JOURNAL of MILK and FOOD TECHNOLOGY

(*including* MILK AND FOOD SANITATION)

Title registered U. S. Patent Office

Volume 13 January–February Number 1

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 the transactions.

PRESIDENT'S MESSAGE

BEFORE we consider the future of our Association, let us briefly review the past. When I first became a member in 1929 the Association was known as the International Association of Milk Inspectors, later the name was changed to the International Association of Milk Sanitarians, and of course our new name is INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS. The membership has steadily increased over the years until now we find that the Association is too large for all officials to be part time and yet not large enough to support adequately full time employees. However, this problem is with us and we have only one of two ways to overcome it: stop growing and live within our means and have only part-time employees (and this I know you do not want), so that leaves us only one course to pursue—grow and go forward. The big question is HOW?

Dr. M. R. FISHER

As your President I feel it my duty to present to you one way for us to expand within our means. But first I want to say the Association does not belong to the officials but belongs to you members. Therefore it is only through you that the Association's constitutional by-laws can be changed so that your officials can serve you in a greater capacity.

I propose for your consideration the idea of making it possible for our part-time Secretary-Treasurer to have a full-time assistant to take care of the

increased clerical work that has accrued because the Association is growing. To me this seems to be the less expensive way to give the needed services to the Association. As we go forward, and when the income and expenses will justify same, I believe the Secretary-Treasurer position should be a full time job, other officers remaining as at present.

There is a second problem—The JOURNAL—which needs attention, and changes should be made soon. The editorial staff is overloaded because all these positions are part-time. I suggest that a full-time person be added here as soon as possible and when this is done, the JOURNAL be published monthly.

We cannot create full-time positions with our present limited income. For those of you who did not attend the Business Meeting at Columbus, Ohio, it was decided by the majority present, that the dues should be raised to $5.00 per annum. Since returning to St. Louis and thinking this matter over, I would like to offer for your consideration the following: (a) That the affiliates of the Association be described in the new by-law in a more clarified manner; (b) Each affiliate be required to send two member-representatives to the annual meeting. I should suggest their Secretary-Treasurer and one delegate. (c) That the local Association, if possible, pay all expenses of these two members to our annual Association meeting. The elected delegate be required to hold an active membership card in the International. (d) Membership dues in the International Association for all members not a member of a local affiliate, to be $5.00 per year. International members, who are also local affiliates, pay $2.00 dues to the local Association and $3.00 to International, totaling $5.00. Both kinds of memberships would receive the JOURNAL. (e) At least 50¢ or more of the $2.00 local membership fee should be set aside for expenses of the two members sent to the annual meeting. (f) We have International members who are members of more than one affiliate. Such members should pay local dues of only $2.00 when joining the second or more of the local affiliates, because the $3.00 International dues was paid by the first Association and only one JOURNAL to each member.

As you know, the Executive Board is considering changes in our present by-laws for your consideration at a future time, and if the new by-laws are to be adequate and cover our present needs, we must have your help.

I offer the above to you and ask some member of each local affiliate to bring up this subject for discussion at a local meeting, and have your Secretary write your suggestions to Dr. J. H. Shrader, editor, and send me a copy. We officials will be guided by what you decide and will have a new constitution for your consideration at the next annual meeting.

Let me close by saying we need more income and more members in order to give you the desired service. Look around you for a friend who is not a member and invite him or her to become a member of the International. Before the next annual meeting, let each one of us send in the name of a friend as a new member. The Association belongs to you and we need your help.

Here's wishing you a Happy and Prosperous New Year to all members everywhere, of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS.

MILTON R. FISHER, *President*

UNDERGRADUATE SANITARY ENGINEERING TRAINING IN THE UNITED STATES

THE Public Health Service has just published the results of a survey of undergraduate sanitary engineering training, by studying the replies of 32 schools which reported out of the 37 schools interrogated. The time allocated to the several classifications as per the Public Health Service pattern were as follows: Sanitary engineering 9.4 percent; public health 0.3 percent; pure science 29.7 percent; general engineering 39.5 percent; cultural 16.3 percent; miscellaneous 4.8 percent—when the pure science subjects beyond general chemistry were not included as part of sanitary engineering groups of subjects. Data are presented from each institution in detail in tabular form, and comparison is made with the breakdown of courses in civil engineering as follows: sanitary engineering 3.8 percent; pure science 25.6 percent; general engineering 49.5 percent; cultural 16.4 percent; and miscellaneous 4.8 percent. In both disciplines, the range in maximum and minimum values is large in some instances. There appears to be a wide diversity of opinion as to what courses should be offered in sanitary engineering. Comparison with the earlier surveys shows that there appears to be a slight decrease in time allocated to sanitary engineering during the past twenty years, a decrease in public health and general engineering, and an increase in pure science and cultural subjects. "The time allotted to cultural subjects has increased substantially since 1936–7. This trend is in line with the recommendation made by the American Society for Engineering Education Committee (2), 'Introduction of a carefully planned and integrated stem of humanistic-social courses which would take about 20 percent of the students' time. . . .'"

The medical profession is also finding that more time must be given to the socalled cultural subjects, for example, the humanities. Experience seems to have taught these professional groups that education must be broader than the over-specialization which has produced the present generation of professionals. Men are wanted with more than training and information—they must have resources. The latter come from inspiration and association. Inspiration stems from deep springs of spiritual and intellectual power, watered by deliberation and breadth of vision. Association with the productions of the best minds of the ages fosters these qualifications. Such knowledge is indeed power. The medical profession seems to have been the first to recognize this present need. Now comes the engineers. Other professions might do well to follow suit, certainly the chemists, the nurses, the lawyers and the sanitarians.

J. H. SHRADER

REFERENCES

1. Undergraduate Sanitary Engineering Training in the United States, by Conrad P. Straub. *Pub. Health Reports* **64**, 1315 (1949).
2. Pendulum Swings Toward Broadening of Curricula in Engineering Education, by Harold E. Wassman. *Civil Engineering* **19**, 242 (1949).

BIOGRAPHY OF MILTON REID FISHER

Born in Paducah, Kentucky, January 26, 1900, he attended the public schools there and St. Mary's Academy, and graduated from the Reidland High School.

He attended the Ohio State University at Columbus, Ohio, and graduated in June, 1925, receiving the degree of Doctor of Veterinary Medicine. He is a member of Alpha Psi Fraternity. Immediately after graduation, he accepted a position in charge of meat and milk inspection for the City of Paducah, Kentucky. Paducah was the first city in the State of Kentucky to adopt the U.S.P.H.S. Standard Milk Ordinance in 1926. At this time Paducah was the largest city to operate under this ordinance. He resigned that position to accept one with the City of St. Louis, Health Division, in July, 1933. The St. Louis Milk Ordinance was revised in 1934. He became Supervisor of Milk Control in 1935, and in 1936 was given title of Chief of Milk Control.

St. Louis inaugurated a new Milk Ordinance in 1936. This Ordinance was recognized by the U. S. Public Health Service, as this ordinance met the minimum standards incorporated in their 1936 code.

He is a member of the American Public Health Association, and the American Veterinary Medical Association. He is a past President of Missouri Milk Sanitarians, and is a member of the Greater St. Louis District Dairy Technology Society. He was Secretary-Treasurer for several years of St. Louis District Veterinary Medical Association.

At the annual meeting in Columbus, Ohio, October, he was elected President of the International Association of Milk and Food Sanitarians, Inc.

RESOLUTION ADOPTED AT THE 36TH ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC. ASSEMBLED IN COLUMBUS, OHIO ON OCTOBER 21, 1949

WHEREAS: the broad aspects of Sanitation and the need for a comprehensive National Sanitation Program have been ably presented to this Association at this meeting, and

WHEREAS: the active interest and concerted action of all individuals and organized groups in the community is needed to secure the full benefits of Sanitation

THEREFORE BE IT RESOLVED: 1. That an expanded sanitation program on a nation-wide basis is needed and should be developed as soon as possible; and

2. That the National Sanitation Foundation in collaboration with official and voluntary organizations and agencies, be urged to stimulate and further develop such a nation-wide sanitation program; and

BE IT FURTHER RESOLVED: that a copy of these resolutions be sent to the National Sanitation Foundation and that the resolutions be spread upon the minutes of the Association.

THE SANITIZING OF MILKING MACHINES*

A. C. DAHLBERG, F. V. KOSIKOWSKY, H. W. SEELEY AND A. A. LEVENTHAL

Department of Dairy Industry, Cornell University, Ithaca, N. Y.

RECENT advances in the development of new water softening, washing, wetting and sterilizing compounds have renewed interest in simplified procedures for sanitizing milking machines.

There is need for such consideration for the task of washing milking machines is an important labor item on the farm. If the rubber parts of the average milking machine were to be taken apart completely after each milking, scrubbed with a brush and reassembled, the task presumably might be done in about 15 minutes per day for two single units. This would require about 91 hours per year or 9 days per farm, the equivalent of the services of about 750 men on New York State farms. This washing time would equal about 13 percent of the total time the machines are in use so that 1 hour would be spent washing for every 8 hours milking. Actually, few dairymen today take the milking machines entirely apart after each milking and this has not been generally done since milking machines were introduced on farms in this country.

In 1946, when this study was commenced, it was believed that sanitizing milking machines might be further simplified by the use of the complex phosphates for water softening, and the new surface active compounds for detergents and germicides. The idea was not new even when the study was started. For several years Rudnick (9) had completely replaced the customary alkaline washing and water softening compounds with a surface active detergent in the rinse wash procedure followed by dry storage. Jensen (5) preferred the combination of a surface active detergent with a neutral water softener, sodium hexametaphosphate. Both investigators eliminated prerinsing the machines with clear water as their methods consisted of rinse washing with the warm detergent solution followed by rinsing with water at 180–200° F. and dry storage between milkings. However, boiling water was required which is not available in most farm dairies.

It was not the purpose of this study to investigate the properties of water softeners, nonionic surface, active detergents, or quaternary ammonium compounds (cationic germicides), as there is much information in recent literature and in the files of manufacturers. This study was limited to the possible application of this knowledge in the sanitizing of milking machines. During the years of this study many detergent-sterilizing compounds have been offered to dairy farmers and their sales have increased enormously.

The warm water flush rinse of milking machines immediately after milking removes most of the fresh milk from the tubes. The tubes might then be rinsed with a sanitizing solution containing both the detergent and germicide. The quaternaries do not rapidly lose their strength and the presence of a wetting agent assures intimate contact with the equipment. Then dry storage would seem feasible. Suction rinsing of the machines with warm water, preferably containing a good sterilizing agent, just before use would be recommended. This

* This investigation was aided in 1946 and 1947 by a grant from the Rohm and Haas Company of Philadelphia, Pennsylvania.

seemed to be a logical procedure for consideration.

Unfortunately, some of the best water softeners combine with quaternaries to inactivate them. Both sodium hexametaphosphate and sodium tetraphosphate are considered to be in this group. Sodium metasilicate and tetrasodium pyrophosphate are reported to be more compatible with quaternaries under proper conditions. Common washing compounds are quite compatible, such as sodium hydroxide, sodium carbonate, sodium bicarbonate and trisodium phosphate.

Experimental

The general experimental method was to try various sanitizing compounds and procedures on three farms of Cornell University, known as the Cornell, Warren, and Reed farms. The laboratory technician visited the farms, gave instructions on how the machines were to be sanitized, observed the farm practices, and prepared the sanitizing solutions or weighed out the powder to be used in each solution. He inspected the equipment in the dairies semiweekly and took samples.

The condition of the milkers was observed by careful examination. Five liters of sterile water were drawn from a sterile tin udder into the milking machine pail by operating the milking machine in the usual way. Samples of this water were iced and immediately taken to the laboratory. Standard plate counts were made on tryptone-beef extract—glucose-skim milk agar incubated at 32° C. for 48 hours. Individual counts less than 10,000 and average counts of less than 5,000 per ml. of sterile water were considered to be satisfactory.

The sanitizing procedures varied considerably but generally the machines were immediately flush rinsed with a pail of luke warm water for each single unit, then rinse-washed with a pail of washing-sterilizing solution drawn through the units, and stored between milkings dry or in a solution rack or in a sink of solution. The machines were completely disassembled and brushed and scoured every seven days. The metal parts were inverted on a rack to dry. All machines were flush rinsed with a warm sterilizing solution just before milking.

In view of the fact that the natural cleanliness of the machines varied from barn to barn it was thought most enlightening to present the data by barns as well as by methods. The approximate details of the several washing procedures are presented to assure an understanding of the results. Final approved procedures will be given later.

Two quaternary ammonium compounds and one nonionic detergent which seemed to be most active in the dairy field were selected for this study.

Method 1. Instructions for wet rack storage in lye solution after rinse washing in solution of washing powder.

Directions: Rinse wash by drawing a pail of warm water through each milker immediately after milking. Rinse pails and other equipment. The same prerinse water should not be used for more than one unit. Discard water. Rinse wash by drawing through each unit a pail of hot washing solution. Brush pail inside. Dump washing solution into sink and wash pail and milker equipment. Place milker unit on solution rack and fill with 0.4–0.5 percent lye solution. Rinse pails and equipment with water and sterilize in hot air sterilizer. Just before milking rinse milkers by drawing through a pail of warm water.

The bacteriological samples were taken before this warm water rinse. Every seven days the milkers were completely disassembled, scrubbed, scoured, and examined to assure good rubbers and cleanliness.

Method 2. Instructions for wet rack storage in chlorine solution. This method was identical to method 1 except that 300 p.p.m. of chlorine replaced lye.

Method 3. Instructions for wet rack storage in quaternary or detergent quaternary solution after rinse washing in washing powder or detergent-quaternary solution. The directions were identical with method 1 except that lye was always omitted and sometimes the washing powder solution was omitted. If the tubes were stored in a rack with a quaternary solution, they were previously rinse washed with a washing powder solution but where the tubes were stored in a rack with a detergent-quaternary solution they were previously rinse washed in that same solution. The quaternaries were generally used in 1–4,000 dilution.

Method 4. Instructions for dry storage. In all instances except one the milkers were rinse washed with the sterilizing solution according to the routine of method 1 but instead of filling the tubes with lye they were hung up to dry.

Method 5. Instructions for wet sink storage in quaternary or detergent-quaternary solution after rinse washing in washing powder or detergent-quaternary solution. This method was identical with method 3 except that the entire teat cup assembly was filled with solution as it was submerged in a warm solution of the sanitizing material in the wash sink where it was left between milkings. The sanitizing solution was replaced 3 times each week and the used solution served for washing utensils.

Method 6. Instructions for dry storage after soaking and daily brushing in hot sanitizing solution. The basis for this procedure was recommended to the authors by J. F. Jansen of Sheffield Farms. It consisted of the usual rinse wash procedure and was identical to method 5 except that the teat cup assemblies were taken apart sufficiently to wash, then submerged in the hot solution of sanitizing agent for ½ to 1 hour. The rubbers and metal parts were then brushed and hung up to dry between milkings.

It should be observed that in all methods the machines were rinse washed with warm water just before use (after bacteriological samples had been taken) and that the sanitizing agents were not rinsed out of the tubes between milkings even with dry storage.

Results

Preliminary experiments of 1946. At the beginning of these experiments the three barns were using the rinse wash procedure with wet rack storage in a lye solution. The lye storage was continued for three summer months on two of the milker units at the Cornell barn while samples for bacteriological analyses were taken semi-weekly. The total counts varied from 1 to 7,500 per ml. of sterile water used for rinse washing and the average for each unit was 1,800 and 2,200, Table 1. The rubbers were clean so it is obvious that an excellent job of sanitizing was being done by lye.

At the same time in the Cornell barn two units were rinse washed in quaternary 1 (1–4,000 solution of di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride)—triton (1–4,000 solution of an alkylated aryl polyether alcohol) rinse followed by dry storage with the tubes wet with this sanitizing solution. The bacterial counts were higher, average 16,800 and 5,700 for the two units, and the tubes were not absolutely clean, Table 1. It was apparent that the nonionic detergent quaternary solution was not as effective as lye and for this reason the two quaternaries were tried with wet rack storage as was used for lye. The second quaternary was alkyl dimethyl benzyl ammonium chloride used in a 1–4,000 dilution. It is obvious that wet rack storage with quaternaries was more effective than dry storage but the quaternaries did not give as good results as lye, Table 1.

At the Warren barn the quaternary 2-triton rinse and dry storage results are presented in detail to show that a week elapsed before the very bad results of this method of washing and

TABLE 1

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE CORNELL BARN IN JUNE, JULY, AND AUGUST, 1946

Range of Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
	Wet Rack Storage in Lye		Quat.1 [1]-Triton [3] Rinse and Dry Storage	
Minimum	14	1	190	191
Maximum	7,500	6,800	99,000	17,700
Ave. of 15 Samples	1,800	2,200	16,800	5,700
	Wet Rack Storage in Quat. 1		Wet Rack Storage in Quat. 2[2]	
Minimum	630	465	200	132
Maximum	10,000	12,300	16,300	10,200
Ave. of 6 Samples	3,800	4,300	5,800	3,900

[1] Quaternary 1 is di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride.
[2] Quaternary 2 is alkyl dimethyl benzyl ammonium chloride.
[3] Triton is a nonionic detergent, an alkylated aryl polyether alcohol. Concentration of quaternary 1, quaternary 2, and triton was 1–4,000 for each.

sterilizing was observed, Table 2. A careful scrubbing of the tubes reduced the bacterial count from over a million to less than 100,000 but such counts were still unsatisfactory. Then two of the milker units were rinse washed with quaternary 1 in a tetrasodium pyrophosphate solution followed by dry storage. The bacterial counts remained too high and the rubbers were not clean.

At the Reed barn the quaternary 2 —triton rinse and dry storage was first used. The data, Table 3, show that on the 8th day one of the milker units was high in count and thereafter both milkers were high in count and dirty. The bacterial flora of the milking machines were chiefly of the *Pseudomonas* genus as clearly shown by the yellowish green color of the entire medium in the plates. A severe outbreak of mastitis occurred and the veterinarians isolated *Pseudomonas* as the predominating organism in the udder so this bacteria was assumed to have caused the disease. The seriousness of the trouble prompted the complete laboratory cleansing of all rubbers and metal parts, the former by boiling in lye and the latter by scrubbing and heat sterilization. The same method of sanitizing was followed but the concentration of the quaternary was increased to 1–1,300. It will be noted, Table 3, that the bacterial counts dropped to 35 and 39 due to the laboratory sterilization but in 5 days the counts averaged 78,000 and 128,000 with *Pseudomonas* predominating.

This type of sanitizing experiments with quaternaries had to be discontinued to minimize the danger of mastitis and wet rack storage in lye solution was tried. The bacterial counts promptly dropped to satisfactory numbers and the rubbers were clean inside, Table 3.

Finally, wet rack storage in a chlorine solution, 300 p.p.m., was tried and the bacterial counts increased noticeably to too high levels, Table 3. Furthermore, the rubber tubes were not as clean as with lye.

In general it may be said that in the summer of 1946 the sanitizing pro-

TABLE 2

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE WARREN BARN IN JUNE, JULY, AND AUGUST, 1946

Dates or Range of Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
	Quat. 2—Triton Rinse and Dry Storage			
June 21	9,000	170	320	1,000
June 24	1,040	16,100	850	2,700
June 27 [1]	141,000	78,000	95,500	126,000
June 30 [1]	1,800,000	2,200,000	1,400,000	1,800,000
July 10 [1]	66,000	13,000	23,000	66,000
July 13 [1]	50,000	61,000	513,000	97,000
	Quat. 1—TSPP [2] Rinse and Dry Storage		Quat. 2 Rinse and Dry Storage	
Minimum	12,100	1,200	9,000	9,000
Maximum	166,000	101,000	205,000	139,000
Average of 6 Samples	69,700	51,800	101,000	66,700

[1] The rubber tubes were dirty and after June 30 a general clean up of the equipment was undertaken. Tests showed that over 98 percent of these bacteria were destroyed by pasteurization in milk.
[2] TSPP is tetrasodium pyrophosphate. Quaternaries used in 1–4,000 dilution.

TABLE 3

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE REED BARN IN JUNE, JULY, AND AUGUST, 1946

Dates or Range of Bacterial Counts	*Milker 1*	*Milker 2*
	Quat. 2—Triton Rinse and Dry Storage	
June 20	1,700	3,100
June 24	1,300	580
June 26	600	12,300
June 28 [1]	206,000	11,000
July 4 [1]	452,000	271,000
July 8 [1 2]	990,000	725,000
	Completely Cleaned and Sterilized. Then Quat. 2(1–1,300)—Triton Rinse and Dry Storage	
July 12	35	390
July 14	45,700	35,100
July 17 [1]	78,000	128,000
	Wet Rack Storage in Lye	
Minimum	350	570
Maximum	9,700	9,800
Ave. of 6 Samples	3,400	3,400
	Wet Rack Storage in Chlorine (300 p.p.m.)	
Minimum	400	1,300
Maximum	44,000	87,000
Ave. of 7 Samples	10,800	33,400

[1] The rubber tubes were dirty. *Pseudomonas* bacteria predominated.
[2] Outbreak of mastitis affecting 9 of the 27 milking head. Veterinarians isolated *Pseudomonas* from milk and attributed disease to this bacterium.

