.

*Clark, Clayton W., Plant Manager, 3 Staple St., Danbury, Conn.

*Corlett, Norman J., Production Manager, Borden's, 198 California Drive, Burlingame, Cal.

*Emasiri, Saluey, Animal Husbandry and Dairy Division, Department of Agriculture and Fisheries, Bangkok, Thailand.

*Everly, Kenneth B., Production Manager, Old Meadow Creamery Co., 14115 Baldwin Ave., East Cleveland, Ohio.

*Friedman, Henry, Dairy Inspector, Boston Health Department, 67 Fowler St., Dorchester, Mass.

*Graham, M. M., Plant Superintendent, Borden Co., 224 So. 3rd Ave., Phoenix, Arizona.

*Greenfield, M., Chief of Division, State Public Health Laboratory, University Campus, Albuquerque, New Mexico.

*Gross, Herbert F., Director, Sofkurd Division, M & M Dietetic Laboratory, Inc., 585 Cleveland Ave., Columbus, Ohio.

*Hagberg, Glenn H., Dairy Bacteriologist, Libby, McNeill & Libby, 603 W. Morris St., Morrison, Ill.

*Harris, Henry J. D., President, Cloverland Dairy Products Co., Inc., 3400 S. Carrollton Ave., New Orleans, La.

*Hart, Fred W., Vice-President, Brookridge Farm, Inc., Littleton, Colo.

*Herrington, B. L., Professor of Dairy Chemistry, Cornell Univ., 316 Eastwood Ave., Ithaca, N. Y.

*Hummell, John, Sales Mgr., Producers Milk Co., 4560 W. 35 St., Cleveland, Ohio.

*Hunter, G. G., Milk Sanitarian, Lubbock, Texas.

*Isaacs, Moses Legis, Asst. Prof. Sanitary Science, Columbia University, 56 Bayley Ave., Yonkers, N. Y.

*Johnson, Alice M., Laboratory Director, Franklin Coop. Creamery Assn., 2108 Washington Ave., North, Minneapolis, Minn.

Johnson, La Mar, Sanitarian, Preble County Health Department, Eaton, Ohio.

Kohler, Roy Wm., City Milk & Dairy Inspector, Health Dept., Lincoln, Neb.

*Krehbiel, L. F., Plant Supt., Adohr Milk Farms, 1801 So. La Cienega, Los Angeles, Cal.

*Marshall, Charles G., Director, Special Markets Div., Alba Pharmaceutical Co., Inc., P. O. Box 552, Sparta, N. J.

*Parks, W. E., Borden's Farm Products Co., Millerton, N. Y.

*Reid, Earl, Sanitarian, Seminole County Health Dept., Seminole, Oklahoma.

*Rider, Wm. J., Vice-President & Manager, The Rider Dairy Co., 11 New St., Danbury, Conn.

*Rubloff, Ernest B., Consulting Biochemist, Ohio Valley Testing Laboratory, 304 Zweig Bldg., Bellaire, Ohio.

*Sakai, Peter H., Food Inspector, Territorial Board of Health, 3167 Pahoa Ave., Honolulu, Hawaii.

*Sandford, Wm. H., W. H. Sandford & Son., Lafayette, N. J.

*Shepard, O. G., Laboratory Technician, Borden's Dairy Delivery, 2321 Hedges, Fresno, Cal.

*Shull, Hubert, City Milk Inspector, Texarkana, Arkansas.

*Smith, Wayne, Laboratory Technician, M & R Dietetic Laboratories, Inc., 1360 So. Ohio Ave., Columbus, Ohio.

*Stephenson, Robert, 1002 Bronson St., Marion, Indiana.

*Tiernan, Joseph F., Westchester County Health Department, Harrison, N. Y.

*Tompkins, L. J., Sheffield Farms Co., Inc., Packanack Lake, N. J.

*Turnbull, Alan J., Supt. Plant, Progressive Dairy Co., 1214 Lathrop Ave., Racine, Wis.

*Wendler, E. J., Laboratory Director, Carnation Co., 1639 N. Main St., Los Angeles, Cal.

*Wesemeyer, Rich, Asst. Mgr., Producers Milk Co., 4560 West 35 St., Cleveland, Ohio.

