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August 19, 20, 21, 22, 1968
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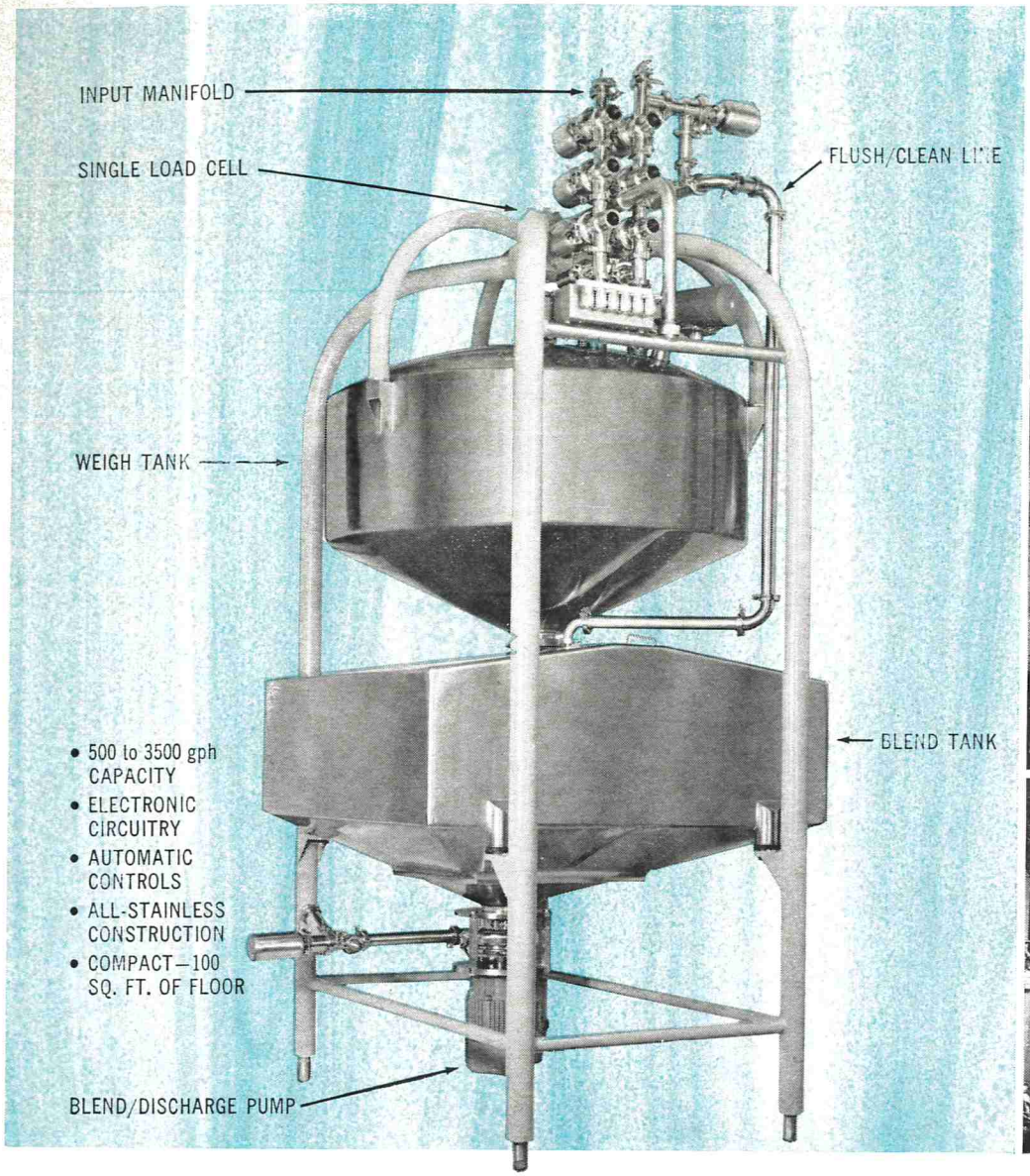

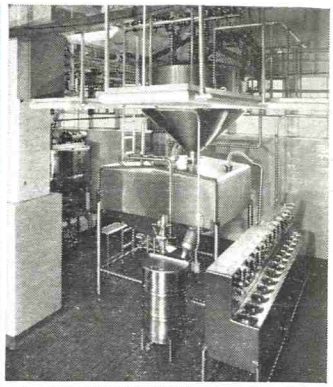

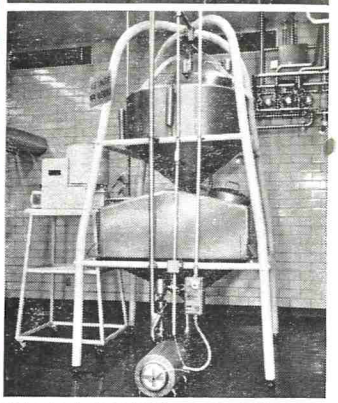

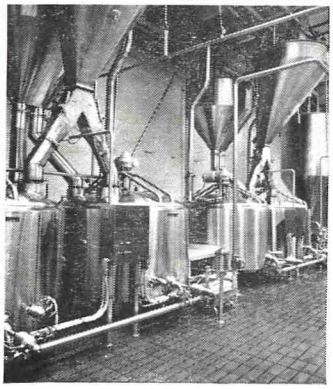

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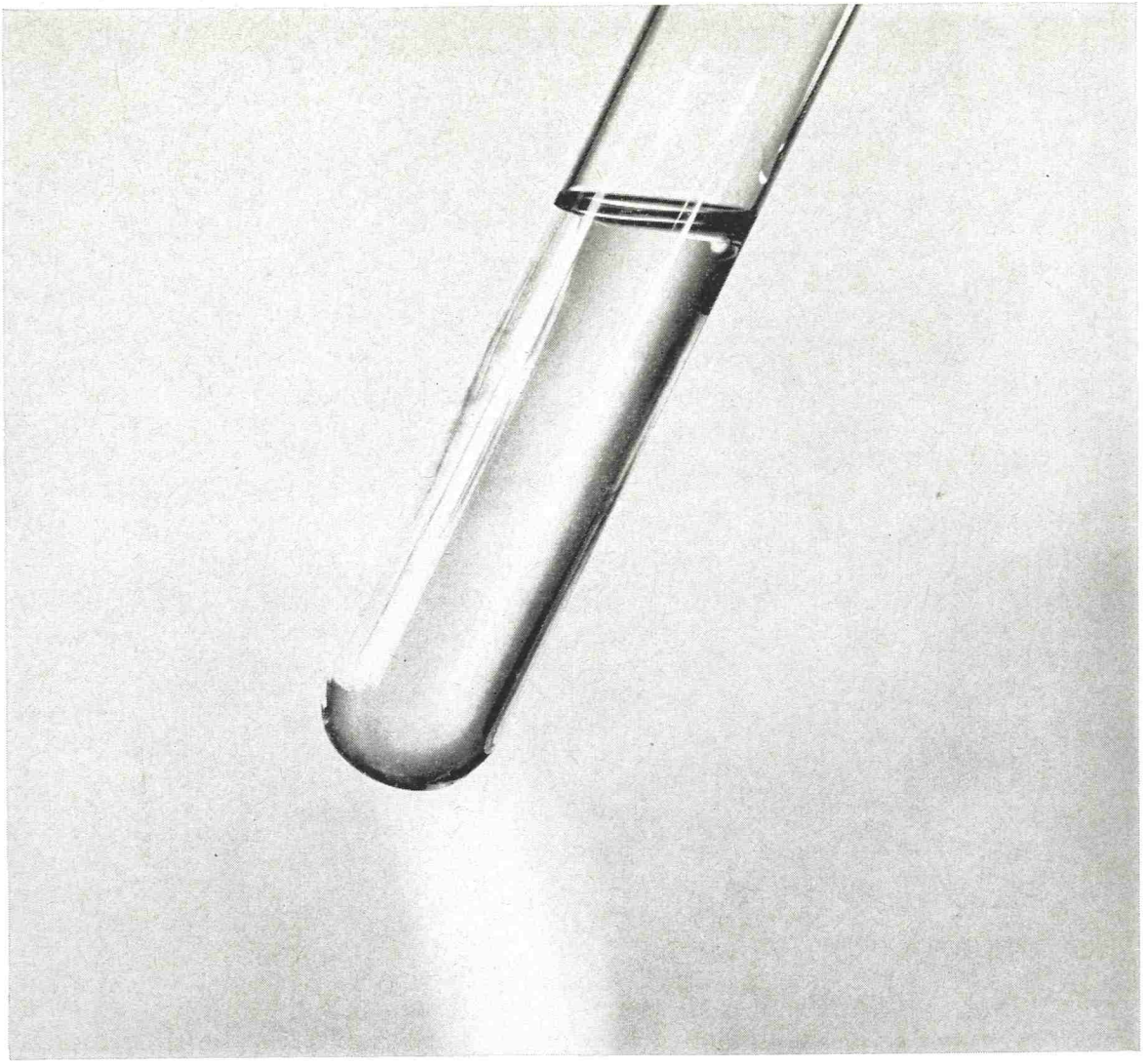

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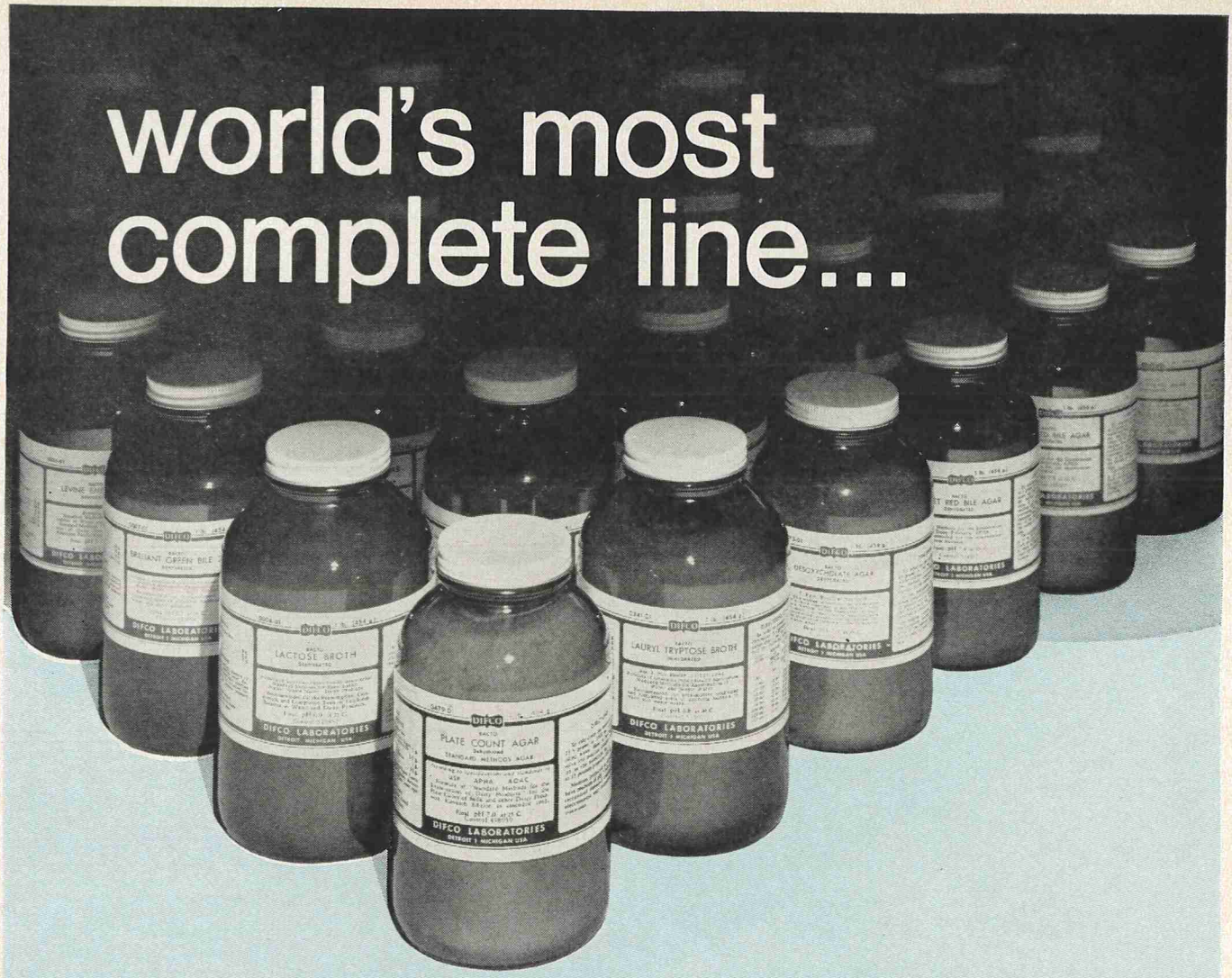

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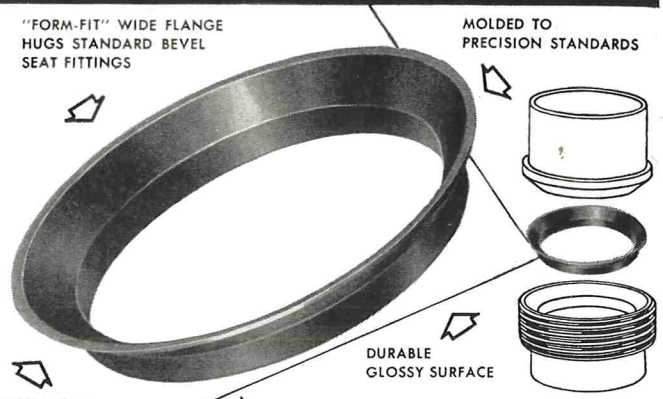

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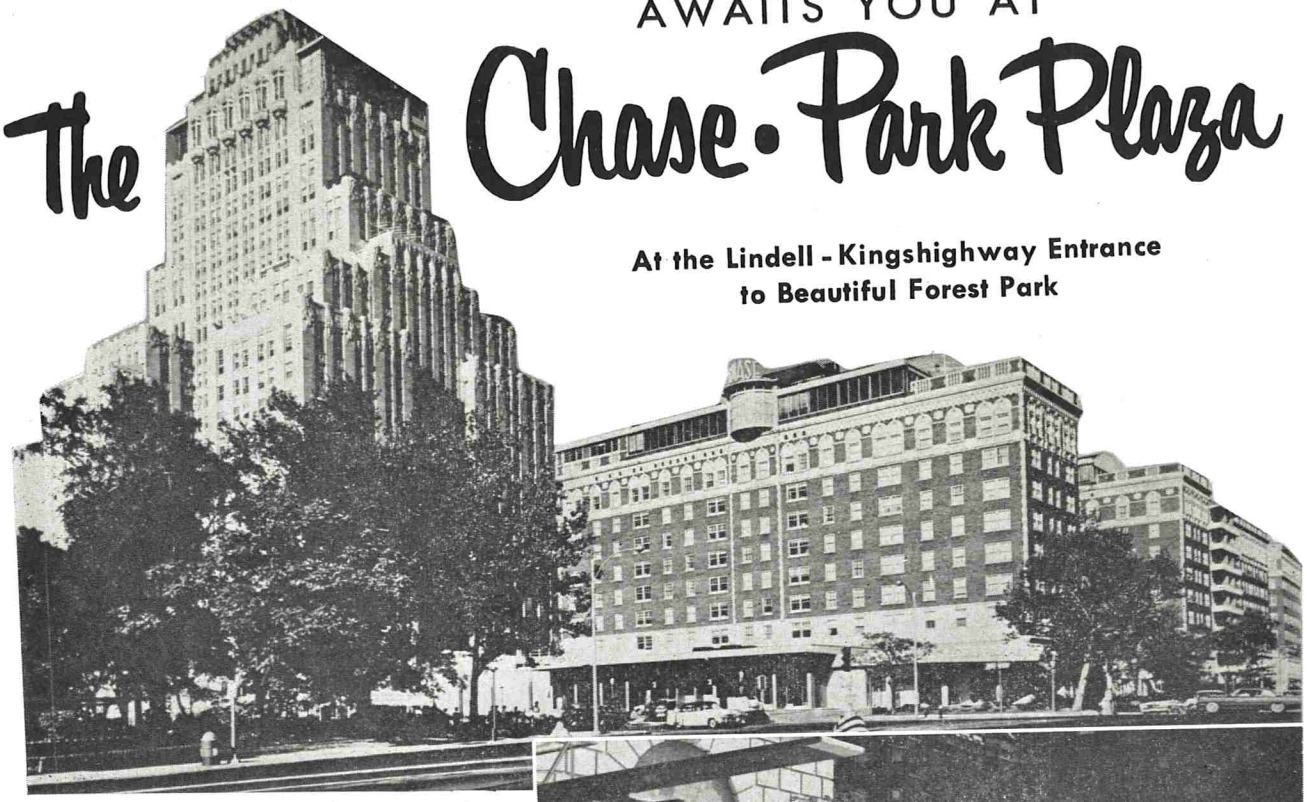

