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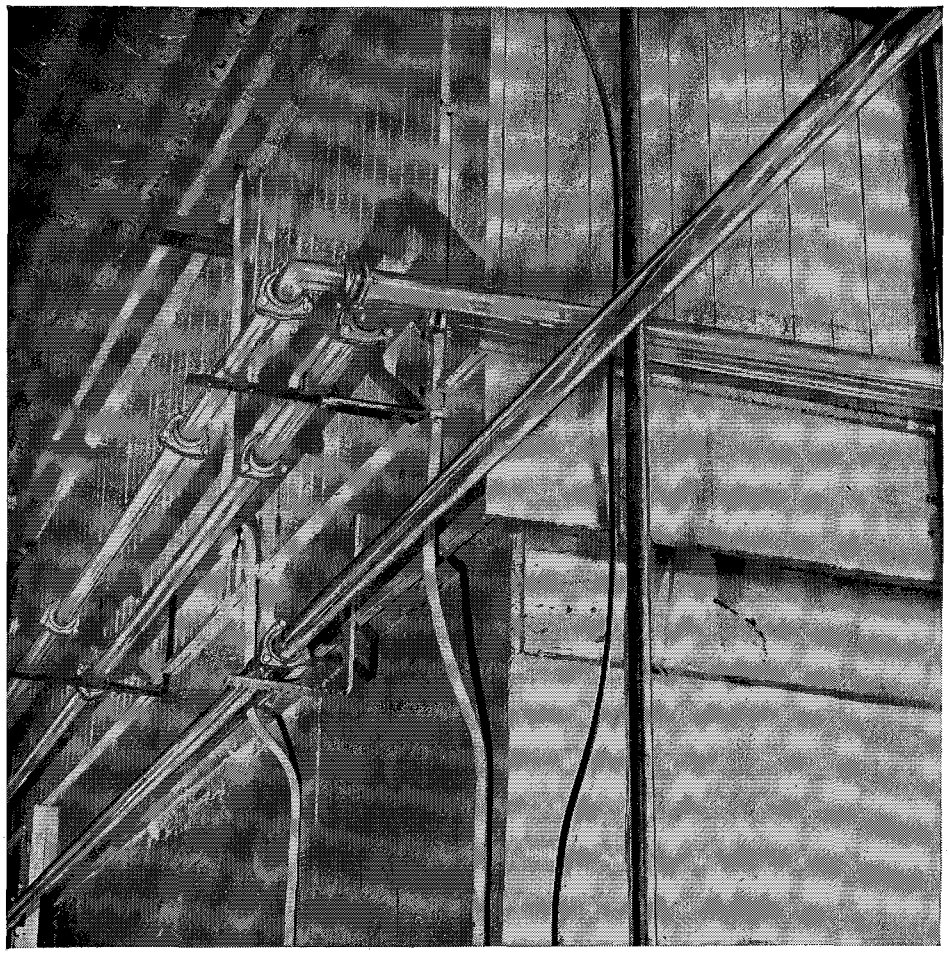
Journal of

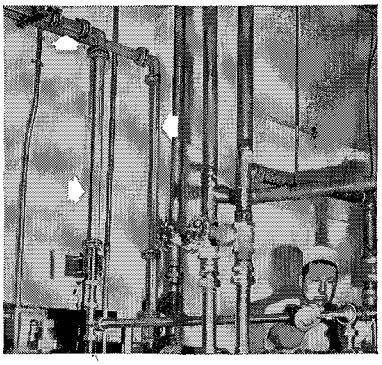
MILK and FOOD TECHNOLOGY

Unit

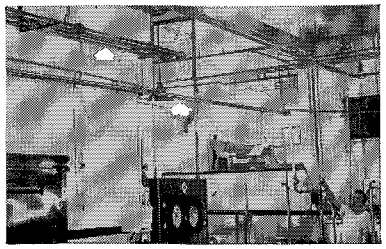
Official Publication

International Association of Milk and Food Sanitarians, Inc.





A turn of the valve sends cleaning solution circulating through the glass pipe.



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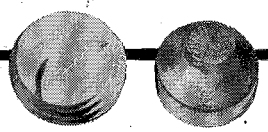

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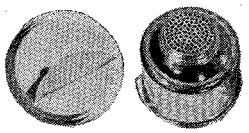

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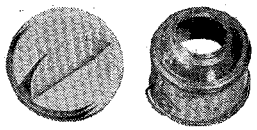

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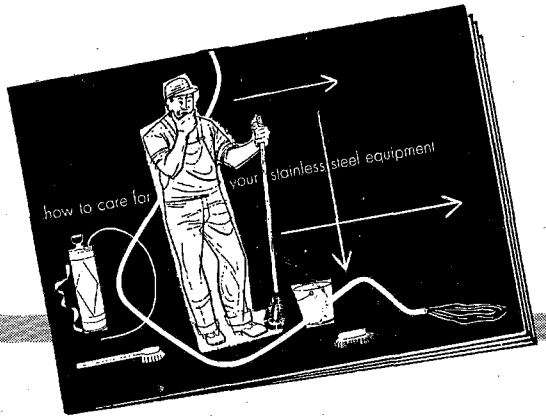

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Journal of

MILK and FOOD TECHNOLOGY

INCLUDING MILK AND FOOD SANITATION

Official Publication

International Association of Milk and Food Sanitarians, Inc.

VOL. 14 SEPTEMBER-OCTOBER 1951 NO. 5

Contents

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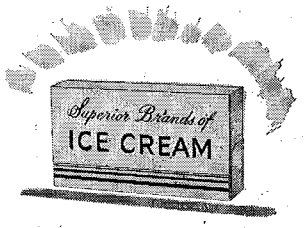

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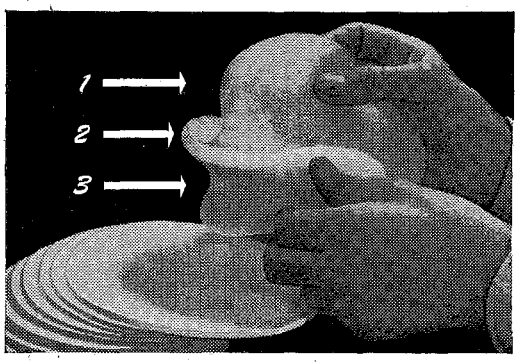

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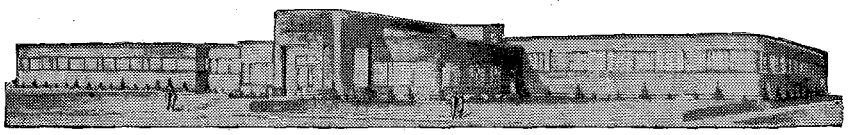

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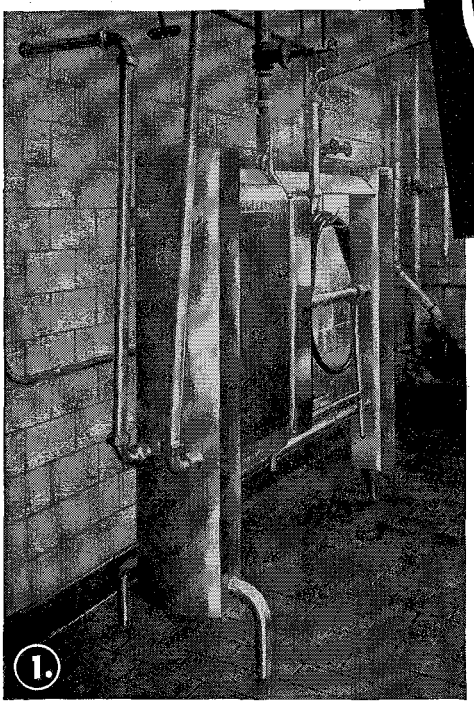

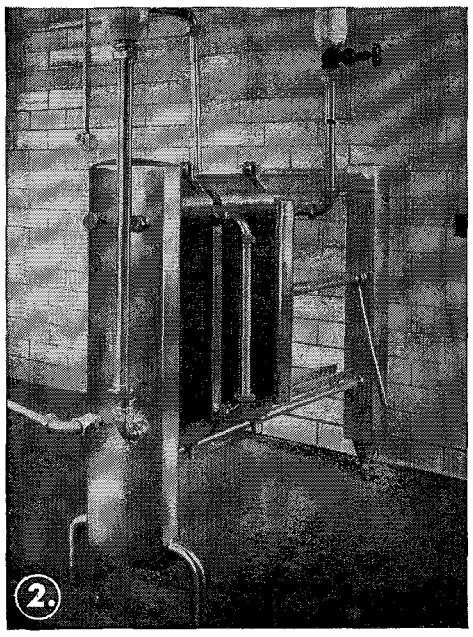

Illustrated here are three typical CP Multi-Pass Plate installations, but each is doing a different job with different capacities. First, at left, is a single section raw milk cooler using sweet water; second, lower left, is a two section mix cooler using city wa[illegible] chilled water; third, below, is a Heater Cooler, Regenerator H.T.S.T. Pasteurizer for market milk.

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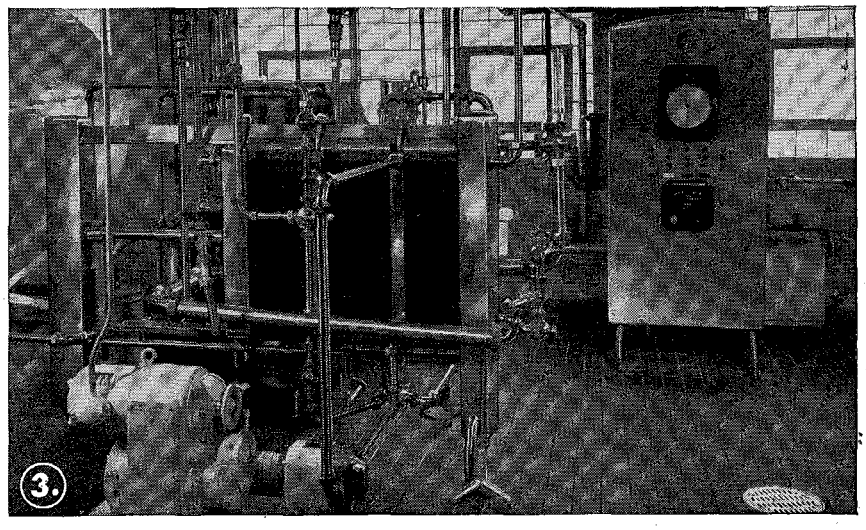

EDITORIAL NOTES

THE MEANING OF SANITIZE

THE verb "sanitize" is an old word that has recently come into general use in the food industry. Unfortunately this word is now often being used with a meaning that is too restricted.

Even though we are all familiar with the correct meaning of the word it is necessary to quote dictionary definitions to emphasize the misuse which is now so common. Sanitary is an adjective whose derivatives mean health. According to the latest Webster's unabridged dictionary it means "of or pertaining to health," "occupied with measures or equipment for improving conditions that influence health," "free from, or effective in preventing or checking, agencies injurious to health, esp. filth and infection." Now it is evident that to sanitize means "to make sanitary," and a sanitarian is "an advocate of sanitary measures; one especially interested or versed in sanitary measures, or, specif. making a procession of the application of such measures for the public benefit."