TABLE 4

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE CORNELL BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1947

Range in Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
	Wet Rack Storage in Solution of Cornell Sanitizing Powder			
Minimum	100	150	150	45
Maximum	4,700	4,500	3,300	7,000
Ave. of 12 Samples[1]	1,400	2,600	1,800	2,300

[1] The rubber tubes were clean.
Cornell sanitizing powder was used 1 ounce per 3 gallons of water to give a dilution of quaternary of 1–5,600 and a pH of 10.5. It consisted of: trisodium phosphate, 30 percent; tetrasodium pyrophosphate, 30 percent; soda ash, 26 percent; triton X 100, 7 percent; quaternary (di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride), 7 percent.

cedures with lye storage were satisfactory but the results with quaternaries varied greatly depending to a considerable degree upon the barn in which they were used. The human factor was as important as the sanitizing materials and procedures. The inability of nonionic detergent-quaternary mixtures to clean and sterilize as well as desired and the growth of *Pseudomonas* in this solution sometimes in nearly pure culture necessitated attention being given to the development of a more satisfactory combination of materials.

Experiments of 1947. A large number of mixtures of substances were prepared to overcome some of the obvious faults of a simple nonionic detergent-quaternary mixture. It was believed that the cleaning efficiency would be improved by a good water softener. The most feasible seemed to be tetrasodium pyrophosphate. Then one of the circulars of a manufacturer of a quaternary ammonium compound stated that trisodium phosphate increased the germicidal action of the quaternary beyond the effect of high pH alone. It is known that high pH generally enhances the sterilizing action of a quaternary. A high alkalinity also improves cleansing efficiency. Soda ash was also included to give high alkalinity. These compounds are all reasonably compatible with quaternaries especially in the presence of a good nonionic detergent. The final mixture which was known as Cornell sanitizing powder was composed of the following ingredients:

Trisodium phosphate	30%
Tetrasodium pyrophosphate	30%
Soda ash	26%
Triton X 100	7%
Quaternary (di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride)	7%

There was every reason to believe that the other quaternary used in this study would have given equally good results. Used at the rate of 1 ounce per 3 gallons of water the sanitizing solution had a concentration of quaternary of 1–5,600, the pH of the solution was 10.5, and the destruction of test organisms *(Eberthella typhosa* and *Staphylococcus aureus)* occurred in about ½ to ¼ the time required for a solution of the quaternary in water at 20° C. In some of the experiments the sodium carbonate in the Cornell sanitizing powder was replaced by borax. This changed the pH of the solution to 9.5. As the results in the barn were identical with those obtained with the carbonate powder the data were presented together in the interest of simplicity. It was hoped that this pH alone would have noticeable germicidal action at warm temperatures and would be high enough to prevent the growth of *Pseudomonas* which normally grows at pH 9.5. This sanitizing powder went into solution readily and the solution was not hard on the hands.

The Cornell sanitizing powder was used as the exclusive powder in the Cornell barn to wash the milking machines by the rinse wash procedure followed by wet rack storage in a solution of the same powder. All of the dairy equipment was washed with a solution of this powder. The bacterial counts on the milkers for the entire summer reached a high individual count of 7,000 per ml. of sterile rinse water and the averages for each unit were 2,600 or less. *Pseudomonas* bacteria did not develop in the machines and the rubbers were clean, Table 4.

At the Warren barn an alkaline washing solution consisting of equal parts of tetrasodium pyrophosphate, soda ash, and trisodium phosphate was used at the rate of 1 ounce for 3 gallons of water as a rinse wash solution. It was used at the rate of 1 ounce in 1 gallon of water to give a pH of 11 in the solution used in wet rack storage. No nonionic detergents, wetting agents or quaternaries were used. The results, Table 5, show rather good counts which averaged about 5,000 or 6,000 per ml. and the highest count was 11,700. The rubber tubes were clean so the results were good but they could have been better. When the Cornell sanitizing powder replaced the old

TABLE 5

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE WARREN BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1947

Range in Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
Wet Rack Storage in Solution of Washing Powder[2] at pH 11				
Minimum	850	23	55	660
Maximum	9,400	10,900	11,700	11,200
Ave. of 7 Samples[1]	5,000	6,600	5,200	6,300
Wet Rack Storage in Solution of Cornell Sanitizing Powder				
Minimum	950	1,200	1,500	930
Maximum	7,300	7,200	5,600	8,400
Ave. of 4 Samples[1]	3,500	3,500	3,600	4,300

[1] The rubber tubes were clean.
[2] This washing powder consisted of equal parts of soda ash, trisodium phosphate, and tetrasodium pyrophospate. It was used at the rate of 1 ounce per gallon of water.

style washing compound the bacterial counts were reduced in half and the cleanliness was improved.

The Reed barn data, Table 6, did not fully confirm the results at the Cornell and Warren barns. The use of the simple old style washing powder as a washing solution and in the tubes during wet rack storage gave high counts. It was assumed that much of the strength of the alkali cleaned the rubber parts and was not available for sterilization. Then a commercial liquid sanitizer with nonionic detergent and quaternary ammonium compound was used exclusively as a rinse wash solution and as a sterilizer in the wet rack storage. The bacterial counts increased to an average of 200,000 and 162,000 per ml. of sterile water rinse and *Pseu-*

TABLE 6

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE REED BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1947

Range in Bacterial Counts	*Milker 1*	*Milker 2*
Wet Rack Storage in Solution of Washing Powder at pH 11		
Minimum	136,000	12,100
Maximum	>150,000	146,000
Ave. of 3 Samples	>147,000	89,000
Wet Rack Storage in Solution of Commercial Liquid Sanitizer[1]		
Minimum	125,000	59,000
Maximum	325,000	275,000
Ave. of 6 Samples[2]	200,000	162,000
Wet Rack Storage in Solution of Cornell Sanitizing Powder		
Minimum	170,000	167,000
Maximum	600,000	500,000
Ave. of 4 Samples[3]	294,000	367,000
Wet Rack Storage in Lye		
Minimum	1,200	1
Maximum	11,700	21,500
Ave. of 3 Samples[4]	5,600	8,500

[1] Commercial liquid sanitizer containing detergent and quaternary ammonium compound, sold in New York State for cleaning and sterilizing milking machines. Dilutions according to directions.
[2] *Pseudomonas* predominated. The rubber tubes were dirty. Another outbreak of mastitis attributed to *Pseudomonas*. Tests showed that over 98 percent of the bacteria were destroyed by pasteurization in milk.
[3] *Pseudomonas* prevalent. The rubber tubes were fairly clean but not acceptable.
[4] The rubber tubes were clean.

domonas predominated. The rubber tubes became dirty and another mastitis outbreak occurred attributed to *Pseudomonas* by the veterinarians.

The Cornell sanitizing powder was then used exclusively at the Reed barn. The bacterial counts remained high but the proportions of *Pseudomonas* decreased and the rubbers became cleaner but were not acceptably clean. Finally, the Cornell sanitizing powder was used for the rinse wash and a 0.4–0.5 per cent lye solution was used in the wet rack storage. Instantly, the bacterial counts became reasonably satisfactory, *Pseudomonas* bacteria were not observed, and the rubber tubing became clean. These results are interpreted to mean that when sanitary measures are only fair, the Cornell sanitizing powder was not effective enough to clean up the situation without special instructions and attention to cleaning details, but the lye was sufficiently active to do a good job.

It was thought that the data of 1947 showed that nearly neutral or slightly alkaline nonionic detergent-quaternary solutions were not good enough cleansers or sterilizers for milking machines. The alkaline washing and water softening compounds compatible with the new detergent-quaternary compounds improved cleansing and sterilizing and tended to eliminate the *Pseudomonas*.

Experiments in 1948. During the final summer of the experiments an endeavor was made to try the procedures that appeared to show most promise of practical value.

At the Cornell barn the method of a half hour soaking in a hot solution (about 130–140° F) of Cornell sanitizing powder followed by brushing and dry storage between milkings was tried for over a month. The bacterial counts were very low, the metal parts were clean and shiny, and the rubbers were very clean, Table 7. This method was very satisfactory. Then the Cornell sanitizing powder was removed from the barn and the commercial liquid sanitizer was used exclusively. The bacterial counts increased to unacceptable numbers and *Pseudomonas* predominated. The rubber tubes were not absolutely clean and the metal parts lost some of their lustre. It became apparent that there was danger of mastitis and the milker units had to be sanitized better.

TABLE 7

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE CORNELL BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1948

Range of Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage				
Minimum	3	5	5	15
Maximum	5,800	6,100	5,600	5,900
Ave. of 9 Samples[1]	1,900	2,200	2,300	2,200
Daily Brush in Solution of Commercial Liquid Sanitizer and Dry Storage				
Minimum	12,000	12,000	9,800	9,800
Maximum	51,000	35,000	35,000	65,000
Ave. of 4 Samples[2]	28,000	24,500	19,200	30,000
Wet Sink Storage in Solution of Cornell Sanitizing Powder				
Minimum	5,500	6,400	10,000	3,000
Maximum	28,000	15,000	14,000	22,000
Ave. of 4 Samples[3]	12,900	11,800	11,700	10,600
Rinse Wash in Solution of Cornell Sanitizing Powder and Dry Storage				
Minimum	8,000	13,000	11,500	18,000
Maximum	100,000	50,000	32,500	60,000
Ave. of 4 Samples[4]	50,600	33,700	18,400	32,600

[1] Tubes very clean and metal bright.
[2] Tubes fairly clean. *Pseudomonas* predominated.
[3] Tubes clean but too slippery. Some pseudomonas bacteria present.
[4] Tubes clean. Some pseudomonas bacteria present.

The Cornell sanitizing powder was again used with the rinse wash procedure and storage of the teat cup assemblies in a solution of the powder in a clean wash sink. Immediately, the bacterial counts dropped, the tubes and metal parts became clean even though not brushed and the numbers were very clean, and the metal parts were clean and shiny, Table 8. Following 2 months of excellent sanitation the Cornell sanitizing powder was replaced by the commercial liquid sanitizer. The rubber and metal parts were soon only reasonably clean, the bacterial counts increased to an average of 16,900 to 27,100 per ml. in each unit, and *Pseudomonas* predominated, Table 8.

At the Reed barn the rinse wash procedure was used with wet rack storage in a solution of a commercial liquid sanitizer. As a matter of fact, the barn was using this procedure prior to the beginning of the experiment.

TABLE 8

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE WARREN BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1948

Range of Bacterial Counts	*Milker 1*	*Milker 2*	*Milker 3*	*Milker 4*
Wet Sink Storage in Solution of Cornell Sanitizing Powder				
Minimum	5	5	5	600
Maximum	3,600	4,000	5,800	5,100
Ave. of 12 Samples[1]	2,200	1,600	2,600	2,100
Wet Sink Storage in Solution of Commercial Liquid Sanitizer				
Minimum	6,700	3,000	5,300	3,200
Maximum	50,000	67,000	50,000	45,000
Ave. of 8 samples[2]	22,000	27,100	22,700	16,900

[1] Rubbers and metal very clean but somewhat slippery which was relieved by an hour soak in warm water before milking.
[2] Rubbers reasonably clean. *Pseudomonas* predominated.

At the Warren barn the milkers were sanitized by the procedure employing rinse washing and wet sink storage in solutions of the Cornell sanitizing powder. To reduce the slippery condition of the tubes, the rubbers were soaked an hour before milking in warm water. The bacterial counts were consistently low, the rubbers of *Pseudomonas* decreased. However, the rubber parts were so slippery that the machines fell apart during milking. Consequently, the rinse wash procedure was continued with dry storage. Now the milkers remained clean but the bacterial count increased and was not satisfactory.

The milking machines were not clean, the bacterial counts were too high, average per milker 46,800 and 44,500, and *Pseudomonas* predominated. After one month this procedure had to be discontinued as 3 cases of mastitis developed with *Pseudomonas* predominating in the udder, Table 9.

Five lots of 5 liters of sterile water were "milked" through one single unit to gain some idea of the bacterial contamination in the teat cup assembly. The 5 total bacterial counts were 32,000, 9,000, 5,000, 4,000 and 5,000. The sterile water rinses washed out of the one unit a total of 275,000,000 bacteria or an average count of 10,000

per ml. for the first 25 liters (about 26.4 quarts) and the bacterial count of the last rinse was still 5,000 per ml.

The procedure of soaking an hour in a hot solution of Cornell sanitizing powder, brushing daily, and dry storage was next tried. The total counts decreased by half, *Pseudomonas* were less prevalent, and the rubbers were fairly clean within 10 days, Table 9. However, another case of mastitis prompted a change in the procedure so daily brushing and dry storage were replaced by rinse washing and wet sink storage. The rubbers and metal parts became very clean, the bacterial counts were low and *Pseudomonas* almost disappeared. The slippery rubbers were very troublesome so in two weeks the former procedure of soaking and brushing daily in a hot solution of Cornell sanitizing powder and dry storage was again tried. Now the results were very satisfactory, Table 9, which showed that the daily soaking in hot sanitizing solution and brushing followed by dry storage was very good for clean rubbers but it was not sufficiently effective to clean up dirty rubbers as previously found at the Reed barn, Table 9.

At the time the commercial liquid sanitizer was used in the Reed barn, eight colonies were fished from one agar plate and they all proved to be *Pseudomonas*. Laboratory tests were made by Barber (1) on these cultures using the 2 quaternaries employed in this study and four detergent-sterilizing sanitizers, one of which was the "commercial liquid sanitizer" used in this milking machine work. He tried the cultures in waters of varying hardness with and without added organic matter, for water hardness and organic matter decrease the activity of the quaternaries. He found that in soft water free from organic matter the quaternaries in 1–5,000 dilution at 20 to 25° C killed *Pseudomonas* in less than two to five minutes and in hard water, 30 g p g, in less than two to 15 minutes.

TABLE 9

BACTERIAL COUNTS PER ML. MADE ON FIVE LITERS OF STERILE WATER THAT HAD BEEN "MILKED" THROUGH ONE SINGLE MILKING MACHINE UNIT AT THE REED BARN IN JUNE, JULY, AUGUST, AND SEPTEMBER, 1948

Range of Bacterial Counts	*Milker 1*	*Milker 2*
Wet Rack Storage in Solution of Commercial Liquid Sanitizer		
Minimum	10,000	12,000
Maximum	134,000	90,000
Ave. of 10 Samples[1]	46,800	44,500
Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage		
Minimum	18,000	18,000
Maximum	36,000	33,000
Ave. of 3 Samples[2]	26,000	25,800
Wet Sink Storage in Solution of Cornell Sanitizing Powder		
Minimum	180	50
Maximum	3,000	5,200
Ave. of 4 Samples[3]	1,400	3,000
Daily Brush in Solution of Cornell Sanitizing Powder and Dry Storage		
Minimum	500	100
Maximum	11,000	170
Ave. of 4 Samples[4]	3,800	120

[1] Rubbers dirty. *Pseudomonas* bacteria predominated. Three cases of mastitis attributed to *Pseudomonas*.
[2] Rubbers fairly clean. *Pseudomonas* present. One case of mastitis attributed to *Pseudomonas*.
[3] Rubbers clean but slippery. Few *Pseudomonas* present.
[4] Rubbers clean. Few *Pseudomonas* present.

Hard water with 0.5 per cent ice cream mix required from less than two to more than 60 minutes to kill these bacteria. These results compared with less than 0.5 or 1 minute in hardwater and four to eight minutes for hard water with 0.5 per cent ice cream mix for coliform bacteria. The solution of the commercial liquid sanitizer, pH 8.4, never killed all *Pseudomonas* in any of the cultures within 60 minutes, the duration of the test. On the other hand, the two detergent-sanitizer powders that made solutions of pH 9.7 and 9.8 destroyed these bacteria in hard water free from organic matter in less than 1 to 16 minutes and with organic matter in less than 1 to more than 30 minutes.

DISCUSSION

The original hope and expectation of this research was to establish that a solution of nonionic surface-active detergent and quaternary ammonium sterilizer might be combined to prepare a solution that would sanitize milking machines by rinse washing followed by dry storage. This hope was not realized, and the new detergent-sterilizers did not appear to revolutionize milking machine sanitation even though their careful and intelligent use appeared to be a definite advance in milking machine sanitation.

A good standard for excellence of sanitizing the rubbers of milker units was a lye solution as introduced by Parfitt (6, 7). It never failed in these experiments to cleanse satisfactorily and sterilize all rubbers or metal parts with which it came in contact irrespective of other details of sanitizing, Tables 1, 3, 6, 9. The nearly neutral new nonionic detergent-quaternary solutions failed to cleanse or sterilize as effectively as lye, especially when the tubes were stored dry, Tables 1, 2, 3, 6, 7, 8, 9. The lack of consistent sterilization by the nearly neutral quaternaries was not explained but there are ample data in the literature to show that these compounds are not too effective in the presence of organic matter and are least effective against *Pseudomonas* which proved to be most troublesome in these trials.

It should be noted that the duration of the experiment was an important element in the testing of methods for sanitizing milking machines. These studies were conducted in June, July, August, and September under warm summer conditions. Laboratory tests need verification in dairy barns and for a week or 10 days a bad method may yield good results, especially if the machines were in excellent sanitary condition at the beginning of the trial, Tables 2 and 3. Contrariwise, a good method may fail to give excellent results because the rubbers were in such poor condition at the start of the trial. A method that will clean up dirty equipment must be very effective, Tables 7 and 9.

Apparently, detergent-sterilizing solutions were very effective when used with due consideration to existing knowledge and practice. The experience of the years could not be discarded on the assumption that the new products revolutionized sanitation procedures. The nearly neutral nonionic detergent-quaternary solutions were not good peptizers of dirt and in the presence of dirt were poor sterilizers. Daily disassembly and brushing of teat cup assemblies did not give perfect results with such solutions even when prepared from a commercial liquid sanitizer. By far the best results were obtained when good alkaline washing compounds compatible with the quaternary were present. These powders should dissolve easily and the solution should not injure the hands. The alkaline pH of 10.5 helped to dissolve fat and proteins, to enhance the sterilizing action of the quaternary, and to check the growth of *Pseudomonas*. In fact, a solution of pH 11 was fairly effective alone as a sanitizing agent, Table 5. It is probable that only a dry sanitizing powder, rather than a liquid sanitizer stock solution, can contain enough of the alkaline compounds to

give a diluted sanitizing solution of a sufficiently high pH.

The important procedures to observe in good sanitation are numerous. Prompt rinsing after milking by drawing a pail of warm water through each milker removed most of the fresh milk. Also, the sanitizing solution in warm or preferably hot water should be more effective than in cold water for both cleansing and sterilizing. Dry storage could be satisfactory only if the sanitizing agent were not rinsed out after soaking in a hot alkaline detergent-quaternary solution, preferably with daily brushing. For wet storage, lye and alkaline detergent-quaternary solutions proved effective. Storage between milkings in a sink of alkaline detergent-quaternary solution or daily disassembling, soaking in the hot alkaline detergent-quaternary solution with brushing and dry storage, or storage in lye solution were all very effective sanitizers. It was not possible to discard good sanitary procedures and obtain satisfactory results by rinse washing in cold nearly neutral detergent-quaternary solutions.

Pseudomonas may become a serious problem on dairy farms due to the indiscriminate use of quaternaries. These bacteria are present in water and soil. It has been known for years that they produce bitter flavor in milk and milk products. The observation herein reported that *Pseudomonas* may be a cause of mastitis in dairy cattle is not new. Investigators in the U. S. Bureau of Dairy Industry (2, 8) have reported mastitis due to *Pseudomonas* infections and that nine percent of recent cases in the Beltsville herd were due to these bacteria. In New York State the veterinarians in the mastitis control program have encountered serious trouble with mastitis in several herds in the last year due to infection with *Pseudomonas* (4). Of more than casual interest is the report by Ensign and Hunter (3) on a severe epidemic of diarrhea in a midwestern city produced by *Pseudomonas aeruginosa* with improperly pasteurized and re-contaminated milk as the carrier. From July 1 to October 15 there were over 400 cases of diarrhea of which 24 occurred in infants in a hospital with nine deaths. The epidemiological data, the very poor sanitary condition of the two pasteurization plants and the milk, and the bacteriological data all indicated *Pseudomonas* in milk as the cause. As *P. aeruginosa* produced hydrocyanic acid the methylene blue treatment for this poisoning was given to the diarrhea patients with "miraculous results". Control measures based upon these conclusions eliminated the epidemic within three weeks.

Pseudomonas bacteria do grow fairly well at low temperatures and are destroyed by proper pasteurization. They grew and increased in numbers in the nearly neutral nonionic detergent-quaternary solution.

Much emphasis has been given in various writings to the control of thermoduric bacteria by the quaternary ammonium compounds. In the research herein reported occasional tests were made for thermoduric bacteria and appreciable numbers were never found even when the total counts were high and the rubber tubes were dirty, Tables 2, 6. The absence of trouble from thermodurics was no assurance of proper sanitation and low bacterial counts. It would appear that thermoduric bacteria were very easily controlled by all methods used in this research. Hot water sterilization was tried only once even though plenty of real hot water is known to be an excellent sterilizing agent. The so-called hot water was only 120°F. so the experiment was stopped, but one would expect the encouragement of the growth of thermoduric bacteria with an attempt to sterilize with water insufficiently hot. Real hot water for sterilization is not common on dairy farms as the temperature ought not be less than 180° F. in the hot water tank.