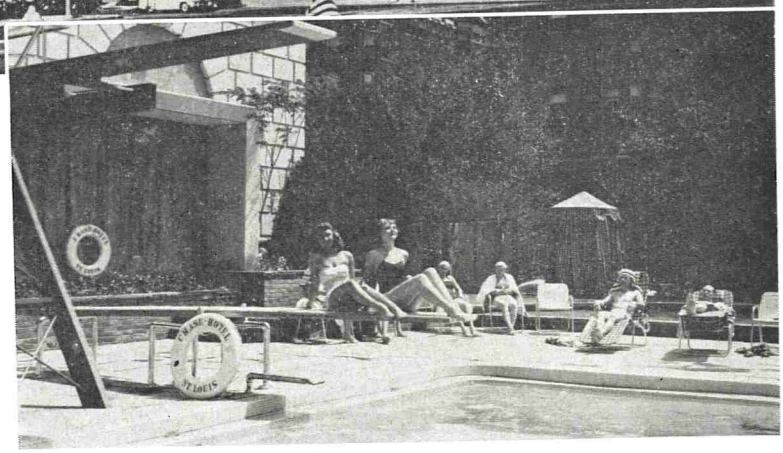

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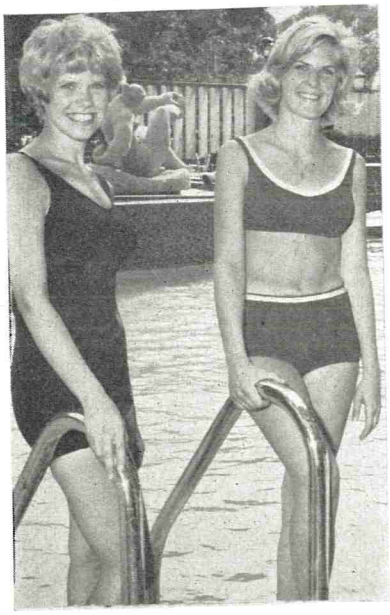

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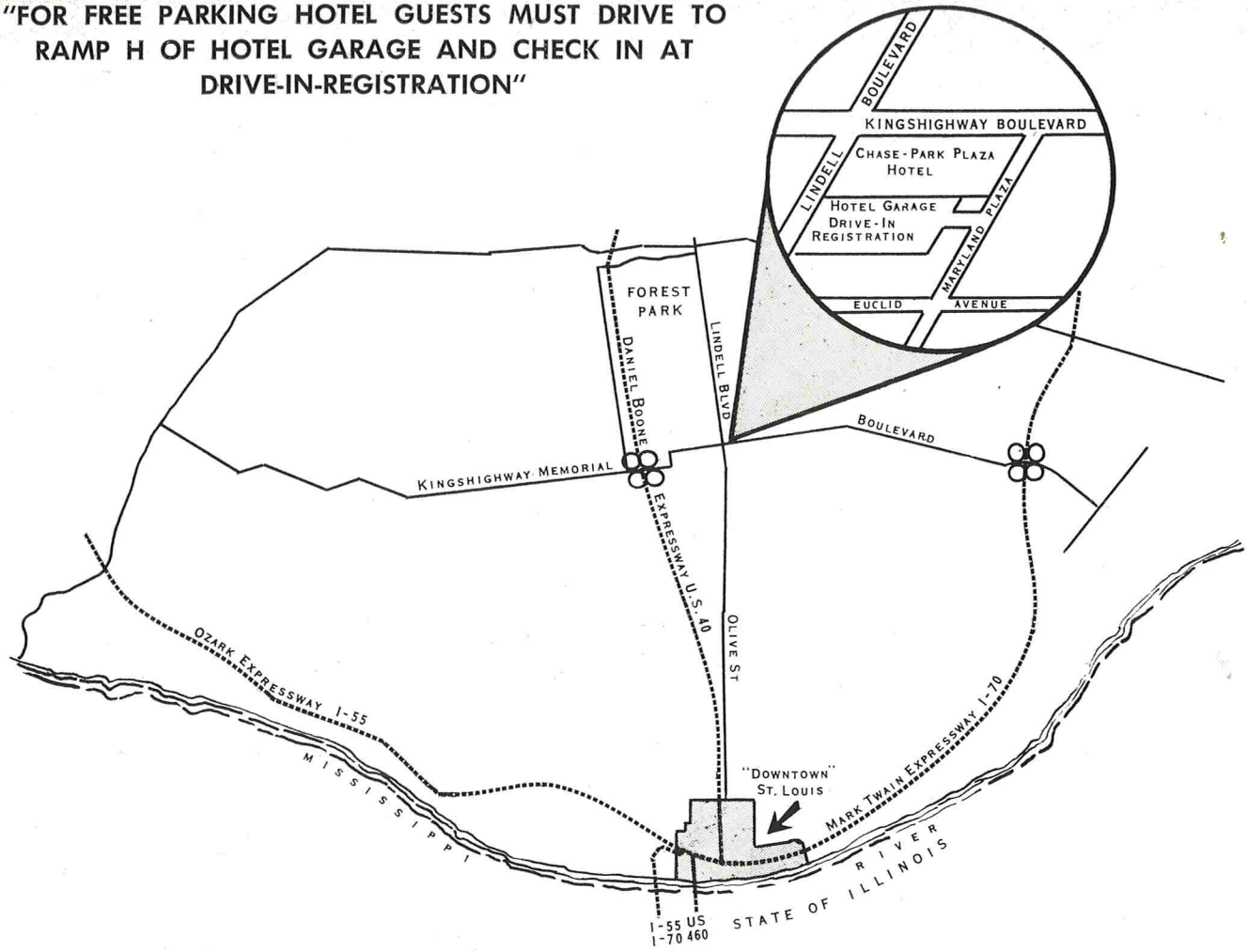

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(Received for publication February 9, 1968)

ABSTRACT

The test for determination of organisms which are oxidase-positive applied to raw milk samples is an effective means for indication of proper cleaning and sanitary procedures on the farm. The total and oxidase-positive counts of raw milk samples from many producers were determined over a 3 month period in order to obtain a basis for minimum standards. The ratio of the total count to the oxidase count, as well as the total numbers of oxidase-positive organisms in the sample, were used to decide if a potential bacterial problem on the farm would develop. Case histories of individual producers are cited to illustrate how to interpret data obtained with the test and to show how use of the data helps to produce milk of good quality. The number of oxidase-positive organisms in laboratory pasteurized samples was also determined and generally found to be low indicating that most, but not all, of such organisms are killed by proper heat treatment.

The consumer deserves the best food available. This means that the starting materials must be of good quality and that processing procedures should be such that the wholesomeness and palatability of the product are maintained. The dairy industry has recognized that its products are no exception to this rule and that they require added attention because of their perishability.

Producing a good quality of milk on the farm is of paramount importance both to the farmer and to the processor. The farmer is interested in keeping the bacterial count low in order to meet legal and industrial requirements, and he does not want his milk to be rejected at the processing plant for off-flavors and -odors. The processor, of course, wants the best possible product for his customers.

The bacterial flora of milk is important since certain genera are able to grow at refrigeration temperatures. These organisms are loosely classed as being psychrophilic. Psychrophilic pseudomonads are particularly detrimental in foods since they have been shown to cause more off-flavor problems (especially in dairy products) than any other single genus *(8)*. Most common in the dairy industry are *Pseudomonas fragi, Pseudomonas viscosa, Pseudomonas fluorescens, Pseudomonas mucidolens* and *Pseudomonas putrefaciens*. Avoidance of such organisms is becoming increasingly important in the production of a high quality product with the advent of bulk cooling, every-other-day farm pickup, and longer holding times, both before and after processing. For these reasons, producers have a stake in the production of "pseudomonad-" or "psychrophile-free" milk. Such milk may be more important today with the advent of so-called "imitation" milk. This product can, if desired, be sterilized, thereby avoiding the possibility of pseudomonad or psychrophile growth. In order to compete with this type of product, both the farmer and processor must of necessity turn out a high quality product.

In order to produce "pseudomonad-free" milk, a method must be available to ascertain quickly in some way whether the farmer is producing milk "potentially free" of such organisms. Further it must be known what the actual numbers are, whether they rise or fall in succeeding tests, and if corrective action taken at the farm is reflected in a lowering of the number of these organisms. Such a method is delineated in this report, and is based in part on a test proposed by the author for the detection of "potential" psychrophiles in pasteurized products *(4)*. Some qualitative data on this aspect have been reported by Castell and Garrard *(2)*.

The basis for the test is the fact that pseudomonads

TABLE 1. TESTS MADE ON PRODUCERS' SAMPLES

	Month of Test			
	July	August	September	Average
Raw Milk				
SPC[1] (median)	20,000	20,000	15,900	18,633
% Oxidase-positive in SPC (median)	16.5	12.5	12.5	13.8
Oxidase count (median)	3,900	3,400	1,000	2,766
SPC minus oxidase count (median)	10,000	17,300	11,400	12,900
Laboratory Pasteurized Milk				
Total bacteria surviving pasteurization (median)	530	680	330	513
(average)	2,925	2,070	1,050	2,015
% of total surviving pasteurization (median)	10.0	11.8	10.5	10.8
Oxidase-positive organisms surviving pasteurization (median)	40	80	30	50
(average)	658	214	111	328
(range)	0—16,200	10—2,450	0—1,430	—
%Oxidase-positive organisms in laboratory pasteurized samples (median)	22.5	14.0	15.3	17.3

[1]Standard Plate Count

(which cause most of the psychrophilic problems in dairy products) are strongly oxidase-positive. That is, cytochrome *c* oxidase produced by these organisms catalyzes the coupling of 2 compounds, *a*-naphthol and *p*-aminodimethylaniline oxalate to form indophenol blue. Thus, when such organisms are present in a mixed flora (on solid media) the colonies turn blue on adding the reagent and are easily detected and enumerated. Most other bacteria are oxidase-negative *(2, 4, 7)*. The number of oxidase-positive organisms in the sample is shown in this report to be an indication of the sanitation and cleaning techniques used on the farm.

METHODS

Standard plate count. Methods as outlined in *Standard Methods for the Examination of Dairy Products (1)* are used unless otherwise indicated.

Oxidase-positive count (4). After making a total count (Standard Plate Count), flood the same plate with the oxidase test solution (about 2 ml) described below. After 10-15 min, count the colonies, enumerating only those which are blue. Place lens or filter paper between light source of counter (Quebec or equivalent with blue bulb) and bottom of petri dish for better visibility of the blue colonies. From the data obtained, the total count, the oxidase count, the percentage of oxidase-positive colonies in the total count and the total count minus the oxidase count are determined.

Laboratory pasteurization. Where used in this report, pasteurization was done at 145 F for 30 min.

Preparation of oxidase test solution. Mix together equal parts of a 1% solution of α-naphthol in 95% ethanol and a 1% solution of *p*-aminodimethylaniline oxalate (Difco) in water. To dissolve the oxalate, the solution must be heated and then cooled before use. The test solution will keep for several days at refrigeration temperatures, but experience has show that clearer results are obtained with fresh solutions. This reagent should be protected from light. *Care should be taken in the use of this reagent; adequate ventilation is essential.*

RESULTS AND DISCUSSION

Results on raw milk samples

Raw milk samples from 48 producers were tested

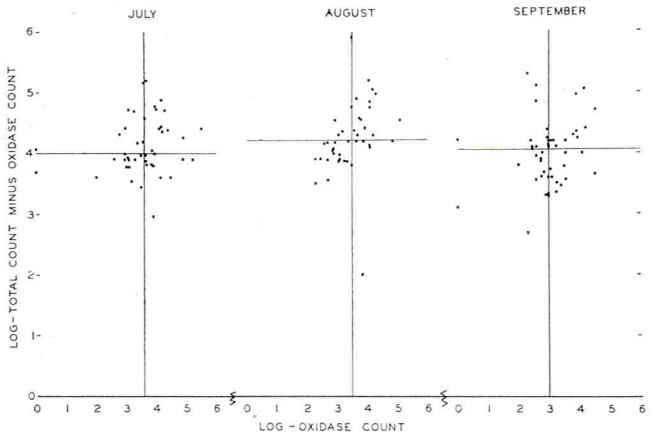

Figure 1. Relationship between number of oxidase positive organisms and non-oxidase positive organisms in raw milk samples taken from same producers over a three month period. Data for the three months are shown. The vertical and horizontal lines within each month's data represent the median in each category.

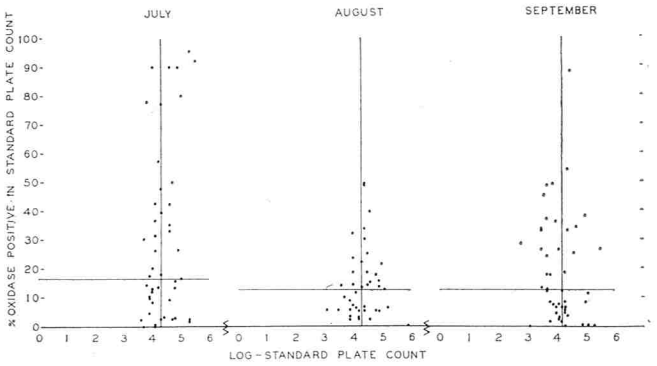

Figure 2. Relationship between the total bacterial count (Standard Plate Count) and the number of oxidase positive organisms expressed as a percentage of the total count. These data are from raw milk samples collected from producers over a three month period. Data for the individual months are shown. Vertical and horizontal lines within each month's data represent the median in each category.

for the presence of oxidase-positive organisms each month for 3 consecutive months (July, August, September). Data were collected on the relative proportion of such organisms in the total bacterial population as well as their concentration in the sample and are presented in Fig. 1 and 2 and Table 1. The data presented in the figures have been subdivided (for each month) into 4 quadrants by the median lines. Fig. 1 shows the relationship between the number of oxidase-positive organisms and all other organisms in the sample. Fig. 2 gives the percentage of oxidase-positive organisms in the total bacterial count. The interpretation of the 4 quadrants of each figure is as follows: *Upper left quadrant* – low number of oxidase-positive organisms; high number of other bacteria. *Lower left quadrant* – low number of oxidase-positive organisms; low number of other bacteria. *Upper right quadrant* – high number of oxidase-positive organisms; high number of other bacteria. *Lower right quadrant* – high number of oxidase-positive organisms; lower number of other bacteria. The lines are drawn at the median level for each determination. High and low are relative. Although it has been shown by Punch et al. *(6)* that considerable numbers of psychrophilic organisms are needed to produce a gross flavor defect in pasteurized milk, the concentration of oxidase-positive organisms needed for raw milk deterioration has not as yet been ascertained. This can vary with the species under consideration as well as with the competing flora. In any event, subtle changes by pseudomonads may take place in milk without a high count. These changes are usually referred to as "lack of freshness," "staleness," or "unclean". Until actual numbers are determined, we can only estimate the levels to operate at by looking at natural samples. This information is provided by the data in Fig. 1 and 2, and the computations shown in Table 1. The average median level of oxidase-positive organisms in the Standard Plate Count for the 3 month test period was almost 14%. However, the actual numbers may be low since many of the samples had a Standard Plate Count of less than 15,000. In fact, the median Standard Plate Count was only 18,600. In actual numbers, the median level for oxidase-positive organisms was 2,766 per ml. The median level for bacteria exclusive of those which were oxidase-positive was 12,900 per ml.

How can a laboratory utilize such data to its fullest extent? Samples are suspect if they meet the follow-criteria: the oxidase count is over 3,900 per ml., the percentage of oxidase-positive organisms in the total count is over 16.5% and the Standard Plate Count is over 20,000. These figures are the highest for any month in the test period. In general such samples fall within the limits of the worst 25% of the samples tested as previously described, i.e. they fall within the upper right hand quadrant of Fig. 1 and 2. If all 3 criteria are met, the sample is certainly suspect in that the possibility of a build-up of oxidase-positive organisms and potential off-flavor development caused by pseudomonads is present. An examination of sanitary conditions on the farm is therefore warranted.

If the total count is low but most of the organisms are oxidase-positive, then there should be cause for concern. These oxidase-positive organisms are important as previously explained *(4)*, since they are "potentially" psychrophilic, and their presence, even in raw milk is detrimental. Even in a short refrigeration period *(3)* such organisms can produce off-flavors which may carry over to the pasteurized product or, if the milk is offensive enough it may be re-

jected by the processor. It is therefore important to know if such organisms are present in large numbers, and, in fact, if they make up a large proportion of the bacterial flora of the sample. If this is true, it would then appear that a single source of contamination is indicated and remedial action can be taken. It is also possible by this test to follow a producer's milk supply and ascertain if the flora is changing even though the total number of bacteria does not change. Such data could indicate a change in methods of handling the milk or in cleaning procedures, that is, changes not detected by the total bacterial count. Further, if remedial action is taken, another diagnostic tool is available to determine if the remedy recommended has been carried out and if it was satisfactory. Where the data obtained with the oxidase test are particularly useful is with samples of Standard Plate Count around 50,000. Farmers producing milk with a count of this magnitude are considered to be good producers. But, if the majority of this count is oxidase-positive, a field man should begin an investigation into the potential source of contamination.

The relative simplicity of the oxidase test as a diagnostic tool in the food industry is of great importance. It requires little additional work for the laboratory. Data obtained from tests already routinely being made are exploited to a fuller extent. Each additional test available to the field man contributes directly to a better understanding of a bacterial problem on the farm and to its solution so as to give a better quality milk.

In order to test the method under actual farm conditions, milk from 50 producers, chosen at random, was examined. Each producer's milk was tested for 3 consecutive bi-weekly periods. At each time a Standard Plate Count, a laboratory pasteurized count and an oxidase count of both was made. Recommendations were made in those instances where trouble could develop. These recommendations were based on the data reported in the first sections of this report.

Several case histories are given which represent how proper interpretation of the results of the test were valuable in assessing a farm production problem.

Samples were considered to merit attention if they were above the minimum standards as shown in Table 1, namely: *(a)* a Standard Plate Count of more than 20,000; *(b)* an oxidase count of more than 3,900; *(c)* oxidase-positive colonies in SPC of more than 16.5%; and *(d)* SPC minus oxidase count of more than 17,300. In the case histories presented below the term *visit* indicates inspection of the farm by the field man and his findings. SPC indicates the Standard Plate Count and Ox.-Pos. is the number of oxidase-positive organisms in the Standard Plate Count.