In April, I attended a three-day seminar on dairy sanitation and almost every speaker who discussed the sanitizing of dairy equipment referred to the steps of cleaning and sanitizing. I am certain that the speakers meant cleaning and proximate sterilizing. Surely, a sanitarian is one concerned with protecting health by the removal of both filth and infection as stated in the dictionary. He is not concerned with only a sufficient degree of sterilization to prevent infection as is implied by the use of the terms cleaning and sanitizing to indicate what ought to be called sanitizing. Dairy equipment is properly sanitized after it has been thoroughly cleaned followed by the destruction of bacteria in sufficient numbers to make the equipment approximately sterile. The thorough cleaning is generally more important from a sanitary viewpoint than the subsequent attempt at sterilization. It is undesirable to imply that the work of the sanitarian is limited to the latter operation only. We do need a good word to designate proximate sterilization. Sanitize has a broader meaning.

In the March-April 1950 issue of this *Journal* "SANITIZATION—WHAT DOES IT MEAN?" was discussed editorially by Dr. W. L. Mallmann. He pointed out that sanitize means "to bring into condition conducive to health" and sterilize means "to free of living microorganisms." He stated that dairy equipment is not sterile so that sterilization should not be used in connection with the treatment given dairy equipment. "There is a need for a word to cover the process of rendering equipment such as dairy utensils and restaurant dishes free of public health hazard. The word sanitize—*to bring into condition conducive to health*—meets the needs."

It is to be assumed that Dr. Mallmann did not mean that filthy equipment free from pathogenic bacteria is conducive to health. In this broader meaning of sanitize he included cleanliness and freedom from harmful bacteria or large numbers of nonpathogenic bacteria.

Perhaps we need to coin a new word meaning to render clean dairy equipment into a desirable bacteriological condition. One word that might be used sounds awkward and too much like inoculate. The word innocuous is derived from the latin prefix in, meaning not, plus the word nocuus, meaning hurtful. So innoculous means harmless, or with no ill effects. If the ending 'ize,' meaning to subject to the action indicated in the root, is added, we have the verb innocuize. This word would mean to make harmless and with no ill effects. To innocuize dairy equipment or dishes would be to treat the clean equipment in such a manner that it would not harm the milk or food placed in it. If the word existed, innocuize would mean proximate sterilization of equipment to such a degree that the equipment has no ill effects upon the milk or food placed in it. Usage of such a word by sanitarians would eventually obtain its general acceptance.

Now it ought to be possible for someone to suggest an acceptable word to mean proximate sterilization as practiced in the food industry. This word is of sufficient importance that anyone with suggestions ought to send them to the editor of the *Journal*. Perhaps the Association itself would consider some action through a properly appointed committee. In the meantime, let us use the words sterilize and sanitize with their correct meaning.

A. C. DAHLBERG

Thirty-eighth Annual Meeting
International Association of Milk and Food Sanitarians, Incorporated
Glenwood Springs, Colorado
September 26–29, 1951 Hotel Colorado

THOMASSON APPOINTED TO FULL TIME POSITION FOR ASSOCIATION

It is with real pleasure that I announce the action of the Executive Board in appointing H. L. Thomasson, President-Elect of the Association, as Executive Secretary of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, and as Business Manager of the *Journal of Milk and Food Technology*. The new address of the office is:

Ritz Building (P. O. Box 286)
Shelbyville, Indiana

The work involved in managing the affairs of the Association became so great that it no longer can be adequately handled on a voluntary basis. With the recent passing of William Palmer, former business manager, the decision to centralize the Association business affairs and to create the position of full-time Executive Secretary was made at the meeting of the Executive Board held in St. Louis on June 1 and 2.

The Executive Board feels that Mr. Thomasson's wide and varied experience particularly suits the needs in filling the position as Executive Secretary and Journal Business Manager, and in representing the Association. The early years of his life, while attending common school and high school included apprenticeship work as in a newspaper office, starting as a "printer's devil" and working up to reporting. After graduation from high school he worked for several years in a printing and bindery concern in Terre Haute. Mr. Thomasson is a graduate of Franklin College, Franklin, Indiana, where he majored in both sociology and economics, and history and political science, the minor being in science.

Upon graduation Mr. Thomasson spent a year in the state of Texas as a sales representative of a supply company. He has served as manager of a creamery company in Shelbyville, Indiana, and subsequently became affiliated with the Indiana State Board of Health as Milk Sanitarian. While in this position he was responsible for the promotion of the Grade A milk program in the local communities; in this period the number of cities in Indiana operating under the Grade A program was increased from one to 70, including 90 percent of the urban population of the state. He has also assisted the Indiana State Board of Health Food Sanitation Section in the promotion of its Restaurant Sanitation Programs.

Mr. Thomasson, known to all his friends as "Red", has been active in the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS for many years, serving as a member of its committees (currently he is a member of the Committee on Sanitary Procedure), and in national affairs relating to milk sanitation. He is an active worker in the Indiana Milk and Food Sanitarians' Association; he is a lecturer on Public Health Regulations and Sanitation Practices at the Indiana Medical School. Mr. Thomasson is forty-seven, married, and has a family of four children. His oldest daughter is a senior in Indiana University.

Mr. Thomasson has established headquarters and offices at the Ritz Building, 12½ East Broadway, Post Office Box 286, Phone 35, Shelbyville, Indiana. It is requested that correspondence from members, Affiliate Association Officers, and from those having business matters concerning the *Journal* be directed to the Association's new headquarters. The Executive Board has confidence that this move in the creation of the office of full-time Executive Secretary will greatly improve the service of the Association to its members, contributors to the *Journal*, and *Journal* advertisers.

K. G. WECKEL
President, IAMFS

Thirty-eighth Annual Meeting
International Association of Milk and Food Sanitarians, Incorporated
Glenwood Springs, Colorado
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LYE SOLUTION FOR MILKING MACHINE RUBBER PARTS*

C. K. JOHNS

Division of Bacteriology and Dairy Research
Science Service
Canada Department of Agriculture, Ottawa, Ontario

Dr. C. K. Johns is Senior Bacteriologist with the Division of Bacteriology and Dairy Research, Canada Department of Agriculture, Ottawa, Ontario, where he has been since 1927. A graduate of the University of Alberta, he obtained his M.Sc. from McGill University and his Ph.D. from Wisconsin. He was President of the I.A.M.F.S. in 1934–35, and is a Fellow of the American Public Health Association, where he serves as a Referee for the Subcommittee on Standard Methods for the Examination of Dairy Products.

To determine how wide a margin of safety existed with the lye soak solution, the residual milk was allowed to dry on to the teat-cup assemblies, then without any attempt at cleaning they were filled with the lye solution. This, supplemented by a weekly brush-washing, maintained these parts in good sanitary condition. The several advantages of the lye solution employed are indicated.

A SIMPLE, inexpensive method of caring for milking machine rubber parts has long been the object of an intensive search. Parfitt's [19] introduction of the lye soak solution method gave rise in 1930 to a suitable method [13] which has, since that time, continued to give complete satisfaction in the Central Experimental Farm dairy. Substitutes, including detergent-sanitizers, have been tried from time to time but none has been found to equal the lye soak method in reliability, simplicity, and economy. Satisfaction with this procedure has likewise been experienced elsewhere.[2, 4, 6, 7, 10, 16] Recently, however, Enright [5] has blamed the lack of cleanliness of teat cup assemblies upon the inadequacies of the lye storage method.

Our method consists simply of rinsing the units in 2½ Imp. gals. (3 U. S. gals.) of cold water, brush-washing the outsides of the assemblies, and filling with 0.5 percent lye solution. The units are then merely drained before use.† Once a week the units are completely dismantled for inspection and all inner surfaces brushed with a hot cleanser solution. The inflations are alternated in use; one week idle, one week in service.

Following this practice the rubber parts have remained clean and the bacteria counts of the raw bulk milk have rarely exceeded 10,000 per ml. Recently the inflations have been boiled once a month in 2 percent lye solution to prolong their life. That the lye soak solution method embodies a surprisingly large factor of safety was clearly shown in 1933–34.[14] Due to a misunderstanding, the suction rinse of two milker units, together with the weekly dismantling and brushing, was omitted for over five months. Nevertheless, bacteria counts remained low, and except for a moderate deposit of calcium phosphate from the residual milk the inflations remained clean. It is, therefore, difficult to understand why this recommended procedure should fail to maintain the teat cup assembly in a sanitary condition.

Apart from failure to fill the teat cup assembly completely, or the use of too weak a lye solution, allowing milk to dry on the milker parts appeared to be the only other form of neglect likely to result in high counts. The effect of such mistreatment was therefore investigated on four DeLaval units fitted with new inflations. For this purpose the usual procedure was abandoned, and instead the teat cup assemblies were hung up in a warm room (around 80° F) for 6½ hours after the morning milking and for 30 minutes after the evening milking. *At no time was the milk residue rinsed off.* Following the drying interval the assemblies were filled with lye solution. Just prior to the next milking they were drained and used without any

* Contribution No. 322 (Journal Series) from the Division of Bacteriology and Dairy Research, Science Service, Canada Department of Agriculture.

† While under our conditions it has not been found necessary to rinse the milker units with a sanitizing solution before use, this practice is recommended to producers.

TABLE 1

SUMMARY OF COUNTS ON MACHINE-DRAWN MILK SAMPLES

CENTRAL EXPERIMENTAL FARM, OCT. 17, 1949–JAN. 14, 1950

Period	No. of Samples	Log. Average Count	Distribution of standard plate counts							
			<5000	5001–7500	7501–10,000	10,001–12,500	12,501–15,000	15,001–17,500	17,500–20,000	>20,000
A. Oct. 17–Nov. 2	7	13,200	....	1	1	....	3	1	....	1
B. Nov. 3–Dec. 16	37	7,798	1	15	16	4	1	....	....	....
C. Dec. 19–Jan. 14	8	6,480	1	4	3	....	....	....	....	....

further treatment. Once a week the units were dismantled, inspected, brushed in hot cleanser solution, and reassembled. Samples of milk were obtained daily from the pasteurizer vat before and after pasteurization and examined for total count and coliform organisms.[1]

The plate count results are summarized in Table 1. Periods A and C represent the preceding and following periods when the customary pre-rinsing with cold water was practiced, while Period B is the experimental period. The arithmetic mean for the 37 samples examined during Period B was 8,025, the logarithmic mean 7,798, per ml. Counts on the pasteurized milk ranged between 21 and 100 per ml with an arithmetic mean of 43. Coliform organisms were present in 0.01 ml portions of 51.35 percent of the raw milk samples during the experimental period, compared with 53.0 percent during the control periods. No coliforms were found in 1 ml portions of the pasteurized milks at any time.

Weekly inspections of the disassembled teat-cup assemblies showed them to be only slightly less clean than when the usual rinsing treatment was employed. The slight film that developed might be expected to result from the precipitation of calcium phosphate from the residual milk by the highly alkaline lye solution. Despite such gross neglect, these units appeared to be in a satisfactory state of cleanliness.

Titration of the lye solution on 20 occasions during the test period gave values ranging from 0.35 to 0.49 percent, with a mean of 0.41 percent.