Two procedures appeared to be best for sanitizing milking machines. The one is the rinse wash procedure with wet storage in a dirt-solvent sterilizing solution such as lye or an alkaline nonionic detergent-quaternary solution. The second procedure is to rinse wash, soak over a half hour in a hot alkaline detergent-quaternary solution, disassemble, brush, reassemble, and store dry. It was our observation that the soak in the hot sanitizing solution was as important as, or perhaps more important than, the disassembling and brushing. Directions for these two basic procedures follow.

Instructions for Wet Rack Storage in Lye Solution After Rinse Washing with a Hot Solution of Washing Powder

1. Before each night's milking, rinse the milkers by sucking one 12 quart pail of warm water, preferably containing 200 p.p.m. of chlorine, through each unit. Empty the pail and drain teat cup assemblies.

2. Immediately after the night's milking, flush each milker unit with one pail of warm water by drawing it through the machine and rock milker unit. Brush pail, lid, and all utensils immediately. Discard the rinse water.

3. Take one 12-quart pail of warm or hot water (preferably hot), add correct amount of washing powder, and stir. More than the recommended amount is of no value and is wasteful. Suck this solution through each milker with rocking. Brush pail and dump washing solution into sink. Brush outside of rubber and all utensils.

4. Place the rubber milker unit on the solution rack and fill tubing level full to end of teat cups with 0.4–0.5 percent lye solution. Leave until next milking. Wash utensils and invert on clean rack to dry.

5. In the morning, repeat steps 1, 2, 3, and 4.

NOTE: Always lift the teat cups in and out of the solution being sucked through them to obtain the most effective cleansing action.

The lye solution of 0.4 to 0.5 percent concentration is to be made by dissolving one 13 ounce can of lye in 1 gallon of water to make the stock solution of which ½ cup is used per gallon of water.

Every seven days the milker units should be completely disassembled. Inspect, soak rubbers in hot lye solution for a half-hour. Brush, scour, and clean thoroughly in a washing powder solution. Lye is corrosive on metals and hard on the hands and clothing.

To obtain maximum length of life of the rubber it is preferable to have two sets for each milker and use them in alternate weeks.

Instructions for Wet Rack Storage in Alkaline Detergent-Quaternary Sanitizing Solution After Rinse Washing with a Hot Solution of the Same Washing Powder

1. Make up the solution of the alkaline detergent-quaternary sanitizing powder according to manufacturer's directions.

2. Follow the instructions for wet rack storage in lye solution, but use the detergent-quaternary solution in place of the washing powder solution and the lye solution.

Instructions for Dry Storage Following Disassembling, Soaking, and Brushing with a Hot Solution of an Alkaline Detergent-Quaternary Sanitizing Powder

1. Before the night's milking, rinse the milkers by sucking one pail of warm water, preferably containing 200 p.p.m. of chlorine, through each unit. Empty the pail and drain teat cup assemblies.

2. Immediately after the night's milking, flush each milker unit with one pail of warm water by drawing it through the machine and rock milker unit. Brush pail, lid and utensils immediately. Discard the rinse water.

3. Take one 12-quart pail of warm or hot water (preferably hot), add correct amount of detergent-quaternary compound, and stir. More than the recommended amount is of no value and is wasteful. Suck this solution through each milker with rocking. Brush pail and dump washing solution into sink. Brush outside of rubber and all utensils. This cleans and sterilizes the milkers and utensils for the morning's milking. Hang up milker units in a clean place. Store utensils inverted on a clean rack to dry.

The used sanitizing solution should still be clean and can be used for other cleaning purposes.

4. In the morning repeat directions 1 and 2.

5. Immediately take one 12-quart pail of hot water, add correct amount of sanitizing compound, stir, and suck through each unit. Flush utensils.

6. Place solution in a clean wash sink and put milkers in the solution to soak for at least 30 minutes to dissolve milk out of the pores of the rubber. Protect the air line so solution does not enter behind the teat cup inflations. This soaking until washed is most important. Disassemble sufficiently to permit thorough brushing of rubbers and utensils. Brush and cleanse.

7. After washing, assemble the machines and hang up in a clean place. Wash and brush the milk utensils in the warm or hot quaternary cleaning solution. Store inverted utensils in a clean place.

NOTE: Always lift the teat cups in and out of the solution being sucked through

them to obtain the most effective cleansing action.

Every seven days the milker units should be completely disassembled. Inspect, soak rubbers and metal parts in hot sanitizing solution for a half-hour. Brush, scour, and clean thoroughly in this solution.

To obtain maximum length of life of the rubbers it is preferable to have two sets for each milker and use them in alternate weeks.

Should the rubbers become slippery this condition can be improved by soaking a half hour in hot water.

Conclusion

The sincere desire and effort to have clean and sterile milking machines on the part of the person responsible for sanitizing them was as important in obtaining clean sterile milkers as the method by which it was accomplished.

A week or 10 days were required before a poor method of sanitizing milking machines showed unsanitary conditions with high bacterial contamination and unclean milker rubbers. This was true especially if the rubbers were in excellent condition before the start of the test. It was evident that very thorough cleaning and sterilizing was necessary to clean up unsanitary rubbers and occasionally more than an ordinary good routine procedure of daily sanitizing was required.

The new nearly neutral nonionic detergent and quaternary ammonium compounds represent a distinct advance in milking machine sanitation providing they were used in conjunction with known good sanitary procedures. Used together they were not good solvents of dirt on milker rubber tubes; unclean rubbers were not satisfactorily sterilized by the quaternary ammonium compounds alone or in combination with the nonionic detergent. However, the combination proved quite effective with brush washing in a hot solution.

Storage in constant contact with the wet sanitizing solution was generally more effective than dry storage. A lye solution in the milker teat cup assemblies on a rack was a very effective solvent cleaner and sterilizer. Chlorine solution was not as satisfactory as lye but a water softening alkaline solution of nonionic detergent-quaternary sanitizer was almost as good as lye as a solvent cleaner and sterilizer. This alkaline detergent-sanitizer was very effective as a solvent cleanser and sterilizer when the milker teat cup assemblies were submerged in a sink of the solution, but the rubbers were too slippery for practical use. A half to one hour soaking in the hot solution with daily brushing and dry storage was very effective with the detergent-sanitizer solution if the solution also contained water softening, alkaline washing compounds. The hot soak increased the solvent cleaning action by the alkaline solution and the sterilization by both the alkali and the quaternary. Without the high pH, approximately 9.5–10.5, in the washing solution the quaternaries not only failed to destroy *Pseudomonas* but growth occurred. These bacteria are known to produce bitter flavors in dairy products and mastitis in dairy cattle.

A formula was presented for a satisfactory detergent-quaternary sanitizer for both cleaning and sterilizing. It contained tetrasodium pyrophosphate, trisodium phosphate, sodium carbonate, a nonionic surface active detergent, and a quaternary ammonium compound. The solution of this powder (1 ounce per 3 gallons of water) had a pH of 10.5, dissolved readily in water, and was easy on the hands. It cleaned well as a solvent and by brushing. It was presented to indicate the type of sanitizer powder that was most effective in the dairy barns in this investigation.

References

1. Barber, Franklin W. National Dairy Research Laboratories, Oakdale, L. I., N. Y. Private communications, January 1949.

2. Cone, J. Frank. *Pseudomonas aeruginosa* in Bovine Mastitis. *J. Agric. Res.* **58**, 141–147 (1939).

(Continued on page 24)

REPORT OF THE COMMITTEE ON SANITARY PROCEDURE, 1949 *

The 1948 Report of the Committee on Sanitary Procedure inferred considerable optimism concerning accomplishments in prospect during the current year. In some respects, that optimism has not been justified by developments. In fact, one phase of the program of the Committee has suffered a set-back. The publication of the 1948 Report of the Committee in the September-October, 1949, number of the Journal, the date of issue being within two weeks of the date of this Meeting, makes the situation inescapably evident.

The Committee has met twice during 1949, in joint session, with the Sanitary Standards Sub-Committee of the Dairy Industry Committee, and representatives of the Milk and Food Branch of the U. S. Public Health Service, first, in New York, on April 5 and 6, and also on October 18 and 19, here in Columbus. At these two joint meetings "Sanitary Standards for Electric Motors and Motor Attachments", "Sanitary Standards for Seamless and Welded Tin-Coated Can-Type Milk Strainers", "Sanitary Standards for Stainless Steel Automotive Transportation Tanks for Milk and Fluid Milk Products", and "Sanitary Standards for Fittings Used on Milk and Milk Products Equipment" have been approved. The first named three have been submitted for publication in the Journal as 3A Sanitary Standards.

A sub-committee has for several years been working toward the development of a procedure for determining, with reproducible results, the holding-time of HTST pasteurizing units, with special emphasis upon the instruments and connections necessary to the conduct of the salt-solution conductivity test, so as to avoid factors favoring erroneous results. It will be recalled that, through the efforts of Past-President Tiedeman and President Fuchs, the National Sanitation Foundation, together with several dairy equipment manufacturers, made possible a research study at Cornell University with equipment provided by several members of the Dairy Industry Supplies Association. The study was conducted by Dr. Wm. Jordan and Dr. R. E. Holland, and was reported at the Philadelphia meeting of the Association.

"A Procedure for Determining the Holding Time of High-Temperature Short-Time Pasteurizers" is being submitted to the Sanitary Standards Sub-Committee of the D.I.C., with the recommendation that it concur in fixing the proposed standards for the conduct of this test so that it may eventually have the status of a 3A method. The sub-committee is to be continued for the study of the thermal wave test procedure.

The development of rigid standards for the salt-conductivity timing determination constitutes the first project initiated and wholly carried out—except for final joint-concurrence, under the auspices of this Committee, as now constituted. Messrs. Weber and Dalzell, who have nursed this project to prospective fruition, and Messrs. Corash, Thomasson, and Wainess, who have served on this sub-committee for shorter intervals, deserve the thanks and commendation of the Association.

Committee reports have, for the past several years, included references to the utilization of a 3A symbol to identify equipment conforming to 3A Sani-

* Presented at the Thirty-Sixth Annual Meeting of the International Association of Milk & Food Sanitarians, Inc., Columbus, Ohio, October 20–22, 1949.

tary Standards. In the more recent reports, registration of the design for such a symbol was discussed. It is a prerequisite for the registration of a mark or symbol that it be in use on a commodity or fabricated article transported across state lines in trade. Such utilization of the symbol had not, to our knowledge, occurred prior to the 1948 Annual Meeting; consequently, no action toward registration had at that time been taken in the name of the Association.

Early this year a fabricator of storage tanks for milk or milk products made inquiry concerning the 3A symbol, and requested permision to stamp or emboss it upon the name plate to be displayed on each tank. Permission was granted, with the understanding that the Committee would be provided with data concerning inter-state shipments of tanks so identified, necessary to satisfy application for registration requirements. Subsequently, two other tank fabricators have requested permission to employ the symbol in like manner.

Utilization of the symbol by the first user appeared to satisfy the missing prerequisite for the filing of an application for its registration. With supporting data, the attorneys initially consulted were instructed to file an application for registration in the name of the Association. It was not until then that the Committe learned that due to an amendment in Federal patent legislation, which became effective quite recently, registration of a mark or symbol covers only its display on the type of equipment listed in the application—in our case, storage tanks. If we could establish use of the symbol on weigh cans and receiving tanks, both of which might be considered by the Patent Office classification milk "receptacles", one application might cover the equipment covered by the first two sanitary standards adopted. However, the types of equipment covered by the other sanitary standards thus far adopted would fall into at least four other classifications, for each of which separate registration of the symbol is necessary, but possible only after utilization of the symbol on it can be established in the application. The cost of each completed registration may be expected to approximate $100.

This situation has been considered at length by the Executive Board, and measures to avoid delay in the registration of the symbol, so as to provide the Association with an equity in it, and to obviate the necesity for multiple registration, will be further explored.

It was suggested in the 1948 Report that affiliated state associations establish committees on sanitary standards, and the logical functions of such committees were set forth. During the current year one such affiliate—the New York State Association of Milk Sanitarians—has taken action and has formed such a committee. Your chairman has personally appeared before two affiliate associations to advocate such action, and has been informed that it has been taken in one case. The Executive Board has approved a proposal that formal requests for the organization of such committees be sent to the officers of all affiliates which cannot be reached personally.

In this connection we might point out the great service that committees on sanitary standards of affiliate organizations can render to this work. In the course of only the past five years our Committee on Sanitary Standards has lost several outstanding members. Replacements are necessary. Such men should be experienced, that is, have a detailed and complete acquaintance with the design and construction of milk-handling equipment, and must have the confidence of the Association membership at large. Work on this subject in the affiliates would operate admirably as a sort of proving ground, so to speak, where men would be able to acquire the experience necessary for the exacting work involved in devising standards which satisfy justifiable sanitation ideals at reasonable cost.

The formulation of sanitary standards results in no starting develop-

ments or movements unless the printed or typed standards are readily available to all who are in any manner affected by them, or who need to know of them and their content. The 3A Sanitary Standards are published in the JOURNAL, as promptly as possible after formal adoption. It might be assumed, therefore, that every member and affiliate of the Association is automatically provided with a copy of each sanitary standard adopted after he joined the Association. But Journal numbers have a characteristic faculty of becoming misplaced, and even when kept in a complete file the numbers containing sanitary standards are not readily identifiable without reference to the table of content. Consequently, the standards published in the JOURNAL are rarely available when reference to them is desirable or necessary. Reprints have always been made for distribution to others than members, and throughout the dairy industry.

In order that reference to the sanitary standards might be facilitated, Dr. Shrader, while Secretary-Treasurer, made up loose-leaf folders of the standards which had then been reprinted, and sent such a folder to every health department of record. Few of those folders appear to have come into the possession of those to whom they would be of most service. More recently, Secretary West has distributed reprints of the Sanitary Standards for Homogenizers to the membership.

By the close of 1949 (or the January-February, 1950, issue of the JOURNAL) eight sanitary standards will have been published. The supply of reprints of the first standards published has been exhausted. It is urged that those who have need to refer to 3A Sanitary Standards make up a special folder for these standards, to which others are added as distributed.

The cost of these reprints, in the aggregate, is no small item. It is debatable whether the Association should assume that cost. It is more logical to take the position that reprints should be sold at a price to cover printing and postage. That is a matter of policy, however, to be decided at the business session or by the Executive Board.

It is pertinent, at this point, to announce that consideration is being given to the possibility of bringing together all of the drawings and dimension tabulations of fittings standards for which have thus far been adopted, to an editorial revision of all 3A Sanitary Standards so that like standards appearing in different Sanitary Standards will be similarly expressed or stated, and of republishing them in one pamphlet or folder. That may or may not transpire during 1950. It may be comforting to you to know, however, that plans and efforts directed at that objective are being made.

C. A. ABELE, *Chairman*
H. E. BREMER
PAUL CORASH
C. B. DALZELL
A. W. FARRALL
M. R. FISHER
O. A. GHIGGOILE
I. M. MARTY
H. L. THOMASSON
HAROLD WAINESS
C. W. WEBER

SANITARY STANDARDS FOR STAINLESS STEEL AUTOMOTIVE TRANSPORTATION TANKS FOR MILK AND FLUID MILK PRODUCTS

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
As of October 19, 1949

IT is the purpose of the IAMFS, USPHS, and DIC in connection with the development of the 3A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Milk Transportation Tank specifications heretofore or hereafter developed which so differ in design, material, construction, or otherwise as not to conform with the following standards, but which, in the fabricator's opinion are equivalent or better, may be submitted for the joint consideration of the IAMFS, USPHS, and DIC, at any time.

3A STANDARDS

Milk Transportation Tanks conforming to 3A Standards, comply with the following in design, material and construction.

A. Material

1. *Inside Lining:* The inside lining shall be of 18–8 stainless steel with a carbon content of not more than 0.12%.

The inside lining surface shall be at least as smooth as # 4 mill finish on stainless steel sheets.

The gauge of material used for the inside lining on tanks shall be as follows:

Tanks of 1,000 gallon capacity and under—not less than 16 U.S. Standard gauge.

Tanks over 1,000 gallon and not exceeding 2,000 capacity—not less than 14 U. S. Standard gauge.

Tanks of over 2,000 gallon capacity —not less than 12 U. S. Standard Gauge.

2. *Outer Shell:* The outer shell shall consist of a continuous metal covering which shall be smooth and waterproof.

3. *Insulation:* Insulation material shall be of a nature and amount sufficient to prevent in 18 hours an average temperature rise of greater than 2° F. in the tank full of water when the differential between the temperature of the water and that of the atmosphere is 30° F.

The above temperature rise does not take into consideration the sensible heat that may be stored in the empty tank at time of filling.

Public Health Reason: Insulation is necessary to maintain temperatures that will retard bacterial growth.

B. Fabrication

1. *Welds:* All inside and outside seams shall be welded. All inside welds shall be ground smooth and polished to a # 4 finish or better. All outside welds of jacket shall be smooth. All weld areas and deposited weld metal shall be substantially as corrosion resistant as the parent metal.

The inside radii of all welded or permanent attachments shall be not less than ¼ inch.

2. *Construction:* The tank shall be constructed so that it will not sag, buckle, or prevent complete drainage.

Where the inside head and partition walls join the lining of the tank the radius shall be not less than ¾ inch.

Longitudinal welds in the drainage line shall be so located as to not interfere with drainage.

The construction of the tank shall be such that complete drainage with water will be obtained with a pitch at the bottom of the tank of not greater than one inch in 100 inches.

3. *Attachments:* Attachments which are removable and which are taken out for the purpose of washing shall conform with 3A Sanitary Standards for Fittings.

C. Size of Tank

The height of the vertical axes of the inner shell of the tank shall be not less than the minimum heights shown in the following tables:

Tanks Having Uniform Vertical Axes

			Up	to	and	including		500 gal.	–36″
Over	500	gal.	and	″	″	″	″	2,000	″ –40″
″	2,000	″	″	″	″	″	″	2,800	″ –42″
″	2,800	″	″	″	″	″	″	3,500	″ –44″
″	3,500	″	.....						″ –46″

Tanks Having Varying Vertical Axes

									Front Min.	*Rear Min.*
			Up	to	and	including		500 gal.	–36″	36″
Over	500	gal.	and	″	″	″	″	2,000	″ –40″	40″
″	2,000	″	″	″	″	″	″	2,800	″ –41″	51½″
″	2,800	″	″	″	″	″	″	3,500	″ –43¼″	55½″
″	3,500	″	.....						″ –43¼″	57½″

D. Openings

1. *Outlet:* The outlet shall be of the flange type, stainless steel, located to provide complete drainage of the tank or compartment thereof. The minimum diameter shall be 2″.

2. *Outlet Valve:* The outlet valve shall be of the compression type, close coupled, of dairy metal, stainless steel, nickel alloy, or a material substantially as corrosion-resistant, that is non-toxic and non-absorbent. The valve body shall be so designed that it can be mounted on the tank with either single service or block tin gaskets. If a block tin gasket is used, it should be scraped in and smoothed off after the valve body is drawn up tightly in its permanent and fixed position.

Public Health Reason: Close coupling valve avoids the formation of a pocket of milk in which bacterial growth may occur. Interchangeability of gaskets permits the removal of the valve body for cleaning.

3. *Outlet Valve Dust Cover:* The entire valve assembly shall be suitably encased in a metal cover which shall be dustproof and tamperproof by means of sealing facilities.

Interior finish of cover shall be smooth.

4. *Manhole Assembly:* Manhole shall be a minimum 15″ x 20″ oval or minimum 18″ in diameter, with 18–8 stainless steel ring, 18–8 stainless steel cover and incorporating welded-in fittings.

Manhole cover attached thereto shall be #4 mill finish inside and out.

Manhole cover gasket shall be of sanitary construction, removable, and easily reversible for cleaning.

Manholes shall be so located that in no case shall either end of the tank be more than 15 feet from a manhole opening.

5. *Vent Opening:* Air vent opening shall not be less than 1½" diameter, and, if not located under the dust cover, shall have a separate cover which shall conform to the standards for the dust cover.

6. *Fill Connection:* A fill connection with sanitary cap shall be provided.

7. *Manhole Dust Cover:* Smooth rubber gasket shall form seal between dust cover and deck plate and shall be removable. Locking device on dust cover shall be designed to provide tight seal against gasket. Deck plate shall be aluminum in the case of aluminum jacketed tanks and stainless steel in the case of steel jacketed tanks. Deck plate shall form an integral part of the insulation cover, and shall be continuously welded to same and shall be self-draining. Dust cover shall have suitable provisions for the use of a sealing device to prevent tampering.

E. Agitators

When specified, tank or each compartment thereof shall be equipped with a built-in agitator having a removable shaft and blade. Agitator shaft and blades shall be of stainless steel and of sufficient size and speed so as to provide adequate agitation of product. (Adequate agitation for whole milk is that degree of agitation which will result in not more than ±0.1 percent variation in fat content in fluid milk after 20 minutes agitation of milk stored 24 hours at 40° F.)

Agitators shall be equipped with a rotary seal and packless bearing.

Public Health Reason: It is desirable that agitators, when furnished, shall be of a design which lends itself to daily cleaning. Agitator shaft at point of entry into tank shall be protected from external contamination.