Case histories

Producer I

	SPC	Ox.-pos.	% Ox.-pos.	SPC-ox.-pos.
Test No. 1	55,000	49,000	89.1	6,000
2	160,000	154,000	96.3	6,000
3	>300,000	>285,000	>95.0	—

Comments: This farmer is usually an excellent producer. He has all new equipment.

Test No. 1. Almost all of the SPC is oxidase-positive. It would appear that dirty equipment may be the causative agent.

Visit: Producer requested to institute aggressive cleaning program.

Test No. 2. Data indicate that farmer did not follow recommendations that he do a better cleaning job.

Visit: Farmer warned to recheck cleaning procedures on tank, electrode, and vacuum pail area.

Test No. 3. Obvious that farmer did not follow recommendations.

Visit: Confirmed observation that cleaning recommendations not followed.

Conclusions: The oxidase test showed possible explosive situation 4 weeks prior to detection by the Standard Plate Count. If the farmer had followed recommendation made after the first test, tests 2 and 3 would have been much lower. This case history points out one advantage of the oxidase test; prediction of potential trouble before detection by the Standard Plate Count.

Producer II

	SPC	Ox.-pos.	% Ox.-pos.	SPC-ox.-pos.
Test No. 1	54,000	60,000*	111.0	—
2	65,000	26,000	40.0	39,000
3	23,000	15,000	65.2	8,000

Comments: This farmer has a new milking system and is considered to be a good producer.

Test No. 1. Execessive oxidase-positive count. Visit recommened to look for dirty equipment.

Visit: Found only that rubber shut-off valves on claws dirty. This was corrected. He was asked to be more conscientious in his cleaning practices.

Test No. 2. Although total count is about the same, the oxidase-positive count was dramatically reduced. It would appear that corrections made after test No. 1 helped. No visit was made.

Test No. 3. Both oxidase count and SPC are down even though the percentage of oxidase-

positive organisms went up. Farmer appeared to heed cleaning recommendations.

Conclusions: The oxidase test helped in making a good producer into a better producer, thus a better quality milk resulted for the consumer. This case history points out how the oxidase test can tell if a producer heeds cleaning recommendations even though the SPC remains about the same.

*It has not been unusual to find that the oxidase count is greater than the SPC. Pseudomonads sometimes form pinpoint colonies which are not discernable under ordinary counting conditions but are easily seen when they turn blue with the oxidase test.

Producer III

	SPC	Ox.-pos.	% Ox.-pos.	SPC-ox.-pos.
Test No. 1	55,000	31,000	56.4	24,000
2	65,000	40,000	61.5	25,000
3	71,000	67,000	94.4	4,000

Comments: This farmer is considered to be a fair producer.

Test No. 1. The oxidase test is grossly over the minimum standards. He requires an immediate visit and close observation. However, it was not possible to visit the farm after this test.

Test No. 2. Reaffirms test No. 1. In fact the oxidase-positive count has risen. A visit was recommended and suggestion made to look for a dirty tank and equipment.

Visit: Everything appeared in order. Unable to check cleanliness of tank since it was full of milk.

Test No. 3. Oxidase count has gone up again. Immediate action needed.

Visit: Visit timed at 0.5 hr before milking. Tank was empty and found to be dirty, greasy and with a bad odor. Tank scoured, followed by acidified rinse and then sanitized.

Conclusions: Potential very high counts caught in time because of data obtained with oxidase test. With the tank in such bad condition it might be expected that the milk could contain an off-flavor. Note that the SPC alone show the farmer to be maintaining himself at approximately the same level.

Producer IV

	SPC	Ox.-pcs.	% Ox.-pos.	SPC-ox.-pos.
Test No. 1	13,000	1,000	7.7	12,000
2	20,000	20,000	100.0	0
3	8,000	1,000	12.5	7,000

Comments: This farmer is a good producer.

Test No. 1. No reasons to believe trouble indicated by any criterion.

Test No. 2. Even though SPC is low and minimum standards for the oxidase test are not quite met, the rise in the oxidase count from 7.7 to 100% indicates reason to inspect this farm.

Visit: Equipment looked clean but highly suspicious that farmer ran out of sanitizing agent for tank and other equipment. He was given some sanitizing solution to use.

Test No. 3. All tests back to normal. No reason to suspect trouble.

Conclusions: Prompt action by field man using data obtained with oxidase test kept this farmer producing a superior quality of milk. This case history is an excellent example of the value of the oxidase test.

The 4 case histories presented are used only as examples to illustrate the potentialities of the oxidase test when applied to raw milk samples. Similar observations were made on other farms and remedial action instigated by the field man helped to keep the bacterial count at a low level. However, the test is not a cure of all ills on the farm. It is only an additional tool in the never ending struggle to help provide quality food. It must be emphasized that proper interpretation of the data obtained is necessary, and for this reason close cooperation between the laboratory and the field man is essential.

The test also will be extremely valuable to persons in official public health control laboratories charged with helping the consumer. Analysis of raw milk samples will give additional insight into farm practices. In effect, it will yield information on whether or not cleaning and sanitary practices as recommended for good milk production have been utilized. It is felt that the greatest help the test can provide is with those dairymen who are producing a good to fair quality milk as determined by the Standard Plate Count. Many instances have been noted where farmers became better producers by knowing the source of possible contamination and immediately doing something towards its alleviation.

Results on laboratory pasteurized producers samples

Application of the oxidase test to laboratory pasteurized samples provides a ready insight into oxidase-positive organisms which survive the pasteurization treatment. Some data on this topic are presented by Macaulay et al. *(5)* who showed that some pseudomonads survive pasteurization and then increase in numbers when grown at 3-5 C. Laboratory pasteurization tests were made of the samples from the 48 producers examined over the 3 month period. The

numbers of oxidase-positive organisms were determined in each instance as well as the percentage of oxidase-positive organisms in the total pasteurized count (Table 1). Although the median number of oxidase-positive organisms is quite low for any month, a perusal of the range shows that there are some samples with high oxidase-positive counts. What effect would the sample with 16,000 oxidase-positive organisms per ml (18,000 SPC) have when mixed with pooled milk and kept under refrigeration? Obviously the answer is not to find out, but to prevent such samples from entering a pooled supply.

It is considered that oxidase-positive organisms which either survive pasteurization or are post-pasteurization contaminants are "potential" psychrophiles. A level of 2% of oxidase-positive organisms in pooled plant pasteurized milk correlates positively with the number of psychrophiles found by standard methods *(4)*. The level that would be important in a milk from a single producer would depend on the volume of raw milk and the volume of pooled milk it was ultimately mixed with before processing, or during pre-processing storage. Results have indicated that many oxidase-positive organisms do survive laboratory pasteurization.

Based on the data obtained with the laboratory pasteurized samples minimum standards for laboratory pasteurized milk were determined as for the raw milks. Samples would bear further consideration if the following criteria are met: *(a)* SPC of more than 680; *(b)* oxidase-positive of more than 80; and *(c)* oxidase-positive organisms in SPC of more than 22.5%.

With this guide as a basis, a reexamination of the 50 producers from which the case histories were drawn was made. No correlation was noted between high oxidase counts in the raw and in the laboratory pasteurized milk. During the 6 week test period, 25 different samples met, or were sufficiently close to, the minimum standards as defined for laboratory pasteurized milk. Of these, 5 producers were above minimum in at least 2 of the test periods, one was above in all 3 periods. In the 25 samples, 18 different producers were represented. Of these 18, ten were cited because they were above the minimum standards for raw milk. No oxidase test on laboratory pasteurized samples exceeded 3,200. This figure is considerably lower than that seen with the first set of samples from which the minimum standards were derived.

It appears therefore that the most efficient use of the oxidase test for laboratory pasteurized samples is to examine only those samples with a Standard Plate Count of greater than 680. If the oxidase count is over 22.5%, the producer should be watched to ascertain if this is a continual occurence. A continual high oxidase test would be cause for close investigation at the farm in an attempt to determine the source of such heat resistant oxidase-positive organisms.

ACKNOWLEDGMENTS

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PREPARATION AND TITRATION OF CRUDE STAPHYLOCOCCAL *BETA* HEMOLYSIN FOR USE IN T.K.T. MEDIUM[1,2]

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Abstract

A simple, effective method for preparation and titration of crude staphylococcal β hemolysin is presented. Factors which affect the results are discussed. This method of production and titration is useful for laboratories which use T.K.T. medium for the identification of CAMP test-positive streptococci in bulk, bucket or quarter milk.

The effectiveness of a selective medium containing thallium sulfate, crystal violet, staphylococcal β toxin (hemolysin) and ovine erythrocytes (T.K.T. Medium)[3] for the isolation of CAMP test *(2)* positive-streptococci from quarter, bucket or bulk milk has been demonstrated by Hauge and Ellingsen *(4)*, Hansen and Winther *(3)*, and Postle *(7)*. In the work done by Postle, the staphylococcal β hemolysin that was incorporated in the medium was a purified product that was not commercially available. At this writing there is no known commercial source of β hemolysin in the United States.

Widespread use of this diagnostic technique would require the availability of β hemolysin. The following is a simple laboratory procedure for the production and titration of crude hemolysin for use in T.K.T. medium.

Materials and Methods

Production of crude hemolysin

A strain of *Staphylococcus aureus* which produced only β hemolysin was isolated on a sheep blood agar plate. This strain produced a 1 cm diameter zone of β hemolysis. It was selected from a stock culture maintained for use in conducting CAMP tests.

A single colony was inoculated into 200 ml heart infusion broth (Difco, Detroit, Michigan), which was incubated at 37C for 48 hr while being agitated (Magnestir, Aloe Scientific, 1831 Olive St., St. Louis 3, Mo.). The culture was centrifuged (500 x g for 30 min) to remove bacterial cells, then sterilized by filtration [Seitz Sterilizing Filter (Pore size 0.5 μ) Aloe Scientific]. The resulting product was identified as crude hemolysin. This product retained its usefulness for use in T.K.T. medium after being stored for several months in stoppered bottles at 4C.

Titration of crude β hemolysin by hot-cold hemolysis

The principle of hot-cold hemolysis of ovine erythrocytes (by β hemolysin) was used to express the concentration of β hemolysin in the crude product. A series of 12 dilutions of crude hemolysin, 1:2, 1:4, 1:8, . . . 1:4,000 in 0.5 ml portions were set up in test tubes containing sterile heart infusion broth as a diluent. To each dilution was added 0.5 ml of 2% suspension of washed ovine erythrocytes *(1)*. Thus the final dilutions were 1:4 in the first tube and 1:8,000 in the 12th tube. The tubes were incubated at 37C for 30 min then stored for 4 hr at 4C.

The resulting hemolysis was recorded as complete (+), incomplete (±) or negative (−). Incomplete hemolysis was recorded for those tubes which contained some non-hemolyzed erythrocytes and a clear, red-tinged supernatant fluid. The highest dilution (least amount of crude hemolysin) in which incomplete (±) hemolysis occurred was presumed to be the appropriate dilution for use in the preparation of T.K.T. medium.

Selection of most useful titer of crude hemolysin

T.K.T. medium was prepared in 100 ml quantities for testing crude hemolysin in the two highest dilutions which produced incomplete (±) hemolysis and the lowest dilution which produced complete (+) hemolysis in the titration study.

A pure culture of *Streptococcus agalactiae* was inoculated into approximately 30 ml sterile milk and thoroughly shaken. A 0.01 ml loopful of this milk was inoculated onto each T.K.T. trial plate which contained a known dilution of crude hemolysin. The inoculum was spread in a pattern which permitted the development of individual colonies. Those culture plates on which the clearest hemolysis could be demonstrated were considered to contain the most useful dilution of crude β hemolysin.

Results

Detailed results of the titration for lot EE of crude hemolysin are presented (Table 1). Incomplete hemolysis occurred in tubes 8, 9 and 10 at the 1:500, 1:1,000 and 1:2,000 dilutions respectively.

Results are presented for the hemolysis produced by *S. agalactiae* on T.K.T. trial plates which contained hemolysin from lot EE in dilutions represented by tubes 9, 10 and 11 (Table 2). The medium containing crude hemolysin in 1:2,000 dilution yield-

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[2]This investigation was supported in part by Public Health Service Research Grant No. UI 00124 from the National Center for Urban and Industrial Health.

[3]Name derived from *T*hallium sulfate, *K*rystal violet, and *T*oxin.

TABLE 1. TITRATION OF LOT EE CRUDE BETA HEMOLYSIN BY HOT-COLD HEMOLYSIS

Tube No.	Dilution	Hemolysis
1	1:4	+
2	1:8	+
3	1:16	+
4	1:32	+
5	1:64	+
6	1:128	+
7	1:250	+
8	1:500	±
9	1:1,000	±
10	1:2,000	±
11	1:4,000	—
12	1:8,000	—

ed the clearest zone of hemolysis around individual colonies.

A summary of results of hot-cold hemolysis and T.K.T. trial plates for 4 lots of crude hemolysin is also presented (Table 3).

DISCUSSION

The titration of staphylococcal β hemolysin by hot-cold hemolysis is dependent upon optimum pH value and electrolyte concentration *(6, 8)*. A pH value below 7.4 inhibits the activity of β hemolysin. Calcium and sulfate ions have an inhibiting effect on hemolysis, while magnesium and manganese ions have an enhancing effect *(6)*. For this reason heart infusion broth was used as a diluent in the titration procedure. This provided a constant relative ionic concentration and similar pH value in all dilutions.

The highest dilution of crude hemolysin which produced incomplete hemolysis by titration, provided the most useful concentration for use in T.K.T. medium in each of 4 lots (Table 3).

The use of trial plates of T.K.T. medium may be advisable as a procedure for verifying the results of titration because of an occasional defective titration *(6)*.

Clarity of hemolysis on T.K.T. medium is affected by the concentration of β hemolysin. A concentration of β hemolysin that is too great produces results which are poorly defined, because of an excessive alteration of erythrocytes. A concentration of β hemolysin which is insufficient in T.K.T. medium produces incomplete hemolysis around CAMP test-positive organisms. However, it should be noted that T.K.T. plates are quite readable in the dilutions on both sides of those selected as most useful.

Pulsford *(8)* and Pedersen *(6)* reported that non-selective blood agar supported a wider zone of hemolysis than the selective medium containing crystal violet and thallium sulfate. The clarity of the hemolysis was not reduced, however, in the selective medium.

TABLE 3. SUMMARY OF RESULTS OF HOT-COLD HEMOLYSIS AND T.K.T. TRIAL PLATES FOR FOUR LOTS OF CRUDE HEMOLYSIN

Lot	Titration		T.K.T. Trial Plates	
	Dilution	Results	Ml Crude Hemolysin/100 ml T.K.T. Medium	Clarity of Hemolysis
CC	1:8	±	12	unclear
CC	1:16	±	6	clear
CC	1:32	—	3	unclear
DD	1:1,000	±	0.1	unclear
DD	1:2,000	±	0.05	clear
DD	1:4,000	—	0.025	unclear
EE	1:1,000	±	0.1	unclear
EE	1:2,000	±	0.05	clear
EE	1:4,000	—	0.025	unclear
FF	1:1,000	±	0.1	unclear
FF	1:2,000	±	0.05	clear
FF	1:4,000	—	Not tested in T.K.T. medium.	

During the final stages of preparation of this manuscript, a report of a similar investigation without titration procedure was published by Jasper and Dellinger *(5)*. The results reported for both investigations are in basic agreement.

TABLE 2. HEMOLYSIS PRODUCED BY *Streptococcus Agalactiae* ON T.K.T. TRIAL PLATES WHICH CONTAINED CRUDE HEMOLYSIN FROM LOT EE

Tube	Crude Hemolysin			Amount agar (ml)	Hemolysis
	Dilution	Per cent	Ml hemolysin		
9	1:1,000	0.1	0.1	100	unclear
10	1:2,000	0.05	0.05	100	clear
11	1:4,000	0.025	0.025	100	unclear

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1968 REPORT OF THE NMC PROGRAMS AND PROCEDURES COMMITTEE,

The Programs and Procedures Committee discussed the responsibility of the National Mastitis Council to recommend a basic mastitis control program. Recognition was made of past activities in this regard, and particularly the existing Mastitis Control Program Recommendations of the Council. The Committee recognizes that an industry-wide mastitis control program is inevitable and desirable, and that the fundamental principles of such a program should be stated by the Council. The Committee recommends that the Council adopt the following statement of principles. This may also be considered a skeleton outline of a desirable universal mastitis control program.

Education must precede action in order to establish a favorable climate for the program and to assure cooperation of the dairy industry. Every segment of the industry should participate in the educational program, with over-all responsibility and coordination centered in the Federal Extension Service.

Mastitis Control Programs can be most effective when organized on a State-wide basis. A State-wide mastitis control committee should be established whose functions should be advisory in nature and to promote the program. Committee membership should be open to all who wish to participate. This would include all concerned organizations and individuals.

All dairy herds should be involved, whether producing grade "A" or manufacturing milk. If an industry-wide mastitis control program is to succeed, enrollment should be compulsory, rather than voluntary, to the extent that assistance can be rendered to individual dairymen as unsatisfactory conditions demand.