DISCUSSION

There are at least two opinions on the subject of milking machine sanitation. The first is that it is imperative that after each milking the teat cup assembly be rinsed, dismantled, brushed in hot detergent solution, rinsed, and finally sanitized by heat or chemical solutions. The second is that few producers will faithfully carry out such a complicated, time-consuming procedure, that most of them will take "short-cuts," and in consequence get into trouble. It is felt that a simpler procedure is much more likely to be carried out faithfully. As Flake[6] observes, "it is preferable to have a high degree of compliance with a procedure that will result in an acceptable machine than to have a low percentage of compliance with a more time-consuming procedure that would, if properly followed, yield a milking machine that is more nearly sterile."

Our aim has been to develop a method which is neither expensive nor time-consuming, and which can be used successfully where the hot water supply is limited. Provided the teat-cups and tubing are completely filled with 0.5 percent lye solution, a satisfactory sanitary condition can be maintained even with gross negligence, as indicated by the results reported in this paper.

While it may not be feasible under all conditions to maintain teat cup assemblies in good sanitary condition without the use of an additional suction rinse with hot cleanser solution, the need for dismantling and brushing twice daily does not appear to have been demonstrated. Our own results[15] and those of others[2, 17] have shown that suction washing gave significantly lower counts than brush washing. Hay[8] has also warned of the danger of destroying the smooth inner surface of high quality milking rubbers by the use of spiral brushes or metal scrapers, while all too frequently worn-out brushes are being relied upon.

It is unfortunate that the idea has gained acceptance that where the teat cup assembly is dismantled only once a week for inspection, this constitutes "once a week" cleaning. This is far from correct. *The lye solution method is intended to keep a clean milking machine in that condition, not to clean up a dirty one.* Lye solution has valuable detergent properties, in addition to its germicidal activity, and might be regarded as the original detergent-sanitizer. Advantage is taken of this in the machine-washing of milk bottles, where brushing is not usually employed. In common with other alkaline salts, however, it is less effective in the control of mineral deposits. In hard water areas an incrustation of calcium carbonate may slowly build up on the surfaces.[10, 12] Such deposits, while unsightly, apparently do not affect the bacterial content of the milk. They are easily removed by a weak acid solution, or avoided by using soft water, or by adding a small amount of polyphosphate as a sequestering agent. The substitution of sodium metaphosphate for lye has also been recommended,[9] as has an occasional treatment with an organic acid detergent.

In the Cornell studies, Dahlberg *et al.*[4] found that "a lye solution in the milker teat cup assemblies on a rack was a very effective cleaner and sterilizer." Jensen and Bortree[10] reported that inflations treated with lye solution absorbed much less fat than did those stored in chlorine, quaternary ammonium, acid detergent, or polyphosphate solutions. Moreover, some of these solutions caused deterioration of the rubber or other undesirable changes. The Arizona studies[2] also indicated that lye solution, following a cold water rinse, gave lower counts than conventional methods, with a daily saving in time of 30 minutes to an hour for a 2-unit machine. Moseley[18] recently queried 16 Guernsey milk producers whose raw milk plate counts during 1950 never exceeded 50,000 per ml. Of the 13 replying, 11 used wet storage and 9 of these used lye solution. The above findings, and our own, do not support Enright's[5] contention that the use of lye solution can be blamed for most of the unclean teat-cup assemblies.

Regardless of the method employed to remove the milk residue, wet storage in lye solution between milkings possesses the following advantages:

1. Lye is more readily obtainable than other recommended detergents or sanitizers.
2. It is the cheapest effective compound.
3. It retains its strength, both in the solid form and in solution.
4. It maintains its efficiency in the presence of rubber and other organic matter.
5. It possesses valuable detergent properties, dissolving casein and saponifying fat, the presence of which causes deterioration of rubber liners.
6. It does not cause oxidation of the rubber.
7. It does not form the granular deposit reported by Parfitt[19] with hard water solutions of hypochlorites.

(Continued on page 160)

THE EFFECT OF ANTIBIOTICS IN MILK: A REVIEW*

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THE advances made in the use of antibiotics during recent years have done much to aid the farmer in controlling and curing mastitis in dairy herds. Such antibiotics as penicillin, aureomycin, streptomycin, chloromycetin, bacitracin, tyrothricin, and subtilin have been used for the treatment of mastitic cows. Today, penicillin probably is used more widely than the other antibiotics for this purpose. Some investigators have reported using as high as 100,000 to 400,000 Oxford units of penicillin for each infected quarter. In other cases, where the infection has been quite serious, whole herds have been treated in the "flash method."

In a number of cases the antibiotics have been found in sufficient quantities in mixed herd milk to cause arrested acid development of lactic cultures when such milk is used for cheese or other cultured dairy products. The presence of antibiotics has resulted either in the inability to make the product or in a greatly lowered product quality due to abnormalities. The mode of action of antibiotics on the sensitive bacterial cells is not clearly known; however, several investigators have summarized evidence suggesting that the action is essentially an intracellular one.

Although the presence of antibiotics in milk has been associated primarily with treatments of udder infections, Foley and Byrne [7] suggested that penicillin or other antibiotics should not be used as a substitute for cleanliness or accepted sanitary practice.

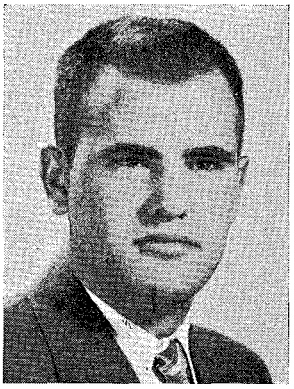
Whitehead,[43] although he had not actually observed this type of difficulty, warned patrons that milk from mastitic cows under treatment with penicillin should not be sent to a cheese factory during the treatment, since penicillin has an effect upon starter action in the factory. Another early warning appeared in a German trade journal, Anonymous.[1] Beale [3] warned producers to withhold milk from antibiotic treated cows for 48 hours after treatment. Others who have warned producers against antibiotic-treated milk are Anonymous,[2] Doan,[6] Hansen *et al.*,[10] Jørgensen,[20] Krienke,[24] Petersen [34] and Yahraes.[44]

AMOUNT OF ANTIBIOTICS FOUND IN MILK FROM TREATED UDDER QUARTERS

Numerous workers have dealt with the treatment of bovine mastitis by antibiotics. Many have determined the amount of antibiotic remaining in the milk after treatment. A few of these findings are presented here.

Schalm and Casselberry [36] injected 20,000 units of penicillin per quarter into udders of cows averaging 30–35 pounds and 48–68 pounds of milk per day. At the end of 12 hours the milk from the two groups averaged 14 units and 5 units per ml respectively. When 100,000 units were injected into eight "dry" quarters, there were from 5.5 to 29 units per ml of milk 24 hours afterwards. Stevenson [38] found 14 units of penicillin per ml of milk 24 hours after treatment with 25,000 Oxford units. Murnane [32] found 0.25 unit of penicillin per ml 24 hours after treatment with 25,000 Oxford units. Hunter [13] estimated that approximately 5 units of penicillin per ml was the concentration of penicillin in milk 12 hours after treatment with 25,000 Oxford units. Weirether and others [42] injected 30,000 units per quarter and found 0.5 unit per ml after 24 hours.

Packer [33] found that penicillin is evenly distributed throughout the quarter after injection. The average penicillin content of foremilk in 15 quarters was 26.4 units per ml, and of strippings 21.7 units per ml. He also reported that the amounts of penicillin remaining in the udder 24 hours after injection of 25,000 or 200,000 units were similar. Watts and McLeod [41] determined that 0.04 unit of penicillin per ml inhibited 56 strains of *Streptococcus agalactiae* and 4 strains of *Streptococcus aureus*.



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McCullock *et al.*[31] reported that the normal aureomycin treatment for mastitis was from 100 to 200 mg per infected quarter. They found that 48 hours after treatment, the milk contained from 0.64 to 5.1 μg per ml of milk. After 72 hours (six milkings), enough aureomycin was present to inhibit *S. agalactiae*.

Jackson and Bryan [16] found that the vehicle used in penicillin treatments helps determine the time it may take to reduce the high milk levels of penicillin in the udder. They found that procaine penicillin in oil with aluminum monostearate maintained the highest milk level of penicillin for the longest period of time. If the penicillin was injected in a water solution, the penicillin level was reduced in 24 to 36 hours to a level ineffective against the mastitis streptococci; if in oil, approximately 36 hours were required and when in an ointment base, approximately 48 hours. The total number of Oxford units injected into the infected quarter also influences the time to reduce the penicillin level in the milk. The larger the volume of water used in the treatment, the sooner the penicillin content was reduced to a non-inhibiting level. Cows at the beginning of their lactation periods, because of their higher production levels, excreted the penicillin quicker than the cows in the middle or at the end of their lactation periods.

Foley *et al.*[8] found that a penicillin vehicle containing water, mineral oil,

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lanolin, propylene glycol and a non-ionic wetting agent maintained approximately 5 units of penicillin per ml of milk, even after 72 hours (six milkings), when 100,000 units of penicillin were used as the treatment.

RECOMMENDATIONS FOR HANDLING MILK FROM TREATED QUARTERS

Hunter [15] calculated that it would take from 45 to 171 treated quarters to provide a critical level of 0.10 unit of penicillin per ml in a 900-gallon cheese vat. Hunter [13] determined also that this critical level could be reached when 90 gallons of milk containing 5 units of penicillin per ml is diluted up to 4,500 gallons with penicillin-free milk. He estimated that approximately 30 treated cows or 120 treated quarters would be necessary to produce the 90 gallons. These 30 treated cows would constitute about 2 percent of the cows on a milk shed. Johnson and Bryan [17] found that approximately 22 percent of the cows had mastitis; hence, it would be possible to have 2 percent of the animals on a milk shed being treated simultaneously for mastitis.

Krienke [24, 26] pointed out that the milk of one average cow, which had been treated in all quarters, would provide a critical level of 0.10 unit per ml when diluted with the milk from 80 non-treated cows. Katznelson and Hood [22] calculated that if the milk of one treated cow, 12 hours after infusion, is pooled with the milk of ten non-treated cows, the resulting milk would contain approximately 1.4 units of penicillin per ml of milk. Petersen [34] recommended that the first milking after treatment, with a "strong injection" of penicillin should be diluted over 200 times before using the milk for cheesemaking.

Hunter,[15] Jørgensen,[20] Krienke,[24, 26] and Petersen [34] recommended that the milk from treated cows should be discarded for the first two or three milkings after treatment. Whitehead [43] and Doan [6] recommended that the milk from treated cows be withheld from the market for three milkings. Ruehe [35] recommended that the milk be withheld from the market the first 24 hours after treatment. Of somewhat different opinion were Hansen *et al.*,[10] who found that it took from five to six milkings before the milk was back to normal, as determined by its ability to support the growth of lactic acid bacteria, after an injection with 100,000 units of penicillin in a physiological salt solution. They found there was no diffusion of the antibiotics from one quarter of the udder to another; hence, they recommended that the milk from only the treated quarters should be discarded. Kastli [21] also recommended longer withholding periods. He thought milk should be withheld from the market for 4 days before it was used for manufacturing purposes.

ACTION OF ANTIBIOTICS ON LACTIC DAIRY CULTURES

Probably the first worker to deal with the effect of penicillin on *Streptococcus lactis* was Bornstein.[5] He found that of 27 strains of enterococci and 6 strains of *S. lactis,* all were resistant to 8 units of penicillin in 1 percent glucose broth. These units were not Oxford units.