*Wilkes, James H., Credit Mgr., Turner & Wescott, Inc., 1327 N. Marston St., Philadelphia, Pa.

*Wolff, Stephen J., Research, Pevely Dairy Co., 1001 S. Grand Blvd., St. Louis, Mo.

*Woodruff, Alfred C., Plant Superintendent, Averill Dairy Co., Akron, Ohio.

International Association of Milk Sanitarians, Inc.
Committees for the Year 1941

Communicable Diseases Affecting Man
Their Relation to Public Milk Supplies.

Paul B. Brooks, *Chairman* ....Albany, N. Y.
R. G. Flood ....San Francisco, Cal.
A. W. Fuchs ....Washington, D. C.
J. G. Hardenbergh ....Chicago, Ill.
I. A. Merchant ....Ames, Iowa
F. L. Mickle ....Hartford, Conn.
H. N. Parker ....Jacksonville, Fla.
A. R. B. Richmond ....Toronto, Ontario

Sanitary Procedure

W. D. Tiedeman, *Chairman* ......Albany, N. Y.
C. D. Dalzell ....Little Falls, N. Y.
W. D. Dotterrer ....Chicago, Ill.
H. C. Eriksen ....Santa Barbara, Cal.
A. W. Fuchs ....Washington, D. C.
George W. Grim ....Ardmore, Pa.
Ralph E. Irwin ....Harrisburg, Pa.
John A. Keenan ....Boston, Mass.
Paul F. Krueger ....Chicago, Ill.
M. E. Parker ....Chicago, Ill.
Sol Pincus ....New York, N. Y.
George W. Putnam ....Chicago, Ill.

Dairy Farm Methods

H. N. Parker, *Chairman* ....Jacksonville, Fla.
C. I. Corbin ....New York, N. Y.
H. E. Erickson ....St. Paul, Minn.
R. L. Griffith ....Oakland, Cal.
F. D. Holford ....New York, N. Y.
C. K. Johns ....Ottawa, Canada
Ernest Kelly ....Washington, D. C.
J. M. Lescure ....Baltimore, Md.
Russell Palmer ....Detroit, Mich.
J. J. Regan ....Utica, N. Y.
L. C. Bulmer ....Birmingham, Ala.
R. G. Ross ....Tulsa, Okla.
John M. Scott ....Gainesville, Fla.
R. M. C. Harris ....Richmond, Va.
S. V. Layson ....Springfield, Ill.

Sanitary Control of Ice Cream

F. W. Fabian, *Chairman*....East Lansing, Mich.
Ralph E. Irwin ....Harrisburg, Pa.
Andrew J. Krog ....Plainfield, N. J.
H. N. Parker ....Jacksonville, Fla.
R. V. Stone ....Los Angeles, Cal.
G. J. Turney ....Lansing, Mich.
L. C. Bulmer ....Birmingham, Ala.
W. C. Cameron ....Ottawa, Canada
H. E. Erickson ....St. Paul, Minn.

Applied Laboratory Methods

T. H. Butterworth, *Chairman*
San Antonio, Texas
C. A. Abele ....Chicago, Ill.
J. L. Barron ....Hempstead, L. I.
Sarah Vance Dugan ....Louisville, Ky.
H. A. Harding ....Detroit, Mich.
F. D. Holford ....New York, N. Y.
H. R. Thornton ....Edmonton, Alberta
C. K. Johns ....Ottawa, Canada
Ernest Kelly ....Washington, D. C.
John A. Keenan ....Boston, Mass.
I. A. Merchant ....Ames, Iowa
F. P. Wilcox ....Los Angeles, Cal.

Resolutions

Ernest Kelly, *Chairman* ......Washington, D. C.
Paul B. Brooks ....Albany, N. Y.
V. M. Ehlers ....Austin, Texas
J. G. Hardenbergh ....Chicago, Ill.
J. B. Hollingsworth ....Ottawa, Canada
Ralph E. Irwin ....Harrisburg, Pa.
C. K. Johns ....Ottawa, Canada
Horatio N. Parker ....Jacksonville, Fla.
William B. Palmer ....Orange, N. J.
A. R. B. Richmond ....Toronto, Ontario
A. R. Tolland ....Boston, Mass.