Administration of the mastitis control program should be vested in someone with regulatory experience and/or authority. For example, this could be the State Veterinarian or his equivalent. Because manpower is a problem it should be used efficiently. There should be no overlapping of responsibilities, but all essential services of an effective program must be provided. Assistance should be enlisted from all qualified sources. The Committee recommends to the Council that it encourage the U. S. Department of Agriculture to make the animal health field forces available insofar as possible in support of State mastitis control programs.

Laboratory services are basic to the success of a mastitis control program. There should be no duplication of effort; there is no purpose in spending taxpayers' money for duplicating laboratory activities. Certification of laboratory services should be a responsibility of Departments of Public Health and the U. S. Public Health Service.

The Committee recognizes two basic aspects of a mastitis control program—milk quality and animal health—both aspects should be served in the basic laboratory program. An approved screening test to estimate cell content should be applied to bulk milk from all producers. The certifying agency should determine the acceptability of the particular screening test to be chosen. Ideally, all laboratories would use the same screening test. If consecutive indirect screening tests for estimating cell concentrations in milk are satisfactory, no further action is indicated. If unsatisfactory, a herd mastitis control program is initiated.

Recognizing that the fundamental aim of the mastitis control program is to assist dairymen to overcome mastitis problems, it is recommended that bulk milk samples should be plated on selective medium for detecting *Streptococcus agalactiae*. One reason for this recommendation is the fact that bulk milk screening tests do not disclose mastitis problems in individual animals, but rather, indicate the general herd situation. Another reason is that the particular type of infectious mastitis caused by S. *agalactiae* can be eradicated following detection and proper treatment of individual infected animals. However, the details of an individual cow health program are not within the scope of this report.

All tests of all kinds should be reported to all persons concerned. Practicing veterinarians should treat or supervise treatment of individual animals and furnish all other services they are qualified and willing to provide.

The Committee has noted the significant, though sometimes limited, success of various existing control programs. Therefore, optimism is encouraged in well coordinated programs which include all of these basic recommendations.

PROGRAMS AND PROCEDURES COMMITTEE
Wayne Burch, Chairman
February 14, 1968

THE PROBLEMS OF MILK AND IMITATION MILK

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(Received for publication March 1, 1968)

The dairy industry in the past decade has been burdened with butterfat surpluses and with the uneasy knowledge that uses for butterfat have been decreasing. To complicate the picture, it is now faced with the specter of competition from imitation milk and filled milk.

One way for the dairy industry to compete effectively is to find wider utilization for both butterfat and solids-non-fat. What is the research potential for such a development?

First, it may be explained that sometimes the problems involved in the research development of dairy products are not fully understood by even the best intentioned. For example, the question has been asked, "Why can't butter be produced at 60 instead of 80% fat to make a lower priced food?" The answer is simple. It cannot be produced at this lower fat content and still look and taste like butter. Butter is a natural food and whether churned from 3% fat milk or 40% cream, the resulting product comes out of the churn about 80% fat.

Just like butter, milk is a natural food and so is ripened Cheddar cheese. They can't be changed drastically without losing their identity. Research on these natural foods is largely limited to producing and distributing them efficiently, to adjusting their composition within narrow limits for optimum consumer acceptance, to developing good flavor and texture, and to packaging them attractively.

A potential exists, however, for new processed products which are off-shoots of our natural milk foods, in spite of some road blocks to development and acceptance. Not the least of these road blocks is the present wide price differential between butterfat and vegetable fat which does not permit new dairy products to compete easily in the marketplace.

POTENTIALLY NEW DAIRY FOODS

Specific examples of new dairy foods recently developed though not necessarily readily available to the general public, are low-fat milks, whipped toppings, flavored milks, dried whole milk and canned vegetables containing butter and cheese sauces. All are in a trial phase and all require continued research. For example, from surveys at Cornell University *(3)*, the flavored orange and strawberry milks, available in a few markets, are too bland. But, if made tart with acids, the flavored milks would curdle. Whole, dried milk, developed by the USDA Eastern Regional Utilization Laboratory, Washington, D. C., and packaged in cans, soon will be making its market test debut in 10 stores at Lansdale, Pennsylvania *(1)*. Upon reconstitution of this product, milk with a good flavor results, but the powder itself has a relatively short shelf-life at room temperature, perhaps 3-4 months. Otherwise, whole milk powder shows much promise. The canned vegetables, including peas, corn, carrots, and beans, covered with butter or cheese sauce, developed at the University of Wisconsin *(9)*, are just coming onto production lines. If accepted by the consumer, these foods will use considerable milk product.

Other new foods utilizing milk and milk products, for which either laboratory or marketing research is lacking, include flavored milk puddings, canned rice pudding and white milk candies. The latter, made on a small scale in Puerto Rico, are popular with the native population.

In other areas there is a need for a satisfactory liquid cooking butter oil for home, restaurant and institutional cuisines, and for a butter with easier spreadability and a distinctly characteristic flavor.

Research on the development of a wider variety of cheeses could lead to long term benefits. Demand for more cheese varieties with fine flavor, soft or waxy texture, and distinctive appearance is growing among the nation's consumers, but there is much to learn about their proper manufacture, particularly with new mechanical procedures.

There are those who say that the development of new dairy products should be limited to products that can be sold under Class I prices. It is, however, not a point for the scientist to be concerned about. He has enough problems coming up with any original idea in a highly competitive field, let alone worrying about whether or not it commands a Class I label. What is important is that the scientist's creative thinking leads to more and better products. The more that are produced, the more competitive will be the dairy industry, both substantively and psychologically and the fewer will be the problems.

TABLE 1. COMPOSITION OF IMITATION MILK COMPARED WITH COW'S MILK

Composition and acidity	Imitation milk[1]	Cow's milk[2]
Fat — %	2.85	3.70
Total protein — %	0.75	3.50
Total solids — %	10.83	12.6
Calcium — mg/liter	21	1230
Magnesium — mg/liter	6.3	120
pH	7.4	6.6
Titratable acidity[3] — %	0.03	0.17

[1]Not a filled milk. Fat exists as cocoanut; protein as sodium caseinate. Other added ingredients include polysorbate 60, potassium phosphate, salt, water, carrageenan, corn syrup solids, vitamins, artificial color, and artificial flavor.
[2]Data — fat, protein and T.S. — obtained from USDA Agricultural Handbook No. 8. Composition of Food. 1963 *(7)*. Data on minerals obtained from *Fundamentals of Dairy Chemistry,* AVI Publishing Co. 1965. *(8)*.
[3]Expressed as lactic acid.

THE NATURE AND PROPERTIES OF IMITATION MILK

Filled milk is a beverage made from vegetable fat and skimmilk, or skimmilk powder. If handled properly, filled milk can be an asset to the dairy industry by serving as a safety valve to alleviate pressures arising from inflexible price situations when the true imitation milks appear in full force.

Imitation milk, in its true sense, is defined as a beverage made to resemble milk but containing no dairy product. It is destined to be the dairy farmer's greatest future adversary.

Sodium caseinate is used as a "non-dairy protein source" in imitation milk, although this chemical in reality is a derivative of milk and actually may exist as a natural component of cow's milk and surely does in fermented milk products. Ultimately however, the soybean appears destined to become the principal source of protein for imitation milk. Sodium caseinate and soybean protein at high concentration are known to adversely affect flavor so low levels will be expected in beverages.

Under the circumstances, it may appear unusual that so little technical information is available on the composition, nutritional properties and behavior of imitation milk. Perhaps this is because of its newness and relative scarcity, although much commentary about the economic and regulatory aspects is evident *(5)*.

Recently an imitation milk was introduced in the dairy cases of some Eastern supermarkets in 2-quart paper containers. The ingredients were listed on the container but without any amounts. Samples of this product were purchased and examined at our Cornell laboratories. The flavor of the imitation milk scored low with criticisms of bitterness and of a polysorbate-type aftertaste.

Composition analyses, involving fat and total protein, were made respectively by the Babcock test and the Kjeldahl method *(2)*. Calcium and magnesium were determined by the calcein method of Ntailianas and McL. Whitney *(6)*. The composition of this commercially available imitation milk is listed, Table 1. When compared to average cow's milk the imitation milk contained 23% less fat, about 80% less protein and 17% less total solids. Amounts of calcium and magnesium in the imitation milk were extremely low. In fact, analyses indicated 59 times less calcium and 19 times less magnesium in the imitation milk than in average cow's milk, Table 1.

Quantitative analyses for chemical components other than fat, protein, and 2 minerals were not undertaken, but additional ingredients indicated for the imitation milk were water, salt, polysorbate 60, dipotassium phosphate, carrageenan and corn syrup solids, vitamins, artificial flavor and artificial color.

Acidity was determined by a glass electrode Beckman potentiometer and by the standard titration test using sodium hydroxide. The titratable acidity of the imitation milk, expressed as lactic acid, was .03%

TABLE 2. BACTERIAL QUALITY OF IMITATION MILK

Type	Number per ml
Total — SPC	155,000
Coliforms	120,000

TABLE 3. RESPONSE OF IMITATION MILK TO LACTIC ACID FERMENTATION

Type of product manufacture attempted	Behavior
Buttermilk Incubated with 1% active starter	After 20 hr at 72 F, pH of beverage was 6.4 and without visible evidence of curd. No acceptable product formed.
Cottage cheese — short set Incubated with 5% active starter	After 8½ hr at 88 F, pH = 4.78, very soft curd. After 28 hr at 88 F, pH = 4.4, firmer curd. No attempt made to cook-out.
Cheddar cheese Incubated with 1% active starter and 90 ml single-strength rennet/100 lb fluid	After 5 hr at 88 F no curd formed. Further attempt to make Cheddar cheese abandoned.

and the pH 7.4, Table 1. These values are contrasted with normal values of whole cow's milk of about 0.17% titratable acidity and pH 6.6.

The bacterial quality of the imitation milk was ascertained by total bacteria and coliform numbers. Standard plate count agar and desoxycholate agar procedures, outlined in *Standard Methods for the Examination of Dairy Products (2)* were used on chilled samples taken from sealed paper cartons. The standard plate count of the imitation milk was 155,000 bacteria per ml and the coliform count was 120,000 per ml, Table 2. These bacterial numbers are considered excessive by present public health standards and regulations as applied to pasteurized cow's milk.

Small scale manufacture of cultured buttermilk, Cottage cheese, and Cheddar cheese was attempted with the imitation milk. An active commercial lactic acid culture was used and the procedures were those outlined in *Cheese and Fermented Milk Foods (4).* Results showed an extremely slow lactic acid production rate in imitation milk. No acceptable fermented milk products were formed during normal and extended time periods, Table 3. The high pH, 7.4, displayed by the imitation milk presumably prevented rennet from forming a coagulum in the Cheddar cheesemaking attempts.

PROBLEMS OF IMITATION MILKS

The present analyses are confined only to one brand of imitation milk, but, unfortunately, at present the number of different basic commercial sources are very limited. As more imitation milks appear, a wide surveillance and better interpretation will be possible. Yet, it must be recognized that the imitation milk in question is actually being sold in the dairy cases of supermarkets and that to some consumers it might represent a total replacement for milk with implications of equal nutritional and sanitary properties. Furthermore, until more study is conducted on raising sodium caseinate and calcium levels without adversely affecting flavor or physical properties, the particular composition of the present imitation milk may well represent future generations of imitation milk.

This composition of imitation milk itself is rather striking because of the low amount of protein and calcium present and the apparent lack of milk sugar, lactose. Many classical scientific investigations have emphasized the importance of sufficient high quality protein and calium for the growing child and the role of milk as a supplier of these essentials. In fact, it is estimated that cow's milk supplies 85% of the calcium requirement of the child. Also, much nutritional research has indicated that more efficient absorption by the human occurs when lactose forms part of the diet. It is disturbing and difficult to comprehend that imitation milk may not take into account these principles of good nutrition.

Considering next the economic sphere, imitation milk has been extolled as an inexpensive replacement for cow's milk. The availability of imitation milk in the marketplace now permits some degree of judgment as to the validity of such claims. In the supermarkets this imitation milk was 19.5¢ per quart and cow's milk 25¢ per quart. Based on the relative quantities and qualities of nutrients provided by each beverage, Table 1, imitation milk by a significant margin appears more costly than cow's milk.

In a world said to be growing short of food, there is definitely a place for inexpensive nutrient protein beverages. What is more, every effort should be made to develop and produce such nutrient protein beverages for various age groups in an expanding world population. But if imitation milk is to serve in this capacity and be considered a replacement for milk, it should provide a nutrient base equivalent to milk and be subjected to the same quality standards. Otherwise, nutritionists, public health personnel, regulatory officials and consumers should become concerned about the relationship of imitation milk to the future health and welfare of growing children. Herein, apparently, lie the problems for the imitation milk industry, problems which may require extensive basic research on formulas and adequate sanitary supervision to overcome.

ACKNOWLEDGMENT

Appreciation is expressed to David Brown, Photini Mavropoulou, Janice Miller, Mary Martin, and Joseph Chen for conducting the analyses on imitation milk.

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SHORT-TIME MEMBRANE FILTER METHOD FOR ESTIMATION OF NUMBERS OF BACTERIA[1]

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Abstract

Directions are given for the 8- to 12-hr membrane filter-colony technique for the estimation of numbers of viable bacteria in rinsings or swabbings from the surfaces of foods or equipment. Tests on 6 species of bacteria often found in foods demonstrated good recovery of organisms from pure cultures or mixtures of 2 or 3 cultures. Tests with dairy rinses and fresh green beans and sweet corn gave counts almost as high as by the 48-hr plate count. Results with frozen or blanched and frozen beans and corn and with chlorinated flume waters were unsatisfactory.

Methods for testing the sanitary condition of equipment surfaces coming into contact with foods or the bacterial content of the surfaces of raw foods usually involve removal of microorganisms from a selected area or weight and counting by some cultural procedure, such as the plate count method or an agar contact method. To obtain colonies large enough to count, incubation for 24 to 48 hr is required, so that results are obtained long after the equipment has been cleansed or the food processed. It would be advantageous to get results within a shorter time.

The Micro Plate Method of Frost, as described in the 11th Edition of *Standard Methods for the Examination of Dairy Products (1),* calls for incubation of the agar culture on the glass slide for 12-20 hr at 32 or 35 C, and employs a rather difficult technique. The method to be discussed is a membrane filter-colony (MFC) technique, based on procedures described in a brochure from the Millipore Filter Corporation *(4),* or one from the Gelman Instrument Company *(3).* The efficacy of the technique was judged by a comparison with the results by the plate count method.

Materials and Methods

Sampling of surfaces and plant waters

Surfaces of food equipment were sampled by means of methods usually employed, e.g. rinsing from pipelines and similar equipment, or swabbing of specific areas. Procedures were those described in the 12th Edition of *Standard Methods for the Examination of Dairy Products (2).* Rinsings from dairy equipment treated with chlorine were neutralized with sodium thiosulfate before tests were made.

Surfaces of raw foods were sampled by shaking foods in sterilized water and examination of these rinsings, or by swabbing of the surfaces.

Flume waters were examined directly, after treatment with sodium thiosulfate if the waters had been chlorinated.

Preparation of samples for examination

Samples containing considerable amounts of suspended matter were pre-filtered through sterilized No. 1 Whatman filter paper in a Buchner funnel. This funnel can be inserted in the top of the membrane filter funnel by means of a suitable rubber stopper (No. 13.5 for our funnels). Centrifugation of the sample is effective but laborious.

Description of Filter Membrane Procedure

1. Cultures or samples are diluted, if necessary, to give 1 to 30 stained bacterial colonies per microscopic field. Dilutions are made in 0.1% peptone solution warmed to 35 C.
2. A measured volume of culture suspension or liquid sample is run through membrane filters (Millipore HA 0.45 mμ, white, plain, 47 mm diam.) held in Pyrex filter holders. At least 250 ml of sample or diluted sample should be used.
   (a) Vacuum is applied to the sterile membrane filter before the sample is introduced into the funnel. This prevents curling of the membrane later. A water pump will provide sufficient vacuum.
   (b) Sterile rinsing water is passed through. The vacuum is maintained for a short time thereafter to make the filter dry better.
3. The filter is placed into a sterile 50 mm petri dish on top of an absorbent pad (Millipore) saturated with Trypticase Soy Broth (BBL) at 35 C. A little over 2 ml are required. The filter must lie flat, and the broth must saturate it.
4. The dish is incubated for 8 (or more) hr at 35 C.
5. The filter is placed on top of an absorbent pad saturated with acid-and-water-free (AWF) stain *(1)* in a petri dish cover and stained for 5 min or longer. The stain should not be allowed to run over the top of the filter.
6. The stained filter is dried on a blotter for 10 min.
7. Colonies are counted by means of a microscope with a 10x objective and 5x ocular. This will give a microscopic factor of about 315, i.e., each colony represents 315 bacteria in the sample or portion of the sample used. Preparations with 5 to 30 colonies per field are best. The blue colonies are readily distinguishable from debris.

To obtain rapid growth and hence distinguishable colonies within 8 hr, the incubation temperature of 35 C was selected in preference to 32 C. This temperature was satisfactory for pure cultures tested and for bacteria in samples from

[1]Published with the approval of the Director of the Wisconsin Agricultural Experiment Station.