1. *Alternate Agitation:* Compressed air may be used, in which event the air is filtered through single service filters from which position it is conveyed to the milk in sanitary pipe and fittings. Air should be applied in such manner as would prevent the backing-up of milk to the air filter.

Where air compressors are made part of the truck and tank structure, such compressors must be equipped with an air filter both on the suction and discharge sides.

F. Access to Top of Tank

If the manhole is on top of tank, the tank shall be provided with a ladder on each side.

C. A. ABELE,
Chairman—CSP of IAMFS
A. W. FUCHS,
In Charge—MF-USPHS
E. H. PARFITT,
Chairman—SSS-DIC

Sanitizing of Milking Machines

(Continued from page 18)

3. Ensign, Paul R. and Hunter, Charles A. An Epidemic of Diarrhea in the Newborn Nursery Caused by a Milk-Borne Epidemic in the Community. *J. Pediatrics,* **29,** 620–628 (1946).

4. Fincher, M. G. College of Veterinary Medicine, Ithaca, New York. Private communication. June 1949.

5. Jensen, J. M. Farm Daily Utensils Washed Effectively by New Methods. *Mich. Agric. Exp. Sta. Quat. Bul.* **26,** No. 4, May 1944.

6. Parfitt, E. H. A Study of Methods for Cleaning Milking Machines. *Purdue Univ. Agric. Exp. Sta. Bul. 348,* 1931.

7. Parfitt, E. H. Bacteriological Studies on the Cleaning of Milking Machines. *Ibid. Bul. 449,* 1940.

8. Reed, O. E. Report of the Chief of the Bureau of Dairy Industry, Agricultural Research Administration, United States Department of Agriculture, 1948.

9. Rudnick, A. W. (as reported by C. R. Elder). Presto! Now It's a Two-Minute Job. *Successful Farming,* p. 25, March 1943.

SANITARY STANDARDS FOR ELECTRIC MOTORS AND MOTOR ATTACHMENTS

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
As of October 19, 1949

IT is the purpose of the IAMFS, USPHS, and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Electric motor specifications which are developed and which so differ in design, material, construction or otherwise, as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent, or better, may be submitted at any time for the consideration of IAMFS, USPHS, and DIC.

3A Sanitary Standards for Electric Motors and Motor Attachments

These standards are to apply to motors not otherwise enclosed, for use in connection with milk and food processing equipment when prescribed in 3A Sanitary Standards for such equipment.

These motor standards are intended to apply to motors as made available for new equipment, and are not intended to apply to motors to replace serviceable ones now in use.

Public Health Reason—Motors of a sanitary design, which can be mounted in a sanitary manner on food and milk processing equipment, and which are enclosed in a manner that will prevent the entrance of roaches and other insects and the escape of oil or grease, can be maintained more easily in a clean and sanitary condition.

A. Electrical and Mechanical Design

1. These standards shall apply to horizontal and vertical, two-bearing motors and gearmotors in fractional and integral horsepower sizes, which shall conform to the National Electrical Manufacturers Association (NEMA) Motor and Generator Standards which are applicable.

2. Motors of ratings up to and including the following shall be in totally enclosed non-ventilated frames:

Rpm (Syn.)	3600	1800	1200
Polyphase—HP	2	2	1½
Single-phase—HP	1½	1	¾

Motors having ratings higher than the above may be (a) totally enclosed non-ventilated, (b) splashproof, or (c) totally enclosed fan-cooled. Where splashproof or totally enclosed fan-cooled motors are used, screens shall cover all openings.

3. Temperature rise shall be in accordance with NEMA Standards, as follows:

Totally enclosed non-ventilated motors: 55° C. rise, continuous duty.

Totally enclosed fan-cooled motors: 55° C. rise, continuous duty.

Splashproof motors: 50° C. rise, continuous duty.

4. *Insulation:* All motors shall be provided with high moisture-resisting insulation such as is commonly used in motors subjected to high humidity conditions.

5. *Thermostats:* Thermostats may be mounted inside motors, as an optional item, where it is desired to prevent a condition of overheating from stoppage of ventilation or other causes.

B. Sanitary Design

1. *Frame:* The frame shall have a smooth external surface without fins, pockets, crevices or sharp corners. A radius of 1/8", or larger, shall be provided at all inside corners on external surfaces having angles less than 135 degrees.

All ventilating openings shall be designed for the use of removable screens of the same construction as specified under subsection 6 of this section.

Terminal leads of all motors where they pass through the motor frame into the conduit terminal box, shall be sealed with a suitable compound which will prevent the entrance of roaches or other insects.

If drainage holes are provided, they shall be screened as described in subsection 6 of this section, or equipped with porous plugs or similar suitable devices.

External surfaces of the motors shall be self-draining for any position of mounting.

2. Foot or base-mounted motors may be of four types:

a. Flat-bottom base which has a continuous contact surface for mounting on a continuous flat surface.

b. Base with a continuous contact surface at outside edges for mounting on a continuous flat surface.

c. Foot-mounted motor without pockets or connecting webs with individual feet in same plane.

Note: A necessary cleaning space required under the motor housing shall be provided by whoever mounts the motor (3/4" minimum required).

d. Foot-mounted motor with connecting webs between feet forming cavities under the frame.

Note: A necessary space required under the motor housing to provide inspection and cleaning shall be provided by whoever mounts the motor (4" minimum required).

3. *End Shields and Attached Gear Housing:* End shields, gear housings and other motor attachments and accessories, shall have a smooth exterior surface without fins, pockets, crevices, or sharp corners. A space of less than 3/4" in the assembly shall be filled with a suitable non-shrinking, non-softening compound. A radius of 1/8", or larger, shall be provided at all inside corners on external surfaces having angles less than 135 degrees. If holes are required for plugs, gauges, etc., or for cap screws or through bolts securing end shields, raised bosses shall be provided. Convex or sloping surfaces shall be provided to avoid the accumulation of dirt or liquid matter when mounted in either the horizontal or vertical position.

4. *Vents:* Vents in the gear housings, or where otherwise provided, shall be of the normally closed type, opening only when air in the gear casing expands. Such vents shall prevent entrance of water or liquid into the gear case.

5. *Ventilating Openings:* Ventilating openings in end shields, gear housings, etc., shall be effectively screened against the entrance of roaches and other insects.

6. *Screens:* Screens shall be constructed of corrosion-resistant perforated metal with openings not over 3/32" in diameter or slots not over 3/32" wide. They shall be located and mounted so as to be readily removable for cleaning. The screens shall be tight fitting.

7. *Screws, Nuts, Bolts and Studs:* Cap screws used to fasten end shields, gear covers, screens, etc., to motor frames shall be hexagonal head type. Washers are permitted where necessary for mechanical reasons, or as an aid in eliminating open cracks. If studs or through bolts are used, crown nuts covering all threads shall be used. (Slotted, countersunk, or socket head cap screws or set screws are not acceptable.)

8. *Bearings and Bearing Seals:* The bearings shall be designed to effectively prevent leakage of oil or grease to the exterior. Seals shall be provided to close shaft openings in end shields or gear cases. Such seals shall be designed to effectively prevent leakage of oil or grease during ordinary operations.

9. *Material and Finish:* Exteriors shall be of corrosion-resistant material or shall be rendered corrosion-resistant by plating or by baked or air dried lacquer or enamel. Chrome plate shall be used only on castings of brass or bronze.

C. Fittings and Accessories

1. *Fittings:* All fittings, plugs, screws, nuts, caps, washers, and gauges (provided to facilitate inspection, lubrication and cleaning of bearings and housings) shall have corrosion-resistant surfaces and shall have no exposed threads when installed. Plugs shall be fitted tightly against shoulders. (Grease cups of the screw down pressure type are not acceptable.)

2. *Conduit Terminal Boxes:* Conduit terminal boxes, if used, shall have smooth external surfaces, shall be of such shape as to permit easy cleaning, and shall have no concave or flat horizontal surfaces which might permit accumulation of liquid or dirt.

Conduit terminal boxes shall either (1) fit tightly against the motor frame so that no open crack or crevice is formed, or (2) shall be mounted so that the back of the box shall be not less than 1/4" from the motor frame at any point to permit cleaning behind the box. The nipple or spacer between the terminal box and frame, shall have no exposed threads.

D. Nameplates

Motors shall bear a nameplate of corrosion-resistant material with nameplate data called for by the NEMA Motor and Generator Standards. Nameplate data shall be permanently readable. The nameplate shall fit the frame and be attached to eliminate cracks and crevices.

C. A. ABELE,
Chairman–CSP of IAMFS
A. W. FUCHS,
In Charge–MF-USPHS
E. H. PARFITT,
Chairman–SSS-DIC
H. S. FIELDER,
Chairman–TC*-DISA

* Technical Committee, Dairy Industries Supply Association.

Type "O" Foot-and-Mouth Virus Identified in Mexican Outbreak

The recent outbreak of active infection of foot-and-mouth disease in Chicoloapan, State of Mexico, reported on October 24, was caused by a virus type which had not been present before in the current Mexican plague. The infection since 1946 had been entirely from the foot-and-mouth disease virus Type "A". The new outbreak was caused by Type "O" virus.

Immunity built up in susceptible animals against infection from Type "A" virus is not effective against exposure to Type "O". In the event Type "O" should become widespread in Mexico, it probably would be necessary to provide a bivalent vaccine—one that would develop a resistance to both types of virus.

There are three types of foot-and-mouth disease virus known. Types "A" and "O" are the ones most frequently present in European outbreaks of the disease. Type "C" occurs frequently in Mediterranean areas, and all three types are present in South America.

Investigations are continuing in an attempt to discover the source of Type "O" virus in Mexico.

SANITARY STANDARDS FOR SEAMLESS AND WELDED TIN-COATED CAN-TYPE MILK STRAINERS

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
As of October 19, 1949

IT is the purpose of the IAMFS, USPHS, and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Seamless and welded tin-coated can-type milk strainers which are developed and which so differ in design, material, construction, or otherwise, so as not to conform with the following standards, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of IAMFS, USPHS, and DIC.

Strainers shall be sized and designed for use with single service straining material of not less than 6½" diameter or if square, 6½" on each edge, and shall be so made as to insure all milk passing through the straining material. Wire gauze type strainers are not acceptable.

A. Materials

The strainer shall be constructed of mild open hearth steel (24-gauge minimum for 14-quart or larger; 26-gauge minimum for smaller sizes). The tin shall be of commercially pure quality for application by the hot dipping method.

B. Construction

1. The seat (ring) or area, of the strainer which holds the straining material in place shall be sufficiently rigid to resist denting.

2. Perforated or slotted disks in the bottom of the strainer are acceptable. Wire grids are not acceptable.

3. The smallest diameter of all holes in the grid shall be $^3/_{16}$". The smallest width of slots shall be ⅛". Burrs shall be removed from all holes and slots before tinning. No holes or slots in bottoms shall be within ½" of outer edge.

4. Domes or baffle plates shall be provided, shall have smooth contours to permit ease in cleaning and shall be so constructed as to prevent milk from directly hitting the straining material while being poured.

5. No two plates in a strainer, which are soldered or fixed in place, shall be closer together than 4".

6. Handles on strainer are not acceptable. (Hole for hanging permissible.)

7. The handle on the dome shall be welded in place and shall be sufficiently high to facilitate thorough cleaning. Minimum clearance between handle and dome shall be 1½".

8. With the exception of "working corners", where sharp radii are required to eliminate by-passing of milk, all other radii shall be sufficiently large to facilitate easy cleaning.

9. Strainers shall be completely and smoothly tinned by the hot dipping method, after all fabrication has been completed. Tinning must produce a commercially smooth, plane, and even surface.

C. A. ABELE,
Chairman—CSP of IAMFS
A. W. FUCHS,
In Charge—MF-USPHS
E. H. PARFITT,
Chairman—SSS-DIC

Conference on Polluted Waters

On January 27, 1950, there will be held in El Paso, Texas, a conference on polluted irrigation waters. This meeting is being sponsored jointly by the Environmental Health Study Section, National Institutes of Health, Public Health Service, Federal Security Agency; the El Paso Texas Health Department, and the Texas State Health Department.

The program will be devoted to discussions of general problems on irrigation waters in several western and southwestern states. current research relative to the incidence and behavior of pathogenic organisms in irrigation waters, vegetable washings, and soils; discussion of epidemiological aspects of sewage polluted irrigation waters; in addition, papers will be presented on the utilization of waste water; impounding and use of water of the Rio Grande; machines for vegetable washing; present standards for irrigation water; and use of sewage sludges for soil improvement.

All persons interested in this phase of environmental health are cordially invited to attend the meeting. Copies of the program will be sent at a later date, upon request.

Inquiries should be addressed to:

MR. IRVING GERRING, *Executive Secretary*
Environmental Health Study Section
Division of Research Grants and Fellowships
National Institute of Health
Bethesda 14, Maryland

Washington State Institute of Dairying

The Nineteenth Annual Institute of Dairying will be held at Pullman, Washington, March 6–11, 1950. Special sessions for producers and fieldmen, for milk inspectors, general sanitarians, milk processors, and manufacturers of ice cream, butter, cheese, and concentrated milk products. Nationally known guest speakers. Dairy products judging and scoring contests open to the world. Excellent prizes and diplomas. For further information write Professor H. A. Bendixen, Department of Dairy Husbandry, State College of Washington, Pullman, Washington.

Pincus Resumes Consulting Practice

Sol Pincus announces the resumption of his practice as consultant sanitary engineer after six months in Europe, during which he served the World Health Organization as consultant on sanitary problems of various countries, and helped set up its Section of Environmental Sanitation. His address is 11 Park Place, New York 7, N. Y.

REPORT OF THE COMMITTEE ON FOOD HANDLING EQUIPMENT, 1949 *

THE activities of your committee on F.H.E. during the past year has had no direct influence on the improvement in the sanitary design of equipment used in the food industries and on the sanitary quality of the products processed therein. Although tangible progress is not in evidence, significant progress has been made.

This Association is warranted in being proud that it has had the *vision* to see the need for uniform requirements in the sanitary design of food handling equipment and the *modesty* to realize that this goal could not be reached without the spirit and performance of collaboration with others desiring to reach the same goal.

Because similar thinking had not been crystallized in other national sanitation-minded groups to the point where they had formed comparable committees, we called upon our President and Executive Committee to extend to such groups our desire to explore with them the merits of such a program and the means of making it successful. The credit for the progress which has been made (the first step is good assurance that others will be taken) should be given to our President and Executive Board. Mr. Fuchs was instrumental in arranging for a meeting of minds around a conference table last June.

The two Co-Chairmen represented the Committee on Food Handling Equipment at this meeting held at Ann Arbor, Michigan, on June 15. Messrs. Fuchs, Shrader and Tiedeman also represented our Association. The purpose of the meeting was to explore the possibilities of organizing a coordinated program of all parties and organizations interested in securing improvements in the sanitary design and construction of food handling equipment.

This exploratory meeting was highly successful as reported by the National Sanitation Foundation in its *Sanitation News,* Vol. 4, No. 1, July 1949.

"SET STANDARDS FOR EQUIPMENT"

"A committee comprised of a cross section of representatives from all the official organizations in the field of sanitation has been formed to establish standards on food equipment.

"The committee will act as a subcommittee of the National Sanitation Clinic and the Sanitation Council of the National Sanitation Foundation.

"Groups which participated in organization of the new committee were: the Engineering Section of the American Public Health Association; United States Public Health Service; International Association of Milk and Food Sanitarians; National Association of Sanitarians; Conference of Municipal Public Health Engineers; and Conference of State Sanitary Engineers.

"The committee plans to meet the industry representatives in the near future. Standards set by the committee will be used by the Foundation in its testing laboratory."

With the organizational phase of this program well established, it is hoped that some constructive work will be started in the near future.

C. W. WEBER, *Co-Chairman*
C. A. ABELE, *Co-Chairman*
PAUL DEKONIG
LEWIS DODSON
F. H. DOWNS, JR.
JOHN FAULKNER
W. A. MACLINN
JEROME TRICHTER

* Presented at the Thirty-Six Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK & FOOD SANITARIANS, INC., Columbus, Ohio, October 20–22, 1949.

THE OCCURRENCE OF *PROTEUS* SPP. IN RAW AND PASTEURIZED MILK

ARNOLD J. ZARETT, D.V.M., RAYMOND N. DOETSCH, PH.D., AND P. ARNE HANSEN, PH.D.

Department of Bacteriology, University of Maryland, College Park, Maryland

MANY investigators in the past have isolated members of the *Proteus* group in feces of humans and animals. Recent investigations include those of Cope and Kilander (1) who isolated *Proteus rettgeri* from the feces of 83 adults with proven or suspected enteric diseases; Rustigian and Stuart (2) found *Proteus* spp. in 36.3 percent of 110 normal fecal specimens; Neter (3) recovered *Proteus* spp. from 40 percent of the fecal samples of 50 healthy infants; and Craige (4) isolated *Proteus* spp. in the feces of many dogs with enteric disorders.

In a general survey of the occurrence of *Proteus* spp. in nature, Levine (5) noted that these organisms were rarely or never isolated from the following: throats of normal individuals, or from air, soil, dust, fresh water ponds, insects, or cannery wastes. On the other hand, the recovery from packing house waste and the feces of white mice and white rats was frequent.

In spite of the acceptance of *Proteus* as an intestinal habitant, little work has been done on its occurrence in milk. In those instances where investigations were carried on, however, it was found that the recovery of *Proteus* from milk was of sanitary significance. Groot (6) concluded that only slovenly handled pasteurized milk contained organisms of this genus. Maccolini (7) stated that *Proteus* occurred in raw milk only when the udder or the hands of the milker were improperly cleansed.

Since these two investigations on milk were carried out, however, the description and the classification of the genus has undergone a considerable change. The group, as it is recognized today, consists of four species (8). Each of these is capable of attacking urea rapidly, with the resultant formation of ammonia. Many organisms which were previously classified as *Proteus* were eliminated from the group on the basis of inability to attack urea. On the other hand, new species were added to the genus due to the possession of this characteristic as well as the other genus prerequisites. Considering, then, the alteration in the description, as well as the members of the genus *Proteus,* a re-investigation of the occurrence of these organisms in milk was considered desirable.

For the quantitative detection of *Proteus* in milk, it was necessary to develop a selective pour plate medium for this genus. Investigations by two of the authors have resulted in such a medium (9). The preparation, urea-ricinoleate agar, was found to give approximately 100 percent recovery of *Proteus* spp. Tests performed upon 19 organisms commonly found in milk resulted in the growth of only 3 in urea-ricinoleate agar. These were *Pseudomonas aeruginosa, Aerobacter aerogenes,* and *Escherichia coli.* Further experimentation with mixed cultures indicated that the presence of a vastly superior number of *Escherichia coli* did not interfere with the complete recovery of *Proteus* spp.

The sole change in the medium as it was originally described (9) has been the addition of crystal violet at a final dilution of 4 x 10.$^{-5}$ Sterilization of urea-ricinoleate agar was also found to be unnecessary due to its inhibitory properties.

METHODS

Twenty samples of raw milk and 20 samples of pasteurized milk were examined for the presence of *Proteus* organisms. The raw milk was obtained from 10 different farms as shipments arrived at the pasteurizing plant of the University of Maryland dairy. Each can of pooled milk was stirred, and samples were collected asceptically in sterile bottles.

The pasteurized milk of 5 different processors was obtained at commercial establishments in College Park, Maryland. These samples of milk represented three different methods of processing: pasteurization with no other treatment; pasteurization and homogenization; pasteurization, homogenization, and ultra-violet radiation.

All milk samples were refrigerated until tested. Refrigeration never exceeded one hour. The raw milk was tested at dilutions of 1, 10^{-1} and 10^{-2} in urea-ricinoleate agar and violet-red bile agar (Difco). The pasteurized milk was tested at dilutions of 1 and 10^{-1} in the same media. In addition, 0.1 ml. of each sample was pipetted onto S.S. agar (Difco) and streaked. All plates were inoculated in triplicate. The violet-red bile agar plates were incubated for 18 hours, S.S. agar plates for 24 hours, and urea-ricinoleate agar plates for 36 hours at 37 C.

Violet-red bile agar was used to correlate the occurrence of coliform organisms with *Proteus* in milk. S.S. agar, on the other hand, was used to confirm the finding of *Proteus* in urea-ricinoleate agar, the former medium having been found to be very efficient in the recovery of *Proteus* (10).

The occurrence of concentrically ringed red colonies in urea-ricinoleate agar was considered presumptive evidence for *Proteus* spp. This was confirmed by picking representative non-lactose fermenting colonies from S.S. agar plates and inoculating into nutrient broth tubes. After incubating for 24 hours at 37 C., a loopful from each tube was streaked on nutrient agar slants and incubated for 24 hours at 37 C. Gram stains were made, and 0.5 ml. of urease test medium (BBL) was inoculated heavily from each agar slant. The presence of *Proteus* was confirmed by the production of ammonia within 7 hours by a Gram-negative organism.

RESULTS

Of the 40 milk samples examined, only one was positive for *Proteus*. This was raw milk sample (3A), in which *Proteus* was found in as high as the 10^{-1} dilution. On the other hand, 19 samples of raw milk and 9 samples of pasteurized milk contained coliform organisms. The results are tabulated in Table 1.