Affiliation

V. M. Ehlers, *Chairman* ....Austin, Texas
Paul B. Brooks ....Albany, N. Y.
M. A. Heinzman ....Ventura, Cal.
Wm. B. Palmer ....Orange, N. J.
J. H. Shrader ....Wollaston, Mass.
M. B. Starnes ....Dallas, Texas

Local Arrangements

R. G. Ross, *Chairman* ....Tulsa, Okla.
Burley Walker ....Ada, Okla.
W. J. Wyatt ....Oklahoma City, Okla.

Tulsa—The Oil Capital of the World

R. G. Ross
City Health Department, Tulsa, Oklahoma

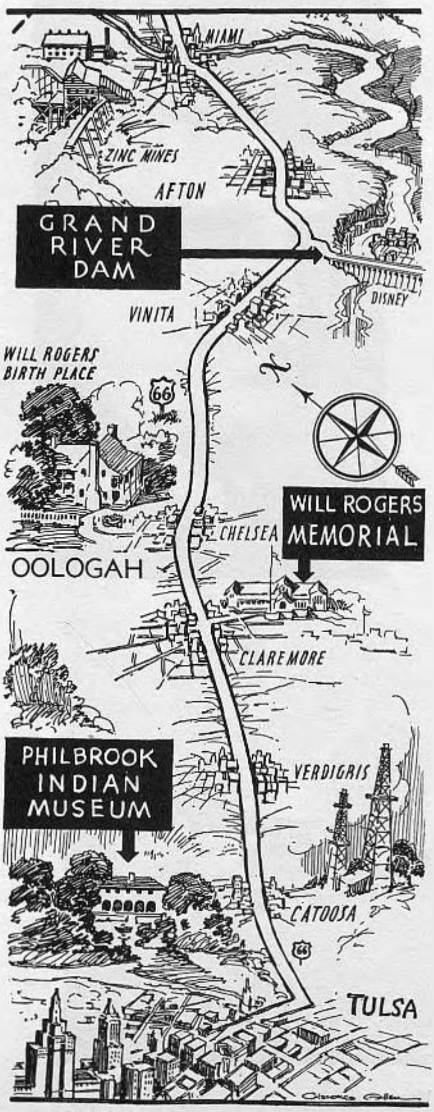
Dr. R. G. Ross of the Tulsa City Health Department, is in charge of arrangements for the 1941 convention in Tulsa. He extended the invitation which will bring the meeting westward, October 27, 28 and 29, 1941.

Most popular shrine in the United States, except for those in Washington, D. C., is the Will Rogers Memorial, shown below. It is in Claremore, Oklahoma, only a few miles from Tulsa, where the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS' convention will be held in October. Will Roger's body is buried on the grounds.

The Mayo hotel, (next page) one of the finest in the southwest is headquarters for the convention of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS in Tulsa, Oklahoma on October 27-29, 1941.

Will Rogers Memorial

Many delegates and visitors to the convention of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS will approach Tulsa, Oklahoma, from the east. Highway travelers will find many points of interest along U. S. Highway No. 66, sometimes called the "Will Rogers Memorial Highway." It can be followed all the way from Chicago or can be picked up at St. Louis or at other intermediate points. The "66"



The Mayo Hotel

traveler sees part of the famous Ozark mountains, can stop off to see the tremendous lake formed by Grand River Dam in northeastern Oklahoma, and can visit the world-famous Will Rogers Memorial at Claremore. Check your highway map with the above map of Highway No. 66 leading into Tulsa.

Among the many reasons why Tulsa is "The Oil Capital of the World" is the International Petroleum Exposition, held exclusively in Tulsa in May of every other year. The above scene is from the 1940 exposition. Most of the buildings are permanent, and can be seen by delegates to the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS in Tulsa when they meet for their annual convention in October.