TABLE 1. COMPARISON OF PLATE COUNTS AND MEMBRANE FILTER COUNTS WITH PURE CULTURES

Bacterial Species	Avg. Plate Count-48 hr	Avg. Membrane Count-8 hr	No. of trials
	(No./ml x 10^6)	(No./ml x 10^6)	
Pseudomonas fluorescens	138	145	25
Micrococcus freudenreichii	110	92	16
Streptococcus faecalis	112	116	10
S. faecalis var. *liquefaciens*	200	160	10
Aerobacter aerogenes	210	230	10
Proteus vulgaris	90	80	5

TABLE 3. TESTS ON CUT GREEN BEANS AND WHOLE-GRAIN SWEET CORN

Vegetable	State	Nos./g-Plate Count	Nos./g-Membrane Count	Per cent Recovery
Beans	fresh	65,000	48,000	74
Beans	fresh	86,000	70,000	81
Corn	fresh	100,000	84,000	84
Corn	fresh	12,000,000	8,900,000	74
Corn	fresh	20,000,000	14,000,000	70
Beans	b,f[1]	41,000	9,800	24
Beans	b,f	51,000	5,000	10
Beans	b,f	65,000	14,000	22
Corn	b,f	3,000	330	11
Corn	b,f	2,400	720	30
Corn	b,f	570	120	21

[1]Blanched and frozen.

vegetables or dairy sources. Trypticase Soy Broth was found to be the best of a number of media tested for general use, although APT Broth was better for lactic acid bacteria, and other special broths could be used for special kinds of bacteria. Trypticase Soy Agar was used for counts by the plate count method.

Tests with pure cultures

Representatives of 6 species of bacteria commonly found in foods were selected for comparison of viable counts by the membrane filter method and by the customary plating technique. All of these tests were on cultures well into their maximal stationary phase of growth when they would have an appreciable lag period.

RESULTS

Tests with pure cultures

Results with pure cultures of the 6 common species of bacteria found in foods are shown in Table 1. A comparison of plate counts and membrane counts of colonies agrees within the variation in colony counts expected in different tests on a sample (5). The counts of colonies of the bacterial species rarely differed more than 20% from the plate count, and usually were much closer.

Various combinations of 2 or 3 species gave equally satisfactory recovery by the membrane method. Five trials each of different pairs yielded 85 to 97% of plate counts, and of trios 70 to 90%.

Tests on dairy rinses

Results on rinses of dairy plant equipment taken just prior to use are shown in Table 2. The first two samples listed in the table were taken from heavily and purposely contaminated equipment. The membrane filter count agrees well with the plate count, and has the added advantage of permitting a count on rinses very low in numbers of bacteria after the passage of large amounts of rinsings through the membrane (see last 2 samples in Table 2). Such

TABLE 2. TESTS ON DAIRY RINSES

Sample No.	Agar Plate Count	Membrane Count	Recovery
	(Nos./ml)	(Nos./ml)	(%)
1	$27x10^7$	$27x10^7$	100
2	$55x10^7$	$51x10^7$	92
3	65	65	100
4	44	40	91
5	260	250	96
6	<10	24	
7	<10	10	

samples cannot be counted by the usual plate count method.

Tests on vegetables

Samples of cut fresh green beans and whole-grain sweet corn were obtained from a freezing plant. As shown in Table 3, where results from representative samples are recorded, reasonably good counts were obtained by the 8-hr membrane filter technique, usually lower than by the plate count by 19-30%.

On the other hand, as shown in Table 3, when blanched and frozen beans and corn were tested, a much smaller percentage of viable bacteria were recovered by the membrane filter method than by the plate count method, from 10 to 32% from beans (13 trials), and from 11 to 36% from corn (4 trials). The results were not unexpected, for the blanching and freezing processes would damage many of the bacterial cells and greatly slow down their rate of multiplication. This was evident from the large proportion of very small bacterial colonies on 48-hr agar plates.

Attempts to improve the removal of bacteria from the surfaces of vegetables by means of nonionic detergent (Tween 80 and 20 and others) were unsuccessful.

Tests on flume water

Results with flume water from a plant freezing green beans were very irregular. Often higher counts were obtained by the membrane filter method than by the plate count method. These waters had been chlorinated, and undoubtedly the level of available chlorine and time of exposure differed from sample to sample.

DISCUSSION

Variations in time and temperature of incubation and in culture medium are possible in the application of the membrane filter-colony method. The incubation temperature of 35 C was chosen, after trials at 30, 32 and 35 C, as being nearly the maximum for satisfactory growth of psychrotrophic food bacteria. The incubation period of 8 hr was selected as representing the length of a work day, but 10 to 12 hr would yield better results. Still longer incubation times could be employed, the limit being how soon colonies on the membrane will become large enough to grow together, or whether spreaders are present. If a period longer than 8-10 hr is more convenient, the incubation temperature may be decreased accordingly to yield the desired size of colonies within that time. So, samples taken at the end of a day's run in a food plant could be incubated until the start of the following work day.

As has been indicated, the broth medium employed to soak the membrane can be selected to favor the desired kind of bacterium or selectively grow it, and incubation temperature and time can be adjusted accordingly. For coliform bacteria, for example, a selective broth for them, coupled with incubation at 40-42 C would produce results in even less than 8 hr.

Lengthening the lag periods of bacteria, as from exposure to heat, freezing temperatures, or chemicals, may necessitate incubation periods longer than 8 hr. If colonies are very small, even after 48 hr on agar plates, the membrane filter method usually would not demonstrate them. And, of course, no culture medium is going to support good growth of all bacteria.

Although the membrane filter-colony method usually yields colony counts a little lower than those by the plate count method, these counts are proportionally lower and therefore are useful.

ACKNOWLEDGEMENT

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INSTRUMENTATION FOR IMPROVED SANITATION IN THE FOOD INDUSTRY: PRESENT AND FUTURE[1]

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Abstract

The evolution of traditional sanitary temperature and pressure measuring elements is discussed as well as how these devices will change in the future to utilize standard CIP connection techniques. The concept of mounting these measuring elements in a "short-legged" tee to minimize the "dead pocket" is described in some detail.

Other more sophisticated measurements such as liquid level, flow and density which are now being used more widely in the industry are mentioned. It is shown how instruments measuring these variables have been adapted for or designed to meet sanitary requirements of the industry.

Because of the damage which often results from frequent disassembly and hand cleaning, particular emphasis is placed on the importance of evaluating how well these instruments clean-in-place rather than evaluating them on the basis of ease of disassembly and hand cleaning.

Familiar Sanitary Elements

In past years, manufacturers of industrial process control instrumentation have modified basic designs to adapt them to the sanitary requirements of the dairy industry, in particular, and to satisfy, as well, the general requirements of the food industry. The modifications of the basic design have, of course, been made on those elements which are directly in contact with the process fluid. For example, standard temperature systems designed to be inserted in a standard, nonsanitary piping system have been modified to a number of forms to meet the particular requirements of the dairy industry. Figure 1 shows a comparison between the standard, nonsanitary temperature bulb and the familiar sanitary construction designed to be used in a sanitary piping system. This particular bulb is of rather universal design since it can be used in any normal sanitary piping system merely by the selection of the proper size adapting ferrules. The basic construction differences between these two thermal systems are obvious. The sanitary version is made of highly polished stainless steel with no pits, no internal threads, no sharp crevices in contact with the product, etc.

The same general approach has been taken in measurement of process pressures. Many years ago pressure measurement could be handled only by using so-called "open pressure systems" where the connection between the process piping and the pressure measuring device consisted of a piece of tubing into which the product would enter and be trapped. From a sanitary standpoint, of course, this is highly undesirable, and consequently pressure measurement did not come into its own, so far as process pressure measurements were concerned in the dairy and food industries, until the advent of the volumetric pressure measuring element. Figure 2 shows 2 volumetric pressure measuring elements, one a nonsanitary type, and the other a sanitary type. The volumetric pressure

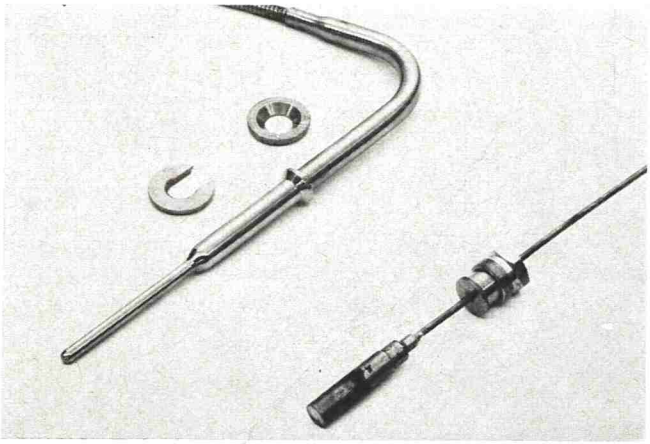

Figure 1. Typical sanitary (left) and non-sanitary temperature bulbs.

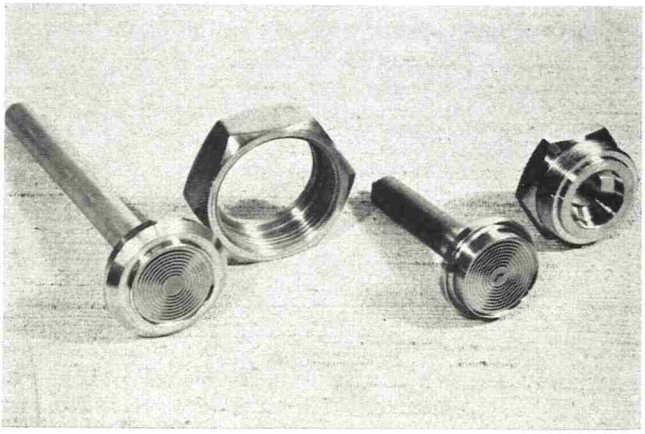

Figure 2. Typical sanitary (left) and non-sanitary volumetric pressure elements.

[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Miami Beach, Florida, August 13-16, 1967.

element differs from the open pressure type system, in that the instrument proper is isolated from the process by a stainless steel diaphragm and a filling fluid. The filling fluid merely transmits the pressure at the stainless steel diaphragm to the actuating element of the instrument, which in pressure measuring instruments is usually a Bourdon spring. The same basic approach taken on temperature measuring systems has been taken on these volumetric pressure measuring systems. The basic elements which connect to the process have been modified to meet sanitary requirements. It can be noted that the sanitary element is of all-welded construction; there are no internal threads or sharp corners to prohibit easy cleaning.

These are certainly traditional and familiar forms of sanitary elements. The devices are designed to be attractive from the outside, to be easly disassembled, and to be easily hand-cleaned after disassembly. It so happens that these elements clean in place reasonably well, but this is only by coincidence, since "clean-in-place" had never been heard of at the time these elements were designed.

DEVICES SUITABLE FOR CIP

What is different in today's technology of plant sanitation? Certainly the difference is the revolution brought about by in-place cleaning technology. The major questions one should ask now are not, "Is the device easily disassembled and hand-cleaned?" but rather "Will the device adequately clean in place?" Hence, it appears the time has come when certain compromises must be made with the traditional outlook on what a sanitary measuring device must be and look like; not a compromise from the standpoint of in-place cleanability but from the standpoint of ease of dissassembly and perhaps external appearance. After all, welded stainless steel piping is not easily disassembled, but it will clean very well if properly fabricated and subjected to adequate clean-in-place procedures.

Not having to disassemble an instrument to clean it should be stressed because, once one progresses past the simple temperature measuring system that is shown in Figure 1, frequent disassembly of more sophisticated measuring devices usually means eventual destruction of the device itself as a result of the physical abuse given it by the average plant operator. A turbine meter, for instance, can give many years of satisfactory performance in measuring product flow rate, but if it is removed from the line frequently for cleaning purposes, the inevitable will happen—the critical part, the turbine itself, will be dropped and damaged or broken.

The external appearance, or esthetic consideration, is primarily economic. Industrial control instrumentation is generally adapted for sanitary requirements. These devices are basically expensive to build. If they all must be built with stainless steel covers and other frills, they will generally be too expensive.

Consequently, throughout the rest of this discussion, the questions that should be asked are: (*a*) Will the device adequately clean in place? (*b*) Can it de disassembled for occasional inspection and, of course, maintenance? (*c*) Does it present an acceptable external appearance?

What type of instrumentation is being used in the food industry today, and what types are expected to be used in the future? Certainly, temperature and pressure will continue to be the most important process variables, and so these should be considered first.

TEMPERATURE ELEMENTS

Temperature measuring elements will in general have the same form as they have had in the past and have at the moment since it has been proved time and time again that the only really reliable temperature measuring scheme has been to use a temperature probe of some description inserted well into the flowing stream of product. Many have attempted other approaches, but these have generally been unsatisfactory. This is not to say that changes are not being made and will not be made, but the general concept of a removable temperature measuring device which projects into the line will be maintained. Other schemes which have been proposed and used in some instances include such items as a thermocouple welded to the wall of a piece of sanitary tubing. This approach is indeed very sanitary but can have the disadvantage of not measuring accurately the temperature of the product, particularly when there is any amount of product build-up on the internal walls of the tubing. Taylor Instrument Companies have heli-arc welded a small thermal system in a short piece of sanitary tubing to form a "spool piece" type temperature system. Although this device does have a projection in the line, it does eliminate the dead pocket encountered when a standard thermal system is inserted in a standard sanitary tee. This temperature measuring system performs very well but has some rather serious drawbacks from the standpoint of manufacturing, since it has to be custom made for each order, depending upon the size of sanitary tubing into which the thermal system is to be welded and perhaps even the type of connection which the spool piece is to have. Because of these practical and economic considerations, this "spool-type" element will probably never materialize into a device which is generally used throughout the industry. It has been and will continue to be manufactured for

very special applications where this approach is the only one which is workable in the long run.

Note this temperature probe does not necessarily have to be the filled thermal system type. It can be a resistance bulb or a thermocouple. The decision as to the type of temperature measurement to be used is basically independent of the geometry of the device which is inserted into the line. Build-up of product on the temperature bulb has been a problem on certain high temperature applications and in the processing of liquid eggs. These problems can best be attacked by such techniques as creating increased turbulence at the point of temperature measurement or by the application of certain "non-stick" materials such as Teflon to the temperature measuring probe. These approaches are being investigated experimentally at the moment with some success.

A major problem with a temperature probe inserted into the line through one side of a standard sanitary tee, particularly on certain high temperature installations, has been that material will build up in the dead pocket of the tee and occasionally may not clean using conventional CIP techniques. The concept of a "short-legged" tee is one, by no means original with the author, which may have considerable merit on those installations where it is difficult to clean the soil out of the dead pocket of a tee in which a thermometer bulb or pressure sensing element is mounted. Actually, there is no reason why a tee of this type cannot come into general use in the industry. Figure 3 is a drawing showing how such a tee might be fabricated. Note the dead pocket is shortened by the amount which is shown in dotted lines, which is the outline of the standard tee. On a 2 in. tee, the dead pocket depth can be reduced from 2.5 in. to 0.5 in. Industrialists who have had a great deal of experience with CIP techniques, will generally agree that this short-legged tee approach provides construction which is readily cleanable even

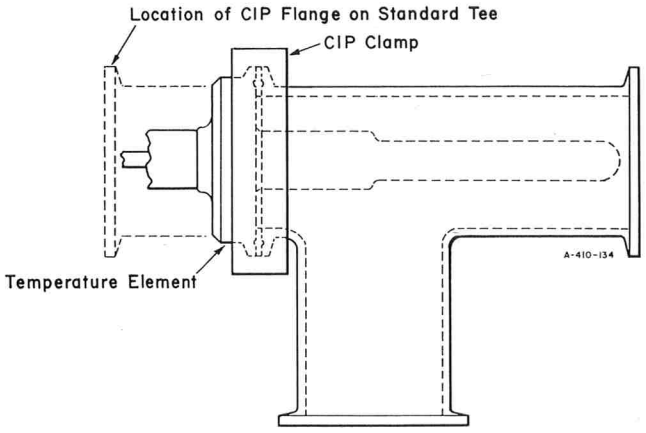

Figure 3. Sanitary temperature element mounted in short-legged tee.

on high temperature applications where the product build-up in the dead pocket of a standard tee has been a substantial problem. This would then permit the use of a universal temperature measuring probe which is the same regardless of the size line in which it is used. To adapt it to various size lines, the same approach would be used as is now employed; that is, providing various size ferrules to mount the probe in the line. The ferrules could be easily manufactured in CIP form so that conventional CIP fittings could be used to attach the thermometer probe to the line. Furthermore, a CIP type joint where the ferrule attaches to the thermometer probe itself could be provided. This approach would provide a CIP type connection, be economical to manufacture and stock,

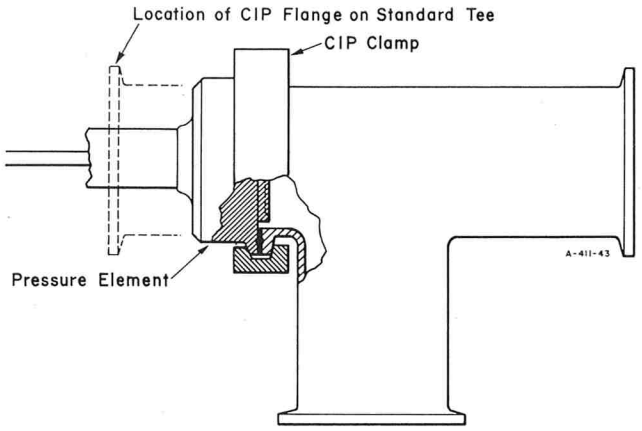

Figure 4. Volumetric pressure element mounted in short-legged tee.

and be flexible since it could be used on any size line merely by changing the size of the connecting ferrule.