Kastli [21] first reported that milk from a penicillin treated quarter would impair the manufacture of butter and cheese. He found that from 0.1 to 1 unit penicillin per ml was sufficient to inhibit the growth of *Streptococcus cremoris* and *S. lactis.*

In his early work, Hunter [13] investigated the effect of penicillin on the sensitivity of 10 single strains of stock cultures of *S. cremoris* and *S. lactis.* All of his trials used 1 percent starter, and the production of acid (calculated as lactic acid) was observed in sterile milk containing various amounts of penicillin. Then strains of *S. lactis* and *S. cremoris* were tested and all showed decreasing acid production with increasing amounts of penicillin. As a group, the *S. cremoris* strains were less resistant than the *S. lactis* strains. Strain K of the *S. cremoris* group was affected by as low as 0.025 unit of penicillin per ml of milk. The other strains were seriously affected by either 0.10 or 0.15 unit per ml of milk. Strain ML-1 of the *S. lactis* group, was affected by 0.10 unit of penicillin, while the others were not affected until the penicillin concentration reached 0.25 to 0.30 unit per ml. Hunter found that when the concentration of penicillin approached full inhibiting strength, the cocci gave place to elongated rods, apparently because of difficulty experienced in the division and splitting off of the daughter cells, a phenomenon also observed by Trembath.[40] The power of *S. cremoris* strains to reduce methylene blue in milk containing 0.15 unit of penicillin per ml was inhibited to a marked degree. The *S. lactis* strains were not affected in this manner by 0.3 unit per ml. Trembath [40] found that one of two *S. lactis* starters were partially inhibited by 0.11 unit penicillin per ml and the other by 0.32 unit penicillin per ml but not by 0.16 unit per ml. Scott,[37] working with an active multi-strain commercial starter, found approximately the same acidities after various incubation periods when the milk contained from 0.02 to 0.08 unit penicillin per ml, although the acidities were slightly lower than the control.

Later the same year, Hunter [15] added known amounts of penicillin to lots of raw milk and, after pasteurization and cooling, made cheddar cheese in 500 lb lots. The cheese was made according to the steps in acidity. His results show that 0.15 unit of penicillin per ml of milk stopped acid production of starter HP at 0.64 percent. When concentrations of penicillin ranging from 0.07 to 0.13 unit per ml were added, the time to make the cheese was extended by 5 to 55 minutes. When starter K was used, only 0.07 unit per ml was necessary to stop the growth of the organisms at 0.38 percent titratable acidity. It also was shown that a low concentration of penicillin will cause slow acid formation with most starters used for cheddar cheese manufacture. The cheese made from vats which were 30 to 40 minutes slow were weak in body and possessed off-flavors. The defects of the final cheese could be correlated with the adverse effect of penicillin on the rate and extent of acid development by the starter cultures in the vat during the manufacture.

Hood and Katznelson [12] worked with mixed and single strains of starter cultures and found partial inhibition of acid production with the mixed strain with 0.5 unit of penicillin per ml and complete inhibition by 50 units. The single strain culture was partially inhibited by 1 unit per ml and completely by 50 units. In their trials a 2 or 3 percent inoculum was used. Katznelson and Hood [22, 23] studied the action of different antibiotics on lactic streptococcus starter cultures used:

in cheddar cheese making. Penicillin was the most active of six antibiotics, with aureomycin and subtilin equal in regard to dilutions giving complete inhibition of growth. However, both penicillin and subtilin caused inhibition over a wider range of dilution than did streptomycin, aureomycin, chloromycetin, and bacitracin. They also found that 45 strains of *S. lactis* all were completely inhibited by 0.2 to 0.4 unit of penicillin per ml of skim milk. Complete inhibition was obtained with 0.5 unit of penicillin per ml with six of the starter (mixed) cultures.

Krienke [24] studied the effects of penicillin on buttermilk starters. When milk contained as little as 0.10 unit of penicillin per ml, the acidity developed slowly with incubation at 68–70° F for 16 hours. When the entire milking (8.6 lb) of one cow was taken 12 hours after one quarter had been treated with 75,000 units of penicillin and a portion of this milk diluted with 95 percent of milk not treated with penicillin, the resulting titratable acidity was reduced, compared to a control containing untreated milk.

Hansen *et al.*[10] encountered occasional trouble in cheddar cheese plants, and traced this to antibiotics. Their study was made to determine the amount of milk from treated quarters required to prevent the growth of lactic acid bacteria when mixed with drug-free milk. They also were interested in the effect on the cream used for cultured butter and the milk for powder, when the milk contained drugs used for the treatment of mastitis. They used penicillin, streptomycin, and aureomycin, as well as two sulfa drugs. Eight different lactic starters were used in the experiments. The results showed that when 100,000 units of penicillin were injected into a quarter, 1 percent of milk from that quarter mixed with drug-free milk, would show restrictive action to cultures after three milkings. When 1 gm of streptomycin was injected into the quarter, 1 percent of the treated milk inhibited the cultures after six milkings. When 200 mg of aureomycin were injected, 1 percent of the treated milk inhibited the cultures for the first two milkings. All milk was pasteurized and 2 percent starter was used. The results also showed that penicillin and streptomycin interfered with the acidity development of cream, when 1 percent of the treated cream was added to drug-free cream. When the same two antibiotics were added to skim milk, pre-heated, condensed and spray dried, the reconstituted milk restricted the growth of lactic bacteria.

Kastli [21] reported that from 0.1 to 1 unit penicillin per ml was sufficient to inhibit the growth of *Lactobacillus lactis*, and *Lactobacillus helveticus*. A concentration of 0.1 unit penicillin completely inhibited *Streptococcus thermophilus*. Hargrove *et al.*[11] reported inhibition of Swiss cheese starters by penicillin and streptomycin in the milk supply. They found that *S. thermophilus* was inhibited markedly by 0.01 unit penicillin or 5 μg streptomycin per ml, and *Lactobacillus bulgaricus* and *Propionibacterium shermanii* by 0.1 unit penicillin or 5 μg streptomycin per ml.

Katznelson and Hood [22, 23] found one *Leuconostoc citrovorum* culture to be completely inhibited by 1.6 units penicillin per ml. Contrary to this report was the work of Petersen [34] who found that *Leuconostoc sp.* were especially sensitive to penicillin. The penicillin impaired the development of flavor and aroma in the cream used for butter.

Herrell [11a] noted that aureomycin and penicillin were more active against Gram-positive organisms than were streptomycin and chloramphenicol. Aureomycin also was active against Gram-negative organisms and thus could be used against both types of organisms with a great deal of success in treatment of mastitic cows. This is especially true when the causative organisms are resistant to penicillin. While organisms will build up a resistance to penicillin, no evidence has been shown that bacteria will develop resistance to aureomycin.

Krienke [25, 26] studied the effect of aureomycin in two ways: (a) when added to the milk and then pasteurized, and (b) when five cows had been treated with aureomycin in an ointment base. Milk containing 0.0005 mg of aureomycin per ml inhibited the acid production of cheese starters, while 0.00005 mg of aureomycin did not. Inocula of 1 and 3 percent starter were used. The milk of three of the five cows treated contained enough aureomycin in 12 milkings after treatment (2X per day) to retard acid production. When mixed with 90 percent aureomycin-free milk the acid production was inhibited until the sixth milking. On the basis of his work, Krienke recommended that careful consideration be given to the acceptance of milk from aureomycin-treated cows.

Johnston [18] found that most cultures were inhibited by 0.05 μg of aureomycin. However, he had found some resistance strains that could be used for cheese starters. When mastitic cows were treated with aureomycin, he found large enough quantities of the antibiotic 4 days after treatment to inhibit starter activity.

Hansen *et al.*[10] found that aureomycin did not inhibit eight lactic acid cultures when 1 percent milk from a treated quarter was mixed with drug-free milk, separated, the skim milk powdered and reconstituted and the cream made into cultured butter.

A comparison of the effectiveness of four antibiotics against bovine mastitis has been made by Benson.[4] He found that penicillin was more satisfactory for treatment of mastitis than tyrothricin, bacitracin, and streptomycin. Streptomycin was more effective than penicillin against *Escherichia coli*. In his experiments he used 20 to 40 ml of the tyrothricin; however, he found that the milk from the treated quarters had an increased viscosity. When the bacitracin was used, about one-tenth the number of units of penicillin was used. In the treatment of the *E. coli* infection, he used 500,000 units of streptomycin.

TESTS FOR ANTIBIOTICS IN MILK

If antibiotics are going to be used for treatment of udder infections, they will be found in the milk supply at a critical level from time to time. Several assay methods are available; however, these take considerable equipment and time and frequently do not detect accurately the small amounts that would provide a critical level in dairy plants.

Krienke,[25] Ruehe [35] and Stoltz and Hankinson [39] have outlined tests for detecting the presence of antibiotics in raw milk. Krienke and Ruehe both added an active starter culture to previously-heated raw milk samples. Krienke used 3 percent starter, while Ruehe used only 1 percent. Ruehe incubated the samples 10 hours and noted the coagulation of the samples, while Krienke tested the

titratable acidity at the end of 2, 3, and 4 hours. Both incubate the samples at 98° F. Stoltz and Hankinson [39] have modified the Scharer field test for phosphatase activity. The test is based on the fact that the activity of the phosphatase enzyme is retarded in the presence of antibiotics. They show that as little as 0.01 unit of penicillin, 0.01 mg streptomycin, 0.01 mg aureomycin, and 0.01 mg of tyrothricin can be detected by use of this test. A gray color indicates complete phosphatase inactivation, while a green color indicates only partial inactivation. None of these tests indicate the amount or kind of antibiotic present in the milk.

One of the greatest needs at the present time is an accurate, simple, and rapid test for antibiotics in milk.

EFFECT OF ANTIBIOTICS ON REDUCTASE OR QUALITY TESTS

Many plants use a reductase test as an indication of the relative numbers of organisms in raw milk; however, if a critical level of antibiotic is present, difficulty may be experienced in interpreting the results of these tests. Hunter [14] and Johns and Katznelson [19] have studied the effect of penicillin on dye reduction tests for milk quality. Hunter worked with methylene blue, while Johns and Katznelson were working with resazurin. Both investigators found that presence of antibiotics may permit acceptance of poor quality milk as high quality milk when tested with either the resazurin or methylene blue tests. Hunter concluded that the presence of penicillin or other antibiotics sometimes gives an improvement in the quality of the milk by inhibiting contaminating organisms and thus may have a variable effect in the reductase test for milk quality.

PENICILLIN ADDED TO PASTEURIZED MILK

Two workers have determined the effect of adding penicillin to raw milk before pasteurization. Foley and Byrne [7] added penicillin to raw milk at the rate of 3 units per ml, pasteurized the milk, and noted the effect on growth of organisms. There seemed to be no effect with or without the penicillin when the milk was held at 7° C. The penicillin inhibited growth of the Gram-positive organisms in the milk held at 27° C for about 24 hours. Pasteurization efficiency was increased by the addition of penicillin. However, on high grade milk there seemed to be no advantage to its addition. Krienke and Fouts [27] added 0.25 unit per ml to raw milk and pasteurized it. The addition of the penicillin kept the growth of *S. lactis* down for 10 days at refrigeration temperatures. They also carried out studies on evaporated milk, condensed whole milk, condensed skim milk, and non-fat dry-milk-solids. When penicillin was added at the rate of 1 unit per ml before pasteurization or the heat treatment, only the processing of the evaporated milk gave any reduction in antibiotic activity.