DISCUSSION AND CONCLUSIONS

Based on the findings of many investigations that *Proteus* organisms are primarily of fecal origin, it is apparent that milk sample (3A) was contaminated with human or animal excreta. As indicated by Groot (5) and Maccolini (7), such milk was probably improperly handled.

It is questionable, however, whether *Proteus* can be used as the sole index for fecal contamination of milk. Neter (3) found *Proteus* in only 40 percent of 50 samples of normal human (infant) feces examined. This was the highest recovery from human feces reported by any investigator in recent years. Assuming that this figure applies to all human feces, less than half of the milk contaminated with feces would be positive for *Proteus*. Furthermore, the method used for the determination of these organisms in excreta has been by streaking on selective agar plates, usually after preliminary enrichment. Since direct counts have never been made for *Proteus* in feces, the concentration per gram in *Proteus*-positive feces is not known. Should this concentration be low, it would be necessary, perhaps, to examine several milli-

TABLE 1

THE RECOVERY OF PROTEUS AND COLIFORM ORGANISMS FROM RAW AND PASTEURIZED MILK IN VARIOUS TEST MEDIA

Sample	Medium: *Violet red bile agar for coliform organisms* Dilution			*Urea-ricinoleate agar for Proteus* Dilution			*S. S. agar for Proteus*
	1 ml	10^{-1}	10^{-2}	1 ml	10^{-1}	10^{-2}	10^{-1} ml
Raw Milk							
1A	+	+	+	O	O	O	O
2A	+	+	+	O	O	O	O
3A	+	+	O	+	+	O	+
1B	+	+	O	O	O	O	O
2B	+	+	O	O	O	O	O
3B	O	O	O	O	O	O	O
1C	+	+	O	O	O	O	O
2C	+	+	O	O	O	O	O
3C	+	O	O	O	O	O	O
1D	+	+	O	O	O	O	O
2D	+	+	O	O	O	O	O
3D	+	O	O	O	O	O	O
1E	+	+	O	O	O	O	O
2E	+	O	O	O	O	O	O
3E	+	+	O	O	O	O	O
F	+	O	O	O	O	O	O
G	+	+	O	O	O	O	O
H	+	+	+	O	O	O	O
K	+	+	+	O	O	O	O
L	+	O	O	O	O	O	O
Pasteurized Milk							
1M*	O	O		O	O		O
2M	O	O		O	O		O
3M	+	O		O	O		O
4M	O	O		O	O		O
1N**	+	O		O	O		O
2N	+	O		O	O		O
3N	+	+		O	O		O
4N	O	O		O	O		O
1P**	O	O		O	O		O
2P	O	O		O	O		O
3P	+	O		O	O		O
4P	+	+		O	O		O
1R*	+	+		O	O		O
2R	+	+		O	O		O
3R	O	O		O	O		O
4R	O	O		O	O		O
1S	+	+		O	O		O
2S	O	O		O	O		O
3S	O	O		O	O		O
4S	O	O		O	O		O

+—positive
O—negative
* homogenized
** homogenized—Vitamin D

liters of a sample of milk in order to find a plate positive for *Proteus*. It can be stated, then, that any milk sample positive for *Proteus* has probably been polluted with human or animal feces. Conversely, the absence of *Proteus* does not necessarily indicate uncontaminated milk.

The use of *Proteus* spp. as an index of fecal pollution in milk is appropriate from one point of view: each member of the genus is primarily of fecal origin. Species differentiation, therefore, is unnecessary; each species is of sanitary significance. From this consideration, a *Proteus* index is more efficient than a coliform index for fecal pollution. The media recommended for the counting of coliform organisms in milk (11) do not differentiate between *Escherichia coli* and *Aerobacter aerogenes*. Although the latter organism occurs in feces occasionally, it is predominantly of soil and vegetation origin; thus, its occurrence in milk should be of little sanitary significance. This necessitates the performance of various biochemical tests to determine which of the coliform organisms are present in order to ascertain fecal contamination. The use of *Proteus* organisms as a sanitary index would present no such difficulty. By means of urea-ricinoleate agar, 100 percent recovery of *Proteus* is obtained, and the characteristic colonies produced necessitate no further biochemical tests.

SUMMARY

Forty samples of raw and pasteurized milk were examined for the presence of *Proteus* by plating in urea-ricinoleate agar. One sample of raw milk was positive for *Proteus*.

The merits of *Proteus* as an indication of fecal contamination in milk are discussed.

REFERENCES

1. Cope, E. J., and Kilander, K. Study of the Atypical Enteric Organisms of the Shigella Group. *Amer. J. Pub. Health*, **32**, 352–354 (1942).

2. Rustigian, R., and Stuart, C. A. The Biochemical and Serological Relationships of the Organisms of the Genus *Proteus*. *J. Bact.*, **49**, 419–436 (1945).

3. Neter, E. R. Paracolon and *Proteus* bacilli in the Feces of Healthy Infants. *J. Pediatrics*, **26**, 390–394 (1945).

4. Craige, John E. *Proteus* Group Organisms Infecting Dogs. *J. Am. Vet. Med. Assoc.*, **113**, 154–156 (1948).

5. Levine, Milton. An Ecological Study of *Proteus*. *J. Bact.* **43**, 33–34 (1942).

6. Groot, K. P. Recherches sur le *Bacterium (Proteus) Anindologenes*. *Ann. Inst. Pasteur*, **32**, 299–309 (1918).

7. Maccolini, R. Le frequenza ed il significata del *Proteobacillo* nel latte. *Ann. Igiene*, **49**, 501–522 (1939).

8. Breed, R. S., Murray, E. G. D., Hitchens, A. P. *Bergey's Manual of Determinative Bacteriology*, 6th ed. (1948), Williams & Wilkins Company, Baltimore, Maryland.

9. Zarett, A. J. and Doetsch, R. N. A New Selective Medium for the Quantitative Determination of Members of the Genus *Proteus* in Milk. *J. Bact.* **57**, 266 (1949).

10. Neter, E. R. and Clark, P. The Isolation of *Proteus morganii* Type I and Paracolon Bacilli from Selective Culture Media. *J. Bact.* **47**, 459 (1944).

11. *Standard Methods for the Examination of Dairy Products*. 9th ed. (1948). American Public Health Association, New York, N. Y.

Dried Milks

The U. S. Department of Agriculture has just issued a revision of its mimeographed information sheet on Dried Milks. In 12 pages, useful data is presented on statistics of production, manufacturing processes, packaging methods, keeping quality, costs of processing, uses, redispersing, definitions and standards, literature, manufacturers of milk driers, and manufacturers of dried milks. Copies may be obtained by writing to the Bureau of Dairy Industry, Agricultural Research Administration, Washington 25, D. C.

SANITARY PROBLEMS IN THE PROCESSING AND DISTRIBUTION OF FROZEN FOODS

CLIFFORD F. EVERS

Fishery Technological Laboratory, College Park, Maryland

BEFORE discussing the sanitary problems in the processing and distribution of frozen foods, it might be well to review briefly the history of the frozen food industry. The freezing of foods as a means of preservation is not new. At least in real northern climates it is probably as old as man. However, the frozen food industry is comparatively recent in origin.

DEVELOPMENT OF THE INDUSTRY

Fish was first frozen commercially about 1865, however it was not until 1922 that packaged haddock fillets were frozen for the retail market. The slow freezing of poultry also came into use about 1865; followed by meat about 1880 and small fruits for remanufacture about 1905.

The commercial quick freezing of vegetables and fruits for the retail market started about 1929. Frozen foods, packaged in consumer size cartons, constitutes the largest portion of the quick freezing industry as it exists today.

In the early days of the industry, little consideration was given to the quality of the food being frozen or to the methods of preparation, processing and freezing, or to distribution. Hence it is easy to understand why the general public considered frozen foods to be products of inferior quality.

There was many a sad consumer experience with poor quality "cold storage" merchandise that had been frozen not as quality products, but only to remove fresh produce of questionable quality from an already glutted market.

Starting about the middle twenties, certain fishery companies began to be very careful of the quality of the fish selected for freezing and the sanitary conditions under which the product was packed. This was a most important step, but the public was still skeptical and was slow to accept these products. Later on, the term "frosted" was coined and this probably was to get away from the stigma attached to "cold storage goods." At the same time, more careful attention was being given to the selection, handling, preparation, freezing, storage, and marketing of "frosted foods" and the products began to sell.

The industry had a slow beginning during the years of the depression, and it was 1939 before any rapid expansion took place. Starting about 1943, and for the four years following, the frozen foods industry made about as much progress in the number of freezing plants built and the variety of products frozen as formerly would have taken place in a period of ten years. The war years gave impetus to this mushroom growth.

Today the quantity of food frozen commercially exceeds 2,000,000,000 pounds. This figure excludes ice cream, which would bring the total to nearly 5,000,000,000 pounds.

DEVELOPMENTAL PROBLEMS

The circumstances attending the recent rapid growth gave rise to serious additional problems for the industry as a whole. People entered the field lacking technical training and experience. Labor was difficult to secure, and to

Presented at the Conference for Dairy and Food Technologists and Sanitarians, University of Illinois, Galesburg, Illinois, March 15–17, 1949.

keep throughout an entire packing season, and the high cost of raw products led many processors into the practice of packaging poor quality merchandise. The result was consumer complaints and a setback to the industry.

The industry has been slowly crawling out from under the burden of an over-stocked quantity of unsatisfactory merchandise. A number of "get-rich-quick" companies have fallen by the wayside. At present, the industry appears to be established once more, and should continue to expand. However, unless all those in the industry take the necessary precautions to pack under sanitary conditions and are careful of the quality of frozen foods that they offer, the reputation of the industry as a whole will suffer, and the demand for the products will fall off again. Continued success will depend upon the ability of the packers to produce and market frosted foods substantially the equivalent of the better grades of fresh foods. Frosted foods compete more directly with fresh foods than with canned foods, and if the quality of frosted foods is not maintained, the customers will again turn to fresh foods.

Freezing does not improve the appearance or flavor of any product whether fish, meat, poultry, fruit, or vegetable. To produce frozen foods of high quality requires technical direction and control through each step of the process from the planting of vegetables, breeding of chicks and the like to the processing, packaging, freezing, warehousing, and retailing of the finished frozen product.

Sanitary Requirements

All of these problems may be classified under one or both of the general headings of Sanitation and Quality Control. The technical problems confronted in freezing and packaging may differ with each type of product, but in general the practices recommended will form the nucleus of quality packing procedure.

Sanitation may be defined as the adoption or carrying out of hygienic measures designed to protect or to secure health. Proper sanitation is not only good economy, but also is of primary importance in producing a high quality product.

Federal law requires frozen food packers to give careful attention to all aspects of sanitation. The Food, Drug, and Cosmetic Act of 1938 under Section 402 (a) (3) states that a food shall be considered to be adulterated "if it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it is otherwise unfit for food." Section 402 (a) (4) hold special significance for processors since it rules that any food may be deemed to be adulterated "if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health." Foods which are adulterated within the meaning of the sections quoted are subject to seizure if shipped in interstate commerce.

On this basis, modern plant sanitation is no longer simply a matter of good housekeeping, but requires the practice of combining general cleanliness and tidiness with adequate technical control of micro-organisms and infestation. In nearly every condemnation of a food plant considered to be insanitary, emphasis has been placed upon one or more of the following: (1) the presence of rats and/or mice; (2) the presence of flies and/or other insects; (3) filthy toilets; (4) polluted water; (5) decomposed or insect infested raw materials; (6) improper or insufficient cleaning of equipment; (7) improper disposal of waste materials; and (8) unhygienic personal habits of employees.

The dairy industry has been most progressive in outlining and studying the many sanitary problems connected with their particular field of the food industry.

Likewise, much credit must be given to The National Canners Association for fostering and promoting sanitation in their industry. As early as 1913, they appointed a Committee on Sanitation which recommended a set of sanitary requirements for canneries. In 1923, they adopted a most comprehensive Sanitary Code and during the past 10 years they have issued a series of publications on sanitation.

It is regrettable that the frozen food industry has not been as active in establishing similar regulations.

Personnel Training

One of the basic points underlying sanitary problems in the processing and distribution of frozen foods is the lack of education on the part of producer and distributor. Starting at the top of the ladder it is most difficult to convince management of the need of sanitary measures and of the adherence to a sanitary code. Management often considers sanitary maintenance as an unnecessary cost, or at least many of them seem to begrudge the money that might be spent to improve sanitary conditions, especially so in regard to the everyday cost of a good "clean up" crew. Practical sanitarians do not ask for a tile-walled palace, for one can keep even a barn in a tidy condition. Likewise the good old-fashioned mop, if properly used, is just as effective as the more modern cleaning devices. Hence to a considerable degree, the cost of maintaining a sanitary food plant can be simple or elaborate, depending on the assets of the company and within those limits it is almost a guarantee of repeat sales and profits. In addition there is always the personal satisfaction of one knowing that he has done a good job.

Plant superintendents and other supervisory personnel have a tendency to be over cost conscious and attempt to cut corners in every way possible. True it is part of their job to keep operating costs at a minimum but it is no longer good economy when food is packed under insanitary conditions resulting in consumer complaints and possibly even seizure by the Food and Drug Administration. Condemnation procedures can be mighty costly legal problems.

Getting down to the working clean-up crew itself, there is always the tendency to assign old, decrepit, and otherwise poor labor to these jobs. A good clean-up crew requires the service of strong able-bodied men, as theirs is a tough assignment. These men should be given a thorough "on the job" training program and should be made to realize their responsibility. They must have pride in their work and be taught that their job is not menial but very essential to the production of a high quality product. When they do this well they should be complimented on their efforts, and when otherwise, they should be told wherein they failed and be taught how to do a good job.

The clean-up crew foreman should be above the average in intelligence for supervisory personnel. Unless the plant is a large one he need not be a graduate sanitarian, but he should be well versed in sanitary techniques, including its various ramifications. In these same small plants it is anticipated that there is a food technologist or plant sanitarian who has full knowledge of the underlying principles of sanitation and a knowledge of microbiology and bacteriological technique through which one can locate the hidden danger spots of possible contamination.

Distribution

Education is also needed on the part of the distributor of frozen foods. It might be reasoned that sanitary problems here seem to fall more in the category of quality control but the two are so closely related, each influencing the other, that it is usually impossible to draw a line of demarcation between the two.

Distribution starts with the time the frozen product leaves the packers' hands

and ends when the same package is sold to the housewife or institutional user. This covers a long range of handling involving shipping, warehousing, shipping again, and finally retailing, and during each of these steps there are problems of a sanitary nature. In shipping, care must be taken to select a suitable type of refrigerator car or refrigerator truck, namely one that will not permit excessive increases in temperature thereby resulting in bacterial growth and spoilage.

Refrigerated storage rooms should be properly constructed of impervious materials and be held at the proper temperatures required by the product in storage. All frozen foods should be held at a temperature of 0° F. or below. Under no condition should frozen foods be stored at a temperature higher than 5° F. Cold storage rooms should be free of all foul and bad odors at all times. Containers of frozen foods should be properly stacked, but never directly on the floor of the holding room. Strips of wood, commonly known as dunnage, should be laid on the floor, or floor racks should be used so that the first layer of cases is about 2 or 3 inches above the floor. Low temperature holding rooms should not be overloaded, and should be kept clean at all times. Broken packages and containers should be kept in barrels or crates and be kept separate from the rest of the piles.

The Refrigeration Research Foundation, under the able direction of H. C. Diehl, has done much to foster these principles and to educate the warehousemen throughout the country in the proper handling of frozen foods.

The retailers need to be educated on the proper handling of frozen foods. Frozen foods are perishable products and therefore must be kept at low temperatures at all times. Many a retailer has been known to place frozen foods in non-refrigerated locations and later to refreeze the thawed or partially thawed product. Retail cabinets must be kept in a sanitary condition and be kept free of broken and soiled packages. A good appearing cabinet containing orderly stacks of frozen merchandise does much to increase sales.

SANITATION

Another problem facing the packer is the selection of a suitable detergent to do a particular job. Many purchasing agents are at the mercy of high pressure salesmen due to the fact that they do not know where to turn to obtain information on the relative value of the many types that are on the market. Unfortunately the frozen food industry has never seen fit to support studies of this nature, in contrast to the dairy industry who are so much on their toes, that we often learn of a new detergent through studies that have been made to determine its suitability and adaptability to the sanitary problems of the dairy industry.

Even within the frozen food industry there are examples of progressiveness and regressiveness. The fish freezing industry has long appreciated the value of chlorination, yet only in very recent years have packers of fruits and vegetables shown any interest in such sanitary measures.

Some problems of sanitation arise before the products are delivered to the processing plant. For instance in the case of shellfish, the quality of the waters from which they are taken is of primary importance. From a bacteriological standpoint, shellfish waters must meet the same standards as those for drinking water. Some frozen shellfish are given no heat treatment and are eaten raw. One big problem in fish handling is the use of forks. A satisfactory product is obtained as long as the forking is confined to the head, but the procedure is most insanitary when the fish is stabbed through the viscera.

Some vegetable raw material delivered to the plant may be infested with insects, such as worms and plant lice on broccoli and brussel sprouts. Careful inspection is necessary to prevent

products in these conditions from being packed. Besides rejection at the plant, measures should be taken to keep infestation down to a minimum long before the product is harvested.

The problem of rodent control is not one of easy solution, as the use of poisons is dangerous in food producing establishments. Sewage disposal is another problem that is difficult to solve as most freezing plants have a seasonal operation and therefore the expense of settling tanks and the like is hard to justify. Like in all food plants, the frozen food processing plant has the usual problems of plant sanitation, water supply and personal hygiene.

Some sanitary problems of the frozen food industry fall in the field of the analytical laboratory. Berries are subject to mold growth if held prior to freezing, especially during warm and humid weather. The presence of mold might not be visible to the eye yet the finished product could well be subject to seizure by the Food and Drug Administration. If a packer has a food technologist on his staff he can check his raw material, but by what method? The Association of Official Agricultural Chemists gives methods for the detection of mold and rot fragments but the methods are most unsatisfactory. There is an excellent thesis problem for some graduate student.

Many packers run bacteria counts on their finished products, but unfortunately the industry has never agreed on a standard method, nor is there any agreement on what the count should be and still fall within the realm of good sanitary practice. One maximum count cannot be set for all frozen products any more than one could use the acceptable count for milk as the acceptable count for water. Off flavors are detected by taste tests only. Maybe some day it will be possible to have a chemical method.

The sanitary problems in the processing and distribution of frozen foods are many and varied. Only by continual research and education can they be solved and even then it will require considerable time. In the mean time it is hoped that the packers and distributors will adhere to the basic principles of sanitary practices.

New Dairy Industry Department in Florida

A new department has been created at the University of Florida and the Florida Agricultural Experiment Station in which both dairy manufacturing and dairy production activities have been combined. It will be known as the Department of Dairy Husbandry and Dairy Manufactures.

Dr. E. L. Fouts, who has been Dairy Technologist at this institution since 1940, has been named head of this new department. He has received degrees from Purdue University, Oklahoma A. and M. College, and Iowa State College. He has had considerable practical experience in dairying in several sections of the United States.

The new department has excellent facilities for teaching and research in dairying. A well equipped Dairy Products Laboratory contains modern equipment for the processing of milk and the manufacture of ice cream and other dairy products. The newly constructed dairy production unit is located on 1,200 acres of land suitable for research in dairying.

The production staff members are Dr. R. B. Becker, Dr. Sidney Marshall and Prof. P. T. Dix Arnold. The members of the manufactures staff are Prof. L. E. Mull, Prof. W. A. Krienke, and Prof. L. R. Arrington.

MILK and FOOD SANITATION

THE "5 MINUTE" RESAZURIN TEST FOR DETERMINING THE QUALITY OF RAW MILK

J. C. Boyd and H. C. Hansen
Department of Dairy Husbandry
University of Idaho, Moscow, Idaho

The sale of large amounts of butter, cheese, evaporated milk, and milk powders to government agencies has caused many milk processing plants in the West to adopt a policy of manufacturing only one grade of products. These products are designed to meet the grade specifications of the buying agencies.

Under such a policy, milk which is of such poor quality that its use may jeopardize the quality and grade of the finished products is rejected and returned to the producer.

The success of such a procedure depends upon the ability of milk graders to distinguish quickly and accurately between those cans of milk which will not injure the quality of the manufactured product, and whose which will. Thus, there is a need for a biological test that gives the end point quickly enough to be an aid to the milk grader in making these determinations.

The 10-minute resazurin test which has received government approval in Great Britain since 1942 (12) has many of these qualities.

Barkworth and associates (2) compared the 10-minute resazurin test with the sense of smell and taste clot on boiling, titratable acidity, and pH, and concluded that the 10-minute resazurin test was the best suited for rapidly weeding out unsatisfactory milk at the receiving platform. The authors emphasized the value of the flexibility of the test. Jones and Barkworth (9) found a significant correlation between the 10-minue resazurin test and the titratable acidity of milk and concluded that the 10-minute test is more closely affected by changes in acidity than the methylene blue test.

Golding (6) compared the 10-minute resazurin test with the standard plate count and concluded that the test had real value in detecting very poor quality milk.

Unfortunately the above studies used a resazurin dye concentration and a color standard commonly used in Great Britain but which differs somewhat from the standards recently approved as the standard method in the United States (12).