VOLUMETRIC PRESSURE ELEMENTS

Volumetric pressure elements have been available in the past only in the standard 3-A bevelled-seat construction. This, being a metal to metal joint, is not generally considered to be CIP. For this reason, Taylor this fall is introducing the standard volumetric pressure element in the 2 in. size but available with 3 different types of CIP connections. It will still be necessary to mount the pressure element in a tee, or cross, but exactly the same concept of a "short-legged" tee can be used for the mounting of the pressure element. Under these conditions, the installed pressure element would clean in place without any difficulty. Because the pressure measuring element has a 0.005 in. stainless steel sensing diaphragm, it is most important that it be cleaned in place, because of the risk of damage to the diaphragm, should it be taken apart daily for hand cleaning. Figure 4 is a schematic

drawing of a sanitary volumetric pressure element with CIP connections installed in a "short-legged" tee.

LIQUID LEVEL MEASUREMENT

Now, what about other process measurements which have been used extensively in other industries, but to a limited extent in the food industries? Consider the measurement of liquid level, product flow rate, product composition (per cent dry solids as measured by density or refractive index, etc.), pH of the process fluid, to mention the more important process variables. The problem of constructing these measuring elements so they would be considered sanitary for the dairy and food industries has been one factor which has discouraged their use. Of course, with some exceptions, the other factor has been that until recent years the processing operations in these industries have been of such a nature that there has not been any significant demand for the continuous measurement of these variables. Now, the demand for measuring them is here, and it is a challenge to instrument manufacturers and sanitarians to agree as to what constitutes acceptable devices.

There has been a flurry of activity regarding the measurement of liquid level in the past several years. A number of manufacturers have offered for sale devices which are designed specifically to measure level in open vessels, such as storage tanks. These devices are designed to be sanitary and to perform a specific function. They were originally introduced to eliminate the need to bubble air through milk in storage tanks to obtain a back pressure suitable for operating conventional liquid-filled manometers. Taylor Instrument Companies first became involved in level measurement in the dairy industry in measuring liquid level in evaporators, or vacuum pans for the purpose of controlling level in an overall evaporator control system. Various means were used, the most workable of which was a small liquid level transmitter of the type shown to the left in Figure 5. This transmitter requires the use of 2 pressure sensing taps. One is in the bottom of the evaporator and is sensitive to evaporator pressure plus liquid level. The other tap, called the reference tap, is then connected to the vapor space and is, therefore, sensitive only to the evaporator pressure. The difference between these 2 pressures is then measured by this differential pressure transmitter, the net result being a signal proportional to the level of liquid in the evaporator. The reference tap, since it was merely connected to the vapor space, never posed a major problem, since it could be connected to the top of a vapor line using stainless tubing and is, therefore, never in contact with the product. The other tap, however, being connected directly to the bottom of the evaporator, requires a purge of air or water to keep the product from entering the sensing lines. There are many installations in the field today which are set up in this manner, and which operate without difficulty.

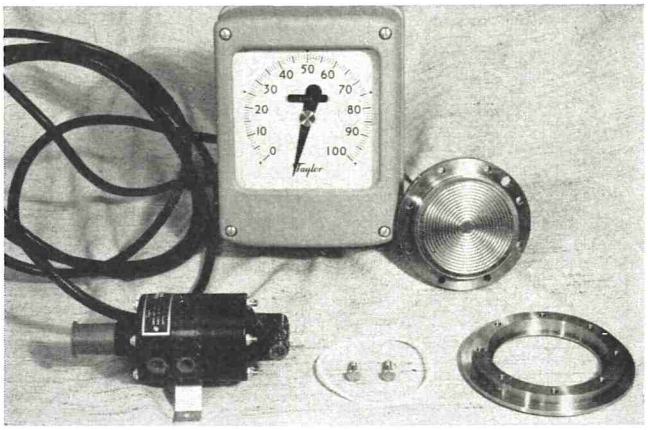

Figure 5. Conventional differential pressure transmitter (left) and sanitary volumetric level transmitter.

A more up-to-date approach, however, is using a liquid level transmitter with a filled volumetric system, much the same as the familiar volumetric pressure system. This transmitter, shown on the right side of Figure 5, incorporates a relatively large pressure sensing diaphragm which is directly in contact with the liquid whose level is being measured. This isolates the process fluid from the transmitter itself and provides quite a sanitary construction. Note that the diaphragm is mounted to a welding bushing which is welded directly to the process vessel. From a performance standpoint, this diaphragm is relatively large, but with ingenuity, it can be mounted in a sanitary manner even in a cone-bottom vessel. Since this is a differential pressure instrument also, it is necessary to connect the other side of the differential pressure transmitter to the vapor space if measuring level in an evacuated or pressurized vessel. This again poses no problem if the sensing line is installed properly. Few will disagree that this instrument, properly installed, will clean adequately, using accepted CIP techniques. It can be noted that it requires the removal of 6 bolts to disassemble the sensing element from its mounting flange. This alone discourages frequent disassembly but encourages long life and low maintenance.

FLOW MEASUREMENT

The most common type of flow measuring device found in the industry today is a postive displacement volumetric flowmeter. These devices are used normally for measuring the total batch quantity of a liquid, such as milk, liquid sugar, fat, and many

other process fluids. Depending on their use, these devices may be of sanitary construction able to be easily disassembled for cleaning. Without question, the major deteriorating effect on long-term accuracy of these flow measuring devices results from their frequent disassembly for cleaning and subsequent abuse.

There are in operation in the industry a number of sanitary turbine meters for measuring liquid flow rate. These devices can be very precise flow measuring elements, but their success is also inversely proportional to the number of times they are taken out of the line, disassembled, cleaned, assembled and put back in the line. There are a number of these in use which are not routinely disassembled for cleaning. They are cleaned in place, although the inherent construction of the device would make most health authorities shudder when it is suggested that they be cleaned in place. These devices have typically 2 journal bearings, which would be considered by most observers to provide a dead pocket that could not be adequately cleaned and which would be a perfect place for bacterial growth. However, if product gets into these dead pockets, then so can cleaning solution, if the device is properly cleaned in place. Devices of this type create such terrific localized turbulence that they frequently clean faster than the connecting sanitary tubing. Periodic disassembly and inspection of several of these meters which have been in use for some time has shown them to be free of soil.

Although not extensively used at this time in the dairy industry, magnetic flowmeters are finding increased application in the food industry in general. In recent years, a number of these units have been provided to the non-alcoholic beverage industry for use in the blending of beverage syrups and water prior to bottling. Without question, the flowmeter itself is basically a sanitary device. Typical construction would be an 18 in. section of 1 in. Schedule 40 pipe lined with Teflon. In the middle of this pipe section would be 2 small stainless steel electrodes embedded in the Teflon. This is completely sanitary and acceptable in the industry from the viewpoints of materials and construction. The only questionable area is the type of end connection to be used on the meter. As manufactured for other industries, the meter is connected in the line by means of a standard, flanged joint. The problem then arises as to whether this flanged joint is acceptable in the food industry. Certainly, a sanitary-type joint could be fabricated, although the relatively small quantity involved would pose manufacturing problems. Maintenance also would be a substantial problem from the standpoint of stocking all the various size combinations with sanitary fittings. These practical considerations lead

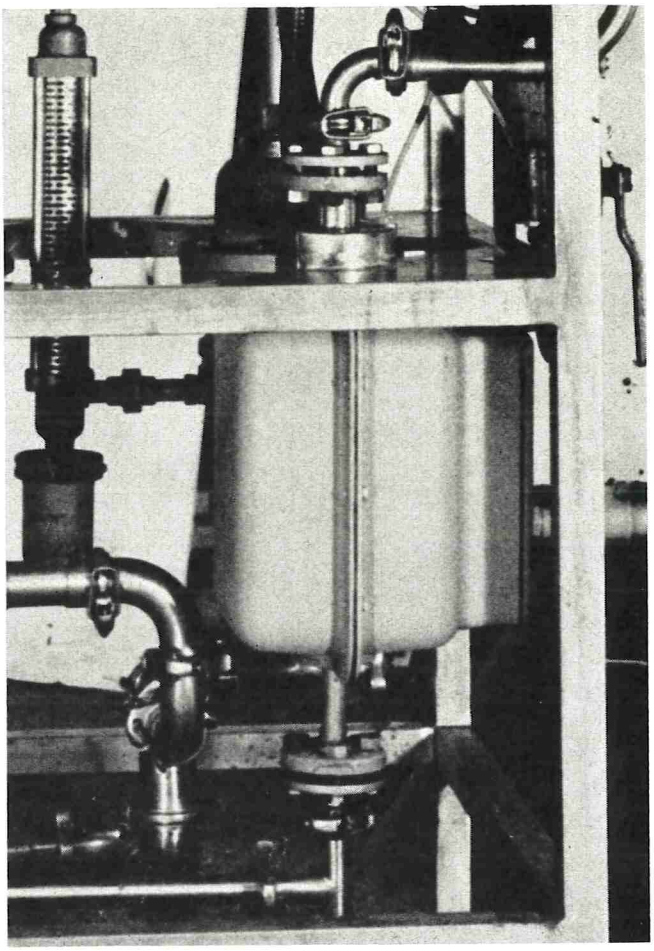

Figure 6. Magnetic flowmeter with adapters to sanitary tubing.

to the belief that the wisest approach is to use a standard meter but to provide adapters from the flanged joint to a normal CIP joint. Figure 6 shows a magnetic flowmeter with an adapter from the 0.5 in. meter to 1 in. sanitary tubing, using CIP connections. This adapter is relatively inexpensive to build and provides, in the author's opinion, a very acceptable solution to the problem. Internally, there is a slight step in the line, but this construction should clean very well, using conventional CIP techniques. This flowmeter can be disassembled periodically for inspection but does not lend itself to daily disassembly for cleaning. The weight of the device itself would discourage this operation. Here, then, is an example of a perfectly standard industrial flow measuring device, inherently sanitary, connected to the sanitary tubing by means of adapters which, if properly constructed, can provide a readily cleanable coupling.

DENSITY MEASUREMENTS

Density has always been difficult to measure in the food industry because of the nature of the traditional technique of measurement. The use of an

open density sample column and associated long bubble tubes is inherently a nonsanitary approach. For this reason, the majority of food industry evaporator and vacuum pan instrumentation does not include the measurement and control of product composition, or density, which is, after all, the "priceless ingredient." Happily, there are available today a number of sanitary product-composition measuring devices; some of which are based on the principle of refractive index, others on density. In-line refractometers are familiar although industrial in-line refractometers which can be used as part of an overall control system have only recently been finding application. A sanitary density measuring device, called a Densometer (Halliburton Co., Duncan, Oklahome), has found reasonably wide application in the food industry in the last 4 yr. This instrument basically weighs a constant volume of fluid and transmits a continuous pneumatic signal proportional to the weight of this constant fluid volume. The measuring section is the U-tube portion of the device, shown in Figure 7. The fluid which is in the U-tube section is weighed by a device using the pneumatic force balance principle, providing a very rugged and reliable industrial measuring instrument. There are no obstructions in the line, the fluid passes continuously from the inlet to the outlet side of the Densometer. To provide some flexibility where the U-tube must pivot, a unique joint, fabricated from an acceptable elastomer is provided. This elastomer is bonded to the stainless steel tubing to avoid any crevices at the joint. This device will clean properly in the same fashion as the sanitary tubing in the rest of the piping system.

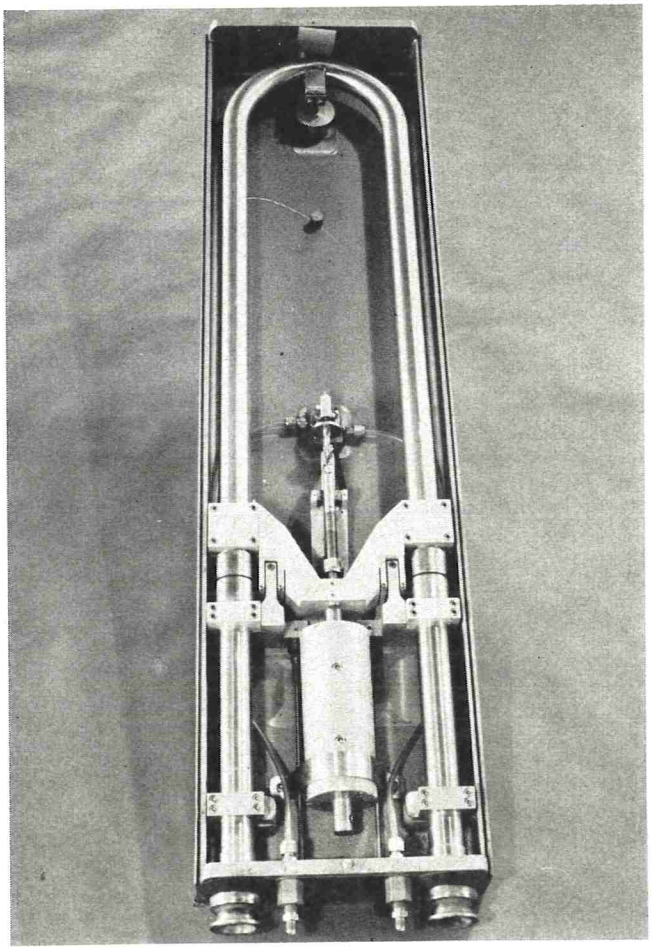

Figure 7. Sanitary Densometer for liquid density measurement.

MEASUREMENT OF pH

The measurement of pH is very important in the food industry, and has been carried out on a laboratory basis for many years. There are an increasing number of processing operations which could benefit from the continuous measurement of the process pH. However, the maintenance of pH electrodes and the sanitary considerations of pH measurement have severely limited its continuous industrial measurement in the food industry.

FUTURE INSTRUMENTATION

Looking at the overall picture of instrumentation in the food industry as it exists today and more importantly, as it will probably exist in the future, the traditional measurement of temperature and pressure will remain relatively unchanged except for some modifications in the construction of the tee, or cross in which the measuring elements are mounted and some modifications in the connection means so that conventional CIP type fittings with appropriately gasketed joints can be used. Various other process measurements, such as liquid level, product flow rate and product composition, which have only recently begun to come into focus in the industry, will be handled by the use of presently available, conventional types of instrumentation which have been modified to meet the needs of sanitation in the food industry, or which by the design of appropriate adapters, can be properly mounted and cleaned in place. Also, as in the example of certain level measuring devices, designs oriented specifically to the food industry requirements have been developed and will see future development where the quantity requirement makes their development feasible. Other process measurements, such as pH, will require considerable discussion and education of all concerned prior to their finding universal application as a continuous industrial measurement.

Sanitary valves have been available and in use for many years, and whether used for on-off or throttling service, are, in general, satisfactory devices from a functional standpoint. There is little question they clean in place adequately if properly designed.

Throughout all future deliberations on what type of device is acceptable, the overriding question which should be asked is: Is the device able to be cleaned-in-place satisfactorily? Secondary considerations are: ease of disassembly for inspection and external appearance. Because many of the more sophisticated measuring devices which are in contact with the product may appear, based on traditional thinking, to be completely unsanitary, there should be an organized means for putting these devices to the real test to see if they do indeed clean satisfactorily.

Based on traditional thinking oriented toward the requirement that a device be able to be taken apart daily to be hand cleaned, some compromises will need to be made if more sophisticated industrial measuring equipment is to be generally used in the future. A realistic approach to the sanitary requirements of in-line instrumentation must be developed. These concepts should be formalized so they are available to all for reference.

The food industry is ready for and needs the types of measurement other than those which have been traditionally used, such as temperature and pressure. Whether these other measuring devices find general use in the future will depend to a large extent on how industry, both the manufacturers and users, and the regulatory authorities, approach the various problems. If these problems are approached, based on good judgment, common sense, and the maintenance of good sanitary standards predicated on a good, in-place, cleaning program, there should be little difficulty in making these more sophisticated measurements in the food industry.

NEW YORK STATE BAR ASSOCIATION FOOD, DRUG AND COSMETIC LAW SECTION ADOPTS RESOLUTION

May 24, 1968

The Honorable Wilbur J. Cohen, Secretary
Department of Health, Education, and Welfare
Washington, D. C.

My dear Mr. Secretary:

Taking note of the resignation of Dr. James L. Goddard as Commissioner of Food and Drugs and sensitive to the occasion for selecting a successor, the Food, Drug and Cosmetic Law Section of the New York State Bar Association, the original bar group dedicated to this field of the law whose members include representatives from all parts of the country, hereby respectfully submits the following resolution adopted by its Executive Committee on May 24, 1968 at New York:

"WHEREAS, it is imperative for the public interest that the Food and Drug Administration be organized to function in the most effective manner possible in the light of today's needs and the even greater needs that lie ahead; and

WHEREAS, the responsibilities of the Commissioner of Food and Drugs are numerous and serious and require corresponding qualifications, the first and chief of which is that he should be an effective administrator;

NOW, THEREFORE, be it

RESOLVED that the person who is selected for appointment to the high office of Commissioner of Food and Drugs should be an administrator of outstanding ability, of known experience and capability, who can attract and hold high caliber scientific and administrative personnel. He should have familiarity with and experience in the work of the agency and his devotion to the office should be a matter of dedication. Such appointment should not destroy the agency career tradition which has encouraged and rewarded the dedicated service of that personnel in carrying out their duties at all levels. It would be unfortunate for the agency and for the public if a Commissioner were appointed who does not have these qualifications."

Most respectively,
Franklin M. Depew
Chairman

CC: The Honorable Lyndon B. Johnson, President of the United States
The Honorable Lister Hill, Chairman, Senate Labor and Public Welfare Committee
The Honorable Harley O. Staggers, Chairman, House Instate and Foreign Commerce Committee

ASSOCIATION AFFAIRS

PROGRAM

FIFTY-FIFTH ANNUAL MEETING

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

In cooperation with

THE MISSOURI ASSOCIATION OF MILK & FOOD SANITARIANS

AUGUST 18-22, 1968

Chase Park Plaza Hotel — **St. Louis, Missouri**

REGISTRATION

Monday, August 19—1:00 P.M.—5:00 P.M.
Tuesday, August 20—8:00 A.M.—6:00 P.M.