STABILITY TO HEAT TREATMENT OF ANTIBIOTICS IN MILK

Foster and Woodruff [9] stated that pasteurization of penicillin in liquid broth at 60° C for 30 minutes resulted in a definite, though variable, deterioration in activity ranging from 5 to 30 percent. Watts and McLeod [41] found that penicillin activity in raw, full-cream milk and sterilized skim milk heated to 100° C for 30 minutes was reduced 50 percent; holding these penicillin solutions for 60 minutes resulted in 75 percent reduction of activity. No destruction was found when the milk-penicillin solutions were heated 15 minutes. Hunter [15] found that when two lots of milk containing 1.3 and 4.5 units of penicillin per ml were steamed for 15 minutes, 73 percent decrease in the activity resulted. It appeared to him that the penicillin was more heat stable in the presence of milk than in an aqueous solution.

Hunter [13, 15] reported that pasteurization temperatures and times did not inactivate or reduce the potency of penicillin in milk. However, he did find that steaming for one hour resulted in approximately 50 percent reduction. Hood and Katznelson [12] also found no inactivation of penicillin by pasteurization temperatures. Krienke [24, 26] found that neither penicillin nor aureomycin was inactivated by heating the milk to 143° F for 30 minutes. The penicillin was not inactivated by heating in milk to 190° F for 60 minutes or when autoclaved at 15 pounds pressure for 15 minutes. Doan [6] stated that pasteurization temperatures did not inactivate antibiotics in milk nor did oxidizing and reducing agents and surface active agents. Autoclaving the milk has only a slight effect in reducing the potency. Scott [37] found that autoclaving milk for 30 minutes at 15 pounds pressure, with penicillin levels from 0.025 to 1 unit per ml almost entirely destroyed the antibiotic activity. When the penicillin levels were increased to 5 and 10 units per ml, no acid development was noticed in the heat-treated milk after 4 days' incubation at 75° F.

Trembath [40] reported that the popular belief in Australia was that the heat treatment given the milk by cheese factories largely inactivated the residual penicillin that would be present in the milk supply. In testing two mixed starter cultures, he found that autoclaving the milk for 10 minutes at 115° C destroyed the potency of the penicillin; however, heating the milk at 155° F for 10 minutes, 185° F for 10 minutes, or 190° F for 30 minutes, did not materially affect the potency of the penicillin.

Hansen *et al.*[10] found no decrease in activity of penicillin or streptomycin when 1 percent of antibiotic-treated milk was mixed with drug-free milk, preheated to 175° F, condensed to 35 percent total solids, spray dried, and then reconstituted and pasteurized at 195° F for 30 minutes. Aureomycin, on the other hand, did not inhibit the growth of the lactic acid cultures under these conditions.

MEANS OF OVERCOMING DIFFICULTIES IN MILK

Increased Inoculum

It can be concluded from the above information that pasteurization temperatures and times are not effective in inactivation of the antibiotics. Therefore other means must be used to reduce the difficulties resulting from the antibiotics. Maas and Johnson [29, 30] reported that 0.8 unit of penicillin was firmly bound to each milliliter of *Staphylococcus aureus* cells collected by centrifugation, or that 750 moles of penicillin were specifically absorbed by each bacterial cell and could not be washed out but remained tightly bound during subsequent multiplication of the cells in a penicillin-free medium. Radioactive penicillin was used in the latter experiment. Krienke [25] concurred with Maas and Johnson. Thus the bacterial cells for the initial inoculum will have absorbed

practically all of the antibiotic and are so weakened that acid production does not progress at a normal rate. When a second inoculation is added, the penicillin is tightly bound to the original inoculum and will not act upon the new cells; consequently they can function normally. It should be pointed out that this is only practical at low concentrations of antibiotics and will not yield a product of quality equal to that resulting from antibiotic-free milk.

Katznelson and Hood [22, 23] and Doan [6] recommended the use of a 3 percent starter to overcome the effect of the penicillin. Ruehe [35] recommended that cheese factories where antibiotics are suspected in the milk use a 5 percent inoculum of the starter culture.

Resistant Cultures

Katznelson and Hood [22] reported a resistant starter which would coagulate milk in the normal time when 3 units of penicillin per ml were present. This culture was found to be resistant after 20 transfers without any penicillin present. Trembath [40] also reported isolating a culture resistant to penicillin. Johnston [18] reported a strain of starter culture resistant to an unstated amount of aureomycin. Hargrove *et al.*,[11] investigating the inhibition of Swiss cheese starters by penicillin and streptomycin, found they could build up resistant starters. Resistant *L. bulgaricus* and *S. thermophilus* would grow in presence of 3 units of penicillin or 500 μg of streptomycin per ml. *P. shermanii* resisted 1 unit of penicillin or 200 μg of streptomycin. These cultures had about 30 times the resistance of the original cultures.

Penicillinase

Katznelson and Hood [22, 23] found that if the enzyme penicillinase were used in the milk at the rate of 0.02 mg per 100 ml of milk, normal acid development occurred in the presence of 0.5 unit of penicillin per ml. Krienke [25, 26] stated that the cost of penicillinase in either a liquid or a powder would be prohibitive and would exceed the cost of the milk if added in quantities to inactivate 1 unit per ml. Doan [6] agreed with Krienke, saying that penicillinase would work but was not practical because of cost. Doan,[6] and Hargrove *et al.*[11] used Penase (Difco) in their experiments and found this to be effective in inactivating penicillin. Lawrence [28] studied the effect of 18 enzyme systems upon penicillin and found two, taka-diastase and clarase, to inactivate solutions of sodium penicillin. Both of these enzymes are derived from *Aspergillus oryzae*.

SUMMARY

Antibiotics used in the treatment of mastitic cows will be found in the milk coming to the dairy plants and may likely be the cause of slow acid production by streptococcus starters. On the other hand, all cases of slow acid production should not be considered due to antibiotics.

The amount of antibiotics present in the milk from animals treated for mastitis will depend on the number of quarters treated, the number of cows in the herd, the number of units or milligrams of antibiotic used in the treatment, the vehicle carrying the antibiotic, the time elapsing after treatment, the level of the production and many others. In general, if farmers would not send the milk to market from treated cows for 24 to 48 hours much of the trouble of the dairy plant operators would be solved. If the farmers would mark cans that contain milk from treated cows, that would help in control of this difficulty.

As low as 0.07 unit of penicillin or 0.0005 mg of aureomycin per ml of milk may be detrimental to the most sensitive lactic streptococci. A concentration of 5 μg of streptomycin or 0.01 to 0.1 unit of penicillin will markedly affect the acid production of Swiss cheese starters. Other antibiotics have not been fully tested against lactic starter cultures.

There seems to be agreement that the normal pasteurization temperatures employed will not inactivate the antibiotics. Autoclaving and prolonged steaming of milk have a slight effect on penicillin and an appreciable effect on streptomycin.

The use of a heavy inoculum seems to be one method of overcoming to some degree the action of small amounts of antibiotics in milk supplies. Development of cultures somewhat resistant to penicillin, aureomycin, and streptomycin has been reported. Penicillinase has been reported to inactivate penicillin but the cost has been reported by two investigators as being prohibitive. Another factor is that use of this enzyme would have to be permitted by the Federal Food and Drug Administration.

A test is available which has been reported to detect the presence of antibiotics in the milk supply rather quickly; however, it does not determine the type of antibiotic. Two other tests have also been outlined and take from 4 to 10 hours to complete.

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Lye Solution for Rubber Parts

(Continued from page 154)

8. Less fat is absorbed by the rubber inflations than when other recommended compounds are used.[11]

9. The slipperiness of the solution affords a simple method of determining that it is up to strength.

10. It is much more effective than chlorine compounds in the destruction of coliform organisms.

11. Periodical boiling in a 2 percent solution is extremely effective in the control of thermoduric organisms,[11] while also prolonging the life of the rubber parts.

12. Lye does not injure the metal parts (except aluminum or aluminum alloys).

13. Even a 5-minute treatment with lye solution is sufficient to maintain surfaces in good sanitary condition.

CONCLUSION

Lye solution maintained milking machine rubber parts in a satisfactory sanitary condition even when the residual milk was permitted to dry on the surfaces.

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PROBLEMS CREATED FOR THE DAIRY INDUSTRY BY ANTIBIOTIC MASTITIS TREATMENTS*

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THE discovery of penicillin by Fleming [4] in 1929 and its comparative lack of irritation when administered to human beings were followed by the early reports of Kakavas [7] and Bryan, Huffman and Horwood [2] concerning its usefulness in the treatment of infectious mastitis. The therapeutic value of penicillin was greatly enhanced by the low degree of irritation resulting to the udder following udder infusion. Since these early reports many papers have been presented to confirm the value of penicillin and other antibiotics, such as streptomycin, aureomycin, chloromycetin, bacitracin, neomycin, tyrothricin, terramycin, and others in the treatment of infectious mastitis. If the milk from the treated quarter is included in the herd supply, the penicillin finds its way into market milk; the only way to prevent this from occurring is to withhold the milk from the treated quarters.

Penicillin Milk Levels Following The Use of Penicillin in the Udder

Since penicillin has become the product of choice for the treatment of many forms of infectious mastitis, it is not surprising to find that a number of new medication forms have appeared on the market. The data of Table 1, by Jackson and Bryan,[5] present the penicillin milk levels obtained by the use of some of these products. To keep penicillin out of market milk, every dairyman should be advised to discard the milk from the treated quarters for 3 days following treatment when crystalline penicillin or penicillin in bougie or ointment form has been used, and up to 8 days when procaine penicillin in oil is used for udder infusion.

Penicillin Levels of Herd Milk

During the past several months 27 samples of herd milk have been collected at random at several milk plants and checked for penicillin levels. The presence of the drug was suspected in only one case where the milk of a penicillin-treated cow was included in the herd milk, but surprisingly, varying levels were present in 26 of the samples. These data are presented in Table 2; they indicate an apparent promiscuous use of penicillin and the lack of withholding milk from the treated quarters. Dairymen must understand that this penicillin or any other antibiotic presents a problem to the milk plant operator, since pasteurization temperatures do not destroy the penicillin.

TABLE 2

The Penicillin Levels Found In 27 Herd Samples

Number of samples	*Units of penicillin per cc. of milk*
1	0.5
5	0.25
7	0.12
10	0.06
3	0.03
1	none

Antibiotics Affect the Manufacture of Fermented Dairy Products

A number of reports have been made of specific instances where antibiotics have adversely affected the production of certain dairy products (1, 6, 8 and 9). Some of these reports are:

1. The presence of 0.5 unit of penicillin per cc. of milk resulted in complete inhibition of acid production by six starter cultures.
2. The presence of 0.1 unit of penicillin per cc. of milk resulted in marked inhibition of acid production by six starter cultures.
3. The presence of 0.05 unit of penicillin per cc. of milk resulted in moderate inhibition of acid production by six starter cultures.
4. The presence of 0.0005 mg. of aureomycin per cc. of milk resulted in marked inhibition of acid production.
5. The presence of 0.00005 mg of aureomycin per cc. of milk had almost no effect on the fermentation.
6. The presence of as little as 1 per cent of milk or cream from a treated quarter resulted in a restriction of acid production for from 4 to 6 milkings after treatment. Sulfanilamide, sulfamerazine and aureomycin were slightly less restrictive in action.
7. Lactic acid bacteria were restricted in growth and acid production in reconstituted milk were the milk powder was manufactured from milk containing at least 1 per cent of milk from recently treated quarters. Under these circumstances sulfanilamide, sulfamerazine and aureomycin exerted a slightly stimulating effect on the lactic acid bacteria.
8. When the milk from one treated quarter (75,000 units of penicillin) was mixed with the milk from 20 untreated cows, starter cultures were greatly inhibited.