Davis (4) studied a 5-minute resazurin test and classified all milks which turned lilac, mauve, or pink as poor quality. The dye concentrations and incubation temperature used, however, differ from those now accepted as standard in the United States (13).

This report deals with a study conducted to determine the value of "5-, 10-, or 15-minute" resazurin tests for the platform grading of raw milk.

Experimental Procedure

Comparisons of a 5- and 10-minute resazurin test with the methylene blue test, direct microscopic count, and titratable acidity were made at the laboratories at the University of Idaho. The milk samples used were taken from milk patrons delivering milk to the local milk bottling plant. In most cases, it was necessary to incubate the samples before they would bring about a change in the resazurin dye in 5 minutes.

Additional comparisons of a 5-, 10-, and 15-minute resazurin test with the methylene blue test and direct microscopic count were made in the field at a representative milk processing plant which manufactures butter and milk powders.

The resazurin test was conducted using "prepared" sterile dry vials (7). These vials were prepared at the State College of Washington and are the same as are being offered for sale to the milk processing plants. The samples were incubated at 98° F. (± 1° F.) and grades were determined using the Munsell resazurin color grades (10) (4 color standards mounted in a single test tube put up by Munsell Color Company, 10 East Franklin Street, Baltimore, Maryland). Grades were assigned to each sample as follows:

Grade	*Colors*
A	Colors from initial Blue to PBP 7/5.5
B	Colors from PBP 7/5.5 to PBP 7/8
C	All milks showing pink of an intensity
D	Milks wherein the dye has been completely reduced

The methylene blue test, direct microscopic count, and titratable acidities were made according to *Standard Methods for the Examination of Dairy Products* (13). The methylene blue tests were read at 20 minutes and 1 hour in the University laboratory and at 20 minutes, 1, 2, and 3 hours in the field tests.

The milk samples were never refrigerated, and the samples taken in the field were not incubated prior to conducting the test. The field samples represent the true quality of the milk as received by the milk processing plant.

Results

Comparison of the samples taken in the field, which reduced the resazurin dye to the "B Grade" (color PBP 7/5.5 to PBP 7/8) in 5, 10, and 15 minutes, with the reduction time of methylene blue is summarized in Table 1.

These results show that based on a 5-minute incubation period, 32.9 percent of the samples reduced methylene blue in 20 minutes or less and an additional 46.8 percent reduced methylene blue in 1 hour. Thus 79.7 percent of the samples, which reduced resazurin to "B Grade," in 5 minutes, reduced methylene blue in 1 hour or less.

TABLE 1

Comparison of a Resazurin Grade of "B" After 5, 10, and 15 Minutes Incubation With Methylene Blue Reduction Time

Incubation time	*No. of samples*	*Resazurin grade*	*Percentage of samples that reduce methylene blue in* 20 minutes	1 hour	2 hours	3 hours	over 3 hours
5 minutes	94	B	32.9	46.8	11.7	3.1	5.3
10 minutes	113	B	7.0	45.1	19.4	8.8	19.4
15 minutes	57	B	0.0	15.8	29.8	22.8	31.5

A comparison of the samples taken in the field which reduced the resazurin dye to "C Grade," in 5, 10, and 15 minutes, with the reduction time of methylene blue is shown in Table 2.

These results show that of samples reduced to "C Grade" in 5 minutes, 84.2 percent reduced methylene blue in 20 minutes or less and an additional 15.7 percent reduced methylene blue in 1 hour. No samples retained the blue color over 1 hour.

These results show that a 5-minute incubation period is more accurate in picking out very poor quality milk, as determined by the methylene blue test, than a 10- or 15-minute incubation period.

Direct microscopic counts were made of those milk samples which reduced the resazurin dye to B and C Grades in 5 minutes. The results are shown in Table 3.

Published with the approval of the Director of the Idaho Agricultural Experiment Station as Research Paper No. 301.

TABLE 2

COMPARISON OF A RESAZURIN GRADE OF "C" AFTER 5, 10, AND 15 MINUTES INCUBATION WITH METHYLENE BLUE REDUCTION TIME

Incubation time	No. of samples	Resazurin grade	Percentage of samples that reduce methylene blue in 20 minutes	1 hour	2 hours	3 hours	over 3 hours
5 minutes	57	C	84.2	15.7	0	0	0
10 minutes	92	C	53.2	39.1	4.3	2.1	1.0
15 minutes	131	C	32.0	32.0	8.3	3.8	3.8

Of the samples reducing the resazurin dye to "B Grade" in 5 minutes, the lowest direct microscopic count was 2,000,000 per ml., the highest 63,000,000 per ml., and the average of 64 samples 31,149,000 per ml. Of the samples reduced to "C Grade" in 5 minutes, the lowest direct microscopic count was 2,000,000 per ml., and the highest 193,000,000 per ml., and the average of 59 samples was 46,470,000 per ml. The majority of the samples (71.9 percent) had direct microscopic counts between 21,000,000 and 60,000,000 per ml.

blue in 20 minutes or less, 1.06 percent reduced methylene blue in 1 hour, 8.51 percent in 2 hours, 10.99 percent in 3 hours, and 79.43 percent retained the blue color of methylene blue after 3 hours' incubation.

Comparison of the resazurin grades after 5 minutes of incubation with the titratable acidity of the milk is shown in Table 4.

Of the 84 samples which did not change from the original blue color of the resazurin dye in 5 minutes, no samples had a titratable acidity of over

TABLE 3

COMPARISON OF RESAZURIN GRADES AFTER FIVE MINUTES INCUBATION WITH DIRECT MICROSCOPIC COUNTS

Direct microscopic count	5 Minute Resazurin grade B	C
Lowest bacterial count	2,000,000 per ml.	2,000,000 per ml.
Highest bacterial count	63,000,000 per ml.	193,000,000 per ml.
Average bacterial count	13,129,000 per ml.	46,470,000 per ml.

Of the samples analyzed in the field, 282 samples retained the original blue color * of the resazurin dye beyond the 15-minute incubation period. Of these samples, 0.0 percent reduced methylene

0.20 percent calculated as lactic acid. The titratable acidities of samples which reduced the resazurin dye to the "B Grade" or beyond, varied greatly. Some of the samples had titratable acidities over 0.25 percent and some with titratable acidities as low as 0.16 and 0.17 percent.

* As shown in Table 4, A grade is a higher grade than defined by Standard Methods.

TABLE 4

COMPARISON OF RESAZURIN GRADES AFTER FIVE MINUTES INCUBATION TO TITRATABLE ACIDITY

Resazurin Grade	No. of Samples	Percentage of samples in each acidity group 15	16	17	18	19	20	21	22	23	24	25	over 25
A	84	16.6	22.6	23.8	27.3	7.1	2.3	0	0	0	0	0	0
B	46	0.0	15.2	17.3	21.7	30.4	30.4	4.3	0	0	2.1	0	2.1
C	39	0.0	5.1	10.2	25.6	2.5	20.5	7.6	5.1	10.2	2.5	0	10.1
D	54	0.0	0.0	3.7	12.9	18.5	27.7	12.9	7.4	3.7	7.4	1.8	3.7
White	56	0.0	0.0	1.7	0.0	1.7	3.4	3.4	1.7	14.2	7.1	12.5	53.1

SUMMARY

A study of the resazurin test using a 5-, 10-, and 15-minute incubation period was made to determine the value of such a test for grading raw milk at the receiving platforms.

Comparisons of a 5-, 10-, and 15-minute incubation period with the reduction time of methylene blue showed the 5-minute reading to be the most accurate in picking out the very poor quality milk. Of the samples which reduce the resazurin dye to the "B Grade" in 5 minutes, 79.7 percent reduced methylene blue in 1 hour or less and 91.4 percent reduced methylene blue in 2 hours or less. Of the samples reduced to the "C Grade" in 5 minutes 100 percent reduced methylene blue in 1 hour or less.

Direct microscopic counts of the samples which reduced the resazurin dye to "B Grade" in 5 minutes show that the majority of the samples, 71.9 percent, had direct microscopic counts between 21,000,000 and 60,000,000 per ml.

Of the samples that retained the original resazurin blue color for 15 minutes or longer, 79.44 percent retained the blue color of methylene blue for 3 hours or more. No samples which retained the resazurin blue for 5 minutes or more had a titratable acidity calculated as lactic acid, of over 0.20 percent.

Numerous studies have shown that the resazurin dye is sensitive to the reducing action of leucocytes or substances associated with leucocyte (5, 11, 8, 1). Previous work at this station (3) on the 1-hour resazurin test showed that approximately 17 percent of the samples reduced in 1 hour were reduced by abnormal conditions other than bacterial content. The ability to include abnormal milks caused by mastitis, colostrum, or late lactation is regarded by some as an advantage. Others regard it as a disadvantage.

To the laboratory technician, fieldman, and milk producer, this feature of the resazurin test tends to cause considerable confusion. Unless the resazurin test is supplemented by tests such as the direct microscopic count or others, determining just what condition in the milk is causing the reduction may be difficult.

The quality test that should be used will, of course, depend upon the quality of the milk supply. The "5 minute" resazurin test, as described, is of value only in those areas where much of the milk will reduce methylene blue in 3 hours or less, and, in the opinion of the authors, should be supplemented with a direct microscopic analysis.

REFERENCES

1. Barrett, W. D., Keenan, J. A., Rutan, H. The Resazurin Test, Its Uses and Practicability as Applied to the Quality Control of Raw Milk. *J. Dairy Science*, **20**, 705, (1937).

2. Barkworth, H., Davis, J. G., Egdell, J. W., Rowlands, A., and Watson, D. W. A Comparison of Rapid Platform Tests for the Bacteriological Quality of Milk, *Proc. Soc. Agri. Bact.*, 1942.

3. Boyd, J. C., Hansen, H. C. Comparison of the Resazurin Test with Other Tests for the Quality of Milk. *The Milk Dealer*, Vol. 38, No. 1, p. 200, 1948.

4. Davis, J. G. A Rapid Test for Detecting Poor Quality Milk. *Dairy Industries*, No. 4–6, 221, (1939).

5. Foyer, J. M. Dye Reduction in Milk Related to Eh, pH, and Dissolved Gasses. *Vermont Agri. Exp. Sta. Bull.* 498, 1942.

6. Golding, N. S., Jorgenson, Irene S. A Correlation of the Resazurin Grade with the Standard Plate Count of Raw Milk. *J. Milk Technol.* **8**, 189, (1945).

7. Golding, N. S. The Resazurin Reductase Test Using Prepared Sterile Vials. *J. Dairy Sc.* **30**, 521, (1947).

8. Johns, C. K. Recent Canadian Research on the Resazurin Test. *Internat. Assoc. Milk Dealers, 34th year, Association Bulletin* 11, 256, 1942.

9. Jones, S. E., Barkworth, H. The Acidity Test Compared with the 10 Minute Resazurin Test and Methylene Blue. *Dairy Industries*, **8**, No. 11, (1943).

10. Ramsdell, A. C. The Resazurin Test for Sanitary Condition of Milk. *Internat. Assoc. Milk Dealers, Processing Laboratory Section*, 30th Annual Convention, p. 3, 1937.

11. Ramsdell, S. A., Johnson, William T., Jr., and Evans, F. R. Investigations of Resazurin as an Indicator of the Sanitary Condition of Milk. *J. Dairy Science*, **18**, 705, (1935).

12. The Ten Minute Resazurin Test, Ministry of Agriculture and Fisheries, National Milk Testing and Advisory Scheme, Form No. C150. T.P.Y., July, 1942.

13. *Standard Methods for the Examination of Dairy Products*, 9th Edition, 1948.

RECENT PROGRESS IN MASTITIS CONTROL *

G. R. SPENCER

Department of Veterinary Science,
University of Wisconsin, Madison, Wisconsin

BOVINE mastitis is a widespread important disease of dairy cattle in Wisconsin. It involves the milk producing gland and results in low production and poor quality milk. Mastitis is caused by an infection of the udder with bacteria. Since it is an infectious disease, it can be controlled or prevented by proper application of the principles of quarantine and sanitation combined with good milking methods. These principles of control can be applied on the average dairy farm with a small additional investment in time and money. Mastitis control will result in more milk and it will pay the dairyman big dividends for the small amount of time spent.

Now, what can a dairyman do to control mastitis? In discussing this problem, we will consider first, herds which are free of the disease. Many Wisconsin herds are in this fortunate condition. They have no cows giving abnormal milk except an occasional infected quarter following an injury to the teat. These herds which are free of mastitis have cows eight, ten, or more years old in heavy production. They are not bothered by blind quarters. Dairymen in such herds can keep them free of mastitis by raising their own replacements. If animals must be purchased, they should be heifers before they freshen for the first time. Cows which have lactated are dangerous to a clean herd, even if they appear to be normal. Mastitis is spread from herd to herd by transfer of infected cows, many of which appear to be all right at the time they were purchased.

Any cow which is milking or has passed through a lactation is a potential carrier to a mastitis free herd and should not be introduced.

If a new dairy herd is to be assembled there is the same danger that mastitis will be introduced with infected cows as in a herd already established. The best way to start a herd of dairy cows is to buy heifers before they freshen for the first time. Purchase of milking cows from sales, dealers, or other sources will often result in a serious mastitis problem.

The other type of dairy herd which we have to consider is the herd affected with mastitis. This would include most of the herds in Wisconsin. The disease can be controlled in these herds, and in some cases eradicated by good husbandry practices with the help of expert assistance by the local veterinarian.

If a dairyman finds that some of his cows are affected with mastitis, there are several procedures which will aid in the control of the disease. The first important step is the accurate detection of the affected animals. Daily use of the strip cup is of great value. The dairyman should milk the first stream from each quarter into the strip cup and watch for flakes, clots, or thick milk. The occurrence of any of these abnormalities is an indication of mastitis and the milk from such a quarter should be kept out of the market supply. In addition to the strip cup, laboratory tests will be of great aid for detecting infected cows. The local practicing veterinarian may be equipped to do these laboratory tests or he will know where laboratory service is available.

When the mastitis-affected cows in a herd are accurately detected the next step in control is proper milking order. Heifers are usually free of mastitis and should be milked first. Older cows which are apparently normal may then be milked next, and the cows affected with mastitis last. This milking order is easier to maintain if the animals are stabled in the order of milking: heifers in one group, clean cows next, and affected animals in a group at the end of the milking line.

Sanitary precautions are necessary to reduce the spread of infection from cow to cow. The teat cups of the milking machine can be disinfected between cows by dipping them in a pail of clean water, and then in a pail of chlorine solution. This chlorine solution should contain about 200 parts per million of available chlorine. The proper strength solution can be obtained by mixing according to the directions on the bottle of hypochlorite powder. Just after the milker's hands are dipped into the chlorine solution a towel may be moistened with it, and used to wipe off the teats of the cow. At the end of the milking period the teat cups of the milking machine are rinsed with clean water and then the cups are hung up in a rack and filled with a one-half percent lye solution. This solution can be prepared by adding one level tablespoon of lye to a gallon of water in a glass or earthenware container. The lye solution is allowed to stand in the teat cups until just before the next milking. The teat cups are then rinsed out with clear water.

These sanitary precautions seem somewhat detailed but they can be accomplished in a few minutes per day when they are made a part of the regular routine. They can be done in about the time required to milk one affected cow by hand.

In addition to detection, milking order, and sanitation in the dairy barn, the handling of the cows is quite important for mastitis control. Milking should be done rapidly, regularly, and thoroughly, and the milking machine must be removed as soon as the milk stops flowing. If the milk is not removed completely, or if the machine is allowed to draw on the empty teats, serious injury may result. Quarters severely affected with mastitis will benefit if milked several times a day.

Stalls of adequate size, and plenty of bedding will help avoid injuries to the teats which are often followed by mastitis. If the cow is allowed plenty of time to get to her feet, she will not be as likely to tread on her own teats.

The correct feeding of affected cows will aid in the control of mastitis. The concentrate or grain mixture should be reduced or eliminated from the feed during the active stages of the disease. Cows which have mastitis in a mild form may become worse when fed large amounts of concentrates, and will often produce little or no abnormal milk if fed only small amounts of concentrates.

Another procedure which will aid in the control of mastitis is the sale of severely affected cows for slaughter. Animals which do not respond to treatment or those affected in two or more quarters are dangerous cows because they may spread the disease to the other animals in the herd. They are seldom profitable producers. If these animals are replaced by heifers, the worst part of the problem of mastitis will be solved.

CONTROL BY TREATMENT OF AFFECTED COWS

Proper treatment of cases of mastitis by a veterinarian will aid in control of the disease. Developments of the last few years have shown that treatment can solve the immediate problem of mastitis in some herds. Many animals affected with the disease can be treated

---

* Presented at Dairy Plant Fieldmen's Conference, Madison, February 8, 1949.

Published with the approval of the Director of the Wisconsin Agricultural Experiment Station as a contribution from Project No. 475 on the Detection and Control of Chronic Bovine Mastitis.

successfully with the new germ-fighting drugs. Treatments will help to bring the mastitis cow back into normal production and prevent her from spreading the disease to clean or normal animals. These treatments have both a curative and a preventive value.

In order to get the best results from treatment, the proper dose of the right drug must be employed. The several types of mastitis should be treated differently to obtain maximum benefit. No one drug or combination of drugs is effective against all types of mastitis. These facts make the treatment of mastitis difficult for the average dairyman. Some dairymen are treating their own cows and have had good results. Many others have been disappointed in their treatments, probably because they used the wrong kind of treatment for the type of mastitis in their herd. It is better to call the local veterinarian to make an accurate diagnosis and to administer the proper treatment.

There are many things a dairyman can do to help his cows recover from mastitis. He should separate the affected cows from other animals and milk them last. If the grain or concentrate feed is reduced, such an animal will have a better chance to respond to treatment. It is helpful to milk the affected quarters out frequently. In severe cases of mastitis, milking five or six times a day will aid recovery. After treatment by injecting drugs into the gland, milking should be stopped for 12 hours so the drug will have a chance to act.

Cold packs or ice packs on the udder may be helpful in severe acute or gangrenous mastitis. They are ordinarily used on animals for only one or two days during the early stages of the disease. Massage of an affected quarter will help to reduce the swelling. It is better to rub firmly toward the teat. By means of alternate rubbing and stripping, one can remove much of the abnormal material from the utter.

Drugs can be administered to cases of mastitis either by mouth or into the affected quarter. Veterinarians may prescribe drugs such as the sulfonamides to be given on the feed or by capsule. These sulfonamides are usually given in large doses once or twice a day for two to four days. The whole body of the cow, including the udder, become infused with the drug. Other germ-fighting materials are injected up into the udder through the end of the teat. Penicillin is usually given in this manner. It spreads around through the quarter injected. The penicillin may be introduced in the form of a water solution or a suspension in oil. A new method of giving penicillin is in the form of a bougie, which looks like a match stick. This bougie is inserted into the teat and it then dissolves, releasing the penicillin into the milk. These bougies are about as good as any other form of penicillin for mastitis.

Chronic mastitis due to streptococci is the most common type of the disease in Wisconsin. This type of mastitis should be treated with a course of penicillin given at a regular interval. In tests made by the Department of Veterinary Science of the University of Wisconsin, penicillin given in this way cured about seventy percent of affected quarters. Most of the quarters which are not cured are improved by treatment. An occasional cow with chronic mastitis shows no benefit from treatment. The animals which are cured are still susceptible to the disease and they can be reinfected if they are exposed to an infected cow. Penicillin has proved to be of great value in herds where the chronic form of mastitis is causing difficulty.

Cases of the acute or rapid type of mastitis are often not benefited by penicillin. For these cases a veterinarian will use one of the sulfonamide drugs. These drugs are usually given by mouth, but they may be injected directly into the quarter. Both penicillin and sulfonamides may be used in severe cases of mastitis. It is important to call a veterinarian early for these cases of acute mastitis because the quarter may become damaged beyond repair in two or three days.

The mastitis which develops following an injury to the end of the teat is always serious. As soon as such an injury is discovered, it should be covered with carbolated vasoline and with adhesive tape to protect it from filth. Milking must be thorough, but with a minimum of manipulation of the teat. Dilaters or teat tubes are dangerous and are to be used only when absolutely necessary. If a firm swelling is found in the gland above the injured teat, the quarter is affected with mastitis. Prompt treatment is necessary then to prevent loss of the quarter. These cases of mastitis following an injury are always a hard problem to handle. The milk must be removed regularly and yet the wound on the end of the teat must be allowed to heal.

In addition to penicillin and the sulfonamides, streptomycin appears to be valuable for cases of acute mastitis. This drug has recently become available to veterinarians. When we learn the proper dose for various types of mastitis, we may be able to save some of the cases which are now lost.

Certain other drugs have been used for mastitis but are not recommended at the present time. Tyrothricin, silver oxide, and acriflavine are all too irritating for the lactating mammary gland. They can be used during the dry period, but even then they are no better than penicillin and the sulfonamides.

The treatment of mastitis is not simple, and some cases do not improve. It is much better to prevent mastitis by good milking and sanitation than to treat the disease after it has attacked a herd. If a herd is free of mastitis, it may be kept free by adding only heifers before they freshen. Rapid and thorough milking, moderate feeding and disinfection of the hands, the teat cups, and the cow's udder will help. A milking order of heifers first, clean cows next, and infected cows last will keep mastitis from spreading. In cases which occur in spite of careful sanitation, the local veterinarian can help them by proper treatment.