Registration Fee $10.00

IAMFES OFFICERS

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TOPICS FOR AFFILIATE AGENDA AT ANNUAL MEETING

1. Current Status of Proposed Merger of IAMFES and NAS.
2. Guidelines for Merging at the State Affiliate Level.
3. A Review of the Purposes and Objectives of the Affiliate Council.
4. Development of a "Speakers' Pool".
5. Affiliate Participation in Development of Annual Program.

SUNDAY, AUGUST 18, 1968

1:30-5:30—Executive Board—Coach Room

8:00-11:00—Executive Board—Coach Room

COMMITTEE MEETINGS

Check Bulletin Board

MONDAY, AUGUST 19, 1968

1:00-5:00—Registration—Chase Lounge

SPECIAL MEETINGS:

8:00-12:00 Noon—Executive Board—Coach Room

1. Report on Local Arrangements
2. Report of Executive Secretary
3. Report on Sanitarians Joint Council

1:30-5:00—Executive Board—Coach Room

1. Report of Journal Management Committee
2. Regular Agenda

1:30-5:00—Individual Committee Meetings (See Bulletin Board)

7:00-8:30—Affiliate Council—Regency Room

7:00-10:00—Executive Board—Park Room

1. Committee Chairmen and Committee Members
2. Meet with Past Presidents
3. Report of Affiliate Council Chairman

TUESDAY, AUGUST 20

8:00—REGISTRATION—Chase Lounge

MORNING—GENERAL SESSION

CHASE CLUB

S. O. NOLES, *President-Elect*, Presiding

9:30—INVOCATION:
REV. FATHER ARTHUR BROMSCHWIG

9:35—ADDRESS OF WELCOME
J. EARL SMITH, M.D.

9:50—PRESIDENTIAL ADDRESS
A. N. MYHR, *President*

10:15—CONCEPTS IN TODAY'S FOOD PROCESSING OPERATIONS
JOSEPH C. OLSON, JR.

11:00—DEVELOPMENT OF PROTEIN FOODS FOR AN EXPANDING WORLD POPULATION
HATTON ROGERS

11:45—NOMINATIONS, 1968

TUESDAY, AUGUST 20

AFTERNOON—MILK SANITATION SECTION

CHASE CLUB

PAUL ELLIKER, *Presiding*

1:30—Door Prize Drawing

1:45—IMITATION AND FILLED DAIRY PRODUCTS—PRODUCTION AND PROCESSING STANDARDS
W. C. LAWTON

2:30—AIR QUALITY REQUIREMENTS FOR FLUID AND MANUFACTURED MILK PRODUCTS PLANTS
T. I. HEDRICK

3:15—Break

3:30—ELIMINATING ABNORMAL MILK FROM A CITY SUPPLY
ROY T. OLSON

4:15—INTER-RELATED RESPONSIBILITIES FOR MILK PRODUCTION AND QUALITY CONTROL
A. E. ABRAHAMSON

TUESDAY, AUGUST 20

AFTERNOON—FOOD INDUSTRY & ENVIRONMENTAL SANITATION SECTION

REGENCY ROOM

DICK B. WHITEHEAD, *Presiding*

1:30—Door Prize Drawing

1:45—SELF-CERTIFICATION IN THE VOLUNTARY COMPLIANCE PROGRAM
FRED J. DELMORE

2:30—PRACTICAL CONTROL OF SALMONELLAE
JOHN C. AYRES

3:15—Break

3:30—BACTERIOLIGICAL QUALITY OF SHELLFISH MARKETED IN NEW YORK CITY
SYED A. SHAHIDI

4:15—RECENT ADVANCES IN PREVENTION OF FOOD-BORNE DISEASES
KEITH LEWIS

TUESDAY EVENING, AUGUST 20

7:30-9:30—EVENING DISCUSSION GROUPS
These discussion groups are for the benefit of our members who have special questions or problems which they wish to discuss informally with others. Selected individuals have agreed to answer questions and otherwise assist in discussions.

7:30—FOOD INDUSTRY SANITATION—INDUSTRY AND REGULATORY VIEWPOINTS
Regency Room
JOSEPH C. OLSON, JR., *Moderator*, KEITH LEWIS, FRED E. UETZ

7:30—MILK SANITATION—LABORATORY AND QUALITY CONTROL
Starlight Room
EDMOND L. SING, *Moderator*, JOHN C. FLAKE, DALE A. SEIBERLING

7:30—ENVIRONMENTAL SANITATION AND POLLUTION CONTROL
Khorassan Room
C. M. COPLEY, JR., *Moderator*, HARRY PRATT

WEDNESDAY, AUGUST 21

MORNING—GENERAL SESSION

CHASE CLUB

FRED E. UETZ, *Presiding*

8:30—Door Prize Drawing

8:45—PROBLEMS IN COMMUNICATIONS
LESTER S. WILLSON

9:30—Break

9:45—Door Prize Drawing

10:00—ANNUAL BUSINESS MEETING
1. Report of Executive Secretary
2. Report of Secretary-Treasurer
3. Committee Reports
4. 3A Symbol Council Report
5. Report of Resolutions Committee
6. Report of the Committee on Inter-Association Cooperation
7. Report of Affiliate Council
8. Old Business
9. New Business
10. Election of Officers

Announcements

WEDNESDAY, AUGUST 21

AFTERNOON—MILK SANITATION SECTION

CHASE CLUB

MILTON HELD, *Presiding*

1:30—Door Prize Drawing

1:45—VALUE OF SANITATION SERVICES IN MILK AND FOOD PLANTS AS AN ADJUNCT TO REGULATORY CONTROL
EDWARD L. HOLMES

2:15—CURRENT AND FUTURE STATUS OF THE GRADE A MILK PROGRAM AND ITS IMPLEMENTATION BY THE PUBLIC HEALTH SERVICE
ROBERT NOVICK

3:00—Break

3:15—ABNORAL MILK CONTROL—A PROGRESS REPORT
J. C. FLAKE

4:00—SANITATION IN PAPER AND PLASTIC SINGLE-SERVICE CONTAINER MANUFACTURING
F. O. DESIEGHARDT

WEDNESDAY, AUGUST 21

AFTERNOON—FOOD AND ENVIRONMENTAL SANITATION SECTION

REGENCY ROOM

VINCENT T. FOLEY, *Presiding*

1:30—Door Prize Drawing

1:45—AIR POLLUTION
C. M. COPLEY, JR.

2:15—EGG PASTEURIZATION—PRESENT AND FUTURE
GEORGE W. PUTNAM

3:00—Break

3:15—WHAT SANITARIANS SHOULD KNOW AND DO CONCERNING COMMUNITY DEVELOPMENT
ROBERT J. BEVINS

4:00—VECTOR CONTROL TODAY
HARRY D. PRATT

4:30—MISSOURI ASSOCIATION ANNUAL BUSINESS MEETING
CHARLES NEIGHBORS, *President*

WEDNESDAY, AUGUST 21

AFTERNOON—FOOD INDUSTRY

SANITARY SECTION

KHORASSAN ROOM

LOUIS A. KING, JR., *Presiding*

1:30—Door Prize Drawing

1:45—FUNDAMENTALS OF MECHANICAL RECIRCULATION IN CLEANING
HARLEY A. WEISSE—"HIGH PRESSURE, LOW VOLUME"
DICK B. WHITEHEAD—"RECIRCULATION"

2:15—RECENT DEVELOPMENTS IN RESIDUAL INSECTICIDES
PERRY FISHER

3:00—Break

3:15—ALIGNMENT OF INDUSTRY-ORIENTED SANITATION PROGRAM
FRED R. VITALE

4:00—CONTAMINATION ROUTES TO FOOD PRODUCTS
KENNETH V. NYBERG

WEDNESDAY EVENING, AUGUST 21

6:00-6:50—RECEPTION—Zodiac Room

7:00—ANNUAL AWARDS BANQUET: Starlight Room

A. N. MYHR, *Presiding*

INVOCATION—IVAN PARKIN

INTRODUCTIONS

Master of Ceremonies—E. R. PRICE

PRESENTATION OF AWARDS

1. Past President's Award
2. Citation Award
3. Honorary Life Membership
4. Sanitarian's Award

The Sanitarian's Award is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., and Pennsalt Chemicals, Inc.; and is administered by the International Association of Milk, Food and Environmental Sanitarians.

INSTALLATION OF OFFICERS

9:00—ENTERTAINMENT
Music by "Joe Schirmer, Banjoist"

THURSDAY, AUGUST 22

MORNING—GENERAL SESSION

CHASE CLUB

A. N. MYHR, *Presiding*

8:30—Door Prize Drawing

8:45—HOW THE SANITARIAN CAN REDUCE THE SOLID WASTE PROBLEM
DONALD TOWNLEY

9:30—THE ROLE OF THE SANITARIAN IN INSTITUTIONAL SANITATION
VINSON R. OVIATT

10:15—Break

10:30—EAT, DRINK, AND BE WARY
DIANNE MCKAIG

11:15—USE OF VISUAL AIDS IN EFFECTIVE EDUCATION
FRANK L. BRYAN

ENTERTAINMENT

MEN AND WOMEN

TUESDAY, AUGUST 20

6:00-7:00—BUFFET—Chase Club
Music by "The Sanitones"

WEDNESDAY, AUGUST 21

6:00—Cocktail Hour—Zodiac Room
7:00—Banquet—Starlight Room
9:00—Music by "Joe Schirmer, Banjoist"

THURSDAY, AUGUST 22

1:30—Tour to Grant's Farm—the original farm home of General Ulysses S. Grant before he became famous, and now the magnificent estate of Mr. August A. Busch, Jr.

ENTERTAINMENT FOR THE LADIES

HOSPITALITY: LIDO ROOM

TUESDAY, AUGUST 20

9:00 a.m. to 3:00 p.m.—Sightseeing tour of St. Louis (Please make reservations at your earliest convenience.)

WEDNESDAY, AUGUST 21

10:30 a.m. to 1:45 p.m. CHOICE OF:
Charlotte Petters live TV show, or Visit to Art Museum and Historical Museum (Please make reservations at your earliest convenience.)

PROGRAM PARTICIPANTS

ABRAHAMSON, A. E.—Assistant Deputy Commissioner for Environmental Services, New York City Health Department, New York, N. Y.

AYRES, JOHN C., PH.D.—Chairman Food Science Division, University of Georgia, College of Agriculture, Athens, Ga.

BEVINS, ROBERT J., PH.D.—Associate Professor, Department of Agricultural Economics, University of Missouri, Columbia, Mo.

BROMSCHWIG, REV. FATHER ARTHUR—Pastor, Holy Trinity Catholic Church, St. Louis, Mo.

BRYAN, FRANK L. PH.D.—*Chief*, Food-borne Disease Unit, Community Services Training Section, Training Program, National Communicable Disease Center, Atlanta, Ga.

COPLEY, CHARLES M. JR.—Commissioner, Air Pollution Control, St. Louis, Mo.

DELMORE, FRED J.—Director, Bureau of Voluntary Compliance, Food & Drug Administration, DHEW, Washington.

DESIEGHARDT, FRED O.—Division of Quality Control, Sealright Corporation, Kansas City, Mo.

ELLIKER, PAUL H., PH.D.—Chairman, Department of Microbiology, Oregon State University, Corvallis, Oregon.

FISHER, PERRY—Research Entomologist, Campbell-Taggart Associated Bakeries, Inc., Dallas, Texas.

FLAKE, J. C., PH.D—Director of Sanitary Standards, Evaporated Milk Association, and Secretary-Treasurer, National Mastitis Council, Washington, D. C.

FOLEY, VINCENT T.—Chief, Food Section, Department of Health, Kansas City, Mo.

HEDRICK, T. I.—Professor, Food Science Department, Michigan State University, East Lansing, Mich.

HELD, MILTON E.—Regional Program Chief, Environmental Sanitation Program, U.S.P.H.S., Region IX, San Francisco, Calif.

HOLMES, E. L.—Executive Director, American Sanitation Institute, St. Louis, Mo.

KING, LOUIS A., JR.—Director of Sanitation Education, Department of Bakery Sanitation, American In-Institute of Baking, Chicago, Ill.

LAWTON, W. C., PH.D.—Director of Quality Control, Twin City Milk Producers Association, St. Paul, Minnesota.

LEWIS, KEITH H., PH.D.—Chief, Food Protection Section, ESP, NCUIH, DHEW, Public Health Service, Cincinnati, O.

MYHR, A. N. PH.D.—Department of Dairy Science, University of Guelph, Guelph, Ontario, Canada.

MCKAIG, MISS DIANNE—Special Assistant to the Secretary (Consumer Interests) Department of Health, Education & Welfare, Washington, D. C.

NOLES, SAMUEL O.—R.S. Certified State Rating Officer and State Milk Consultant, Florida State Board of Health, Jacksonville, Fla.

NOVICK, ROBERT—Chief, Environmental Sanitation Program, DHEW, Public Health Service, Cincinnati, O.

NYBERG, KENNETH V.—Field Sanitarian, American Institute of Baking, Chicago, Ill.

OLSON, JOSEPH C., JR., PH.D.—Director, Division of Microbiology, Bureau of Science, Food & Drug Administration, DHEW, Washington, D. C.

OLSON, ROY T.—R.S., Public Health Sanitarian Supervisor, Spokane City Health Department, Spokane, Wash.

OVIATT, VINSON R.—Chief, Environmental Services Section, Health Facilities Service Branch, Div. of Hospital and Medical Facilities, Public Health Service, Silver Spring, Md.

PARKIN, IVAN, RET.—Extension Dairyman, Pennsylvania State University, University Park, Pa.

PRATT, HARRY D., PH.D.—Chief, Training and Consultation Section, Aedes aegypti Eradication Program, Natl. Communicable Disease Center, Atlanta, Ga.

PRICE, E. R., M.D.—Missouri Division of Health, Jefferson City, Mo.

PUTNAM, GEORGE W.—Consultant, Evanston, Illinois.

ROGERS, HATTON—Vice-President, Food Ingredients Division, The Nestle Company, White Plains, N. Y.

SEIBERLING, DALE A., PH.D.—Manager, Equipment Engineering Department, Klenzade Products, Beloit, Wisc.

SHAHIDI, SYED A., PH.D.—Chief, Environmental Sanitation Microbiology Laboratories, Department of Health, New York City, N. Y.

SING, EDMOND L.—Consultant, W. K. Moseley Laboratories, Indianapolis, Ind.

SMITH, J. EARL, M.D.—Health Commissioner, City of St. Louis, Mo.

TOWNLEY, DONALD—Regional Program Chief, Solid Wastes Program, U. S. Public Health Service, Region VI, Kansas City, Mo.

UETZ, FRED E.—Asst. to the Vice President In Charge of Production, Borden, Inc., Milk and Ice Cream Div. Eastern District, New York Ice Cream Region, New York, N. Y.

VITALE, FRED R.—Director of Sanitation, Continental Baking Company, Rye, N. Y.

WEISSE, HARLEY A.—U. S. Chemical Corporation, Milwaukee, Wisc.

WHITEHEAD, DICK B.—R. S. Consultant, Dairy & Food Industry, Dallas, Texas.

WILLSON, LESTER S.—Manager, Trade Association Liaison, Film Department, E. I. duPont de Nemours & Co. Inc., Wilmington, Del.

MISSOURI SANITARIANS ENTERTAINED BY PAST PREXY

At the 36th Annual Milk and Food Sanitation Conference banquet the Missouri Association of Milk and Food Sanitarians were entertained by James I. Kennedy, former President of the group. Jim joined as a vocalist the orchestra playing for the banquet and gave several renditions. Jim has a fine voice and could have made his mark in the music field had he not chosen to be a "public healther."

The three-day conference held at Columbia on April 8, 9 and 10, 1968 provided for discussions on a number of subjects of timely interest. There were also panels scheduled in the sectional meetings covering particular problem areas.

The honor of being the Sanitarian of the Year for 1968 was extended to Mr. Eugene C. Viets, Chief of Food Sanitation, Missouri Division of Health. In presenting the award, President Charles Neighbors reviewed Mr. Viets' record of accomplishments stating that, while the recipient has worked in all the major fields of milk, food and environmental sanitation, he is currently vitally concerned with the state-wide restaurant program, the establishment of which he strongly supported.

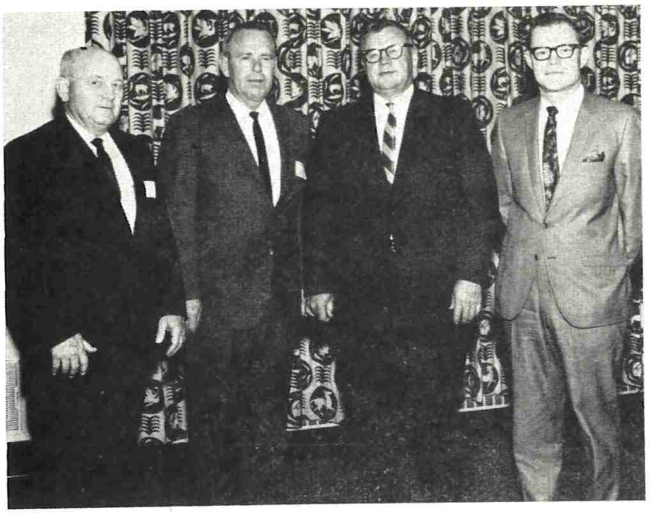
Jim Kennedy singing, "The Little Brown Shack" accompanied by the Medallions, was a big hit at the Missouri Banquet.