The inhibition of starter cultures seriously affects the production of cottage, cheddar and other cheese, buttermilk and butter made from ripened cream. To produce products of high quality, the milk from recently treated quarters must be withheld from the herd milk. A minimum 3-day withholding period is suggested as adequate in most cases.

* Reprinted from Michigan Agricultural Experiment Station Quarterly Bulletin, Vol. 33, No. 3, Pages 223 to 228 Inc., February, 1951.

TABLE 1

The Penicillin Milk Levels Following the Administration of Various Penicillin Products and Dosage Levels to Cows During the Middle of Lactation

Medication forms	*Units of penicillin used*	*Units of penicillin per cc. of milk*; days after the administration of penicillin* 1	1½	2	2½	3	4	5	6	8	9
Penicillin in 10 cc. of water	25,000	1	0.06	—0.06	.....	.....	.....	.....	.....	.....	.....
	50,000	1	0.25	0.06	—0.06	.....	.....	.....	.....	.....	.....
	100,000	4	1	0.25	0.12	—0.06	.....	.....	.....	.....	.....
Penicillin in bougie	25,000	1	0.06	—0.06	.....	.....	.....	.....	.....	.....	.....
	50,000	1	0.12	0.03	—0.03	.....	.....	.....	.....	.....	.....
	100,000	2	0.5	0.03	0.03	—0.03	.....	.....	.....	.....	.....
Penicillin in ointment	50,000	2	1	1	0.5	0.06	—0.06	.....	.....	.....	.....
	100,000	2	1	1	0.5	0.12	—0.06	.....	.....	.....	.....
Procaine penicillin in oil	300,000	40	4	4	.....	2	1	0.5	0.5	0.12	—0.06

*—before a value means less than that amount of penicillin present.

† Deceased. See this Journal, July-August, page 141.

DOES THE PRESENCE OF ANTIBIOTICS IN MILK HAVE ANY EFFECT UPON THE CONSUMER?

At present no specific answer can be given to this question. Felsenfeld[3] indicates that when penicillin first became available for human use physicians found that about 3 per cent of their patients reacted unfavorably to penicillin. Today he reveals that approximately 10 to 12 per cent of children—not previously given penicillin by injection—are sensitive to penicillin. Is it possible that penicillin in the milk consumed by these children may play a part in this reaction?

ANTIBIOTICS ARE AN AID IN A MASTITIS CONTROL PROGRAM

The following five items must be considered and applied, in the order given, in a successful mastitis prevention and control program:

A. Good, sanitary milking procedures.

1. Arrange and/or milk cows in following order: healthy, suspicious and infected.
2. Discard the foremilk into a strip cup, exclude from supply all abnormal milk.
3. Wipe the udder of each cow with warm (120° F) disinfect 1 minute before milking.
4. Exclude infected humans from milking cows.
5. Dip teat cups of milker in disinfectant between cows (have milk tube valve in head of machine open).
6. The hands of person milking or stripping should be dipped in disinfectant between cows.
7. Milk each cow regularly, rapidly, and completely for udder health.

B. Good, sanitary herd management procedures.

1. Proper stalls for cows.
2. Prompt treatment of udder and teat injuries.
3. Clean and disinfect stalls upon removal of infected cows.
4. Keep barn and barnyard clean and dry.
5. Raise heifers as disease-free replacements.
6. Early removal of accessory teats.
7. Preferred source of herd replacements: a-home raised heifers, b-purchase of bred heifers, c-purchase of milking cows—test before purchase.

C. Early and accurate disgnosis.

1. Physical examination of each cow's udder.
2. Bacteriological test to determine if infection is present or absent.

D. Elimination by slaughter or complete segregation of infected cows with badly damaged udders.

1. Such cows usually do not respond to udder infusion treatments.
2. This eliminates or confines the source of infection.

E. Early and proper treatment.

1. A high percentage of cows, without marked change in the udder, recover by udder infusions.
2. Udder infusions are of value only where infection is the cause of the mastitis.
3. Control measures must accompany treatment or recovered case may become reinfected.

Mastitis treatments are of value only when improvements are made in the management procedures; if such changes are not made, the treatments are relatively ineffective.

SUMMARY

The promiscuous use of antibiotics in the treatment of mastitis, without withholding the milk from the treated quarters, results in trouble for the dairy manufacturing industry. The milk from treated quarters should be withheld from the main supply for at least 3 days.

Pasteurization of milk does not destroy the antibiotics commonly used in the treatment of infectious mastitis.

Observations suggest that the ingestion of penicillin in the milk may play a part in the increased number of human beings who are sensitive to penicillin injections.

Antibiotics are an aid to a mastitis prevention and control program. Good, sanitary milking and herd management procedures are basic to udder health.

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THE DEVELOPMENT OF THE MILK AND FOOD SANITATION PROGRAM OF THE PUBLIC HEALTH SERVICE

(Continued from the July-August issue, page 144)

Experimental Laboratory

As the number of communities enforcing the Public Health Service Milk Ordinance increased, there was an increase in inquiries received from State and local health officers relative to problems in milk sanitation. Increasing use of automatic pasteurization systems brought new problems in design and operation of equipment. This necessitated development of additional specifications for inclusion in the Ordinance and Code. Some of the numerous problems required considerable study and research, and in order to deal most effectively with them an experimental laboratory was added in 1933. This laboratory was designed to study problems chiefly of a bacteriological and engineering nature. Some of the investigations previously mentioned were carried out in this laboratory. The pasteurization equipment in use in the laboratory was all full-scale commercial equipment.

Considerable time was given in this laboratory to the development of a satisfactory procedure for using a non-pathogenic test organism for various milk sanitation studies. The test organism was originally isolated by Fuchs from pasteurized milk in 1931 and its resistance to heat and chlorine determined on a laboratory scale. An extensive study was later made by Moss, Thomas, and Havens of the thermal characteristics of this test organism, a strain of Escherichia coli, and cultures were developed which are somewhat more heat resistant than the most heat-resistant milk-borne pathogen.

This test organism was used in the milk can studies previously mentioned, as well as in a study of the bactericidal effect of the paraffining of container board used for single-service paper containers. Methods for bactericidal treatment of glass milk bottles are not generally applicable to bactericidal treatment of single-service paper containers. However, in the paraffining process, which is used primarily to waterproof the paper containers, relatively high paraffin temperatures are used, and this study was made to determine whether the process might also provide adequate bactericidal treatment for the paper containers.

The experimental laboratory was discontinued with the outbreak of World War II. Laboratory researches in milk and food sanitation problems were inaugurated in 1945 at the Water and Sanitation Investigations Station in Cincinnati, later known as the Environmental Health Center. Among these were studies on the effects of detergents on water hardness in 1946 by Chemists Edward H. Mann, Clarence C. Ruchhoft, and Francis I. Norris, who the same year developed a performance test for rating the over-all efficiency of various detergents used in cleaning milk and food utensils. In 1948, Bacteriologists George R. Weber

and Luther A. Black investigated inhibitors for neutralizing the germicidal action of quaternary ammonium compounds, and developed a laboratory procedure for evaluating the practical performance of quaternaries and other germicides proposed for sanitizing food utensils. Staining procedures for the microscopic examination of milk were studied by Bacteriologists Benjamin S. Levine and Black, and a new procedure was proposed in 1948. In 1949, Thomas investigated the operation of several types of home milk pasteurizers and suggested improvements. In 1950, the germicidal properties of chloramine-T were investigated by Black and of quaternary ammonium compounds by Bacteriologists Chester T. Butterfield, Elsie Wattie, and Cecil W. Chambers. Several other studies of laboratory methods used in milk and food sanitation have been conducted by the Milk and Food Laboratory, under Black.

World War II Activities

The wartime shift of population to military and war-industry areas created problems in sanitation. Under the Emergency Health and Sanitation Program, milk and food specialists were called to active duty in the Reserve Corps and assigned to such areas to assist military and civilian health authorities in developing adequate supplies of safe milk and in improving restaurant sanitation. In 1944, 24 milk and food specialists were on duty in war areas, in addition to 16 assigned to the nine District offices. Seven mobile laboratories were equipped and assigned to war areas lacking laboratory facilities. During 1944 these mobile laboratories examined over 30,000 samples of milk, water, and restaurant utensils in 88 war areas in 22 States and found many insanitary conditions. These programs were discontinued in June 1946.

Beginning in 1941 Black was assigned to a survey of milk laboratories in war areas to determine compliance with the Standard Methods recommended by the American Public Health Association and to improve their techniques. By the end of 1943 a total of 408 official laboratories had been surveyed in 48 States.

Many problems in milk sanitation were presented by the war. Assistance was given to the War Production Board in establishing priorities for the manufacture of dairy equipment, to the Office of Defense Transportation on milk delivery equipment, and to the Army Veterinary Corps in establishing standards for milk. A national inventory of needs for milk pasteurization facilities was undertaken in 1943.

Because of world conditions, at the request of the National Security Resources Board early in 1950, the Public Health Service prepared detailed plans for sanitary control in case of an emergency, including food refrigeration, milk sanitation, and food sanitation.

Interstate Milk Shippers

In times of local milk shortages, such as developed in many war areas and exist even in peace time in some sections and particularly during certain seasons, the acceptance of milk from other milk sheds is made difficult by lack of uniformity in milk regulations. In 1939 the Council of State Governments called a meeting of mid-western States at which an agreement was reached on uniform standards for milk shipped interstate for manufactured products. The restrictions on interstate trade in milk were studied and discussed by Fuchs at a nation-wide meeting on trade barriers called by the Department of Commerce in 1942. Spurred by the needs of certain States, the Conference of State and Territorial Health Authorities in 1944, and again in subsequent years, requested the Public Health Service to prepare a plan for the certification of interstate milk shippers. The subject was discussed in 1944 by the American Public Health Association, which in 1946 appointed a Committee on Reciprocal Sanitary Milk Control.

Accordingly, a plan was developed by the Public Health Service and all States were notified by a letter from Surgeon General Parran dated December 31, 1946. The plan provides for sanitary supervision and ratings of shippers by the State of origin, with certification of such ratings by the Service. The purposes are to improve the quality of milk shipped interstate, to ensure receiving areas against laxity of control, and to eliminate multiple inspections of the same source by officials from different areas. The plan was thoroughly discussed and approved at a national meeting on interstate milk shipments held in St. Louis in June 1950.

Frozen Desserts Ordinance and Code

In view of the lesser public health hazard involved, most health departments have devoted less attention to the sanitary control of frozen desserts such as ice cream, sherbet, and water ice, than of milk. Nevertheless, the ten ice cream-borne outbreaks reported from 1934 to 1938 indicated that a definite health hazard does exist.