Arrange Now

To Attend the

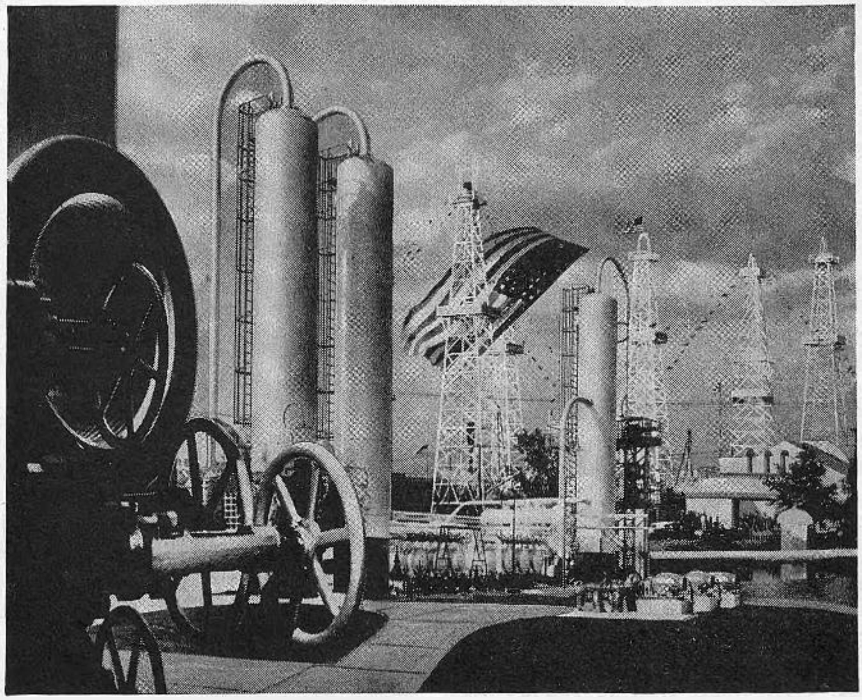
ANNUAL CONVENTION

INTERNATIONAL ASSOCIATION

OF MILK SANITARIANS

TULSA, OKLAHOMA

October 27, 28, and 29, 1941



International Petroleum Exposition 1940

"What Is Milk?"

At the Joint Annual Meeting of the Metropolitan Certified Milk Producers and the Certified Milk Producers' Association of America, held in New York on February 10, the program was enlivened by the popular feature of Certified Milk Information Please. If anyone asked the Board of Experts any question which they could not answer, the questioner was to be given one dollar.

Among the entertaining exchanges, the following is noted:*

Mr. Duemmel (Chairman): I think maybe you can answer the next, Dr. Brown, although it's not entirely in your line. "What is the product as sold to the consumer as cow's milk?"

Dr. Brown: The only answer I can give is cow's milk.

Mr. Duemmel: I'm afraid you would never get the answer. Let me read it to you, as submitted by Mr. W. B. Palmer.

"The secretion forcibly taken from the 'udder end' of a cow, and which has been strained or de-sedimented, chilled, vitaminized, metabolized, mineralized, pasteurized, unified, 'Certified,' approved, homogenized, modified, standardized, aerated, de-aerated, oxidized, de-oxidized, soft-curded, tested, inspected, bottled, hooded, and no one knows just 'What is milk' as evidenced by these technical programs." Do you think we should pay him, Dr. Brown?

Dr. Brown: I guess you had better pay him.

Mr. Palmer received his dollar.

* From *Certified Milk*, March, 1941, p. 15.

"Doctor Jones" Says—*

Speaking of regulations—in the early days of milk sanitation in New York City, so the story goes, the Board of Health used to put inspectors on the ferryboats bringing milk over from New Jersey, to keep 'em from putting water in the milk on the way over. And they had to be tough, these inspectors did; otherwise they were liable to go into the water, as well as the water into the milk. And I guess 'twas the same water. Yes, sir; that was the exercise of "police power," maybe not altogether pure but, anyway, simple.

In those days—in fact I can remember, myself, when that police power idea was pretty general. I never actually saw it but I remember hearing about, when they had a smallpox case—about putting a guard outside with a shotgun, to keep folks from going in and out. Today the smallpox patient—when there is one, which ain't often, around these parts anyway—he goes to the hospital and the rest of 'em—if they're vaccinated they go about their business. The thing of it is: the people have learned, most of 'em, what there is to it. They know the regulations are reasonable and necessary for their protection and it's largely a matter of cooperation. It's like this idea of fighting cancer with knowledge. Nowadays the inspector or the health officer—he don't need brass knuckles or a shotgun. If he's equipped for his job he's armed with intelligence and information.