Field Results

During the past ten years the University of Wisconsin's Department of Veterinary Science has cooperated with a number of dairy herds in the vicinity of Madison in an effort to help control mastitis. Veterinarians in the mastitis research project have examined and tested the cows in these herds over a period of years. Dairymen have been assisted in establishing control programs for mastitis. The herds have been re-examined at intervals to determine if mastitis was being controlled. New drugs for the treatment of the disease were used as soon as they became available.

This work with farm herds was made to determine the value of control methods for mastitis. The dairy herds selected were those in which the owner or herdsman was interested in controlling the disease. Most of the herds had a serious mastitis problem when they were first started on a control program. The results from some of these herds will be described.

The first herd to be mentioned was a small purebred herd studied over a period of 6 years. On the first examination a difficult mastitis problem was discovered. Nineteen out of 23 were infected with streptococci and 6 were giving abnormal milk. A control program was established in which the clean cows were milked first and the milkers dipped their hands in a chlorine solution between each cow. Silver oxide and tyrothricin treatments were given during the dry period and they produced little benefit. After two years there were still 12 infected cows in the herd, but the worse cases had either been cured by treatment or sold. Only one animal was giving abnormal milk at this time. The disease had spread

slowly, probably because the control program was not carefully carried out. The dairyman was then advised to replace the older infected cows with home-raised heifers. He did this gradually over the next 2 years, but the infection continued to spread. A test at the end of the fourth year disclosed 9 infected cows out of 21 in the herd. Penicillin treatment was started and six of the 9 infected cows were cured. No abnormal milk was produced in this herd for a period of several months after treatment with penicillin. Two years after treatment, 6 cows were infected and 2 of these were producing abnormal milk.

The results from this herd demonstrate the value of rearing good heifers for replacements. In spite of treatment the disease spread to other animals in the herd. Penicillin treatment cured the majority of the infected cows, but did not prevent reinfection. As long as infected cows remained in this herd, they endangered the other animals. In this herd, however, practical control was achieved and there was very little abnormal milk after penicillin treatment.

The next herd we will mention was a larger group of 60 dairy cows. On the first examination in 1943, 40 cows had a streptococcic infection in their udders. Twelve were giving abnormal milk. A good program of sanitation and segregation was begun by the new herdsman. Some infected cows were left in the herd and new cases of mastitis continued to appear, but there were fewer new cases than before the control program was established. When penicillin became available, this herd was one of the first to be treated. Immediately before treatment 20 cows were infected. Penicillin treatments were given to all these and about half were cured. Nine months later the infection had spread so that 24 cows had mastitis streptococci. Yearly penicillin treatments reduced the incidence to a very low level but some reinfection occurred between times. After several series of treatments in this herd, cases began to appear which were not benefited by penicillin. Two of those cases were found to be caused by staphylococci, a different type of infection than usual for the herd.

This herd illustrates the value of a combination of penicillin treatment and a herd sanitation program. Even both of these did not prevent new infection in the herd. The results here indicate that cases resistant to treatment may appear after extensive use of penicillin. Mastitis was partially controlled by a combination of good sanitation and treatment.

The mastitis in these 2 herds just described was the type which usually responded to penicillin. A third herd of 35 Holsteins was not so lucky. The owner bought and added four milking cows to his herd. One of these developed mastitis soon after she was bought and put into the herd. The disease soon spread to 12 of his animals and all became severely affected. These cows were much sicker than in the ordinary types of mastitis. They developed large joints, became lame, and stopped giving milk. The owner was advised to sell the affected cows for slaughter and to milk his younger animals first. Penicillin treatment did not cure them and several sulfonamide drugs also failed to help.

It is unusual for the more severe types of mastitis to spread rapidly as in this herd. If the first case had been separated from the other cows and milked last the owner might have avoided most of his trouble with mastitis.

In another herd in which nine cows were affected with mastitis, the dairyman called his local veterinarian. This veterinarian recognized that it was a type of mastitis which should be treated by one of the sulfonamides. He started the treatment and took milk samples for a laboratory test to determine the exact cause of the disease. The laboratory reported that the germ causing the disease was a type which should be treated by a sulfonamide drug. Treatment was continued and all the cows recovered except two, each of which lost one quarter. These two had been severely affected before treatment was begun. The results in this herd demonstrated the value of calling a local veterinarian for an accurate diagnosis and treatment of mastitis. Many cases of mastitis such as in this last herd will not be helped by penicillin, but will respond to sulfonamides.

Other herds have been studied by veterinarians from the mastitis project of the University of Wisconsin. Each herd has been a different problem and required special measures for prevention of the disease. Mastitis has been controlled in the herds in which the dairyman was interested in control and was willing to follow the proper sanitary measures. In herds in which the dairyman was careless the disease has usually not been controlled. The most important control steps for a dairyman to take are as follow: use the strip cup daily to detect cows with mastitis, milk the cows rapidly and in the order of heifers first, clean cows next, and infected cows last, and call the local veterinarian for accurate diagnosis and treatment of mastitis cows.

Devices for Testing Dishwashing Machines

Patents for two "foolproof" devices for testing dishwashing machines have been awarded Paul J. DeKoning, assistant professor of mechanical engineering at Michigan State College.

One machine sprays a liquid mixture of food particles on a revolving piece of china. The plate is then washed in the establishment's dishwashing machine. If the plate is unevenly washed, streaks or spots appear.

The second machine shines light on the revolving plate after it has been washed in the dishwater. Reflections of light from the spinning plate are registered on a meter by a photoelectric cell. Clean plates reflect brightly, and unclean or partially clean plates reflect a diffused light.

Dr. W. L. Mallmann, MSC professor of bacteriology, directed extensive research on the project, and turned mechanical details of invention over to DeKoning.

The patents will be assigned to the National Sanitation Foundation, Ann Arbor, Mich., which launched study of the problem in 1945 and financed the research project at Michigan State College.

The machines will probably retail at $150 to $200 each.

In initial tests conducted in the Lansing, Mich., area, major faults have been found in dishwashers. Only five of 12 restaurant machines tested were deemed "adequate," five were classified as "unsatisfactory," and two were "excellent."

Nelson Appointed Medical Director of FDA

Dr. Erwin E. Nelson has been appointed Medical Director of the Food and Drug Administration, effective in January. He succeeds Dr. Robert T. Stormont who resigned to become Director of the Division of Therapy and Research and Secretary of the Council on Pharmacy Chemistry of the American Medical Association.

Since 1947 Dr. Nelson has served as Chief of the New-Drug Section of the FDA's Division of Medicine, and earlier organized their Division of Pharmacology. He took his A.B., A.M., and Ph.D. degrees at Missouri, his M.D. at Michigan, and additional work at the Johns Hopkins University and at Munich. He taught at Michigan and Tulane and was Director of Research at the Wellcome Research Laboratories.

NEW BOOKS AND OTHER PUBLICATIONS

Industrial Microbiology, by Samuel C. Prescott and Cecil G. Dunn. 2nd edition. Published by the McGraw-Hill Book Co., Inc. New York, 1949. 124 figures, 174 tables, 923 pages. $8.50.

This edition has been greatly expanded over the first edition, 1940, which carried 60 figures, 96 tables, and 541 pages. The new index runs 58 pages as compared with 34 in the first edition. New chapters are added on new processes of saccharification, the production of 2, 3—butanediol, the itaconic and itatartaric acid fermentations, and especially one of 90 pages on about eighty antibiotics with about three hundred references. Other chapters have been expanded and a new section has been added on oxidizing activities of strains of *Pseudomonas* and *Phytomonas*.

Rose's Laboratory Handbook for Dietetics, revised and rewritten by Clara Mae Taylor and Grace MacLeod. 5th edition. The Macmillan Company, New York, 1949. 358 pages. $5.00.

This fifth edition of Rose's well-known book has added much new material since the last edition in 1937. The various tables on food values are reorganized completely to facilitate use of much new quantitative data on food composition for the teacher, the community and public health nutritionist, the hospital dietitian, the advanced student of nutrition, and other interested persons. Part I carries a brief discussion of food needs for various age and activity groups, pages 1 to 38. Part II deals with twelve problems in dietary calculation, pages 39 to 64. Part III consists of many reference tables, some new, on many items of interest to persons who have to calculate nutritional requirements, pages 65 to 112. Part IV has the tables of food composition, arranged conveniently and give values for 100 grams, per ounce, per pound, and per 100 calories. These have been greatly expanded from previous editions. Pages 113 to 339. A table of 65 references to the literature gives supplementary information.

Judging Dairy Products, by John A. Nelson and G. Malcolm Trout. 2nd edition. The Olsen Publishing Co., Milwaukee, 2, Wis. 1948. 105 illustrations, 27 tables. 494 pages. $5.00.

Increased interest in grades, standards, and quality of dairy products has made a wider coverage of the field desirable. Products now included are milk, butter, cheese, ice cream, cream, fermented milks, evaporated and condensed milk, and dry milk solids.

Freeze-Drying, by Earl W. Flosdorf. The Reinhold Publishing Co., New York 18, N. Y. illustrated 1949. 280 pages.

This book describes the development of freeze-drying (drying by sublimation of ice), and brings together the technical knowledge that is widely distributed in "over 300 scientific and engineering publications" within the past ten years. Although originally applied to biological products (e.g. blood plasma, biotics, etc.) there is increasing interest in the food drying field, especially for citrus juices and milk. The book is directed particularly to those interested in applications to microbiological, serological, immunological, chemical, pharmaceutical, and related fields, but the presentation is suggestive for application to other fields. Chapter 1, Introduction, Chapter 2, Basic Principles, pp. 14–68. Chapter 3, Application (including 13 pages on foods) pp. 69–137. Chapter 4, Changes in Product During Dessication, pp. 138–143, Chapter 5, Equipment Used for Medical Products, pp. 144–217. Chapter 6, Equipment for Foods, pp. 218–228. Appendices list U. S. patents, data, techniques, and bibliography.

Laboratory Manual: Methods of Analysis of Milk and Its Products, compiled and published by the Milk Industry Foundation, Washington 5, D. C. 629 pages. 142 figures and illustrations. 1949. $15.00.

This book is a revision and enlargement of the earlier Laboratory Manual, published in 1933, by the International Association of Milk Dealers, the predecessor organization of the present publisher. The scope and format of this edition follows the same general plan of the earlier book except that the increasing of physical tests is recognized by separating these from chemical tests. Much new material has been added and the methods have been brought up to date. Their dependability and practicality are attested by the widely-recognized competence of the revision committee, namely, A. J. Powers, C. J. Austin, A. C. Fay, P. E. LeFevere, F. M. Scales, and E. B. Kellogg, Secretary. The book is valuable not only as comprising all the laboratory tests that a busy dairy plant control laboratory are likely to need, but it would serve well for the rapid screening of many samples that an official food control laboratory may have to handle.

Practical Dairy Bacteriology, by Paul R. Elliker. McGraw-Hill Book Co., New York 18, N. Y. 1949. 47 illustrations. 391 pages. $4.00.

The author states that the book is an outgrowth of a lecture outline for an eight-week course for teaching dairy bacteriology to winter dairy course students. He recommends that this expanded form can be used for the college short-course, the in-service course, and also by the farmer, fieldman, inspector, and plant man. The presentation is indeed geared to the needs of the above workers, although the elementary discussion would be more consistently intelligible to these if some of the more technical under such as titration. surface tension, buffers, etc., were explained. The style is easy for general reading. References are appended to each chapter for supplementary information.

"Have You Seen?"

(Compiled by Dr. K. G. Weckel, University of Wisconsin, Madison)

Brucella Infections, F. M. Pottinger *et al. Merck Report 58,* No. 3, 13 (July 1949).

Procaine Penicillin G. Levels in Udder Treatment of Chronic Mastitis, W. D. Bolton *et al. Vet. Med.* **44**, 244 (1949).

Mastitis in Dairy Cattle, J. W. Conkelman. *Vet. Med.* **44**, 207 (1949).

Diagnosis and Control of Mange in Dairy Cattle, H. H. Schwart. *J. Econ. Ent.* **42**, 444 (1949).

Aureomycin in Treatment of Staphylococcic Mastitis in Cows, E. C. McCulloch *et al. Vet. Med.* **44**, 253 (1949).

Preliminary Report on Use of Sulfamethazine and Penicillin in Bovine Mastitis, R. W. Fuller. *Vet. Med.* **44**, 103 (1949).

The Significance of the Milking Machine in the Etiology and Spread of Bovine Mastitis, L. A. Burkey *et al. U. S. Dept. Agric. Bulletin* No. BDIM 77, Sept. 1949.

The Relationship of Machine Milking to the Incidence and Severity of Mastitis, Edward B. Meigs *et al. U. S. Dept. of Agriculture Tech. Bul.* No. 992, Aug. 1949. Available from Supt. Documents, Washington, D. C. 15 cents.

How to Make the Methylene Blue Reduction Test, H. Calbert and E. Wallenfeldt. *Stencil Circular* 304, Nov. 1949, Univ. of Wis. College of Agric., Madison, Wis.

We Need More Sensible Milk Ordinances, C. J. Babcock. *Hoards Dairyman* **94**, 785 (November 10, 1949).

JOURNAL of MILK and FOOD TECHNOLOGY

(including MILK AND FOOD SANITATION)

Official Publication of the

International Association of Milk and Food Sanitarians

(Association Organized 1911)

The JOURNAL OF MILK AND FOOD TECHNOLOGY (including MILK AND FOOD SANITATION) is issued bimonthly beginning with the January number. Each volume comprises six numbers. Published by the International Association of Milk and Food Sanitarians at 374 Broadway, Albany 7, N. Y. Executive Office, 23 East Elm Avenue, Wollaston 70, Mass.

Subscriptions: The subscription rate is $2.00 per volume. Single copy, 50 cents.

Correspondence regarding business matters, advertising, subscriptions, reprints, etc., should be addressed to Wm. B. Palmer, 29 North Day Street, Orange, New Jersey.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to the Editor, J. H. Shrader, 23 East Elm Avenue, Wollaston 70, Mass.

Membership and Dues: Active membership in the Association is $3.00 per year, and Associate membership is $2.00 per year, including respectively all issues of the JOURNAL OF MILK AND FOOD TECHNOLOGY (including MILK AND FOOD SANITATION). All correspondence concerning membership in the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, including applications for membership, remittances for dues, failure to receive copies of the JOURNAL OF MILK AND FOOD TECHNOLOGY, and other such matters should be addressed to the Secretary of the Association, George A. West, 44 Marshall St., Rochester 2, N. Y.

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS

President, DR. M. R. FISHER.....St. Louis, Mo.
President Elect, DR. K. G. WECKEL.....Madison, Wis.
First Vice-President, C. S. LEETE.....Albany, N. Y.
Second Vice-President, H. L. THOMASSON.....Shelbyville, Ind.
Secretary-Treasurer, GEORGE A. WEST, Rochester Health Bureau, 44 Marshall Street, Rochester 2, N. Y.
Auditors: DR. R. G. ROSS.....Tulsa, Oklahoma
W. H. HASKELL.....Beloit, Wis.

Affiliates of
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS

ASSOCIATED ILLINOIS MILK SANITARIANS
President, C. V. Christiansen.....Chicago
Vice-President, F. M. Keller.....Chicago
Secretary-Treasurer, P. E. Riley, Illinois Department of Public Health, 1800 West Fillmore St., Chicago 12
Executive Board Members:
D. E. Harms.....Dixon
J. E. Meany.....Chicago
Sergeant-at-Arms, C. A. Abele.....Chicago
Auditors:
Ben Cunningham.....Peoria
V. B. Kurrus.....East St. Louis

DUBUQUE DAIRY TECHNOLOGY SOCIETY
President, Martin J. Fangman.....Dubuque
Vice-President, John Welp.....Dubuque
Secretary-Treasurer, Clem Welsh, R. R. 4, Dubuque

FLORIDA ASSOCIATION OF MILK SANITARIANS
President, L. A. Scribner.....Orlando
Vice-President, P. D. Shirley.....Tampa
Secretary-Treasurer, L. R. Arrington, Dairy Products Laboratory, University of Florida, Gainesville
Members of Executive Committee: R. R. Hood, Pensacola; L. T. Smith, Jacksonville

IOWA ASSOCIATION OF MILK SANITARIANS
President, J. H. Burkett.....Sioux City
Vice-President, C. J. Ruppert.....Iowa City
Secretary-Treasurer, Milton E. Held, Iowa Department of Health, Des Moines, Iowa

KANSAS ASSOCIATION OF MILK SANITARIANS
President, Cecil Graves.....Olathe
First Vice-President, Pascal Roniger....Manhattan
Second Vice-President, Roy Mitchell.....Winfield
Secretary-Treasurer, H. M. Weindel, Kansas State Board of Health, Topeka, Kansas.
Auditors: E. F. Kubin, McPherson, Kan.
W. F. Green, Lawrence, Kan.

MICHIGAN ASSOCIATION OF SANITARIANS
President, Philip Shirley.....Mason
Past President, Roy Cromley.....Detroit
First Vice-President, John Wyman...Grand Haven
Second Vice-President, Vernon Waite.....Pontiac
Secretary-Treasurer, Cranston Wilcox, Branch County Health Department, Coldwater, Michigan
Assistant Secretary-Treasurer, Morton Hilbert, Eloise
Directors:
Milo Wilson.....Ludington
Gale Mosey.....Montrose
Hugel Leonard.....Lake City

MINNESOTA DAIRY FIELDMEN AND INSPECTORS' ASSOCIATION
President, C. M. Pesek.....St. Paul
Vice-President, R. Koivisto.....Browerville
Secretary-Treasurer, Dr. J. C. Olson, Jr., Associate Professor of Dairy Bacteriology, Dairy Division, University of Minnesota, St. Paul 1
Board of Directors: J. E. Hortch, Owen Owens, Dr. Geo. S. Failing, C. H. Mattson, Dr. A. L. Sjowall, and H. G. Oldfield

MISSOURI ASSOCIATION OF MILK AND FOOD SANITARIANS
President, Glenn Lotspeich.....Warrensburg
Vice-President, George Reeves.....St. Louis
Secretary-Treasurer, J. L. Rowland, Missouri State Division of Health, Jefferson City, Mo.

NEW YORK ASSOCIATION OF MILK SANITARIANS
President, F. B. Carkhuff.....Binghamton
Vice-President, Sol Pincus.....New York
Secretary-Treasurer, C. S. Leete, State Department of Health, Albany

OKLAHOMA ASSOCIATION OF MILK AND FOOD SANITARIANS
President, Glenn Earley.....Oklahoma City
First Vice-President, Harper Orth.....Shawnee
Second Vice-President, Clyde Harris.Oklahoma City
Third Vice-President, D. C. Cleveland.....Durant
Secretary-Treasurer, Kay Matthews, Sanitarian, County Health Department, Wewoka, Oklahoma

VIRGINIA ASSOCIATION OF MILK SANITARIANS
President, G. S. Kennedy.....Roanoke
Vice-President, H. C. Mitchell.....Richmond
Secretary-Treasurer, A. W. Petty, Town Hall, Virginia Beach
Auditors, H. M. Hallett.....Leesburg
G. E. Musgrave.....Bristol

WISCONSIN MILK SANITARIANS' ASSOCIATION
President, D. D. Nusbaum.....Green Bay
Vice-President, M. P. Welsh.....New Glarus
Secretary-Treasurer, L. W. Brown, 421 Chemistry Building, Madison 6, Wisconsin
Directors:
C. Barbee, D.V.M.....Rice Lake
H. A. Hiller.....Columbus
Auditors:
L. I. Legrid.....Madison
H. E. Tait.....Madison

Associations Which Have Designated the
JOURNAL of MILK and FOOD TECHNOLOGY
As Their Official Organ

CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS
President, A. E. Reynolds.....Sacramento
First Vice-President, Jack Covert.....Los Angeles
Second Vice-President, E. J. Helgren..Santa Rosa
Secretary-Treasurer, C. A. Whipple, San Joaquin Local Health District, P. O. Box 111, Stockton

CENTRAL ILLINOIS DAIRY TECHNOLOGY SOCIETY
President, Russell Pollitt.....Danville
Vice-President, L. H. Winters.....DeKalb
Secretary, P. H. Tracy, Department of Dairy Technology, University of Illinois, Urbana
Treasurer, Hazel Rhode, Normal Sanitary Dairy, 300 Broadway, Normal
Corresponding Secretary, Burton F. Whitmore, J. D. Roszell Company, Peoria
Sergeant-at-Arms, C. L. Einspahr.....Bloomington

CHICAGO DAIRY TECHNOLOGY SOCIETY
President, Roy Robichaux.....Chicago
Vice-President, Adolph Brunner.....Chicago
Secretary, P. H. Tracy, Department of Dairy Technology, University of Illinois, Urbana, Ill.
Treasurer, H. P. Smith.....Chicago
Sergeant-at-Arms, R. W. Atkins.....Chicago

Treasurer, Adolph Brunner, Geo. F. Schwartz Ice Cream Mfg. Supplies, 4547 Milwaukee Avenue, Chicago
Sergeant-at-Arms, Leslie L. Chandler.....Chicago

CONNECTICUT ASSOCIATION OF DAIRY AND FOOD SANITARIANS
President, H. Clifford Goslee.....Hartford
Vice-President, Harold D. Neumann...New Haven
Secretary-Treasurer, C. W. Chaffee.....Hartford

INDIANAPOLIS DAIRY TECHNOLOGY SOCIETY
President, J. Herrin.....Indianapolis
Vice-President, J. Meyerhoff.....Indianapolis
Secretary, Dr. F. J. Babel, Purdue University, West Lafayette
Assistant Secretary, W. K. Moseley...Indianapolis
Treasurer, T. Witham.....Sheridan

MASSACHUSETTS MILK INSPECTORS' ASSOCIATION
President, John J. Curtis.....Quincy
Vice-President, Percy A. Hill.....Worcester
Secretary-Treasurer, Robert C. Perriollo, Department Bacteriology and Public Health, Univ. of Mass., Amherst

METROPOLITAN DAIRY TECHNOLOGY SOCIETY
President, Fred E. Uetz.....New York
Vice-President, A. J. Powers.....Brooklyn
Sergeant-at-Arms, Paul Corash.....New York
Secretary, George L. Franke, L. I. Agri. & Tech. Institute, Farmingdale

PHILADELPHIA DAIRY TECHNOLOGY SOCIETY
President, R. K. Lawhorn.....Philadelphia
1st Vice-President, W. P. Fusselbaugh..Philadelphia
2nd Vice-President, Dr. John L. Barnhart, Philadelphia
Secretary-Treasurer, W. S. Holmes....Philadelphia Dairy Council, Inc. 234 South 22nd Street, Philadelphia 3
Ass't. Secretary-Treasurer, Donald Hayes, Philadelphia

ASSOCIATION NEWS

Minutes of the Chicago Dairy Technology Society

At the November meeting of the Chicago Dairy Technology Society, Mr. Charles Weinreich, Director of the Research Department of the Cherry-Burrell Corporation spoke on some of the things he had seen on his recent two and a half months tour of Europe.