The Public Health Service became actively interested in frozen desserts sanitation in 1935 when it was invited by the Memphis City Health Department to cooperate in formulating the Memphis frozen desserts ordinance. Upon increasing demands from health officers for recommended standards, the first draft of a frozen desserts ordinance was prepared by the Public Health Service for consideration by a specially appointed Advisory Board on Frozen Desserts in July 1937. As a result of discussions several succeeding drafts were prepared. The final draft was published in the January 1940 issue of the Journal of Milk Technology. A code was added in the March 1940 draft, and after a further slight revision by the Advisory Board, the May 1940 edition of the Frozen Desserts Ordinance and Code Recommended by the Public Health Service was finally issued in mimeographed form. This is the current edition.

Although no effort has been made by the Public Health Service to promote the adoption of this ordinance, it has been adopted by 17 large cities and one county. It has also been adopted as State regulations by Florida, Nevada, and Hawaii, and is used as an unofficial guide by Oklahoma, New Mexico, and Texas.

The recommended ordinance establishes a higher temperature for the pasteurization of ice cream mix (155 degrees F. for 30 minutes) than is used for milk (143 degrees F. for 30 minutes). The reasons are (1) bacteria, including certain pathogens, are protected by the sugar and the stabilizer used as ingredients of ice cream, and (2) flavor and cream line disturbances need not be guarded against as in the case of milk. In 1949, several industry groups requested guidance from the Public Health Service in establishing standards for high-temperature short-time pasteurization of ice cream mix. On the basis of tests conducted by industry and university interests, the Public Health Service has tentatively approved 175 degrees F. for 25 seconds as being bactericidally equivalent to 155 degrees F. for 30 minutes, but has not approved 190–200 degrees F. with no appreciable holding time, pending results of studies now in progress.

Development of Recommended Standards for Sanitation of Food Establishments

The Public Health Service first became actively interested in the sanitation of eating and drinking establishments in 1934. In that year minimum restaurant sanitation regulations were proposed by the Conference of State and Territorial Health Authorities, the National Restaurant Code Authority, and the Public Health Service, for approval by the National Recovery Administrator in connection with Section IV, Article VIII of the Code of Fair Competition for the Restaurant Industry. These regulations were never put into effect, as the National Recovery Act was declared unconstitutional by the Supreme Court not long afterwards.

Next, at the request of some health officers for a suggested form of ordinance for local use, the Public Health Service prepared the December 1935 draft of an Ordinance Regulating Food and Drink Establishments. After a detailed study of existing municipal ordinances and State regulations, a tentative Ordinance and Code Regulating Eating and Drinking Establishments was issued in mimeographed form in March 1938. It was not until 1940 that the Sanitation Advisory Board had an opportunity to review the tentative edition and to consider proposed amendments. The first non-tentative edition of the recommended Ordinance and Code Regulating Eating and Drinking Establishments was then issued in mimeographed form in June 1940.

The 1940 edition was soon adopted by several hundred cities and counties and even by a few States. Experience in its enforcement brought suggestions from many health officers for its improvement. These and other suggested changes were considered by the Sanitation Advisory Board in 1942 and, as a result, the first printed edition of the Ordinance and Code was issued in July 1943 as Public Health Bulletin No. 220. This is the current edition.

A number of problems were involved in drafting an ordinance that would be generally applicable. The Advisory Board concluded that the conflicting opin-

ions of health officers on the value of routine examinations of food handlers did not warrant such a requirement. The question of enforcement methods was settled by offering two different forms of the ordinance, one a grading type which permits enforcement by degrading or permit revocation, or both; the other a nongrading minimum-requirements type enforceable by permit revocation only. In the grading type, the competitive effect of grading on public patronage tends to improve conditions in restaurants, thereby aiding in enforcement.

The principal proposal for improvement of the restaurant code is that its scope be broadened to include not only eating and drinking establishments but also all other types of food establishments. This has been recommended by many health officers and by the 1946 Conference of State and Territorial Health Officers.

The recommended restaurant ordinance, or one based thereon, has become the law or regulations of 29 of the States and the District of Columbia, in 19 of which it is enforced State-wide. It has also been adopted by 212 counties and 529 municipalities located in 43 States and the Territory of Alaska. The population coverage exceeds 70,000,000.

Since the beginning of World War II the need for control of eating-establishment sanitation has been recognized as never before. Many communities, spurred by the public clamor for cleaner food service, have inaugurated this activity. This accounts for the rapid growth of adoptions of the recommended restaurant ordinance. A chronological cumulative tabulation of adoptions by 5-year periods is given below.

Year	*State Law or Regulations*	*State-wide Enforcement*	*No. of Counties*	*No. of Cities*	*Population 1940 Census*
1935	0	0	0	1	4,653
1940	8	5	15	40	10,576,992
1945	25*	15*	167	354	47,791,463
1950	29*	19*	212	529	71,000,000

* Also the District of Columbia

Disease Outbreaks from Food

Since 1938 the Public Health Service has collected and compiled annual reports of disease outbreaks traced to food and water submitted by State health departments, in addition to those from milk and milk products which were begun 15 years earlier. The latest year for which a report has been issued is 1948. During the 11-year period 1938 to 1948, inclusive, there was reported an annual average of 37 outbreaks from water, 34 from milk, and 246 from other foods. In other words, outbreaks traced to other foods have been six to seven times more numerous than those from water or milk. Another significant feature is the trend: Whereas outbreaks attributed to water and to milk declined during the period by more than 50 percent, a steady increase occurred in outbreaks traced to other foods. That the reported outbreaks and cases represent only a fraction of those actually occurring is indicated by an analysis of the reports for 1938 and 1939 by Frank and Fuchs.

These figures offer an obvious challenge to health officers and sanitarians to control the cause of food-borne disease. Protection of water and milk supplies deserves continued effort, but food sanitation obviously demands increased emphasis.

Training and Educational Activities

Although adequate legal standards are essential, the mere adoption of a recommended ordinance does not guarantee proper enforcement. To promote effective enforcement by State and local health authorities, the Public Health Service has undertaken a number of educational and training activities.

It has long been recognized that the limited Public Health Service staff engaged in milk and food sanitation could achieve maximum results through advisory, stimulative, and educational methods. Since the beginning of the program the Service has trained new State personnel upon the request of the State health departments. This has been accomplished largely by the Regional milk and food consultants of the Service working with State sanitarians to demonstrate proper methods of inspection, sampling, laboratory procedures, grading, rating of communities, record keeping, and administration. It also has provided in-service training for State and local sanitarians through seminars of three to five days' duration conducted periodically in collaboration with the States on a State or Regional basis. During the period 1937 to 1949, 115 milk and food sanitation seminars were held throughout the country with an attendance of over 7,700 State and local sanitarians. In addition to these seminars, in-service training courses are being given to sanitarians and to milk and food laboratory technicians by Service personnel.

In order to measure the degree of restaurant ordinance enforcement in a community, a rating procedure and form were developed in 1944 similar to those for milk sheds, and have been widely used by the States. Such a rating represents the weighted percentage compliance of a group of establishments, selected at random within a community, with the sanitation standards of the recommended ordinance. When made before the adoption of a local program, and periodically thereafter, such ratings are of value in measuring achievement and stimulating improvement.

During the past eight years major attention has been devoted to the education and training of food and milk handlers. Today it is generally recognized that education of food handlers is an effective method of obtaining compliance with sanitation standards. Beginning late in 1942, the Public Health Service has conducted a large number of demonstration classes in cooperation with State and local health departments, local restaurant and dairy associations, and other civic groups in order to stimulate the development of food handler training courses by States and cities. During the period 1943 to 1949, more than 300 demonstration schools were held for food service employees in restaurants, on interstate carriers, at military and other Federal establishments, and in hospitals, with an attendance of over 100,000. From 1944 to 1949, 70 demonstration schools were held for milk producers and milk plant employees with an attendance of over 6,000. Largely as a result of the impetus from these demonstrations, organized food handler schools are now being conducted throughout the United States as well as in Canada and Great Britain. Many audio-visual aids were developed for use at these training courses.

Sanitary Food Equipment

A basic requirement of the ordinances recommended by the Public Health Service is that containers, utensils, and equipment shall be so designed and constructed that every food-contact surface is readily accessible for cleaning and inspection and is smooth, noncorrodible, and non-toxic. For many years State and local health departments have, upon request, been furnished confidential opinions concerning compliance with specific materials and equipment as a guide to local acceptance. A similar service has been rendered to other offices of the Public Health Service and to other Federal agencies. Manufacturers of equipment have requested assistance in the development of equipment that complies with its standards and will be acceptable to local and State health departments. As a result of pressure from the industry, the Service finally adopted a policy in 1949 of issuing written statements concerning compliance of specific models with its published standards. These requests have involved the investigation of many types of equipment. In addition the Service is represented on the 3-A Sanitary Standards Committee on Dairy Equipment and on the Joint Committee on Food Equipment Standards.

Current Milk and Food Sanitarian Program

In its milk and food sanitation activities the Public Health Service acts in an advisory, stimulative, and research capacity. Actual enforcement is the responsibility of State and local regulatory authorities. The Service has no legal jurisdiction in the control of sanitary conditions except on interstate carriers. It is the aim of the Public Health Service to promote the establishment of effective, well-balanced milk and food sanitation programs in each State, to stimulate the adoption of effective State and local control legislation, and to encourage adequate enforcement through appropriate legal and educational measures.

To implement these aims the Milk and Food Branch engages in the following activities:

1. Compiles annual reports of disease outbreaks traced to water, milk and milk products, and other foods.

2. Prepares and revises model sanitary ordinances on milk, milk products, and food establishments.

(Continued on page X)

Association News

Affiliates of
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS

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JOURNAL of MILK and FOOD TECHNOLOGY
As Their Official Organ

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West Enters Industry

Mr. George West, Secretary-Treasurer of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., has resigned his position as Director of the Food and Sanitation Division, Rochester Health Bureau, to enter commercial employ. He will take charge of milk plant operations and related services of the Genesee Valley Cooperatives, with headquarters in Rochester. He had served for twenty-six years in the employ of the city but felt that he could no longer continue to make the financial sacrifices that continuance in his municipal position entailed. He will continue his official duties with the Association as its elected officer in view of the relief from the mounting volume of its work by the appointment of an Executive Secretary (see page 152).

Molyneux Joins New York State Health Department

Mr. Gordon W. Molyneux has been appointed Senior Milk Sanitarian (restaurants), in the Milk and Restaurant Sanitation Section, Bureau of Environmental Sanitation, New York State Department of Health.

He has had extensive service in this field. After serving with the Albany City Health Department, he served with the Westchester County Health Department where for 18 years he was in charge of the milk control program. More recently he was Supervising Milk and Food Sanitation in charge of the Bureau of Milk and Food Sanitation of the Yonkers Department of Health.

In his new position, Mr. Molyneux will provide consultant service for the country and city units engaged in the conduct of food handler training courses.