Of course, when it comes to regulations, whether it's milk or smallpox or what not, the better informed the public is, the surer we need to be that our regulations are necessary and reasonable. When nobody knew how yellow fever was carried—the mosquito and so on—they could burn up a ship's cargo and get away with it but not any more. People may not all be from Missouri but they have to be shown.

When you find a lot of people resisting some regulation, I figure it's what you might call a red light: a warning that something may be wrong either with the regulation or the way we're handling it. Having the law back of us ain't enough. We need to remember that the people are back of the law. If we ain't prepared to show that our regulations are sound we ought to expect resistance. When they're O. K. what a good health officer needs ain't police power but leadership. All he's got to do is convince folks that complying with the regulations is to their interest. When you lead a horse to water maybe you can't make him drink but nine times out of ten he'll drink because he wants to.

PAUL B. BROOKS, M.D.

* Health News, New York State Department of Health, December 9, 1940.

Dairy Science Association Meeting

The Thirty-sixth Annual Meeting of the American Dairy Science Association will be held at the University of Vermont and State Agricultural College, June 23-26, 1941.

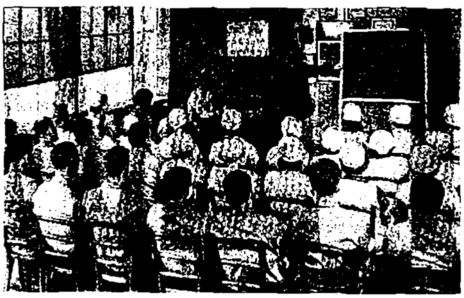
Vermont is a state where the dairy cattle are said to outnumber people. Burlington is located on beautiful Lake Champlain, only 100 miles from Montreal, and within easy driving distance from Ottawa, Quebec, and other eastern Canadian points.

HOW MILLIONS EVERY DAY–

ARE ASSURED OF BETTER PROTECTED MILK

Sealright's Strict Sanitary Code Guarantees Purer Caps and Containers

MANY FOOT-OPERATED WASHSTANDS throughout the vast Sealright Plant, help carry out the strict sanitary code among workers. Every hour there's "time out" to wash up.

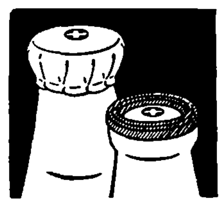


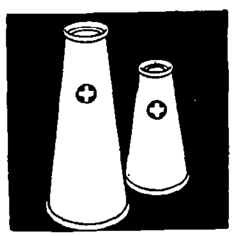
STAFF LECTURES AT FREQUENT INTERVALS and regular classes in modern hygienic practices teach Sealright employees personal hygiene and sanitation.

SEALRIGHT MAKES ITS OWN PAPER from pure, virgin spruce pulp on equipment used for no other purpose. That's a highly significant health measure.

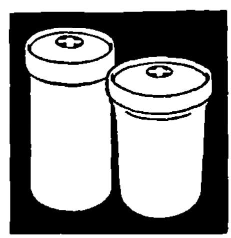
The Sealright Emblem on paper milk bottles, caps and containers is the mark of a modern, sanitary packaging service for milk, ice cream and dairy products. Sealright spares no effort—no expense—to guard the purity of its products. The snapshots shown on this page, taken in the great Sealright plant at Fulton, N. Y., show a few of the many ways Sealright's strict sanitary control safeguards purity.

SEALRIGHT
MILK BOTTLE CAPS
Made in many styles—both cover caps and regular—to suit every capping need.





SEALRIGHT
PAPER MILK BOTTLES
The modern, sanitary, business-building container for milk sold in stores.



SEALRIGHT
CONTAINERS
ROUND AND NESTYLE—for cottage cheese, ice cream and other moist foods.

THIS EMBLEM SAFEGUARDS HEALTH

When you see it on paper milk bottles, bottle caps and hoods, or containers, you know that the manufacturer of the products inside is extra careful of their purity and cleanliness.

We use
SEALRIGHT
SANITARY SERVICE
for Your Protection

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Kansas City, Kan., Los Angeles, Calif.,
Peterborough, Ontario, Canada

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