Mr. Weinreich said they were welcomed to Sweden and to the International Dairy Congress by the Crown Prince. In Sweden, 97 percent of the dairy farmers belong to a co-op. They have even gone into the supply and equipment business. They are in competition with regular supply and equipment dealers who are in another clique.

Pasteurization is not universal. In Switzerland, farmers with small herds deliver their own milk. Pasteurization is too much trouble for them.

Europe has their own continuous churns. Their finished product is different from our butter but is an excellent spread. Its moisture and fat content varies from one to two percent but it satisfies them.

The European processors are easy to satisfy. They think American equipment is too complicated. For example, their continuous pasteurizers have no flow diversion valves. Longer periods of holding and higher temperatures are expected to do the job. They do, however, look up to American equipment and regard it as a standard of excellency.

Over there, they have instituted economies of time. They are using much sealed equipment and pipe lines that are seldom taken down for cleaning. They just flush with cleaning solutions. This has resulted in poorer quality.

Germany is now back to a normal pre-war three percent butterfat basis for whole milk. It was formerly two percent butterfat. Throughout the European cheese export area conditions are good and clean. In general, quality in ice cream does not exist.

Europe is not as well off as America. Switzerland is the most wealthy. They are producing and creating their own wealth. They are well armed and seem to have national security at mimimum cost. In most other countries, the people are not working too hard. The amount of work they did was closely tied in with getting something for nothing. Those countries that received the most help from us were inclined to work the least. Germany is coming back the fastest. They are working harder. The common people in Europe do not have the quality or food we have here. The poorest fed are in England.

Those countries closest to the "Iron Curtain" are the least susceptible to Communism. The farther west one goes the more susceptible they are to Communism; for example, England and the U. S.

The more a government has to do with its people the less they get. Wealth is based on production and only those countries that are working are coming back.

Mr. Weinreich's talk was followed by questions with off-the-record answers.

Attendance was 108.

At the December meeting, with 128 in attendance, Mr. C. A. Abele addressed the meeting on the subject, "Coliform Organisms in Pasteurized Milk—Their Significance and Measures for Control." He said that the lead of the U.S.P.H.S. in fixing a limit for the coliform content of Grade A pasteurized milk will be followed by the Chicago Health Department eventually. That action will introduce a new philosophy respecting the use of bacteria counts in milk control in Chicago and its vicinity. Heretofore, the limitation of the bacteria content of milk has been quantitative, i.e. irrespective of family genus, or strain—30,000 per ml. in the case of Grade A pasteurized milk. Now the limitation is to become partially qualitative—not more coliforms than 10 per ml. This will be the first instance in which qualitative bacteriology has played a role in the legal aspect of pasteurized milk in that area (except briefly during the war). Consequently thorough reexamination of plant clean-up practices in light of this new emphasis would seem to be in order.

H. P. SMITH
Recording Secretary

DISI Publishes Glossary of Spanish and English Terms in Dairy Field

A glossary of Spanish and English terms commonly used in dairy operations has just been published by Dairy Industries Society International (DISI), Washington, D. C.

Prepared by DISI's Committee on Standard Terminology, this handy, pocket-sized volume contains many terms not found in other dictionaries. It was compiled over an extensive period by the gathering of word equivalents by committee members and DISI friends in many areas. Inclusion of vernacular and regional Spanish as well as standard Spanish terms greatly enhances the booklet's value. For example, sour cream in Spanish somewhat universally is "crema agria" but in El Salvador it is "mantequilla lavada," and in Cost Rica "natilla."

Blank pages are provided in the booklet for insertion of additional terms as the Society's Committee brings these to light, and informs glossary users of them. Users are requested by the Society to report terms which may be properly added to the present content.

Highly qualified DISI members were selected to serve on the Committee on Standard Terminology, including three professors and fourteen other members with wide technological backgrounds. Chairman of the committee is Dr. Mario Stincer of Havana, Cuba.

The Glossary was edited by Prof. R. D. Melendez, Scs.Lt.B., A.M., George Washington University, Washington, D. C., a DISI staff member.

Copies may be obtained for a small fee at the Society's headquarters, 1426 G Street, N.W., Washington, D. C., U.S.A.

LETTER TO EDITOR

November 29, 1949

Dr. J. H. Shrader,
23 East Elm Ave.,
Wollaston, Mass.

Dear Dr. Shrader:

I have your letter of November 17, 1949, with further reference to your editorial entitled "Sanitarians and Engineers," which appeared in the issue of September–October 1949, and which urged sanitarians to beware of amalgamating with the Engineering Section of APHA.

As I informed you in my previous letter, some of the members of that Section were discouraged by your editorial because it was being interpreted as representing the official views of our Association. They had been planning to give sanitarians a voice in running the Section by dividing the Section into various divisions, including a Food Division, with each division represented on the Section Council.

I took the liberty of informing them that, while many of the members undoubtedly considered it a good editorial on the whole, the statement warning sanitarians against losing their identity by becoming part of the Engineering Section of APHA did not represent the official views of the International. It has never been the policy of our Association to prevent or discourage its members from joining other associations. I do not believe that our members who have joined or may hereafter join APHA will thereby wish to give up their membership in IAMFS. It is not the intention of the Engineering Section to absorb our Association, nor could that be done even if they desired it. APHA can never take the place of IAMFS for those who are concerned with the field of milk and food sanitation, because its program and its Journal can devote only a small fraction of the total time and space to this particular field.

I also pointed out that the official views of the Association concerning this matter are reflected in the action taken by our Executive Board in September 1949, when the Board authorized Mr. Harold B. Robinson, Chairman of our Committee on Professional Status of Sanitarians, to express, to the Policy Advisory Committee of the Engineering Section of APHA, its approval of the proposal to establish divisions within the Engineering Section, with each Division represented on the Section Council. Unfortunately, through an oversight on my part for which I apologize, you were not informed of this action when the editorial in question was written.

I trust that you will reconsider the statement in your letter that the action of the Executive Board commits our members "to a project of becoming affiliated with another organization." It commits us to nothing more than approval of a proposal to reorganize the APHA Engineering Section.

Sincerely yours,
A. W. Fuchs,
Past President

P.S.: I should appreciate your publishing the above letter in the January–February issue if possible.

New Milk Canning Process

Experimentally, fresh milk has been canned by a new process. Sampled months later, it still had a flavor indistinguishable from bottled milk fresh from a dairy farm.

On farms large enough to have their own canneries, the milk would be drawn from cows under vacuum by milking machines. It would flow through stainless steel tubes to a homogenizer. Thence it would be pumped into a new flash-type pasteurizer consisting of two cylinder steam jackets with a spiraled core of stainless steel. Here it would be pasteurized at the unusually high temperature of 190 degrees. From the pasteurizer, the milk would flow to the canning machine.

Originators of the new process are Dr. Roy Graves, formerly with the Department of Agriculture; and dairy farmer-implement dealer Jack Stambaugh. Experimental work has been done on the latter's farm near Valparaiso, Ind.

GEORGE C. SUPPLEE, 1889-1949

Dr. George C. Supplee, noted food and pharmaceutical chemist, and former president of the International Association of Milk and Food Sanitarians, 1925, died of a heart attack at his home in Bainbridge, November 7, 1949.

Dr. Supplee was widely known for his chemical research work. He is credited with developing the first commercially practical method of irradiating milk.

He developed methods for the commercial isolation of riboflavin from waste milk products. For this work he received the Billings award from the American Medical Association in 1936.

In 1937 he received from the American Chemical Society the Borden award for research in the chemistry of milk. He has authored more than 100 scientific papers on his research work.

Dr. Supplee received his bachelor of science degree at Cornell University in 1913. He served on the Cornell faculty with special assignments for the United States Department of Agriculture in Pennsylvania, New York, California, Michigan, and Minnesota. He received his Ph.D. degree from Cornell in 1919 after specialization in physiological and food chemistry and in bacteriology.

He was employed in 1918 to organize and manage a research and control laboratory for the Dry Milk Company, an affiliate of the Casein Company of America. He continued as director of research until 1919 when this company was absorbed by the Borden Company. From 1929 to 1935 Dr. Supplee was directing head of numerous phases of technical and developmental research relating to milk products and derivatives under the Borden Company. From 1935 to 1944 he was director of the biological and chemical laboratories of the company.

In 1944 he organized the G. C. Supplee Research Corporation, with offices in Bainbridge, to render consulting services to the food and pharmaceutical industries. He was head of this corporation at the time of his death.

INDUSTRIAL NOTES

Changes at National Dairy Research Laboratories Oakdale, Long Island, N. Y.

Left: Dr. H. A. TREBLER recently appointed Director of Engineering Research and Development

Right: Dr. RANDALL WHITAKER recently appointed Director of the Dairy Technology Department

Field service representatives from the Canadian, Detroit, New England, New York, and Philadelphia sales divisions of Oakite Products, Inc., in attendance at technical-sales meeting at Hotel Commodore, New York, Dec. 15–17.

Oregon Dairying Short Course

The Thirty-Ninth Annual Dairy Manufacturing Short Course Convention will be held at Oregon State College, Corvallis, on February 27, 28, and March 1, 1950. Professor C. A. Iverson, Head of the Department of Dairy Industry, Iowa State College, will head the list of many prominent speakers. Professor G. H. Wilster will report on his observations in Sweden and Denmark and will show 200 colored slides of dairy plants, farms, and places of interest. As usual a dairy products contest will be held in connection with the meeting.

Wisconsin Fieldmen's Conference

The annual Wisconsin Dairy Fieldmen's Conference will be held on the Agricultural Campus of the University of Wisconsin, Madison, in temporary lecture room T-16 on February 1 and 2, 1950. The general themes of the Conference will be "Effects of Minimum Standards on Field Work" and "Programs for the Interstate Shipment of Milk and Dairy Products." A panel discussion will be held on problems connected with field work. For further information, write to Professor H. C. Jackson, Professor of Dairy Industry, University of Wisconsin, Madison, Wis.

NEW MEMBERS

ACTIVE

Richard M. Barber, 1918 Loomis, Winfield, Kansas
Hugh Belcher, Crane & Fillmore, Topeka, Kansas
Joseph A. Bradley, Comanche County Health Dept., Lawton, Okla.
Clifton J. Byrd, 8½ A St., N.W., Ardmore, Okla.
E. C. Cannon, D.V.M., Room 254—City Bldg., Topeka, Kansas
William Cottrell, 1007 East 9th, Pittsburg, Kansas
R. L. Cousins, 308 Jones, Norton, Kansas
J. R. Cowdrey, 3225 W. 17th, Topeka, Kansas
W. H. Cranford, 414 South Palm, Ponca City, Okla.
John E. David, 2120 Potomac Drive, Topeka, Kansas
Ray A. Fair, 2200 Main, Parsons, Kansas
Lee A. Fleckenstein, City Hall, Great Bend, Kansas
Grove Gilliland, 1600 3rd, Dodge City, Kansas
Norman D. Glasscock, 515 S. W. 36, Oklahoma City, Okla.
Cecil C. Graves, 572 E. Park Street, Olathe, Kansas
Larry Green, Lawrence-Douglas County H. Dept., Lawrence, Kansas
F. L. Hart, Hiawatha, Kansas, Milk Inspector
Wynn Hull, Box 71, Junction City, Kansas
Dr. Chas. A. Hunter, P. H. Laboratories, National Reserve Building, Topeka, Kansas
S. W. Jackson, State Board of Agriculture, Topeka, Kansas
John M. Johnston, Route 2, Sapulpa, Okla.
Frank Kelley, 2200 Main, Parsons, Kansas
Nelson Keyes, 6 E. Sharp St., Hillsdale, Mich.
Dr. E. F. Kubin, Box 628, McPherson, Kansas
Gene Lockard, Court House, Emporia, Kansas
A. E. Lundstrom, 635 N. Parkway, Wichita, Kansas
Joe Mahoney, 320 North 13th, Kansas City, Kansas
Neal R. Martin, Box 228, El Dorado, Kansas
Percy E. Mausey, 1027 College, Topeka, Kansas
R. B. Meredith, 407 Civic Blk., Edmonton, Alberta, Canada
J. R. Mingle, 118 West 5th, Oakley, Kansas
Roy Mitchell, 106½ E. 9th, Winfield, Kansas
Horace L. Mitten, Jr., Dept. of Dairy Technology, Ohio State University, Columbus 10, Ohio
Noel Morgan, Hillsboro, Kansas
John Mullinix, 2230 Nebraska, Kansas City, Kansas
Paul Negley, 67 Big Spring Ave., Newville, Pa.
Dr. W. O. Nelson, Horton, Kansas, Milk Sanitarian
M. J. Nicholls, Thomas Courts, Hays, Kansas
Roland Noblet, City Hall, Atchison, Kansas
Ivan Van Nortwick, Food and Drug Division, Kansas State Board of Health, Topeka, Kansas
Roy Page, 408½ West 11th, Hutchinson, Kansas
Wilbur Palmer, 428 S. Elizabeth, Wichita, Kansas
George H. Parker, 321 E. First St., Eureka, Kansas
Travis Plunkett, 1137 W. Main St., Tupelo, Miss.
Donald W. Reed, 515 W. 1st, Coffeyville, Kansas
Joe Reid, 832 North Main, Ottawa, Kansas
J. A. Rogers, Box 613, Independence, Kansas
Pascal A. Roniger, Court House, Manhattan, Kansas
L. W. Rowles, D.V.M., City Building, Topeka, Kansas
William A. Salero, 911 Pierre, Manhattan, Kansas
Paul F. Sawyer, 1707 Corning, Parsons, Kansas
D. D. Van Sickle, 614 Market, Emporia, Kansas
Isidore Silverman, 305 Linden Blvd., Brooklyn 26, N. Y.
E. W. Simpson, Jr., Div. of Public Health, Jefferson City, Mo.
Frank Smirl, Columbus, Kansas
Wilson D. Steen, 102½ E. 4th, Hobart, Okla.
Woodrow Swanson, 505 Tyler, Topeka, Kansas
Clarence Thuma, 1441 Laramie, Manhattan, Kansas
Kenneth L. Ticknor, City Health Department, Topeka, Kansas
Kenneth V. Tost, 1153 Rose Ave., New Haven, Ind.
E. L. Whitmore, 1023 Blakeslee, Neodesha, Kansas
Evan Wright, Food and Drug Division, Aetna Building, Topeka, Kansas

ASSOCIATE

Dale Allen, Route 10, Box 56, Arkansas City, Kansas
Clark Anderson, Oskaloosa, Kansas
Orlan W. Bair, Beatrice Foods Co.,
Floyd Baker, 753 Shawnee, Leavenworth, Kansas
James Batten, 506 Loman, Fort Scott, Kansas
James L. Bearden, South Plains Health Unit, Levelland, Texas
Dr. W. B. Bell, Veterinarian, U.P.I., Blacksburg, Va.
Floyd O. Bengtson, 238 South Clark, Salina, Kansas
Braum L. Bentley, Route 2, Liberty, Kansas
H. J. Boese, 834 N. Sycamore, Iola, Kansas
Albert H. Brunwasser, 1319 Fifth Ave., Pittsburgh 19, Pa.
O. F. Burgess, City of Manguin, Manguin, Okla.
C. A. Burns, Midwest Creamery, Ponca City, Okla.
Myron J. Buss, 430 N. Broadway, Green Bay, Wisc.
* M.S.A. Campbell, 1098 W. Michigan St., Indianapolis, Ind.
William H. Chilson, Dairy Department, Manhattan, Kansas
Earl K. Christman, Penn Dairies, Inc., Lancaster, Pa.
E. E. "Gene" Clark, 7919 Ward Parkway, Kansas City, Missouri
T. J. Claydon, c/o Dairy Department, Kansas State College, Manhattan, Kansas
Kenneth H. Colt, 143 Walnut St., East Providence, R.I.
Wm. B. Cope, Box 1151, Seagraves, Texas
Alfred E. Cristian, R-1, Neenah, Wisc.
C. A. Day, 520 Ash, Ottawa, Kansas
Dr. David W. Fassett, Laboratory of Industrial Medicine, Eastman Kodak Co., Kodak Park, Rochester, N. Y.
Dr. C. C. Flora, Dairy Dept., U.P.I., Blacksburg, Va.
C. C. Foard, Biltmore Dairy Farms, Biltmore, N. C.
W. W. Ford, Box 474, Coffeyville, Kansas
B. H. Gardner, 54 Waltham Ave., Springfield, 9, Mass.
Robert L. Goolsby, South Plains Health Unit, Lamesa, Texas
Mrs. Alice R. Grasso, 3807 South Park Ave., Blaisdell, N. Y.
Al Groms, Field Superintendent, National Dairies, Tonganoxie, Kansas
* C. F. Hanger, State Dairy & Food Div., Staunton, Va.
Wesley Hedges, City Hall, Leavenworth, Kansas
Milton M. Hemman, Route 3, Coffeyville, Kansas
Fred R. Hennig, 500 S. Jackson St., Green Bay, Wisc.
Carson Hildebrandt, Route 3, Pittsburg, Kansas
Prof. C. W. Holdaway, Head of Dairy Dept., U.P.I., Blacksburg, Va.
Doyal Hoyt, 317 N. Ash, Apartment 1, Hillsboro, Kansas
S. W. Hurwitz, 202 W. 6th, Lawrence, Kansas
Arthur Jensen, Route 4, Olathe, Kansas
Calvin Jevne, Farmers Coop. Cry. of West Sweden, Milltown, Wisc.
L. E. Jirikovec, Box 214, North Prairie, Wisc.
Dewayne Jones, Box 588, Emporia, Kansas
Willis D. Jones, Box 588, Emporia, Kansas
Clark King, Erie, Kansas
Ralph King, 1408 W. 12th Street, Kansas City, Missouri
L. C. Larsen, 312 West 13th, Concordia, Kansas
Thomas C. M. Larsen, 7018 Montgall Ave., Kansas City, Missouri
Jack B. Lee, State Health Dept., Hugo, Okla.
Lloyd McCracken, Fieldman, Meyer Sanitary Milk Co., Valley Falls, Kansas
M. F. McDaniels, Midwest Creamery, Ponca City, Okla.
W. M. Magathan, 519 West 16th, Topeka, Kansas
W. H. Martin, Dairy Department, Manhattan, Kansas
W. K. P. Maynard, Secretary, Stevenson & Howell, Ltd., Wellington, C2, New Zealand
Phil Metzger, 1421 Virginia, Sabetha, Kansas
Alan B. Miller, Abbott's Dairies, Inc., Locust St., Oxford, Pa.
Jerry Miller, Iola, Kansas
Robert J. Moubry, 809 Grant St., Madison 5, Wisc.
James A. Nelson, 1900 Euclid Ave., Cleveland 15, Ohio
Miss Julia Nevercel, Biltmore Dairy Farms, Biltmore, N. C.
A. C. Nowlin, 1516 S. Trenton, Tulsa, Okla.
Wm. F. Otto, RR #7, Box 29, Toledo 12, Ohio
Alvin M. Paulson, 1615-14th Ave., Green Bay, Wisc.
B. U. Peters, 1441 Burns, Wichita, Kansas
E. T. Peterson, 1610 Ave. B, Dodge City, Kansas
Roger E. Peterson, University of Wisc., Ogdensburg, Wisc.
M. H. Plett, Fieldman, Hillsboro, Kansas
O. L. Pretz, Route 4, Olathe, Kansas
Kenneth Quinby, Sunflower Dairy, Great Bend, Kansas
Prof. Paul M. Reaves, Dairy Dept., U.P.I., Blacksburg, Va.