Mr. Eugene Viets, left, reads 1968 Sanitarians Award presented by Mr. Charles Neighbors.

Mr. Viets assisted in the introduction of the present state Nursery Home Fire Safety Program. He has long been active in Milk sanitation, serving as the first secretary-treasurer of the Missouri Mastitis Council. On the district level he has participated in the development of a number of outstanding environmental sanitation programs.

Gene obtained his B.S. Degree at the University of Missouri in 1949 and completed the Master of Science Degree at the same institution in 1961. He is a past-president of the Missouri Affiliate, a member of the Missouri and the American Public Health Association and is a Diplomate in the American Intersociety Academy for the Certification of Sanitarians.

In concluding his presentation of the Award, President Neighbors pointed out that while Gene has made significant contributions in the field of public health, the comments which seemed to stand out in the nomination data related to his personal character. His unselfish attitude, his promotion of good will among employees, his contribution to community activities make Gene Viets an outstanding sanitarian.



New officers of the Missouri Association, left to right: President C. W. Dromgold, St. Louis City Health Department; First Vice-President Jack Newman, Springfield City Health Department; Second Vice-President William McCown, St. Louis County Health Department; Secretary-Treasurer Erwin P. Gadd, Missouri Division of Health.

DR. I. H. BAIRD, 1967 TOP MISSOURI SANITARIAN RETIRES

"Doc" Baird with his "retirement" cake representing 46 years of service.

Dr. I. H. Baird, Chief of Milk Control for the St. Joseph, Missouri, Health Department has retired after 46 years of service. Dr. Baird was the recipient of the 1967 Sanitarians Award presented by the Missouri Association of Milk and Food Sanitarians. He has been a member of the Association for more than 25 years.

"Doc" began his career in 1922 as a bacteriologist for the St. Joseph Health Department and remained with that organization throughout his career. He was instrumental in the development and adoption of the first milk ordinance in St. Joseph in 1929. Under his supervision a very able control program has been carried on.

One of the more outstanding accomplishments in his career was the institution of a mastitis control program for his milk shed, the first such program in the state. By persuasive actions based on sound principles of good public relations he gained support and respect for the program from interested persons in all areas. His efforts had no small influence on the formation of the Missouri Mastitis Council.

"Doc" is a member of the Missouir Veterinary Medical Association which he served as secretary-treasurer in 1960-61. He is also a member of the American Public Health Association and has maintained a wide interest in state and local health affairs. Throughout his career he has given unselfishly to the betterment of the health and well-being of his community and has been a credit to the sanitarian's profession.

J. GEORGE BAUER

Mr. J. George Bauer, Director of Health for the Springfield-Greene County, Missouri, Health Department passed away suddenly on April 20, 1968. He had been a member of the Missouri Milk and Food Sanitarians Association for more than 25 years and was well known in state and national sanitation and public health activities.

George began as a county sanitary inspector shortly after high school graduation. Realizing the importance of education he soon became a part-time student for two years at Southwest Missouri State College at Springfield. Following a three month course in public health at Vanderbilt University he served in several Missouri counties, returning eventually to Springfield.

In 1952 he set out to complete his education and received a BS degree in Sanitary Science from Denver University in 1954. After three years with the Missouri State Division of Health as state supervisor of milk sanitation he returned finally to the Springfield Health Department as chief of sanitation. Upon the resignation of the health officer in 1962 George became acting director and later director of the department, a position he held until his death.

One of George's accomplishments was the winning of the W. Scott Johnson Award in 1967, presented by the Missouri Public Health Association for outstanding service in the field of public health. He was

cited particularly for the establishment and maintenance of a well-run food handlers training school, the promotion of a county air pollution authority, the creation of a housing and sanitation program on the campus of the state college at Springfield and the able supervision of one of the state's largest milksheds.

George Bauer possessed the character and personality traits necessary for successful leadership, including ability to get along well with his fellow workers and the public, initiative in seeking out and setting up new programs and perseverence to reach his goals. Certainly his struggle to obtain the education necessary for his career proved his character.

PENNSYLVANIA DAIRY FIELDMEN'S CONFERENCE

The 1968 Pennsylvania Dairy Fieldmen's Conference was held at the J. O. Keller Building at The Pennsylvania State University on Tuesday and Wednesday, June 11 and 12. The Program included talks on substitute milks, instrumental testing of milk for butterfat, feeding practices as related to off flavors in milk, ketosis in dairy cattle, procedures to follow in epidemics such as Foot and Mouth disease, and other areas of interest.

The annual meeting of the Pennsylvania Dairy Sanitarians Association was also held during the Conference.

"DUSTY" MILLER HONORED

William C. "Dusty" Miller, Jr., has received the Public Health Service Commendation Medal in recognition of his contribution to the promotion of environmental health in the United States, especially in the field of food protection. Sanitarian Director, Miller, received the Medal from Jerome H. Svore, Director of the National Center for Urban and Industrial Health, on behalf of Surgeon General William E. Stewart.

In making the presentation Mr. Svore said Mr. Miller was cited for "exemplary performance of duty" during his more than 23 years service as a commissioned officer in the Public Health Service. He is nationally recognized as a major contributor to the milk and food activities of the Service. He now serves as liaison representative for the Center in Bethesda, Maryland, in the Washington, D. C. area.

Mr. Miller has had assignments in the Chicago and Boston regional offices and a tour of duty in Alexandria, Egypt, and on the Greek Island of Crete. He earned his bachelor's degree in science and mathematics at Erskine College in Due West, South Carolina and his master's degree in food technology at the Massachusetts Institute of Technology, Cambridge, Massachusetts. Mr. Miller also received a certificate in public health at the University of North Carolina in Chapel Hill, North Carolina. He is a native of Chester, South Carolina.

"Dusty" has long been a member of IAMFES and has taken a most active role in many of its programs and committee functions.

FLORIDA SANITARIANS HOLD JOINT CONFERENCE

The Florida Association of Milk and Food Sanitarians, Milk Laboratory Technicians and the Florida Society of Professional Sanitarians held its Joint Conference at Gainesville on April 10-12, 1968. About 200 persons participated in the interesting program. Joint sessions were held on Wednesday and Thursday afternoons and inspection and laboratory personnel met in concurrent sessions on Thursday morning for special discussions.

Two outstanding talks featured the program. Prof. R. J. Ollry of Florida State University addressed a joint session on the subject "Health Implications of Our Changing Culture." Mr. Bill T. Coram, Jr. of the University of Florida talked about "A Lifetime of Learning." Both speakers were especially effective in inspiring the members of the audience toward greater efforts in their work.

Other topics of interest were: Testing Raw Milk for E. Coli and Psychrophilic Bacteria; Common Carriers Sanitation Related to Food and Milk; Solid Waste As Related to Composting; Significant Changes in the 12th Edition of Standard Methods; and Non-Dairy Products Marketed as Substitutes for Dairy Products. Panel discusions featured the second afternoon's program.

The new President of the Florida Association of Milk and Food Sanitarians is Richard F. Jolley and the new Secretary is Jay B. Boosinger, both of the Florida Department of Agriculture.

WILLIAM J. DIXON

I am very, very sorry to inform all members and friends of the death, Friday, June 14, of our friend and Associate Editor William J. Dixon. A more complete story will appear in our July issue.

NEWS AND EVENTS

RECENT ADDITIONS TO DAIRY STAFF AT UNIVERSITY OF KENTUCKY

Several new faces have joined the University of Kentucky Dairy Staff in the Animal Sciences Department. The four pictured below are: Seated, left to right, Dr. Bronson Lane, Extension Dairy Technologist; Dr. H. H. (Jack) VanHorn, Dairy Commodity Chairman; Standing, left to right, Dr. Darwin Braund, Extension Dairyman and Extension Dairy Production Project Leader; and Dr. William Wunder, Extension Dairyman.

Jack Van Horn, as Dairy Commodity Chairman, coordinates dairy activities in the Animal Sciences Department in addition to doing nutrition research and teaching. Jack joined the staff August 1, 1967, coming from Iowa State University where he served six years as an extension dairyman.

Bill Wunder (starting July 1, 1967) and Darwin Braund (starting December 15, 1967) have both recently finished their Ph.D's at Michigan State University, Bill in Dairy Cattle Breeding and Darwin in Dairy Nutrition. Bill will direct the dairy cattle breeding educational program on a statewide basis while handling area dairy responsibilities in the Bowling Green, Kentucky area. Darwin will use his past experience with the Pennsylvania Extension Service and Beacon Foods in New York to help him in directing the Dairy Production Extension Program.

Bronson Lane, a Pennsylvania product with a Ph.D. at Maryland, will work with the dairy manufacturing industry in the state (fluid and manufacturing milk plants) as well as with milk quality control at the farm level. He joined Kentucky July 17, 1967

In addition to the four full time staff members listed above, Dr. J. D. Fox, a Foods Biochemist from Louisiana State University, joined the Animal Sciences staff February 1, 1968. Dr. Fox will devote a part of his research effort to the biochemistry of dairy foods.

A LETTER OF INTEREST

The following letter should be of interest to all milk sanitarians:

Mr. H. L. Thomasson
International Association of Milk and Food Sanitarians
P. O. Box 437
Shelbyville, Indiana 46176

Dear Red:

You will recall that after the last IMS Conference, MIF made a major effort to secure from Congress appropriations to do research work on abnormal and mastitic milk.

At that time our efforts were rewarded by the inclusion of an extra $100,000 in the budget for USDA.

In the new budget submitted by USDA to the Congress, and presently being considered by the Appropriations Committees in both the Senate and the House, USDA has made a part of its regular budget the additional work on mastitis research. Although we were encouraged by the reaction in Congress last year, we were leaving nothing to chance this year, therefore we have submitted a statement to the Subcommittee on Agriculture of the Senate Appropriations Committee and will be making an appearance before the similar committee in the House this week. A copy of our statement is enclosed.

If you think it is appropriate to do so, you can be helpful in contacting Congressional members whom you know or who represent you. If you need additional copies of the statement, we will be glad to send them.

Cordially — April 13, 1968
Fred J. Greiner
Director of Public Affairs
Milk Industry Foundation
Washington, D. C.

QUESTIONS CURRENT MILK SAMPLING AND TESTING PRACTICES

Dairy plants may be wasting time and money through faulty procedures in conducting quality tests on their products. Food microbiologist E. H. Marth of the University of Wisconsin says that tests on raw milk and finished dairy products will not yield valid

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results if the laboratory worker fails to obtain samples properly or overlooks the weaknesses of common test methods.

Test results can be no better than the sample on which data are based, according to Marth. A sample must be representative, free from contamination during collection, and must not change while it awaits testing. Milk or cream in cans, tanks, vats or tankers should be thoroughly mixed before it is sampled. When milk is allowed to stand for some time, fat globules rise and carry bacteria from the rest of the milk to the surface. Thus, the cream layer contains more organisms than lower layers. Samples can also be misleading if taken from frozen, curdled or lumpy milk.

Marth says equipment used to collect samples should be thoroughly cleaned and sanitized or sterilized. Samples will not yield valid results if contaminated with bacteria or chemicals introduced by sampling equipment or containers. In addition, a dairy product sample should be cooled immediately to 40 degrees Fahrenheit or lower and held at that temperature until it is tested. If the sample is allowed to warm up, bacterial counts may represent numbers resulting from the growth of organisms rather than from those present in the product at the time of sampling.

The laboratory worker can misinterpret results of quality tests if he fails to keep in mind certain inherent weaknesses of test methods such as the agar plate, dye-reduction and direct microscopic techniques. For instance, the agar plate method uses a specific nutrient medium and temperature which favor the growth of certain types of bacteria but screen out others. Marth says it would thus be wrong to assume that the agar plate test measures all bacteria present in a sample.

The dye-reduction test also has limitations. Marth explains that in the past, this method has been fairly satisfactory. But recent changes in dairy production make this test less reliable. He points out, for example, that milk now reaches dairy plants at refrigeration temperatures. This means that bacteria are less active at the start of the test and hence more time is needed before dye-reduction occurs than if the organisms are actively multiplying. Also, modern dairy practices have reduced the number of milk bacteria that respond to this test, while other types may have increased. Thus a milk sample could contain a considerable number of bacteria but still appear satisfactory according to dye-reduction tests.

The direct microscopic method, on the other hand, may produce unreliable results through inaccurate measurements of the sample, faulty preparation of slides, and other mechanical problems.

GEOLOGICAL CHECK PROPOSED FOR NEW LANDFILL SITES[1]

William J. Wayne, Head Glacial Geologist of the Indiana Geological Survey suggests that more restrictions be placed on the location of sanitary landfills to prevent what he termed pollution of underground water. Wayne said that there are no laws which require a geological check of an area before a landfill is located. He spoke at the recent Governor's Conference on Natural Resources in Indianapolis.

Wayne said that the role of the geologist is cast as a trouble shooter and pessimist rather than advisor who can offer constructive suggestions in planning for optimum use of available land. "I would recommend a research program be started in this direction to examine present landfills and to provide adequate proof there is substantial damage to the water table so the legislature might act," Wayne says. He said the problem develops when rain water, or ground water passes through the landfill refuse and then into the ground, eventually reaching the water table.

Landfills have been placed in abandoned gravel pits and in flood plains. "We don't know how far this water travels, or how long it contains pollutants," said Wayne. He explained that California and Illinois, the only two states which have carried out studies, have determined problems exist in certain locations. "We may get to the time we will have to look for suitable areas for a landfill, rather than just locating them helter-skelter." Good sites may include abandoned strip mines and areas of thin clay glacial deposits.

[1]From Indiana Association of Sanitarians' *Newsletter*.

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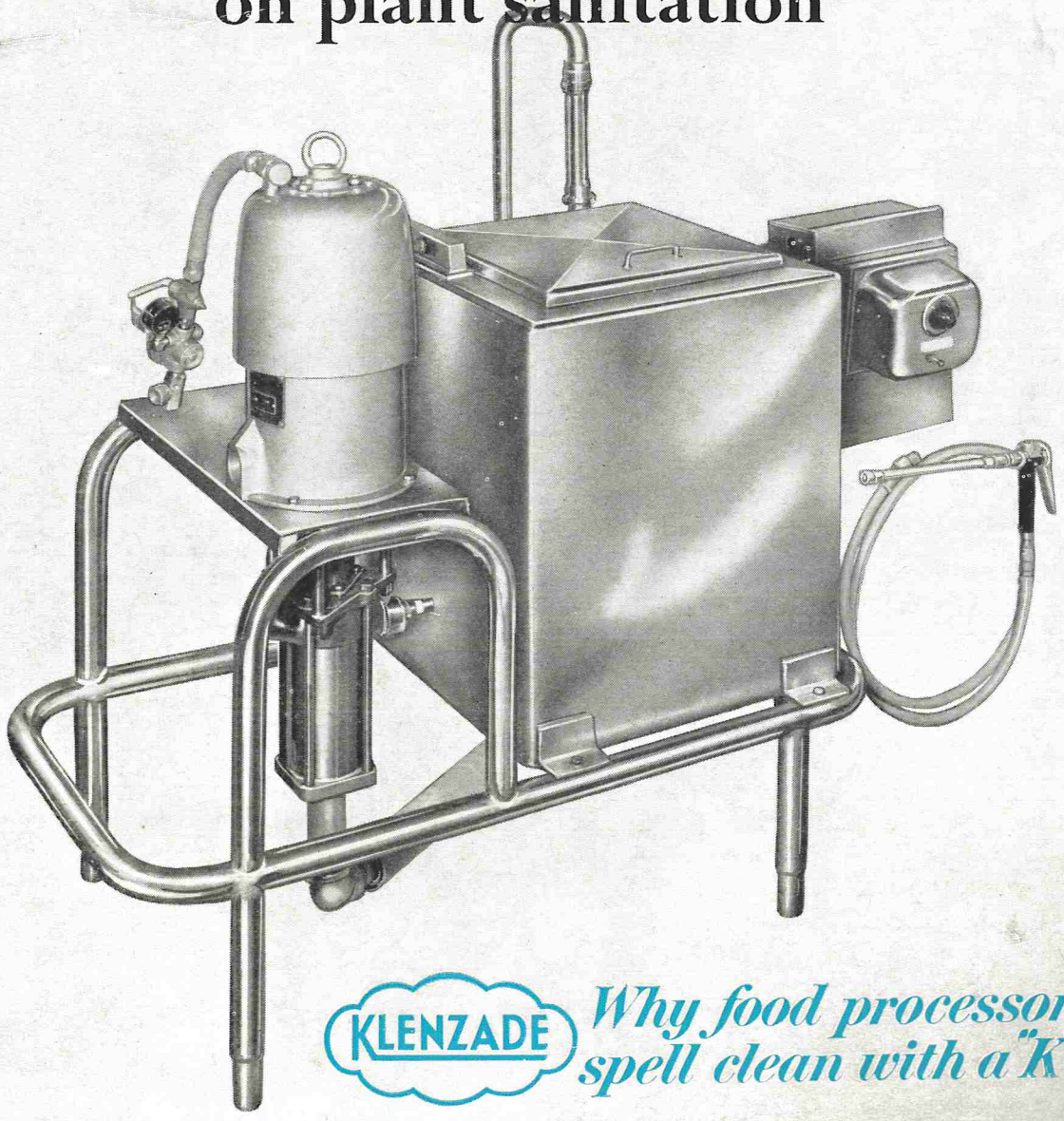

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