News Items

California Association of Dairy and Milk Sanitarians

The annual meeting of the California Association of Dairy and Milk Sanitarians will be held in San Francisco, October 15 to 17 inclusive. On the first day, October 15, Mr. O. A. Ghiggoile will conduct a refresher course limited to dairy control officials. At the general meetings papers will be presented on the following subjects: good housekeeping, public health problems, dairy building construction, H-S pasteurization, milking machine sanitation, dairy inspection, brucellosis, with panel discussion.

Oklahoma Dairy Industry Conference

The annual Oklahoma Dairy Industry Conference will be held at the Oklahoma Agricultural and Mechanical College, October 31 through November 3, 1951. The conference will include discussions and demonstrations on the manufacture of various dairy products and problems of plant operations. For additional information, write to the Department of Dairying, Oklahoma A. & M. College, Stillwater, Okla.

Connecticut Association of Dairy and Food Sanitarians

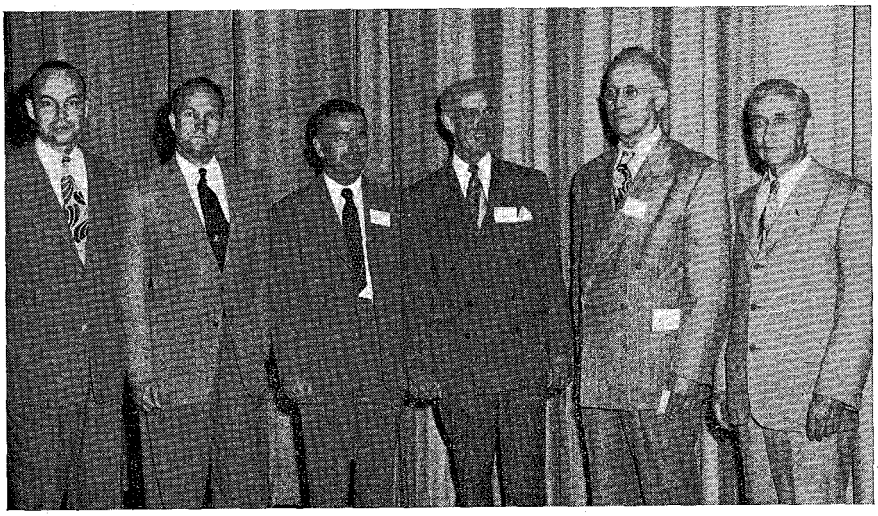
Three new members were elected to the Board of Governors: Mr. Barns from Norwalk, representing state and municipal inspectors; Mr. Jackson from Elmwood, representing industry; and Mr. McKinster from New Haven, representing sales and service. This method of operating our association seems to be working out very well.

H. Clifford Goslee
Secretary

Philadelphia Dairy Technology Society

The May meeting of the Philadelphia Dairy Technology Society was addressed by Dr. D. V. Josephson, Head of the Department of Dairy Husbandry, on "Current Research at Pennsylvania State College." The next meeting of the Society will be held on the second Thursday of October.

Donald D. Hayes
Secretary-Treasurer



American Dairy Science Association Honors Scientists

Left to right, H. B. Henderson (University of Georgia, new vice-president of ADSA); Dr. John K. Loosli (Cornell University); Dr. S. T. Coulter (University of Minnesota); H. A. Bendixen (Washington State College, and new president of ADSA); Dr. T. W. Gullickson (University of Minnesota); E. J. Perry (New Jersey Agricultural Extension Service).

Dairy Technology Conferences

The Division of University Extension announces a series of five conferences to be conducted by the Department of Food Technology for those interested in the field of dairy technology during the coming year. These meetings will be held on the campus of the University of Illinois, Urbana. The schedule for these meetings is as follows:

Soft Ice Cream and Ice Milk	Nov. 6 & 7, 1951
Dairy Stores	Dec. 4 & 5, 1951
Starters and Fermented Milk Drinks	Mar. 4 & 5, 1952
Plant Sanitation	Apr. 1 & 2, 1952
High-Temperature Short-Time Pasteurization	May 6 & 7, 1952

Details of each program will be available at a later date. For further information, contact R. K. Newton, Supervisor of Conferences, 713½ South Wright Street, Champaign, Illinois.

Illi-Wis Dairy Technology Society

The last regular meeting of the society for this season was held on May 15 at Freeport, Illinois. Professor P. H. Tracy addressed it on the subject, "Is There a Place for a Low Fat Product in the Ice Cream Family?".

The next meeting will be held on the third Tuesday of October at the Faust Hotel in Rockford, Illinois.

Stanley J. Goldschmidt
Recording Secretary

Michiana Dairy Technology Club

President, E. S. Grady, Grady Milk Company, Elkhart, Indiana
Vice-President, R. W. Peterson, Elgin Milk Products, Galien, Michigan
Treasurer, Glen Easton, National Milk Company, South Bend, Indiana
Secretary, H. Scott Porter, Milk Council, 306 Whitcomb-Keller Building, South Bend 1, Indiana

The May meeting was held at the LaSalle Hotel, South Bend, Indiana. Mr. H. J. Muldoon spoke on "Greater Sales Through Better Merchandizing." The annual meeting was held on June 6 at Klinger Lake Country Club, Klinger Lake, Michigan.

H. Scott Porter
Secretary

Program for Detroit Dairy Technology Society

October 8, 1951:

E. C. Scott, Crest Foods Company, Ashton, Illinois, "Whipping Aids and Emulsifiers for Ice Cream."

November 12, 1951 :

R. P. Mears, Northland Dairy Division, General Foods Corporation, Evart, Michigan, "Chocolate Products in Ice Cream and Milk."

December 10, 1951:

Edward C. Prophet, Geology and Geography, Michigan State College, East Lansing, Michigan, "Geography in the News."

P. S. LUCAS,
Secretary

Western Michigan Dairy Technology Society

Since the membership of the Western Michigan Dairy Technology Society covers quite a large area, the May meeting was moved from Grand Rapids to Kalamazoo. The change in meeting place was in response to an invitation received from the Vice-President of the Society, Oscar Rothi of the Lockshore Farms Dairy of Kalamazoo. The meeting was well attended and many dairy plant operators from this area attended a meeting of the Society for the first time. Perhaps other locations in western Michigan will occasionally be selected as the meeting place in the future to acquaint more people of the industry with work of the organization. Dr. C. Huffman, of the Dairy Department, Michigan State College, was the speaker and the title of his talk was "Milk Adds Up."

The June meeting of the Society was held at the Highland Country Club, Grand Rapids. This meeting was one of entertainment, and was the last meeting until September.

D. L. MURRAY

Laboratory Personnel Conference Held at N. C. State College

A two-day conference for laboratory personnel conducted by the Dairy Manufacturing Section, North Carolina State College, Raleigh, North Carolina, was held May 22 and 23, 1951. The conference was given for laboratory personnel in dairy products plants and local health laboratories who are concerned with the chemical and bacteriological analysis of dairy products.

The subject material presented and discussed was based on procedures in *Standard Methods for the Examination of Dairy Products.*

Those attending the conference included seventy-six representatives from local health department laboratories, fourteen from dairy plant laboratories, and two from Armed Forces laboratories.

Personnel Needs for Environmental Health and Sanitation Field *

A recent survey about job availability in the environmental health and sanitation field, conducted by Sanitary Engineer Arthur P. Miller, Public Health Service, has revealed the following needs:

	Professional engineers	All other professional categories
Number of existing vacancies (funds available)	107	152
Number of persons who could be employed if funds were available	482	881
Present and future requirements five years from now	1,574	4,582

* Reprinted with permission from *Pub. Health Repts.*, April 27, 1951.

New Personnel at National Dairy Research Laboratories, Inc.

Dr. Byron H. Webb has accepted appointment as a senior scientist with the National Dairy Research Laboratories, Oakdale, Long Island, New York, and will act as a scientific adviser on the staff of Dr. Arnold H. Johnson, Vice-President and Director of Research. Dr. Webb is currently principal dairy technologist in the U. S. Bureau of Dairy Industry, which he joined in 1926.

Dr. Edwin G. Stimpson has been appointed Assistant Director for Biochemistry, Division of Nutrition and Biochemistry of National Dairy Research Laboratories, Oakdale, Long Island, N. Y. He first joined the National Dairy Laboratories at Baltimore in 1930, returning there in 1938 upon completing his graduate work.

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- *Conducting of Tests*
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USPHS Milk and Food Sanitation Program

(Continued from page 164)

3. Undertakes field studies and advises the Environmental Health Center, the Division of Research Grants, and others outside the Service concerning research projects in milk and food.

4. Furnishes technical and administrative advice and interpretations of recommended standards.

5. Trains State and local sanitarians through personal contacts, Regional seminars, and in-service training courses.

6. Prepares technical and educational materials for the training of sanitarians, food service employees, and the public.

7. Conducts demonstration schools for food and milk handlers.

8. Makes surveys of State and local conditions upon request.

9. Certifies the sanitary compliance of interstate milk shippers.

10. Consults with equipment manufacturers on the design and construction of food utensils and equipment.

11. Renders advisory and consultant field services to the Interstate Carrier Branch, other Divisions of the Service, and other Federal agencies.

These activities are conducted by the Milk and Food Branch of the Division of Sanitation in Washington and the 10 Regional offices in the field. Each Regional office has on its staff one or two milk and food consultants who receive technical and policy supervision from Washington.

New Course in Sanitary Science at New York University

A new undergraduate course in sanitary science, for both day and evening students, is being inaugurated this September by the New York University College of Engineering. The new degree will lead to the degree of Bachelor of Science in Sanitary Science and is set up on a four-year schedule. Some of the specialized subjects covered in the new course will be: food engineering, water supply, sanitary engineering, industrial psychology, statistical methods, milk and food sanitation, engineering economics, sewage and sewage treatment, epidemiological methods, public health organization, and public health engineering. Further information can be obtained from the New York University College of Engineering, University Heights, New York 53, N. Y.

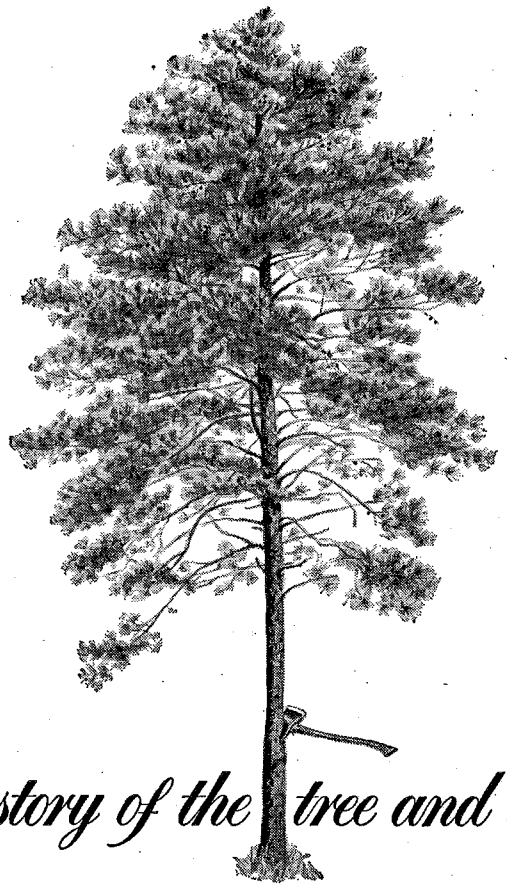
Thirtieth Annual Conference for Vermont Dairy Plant Operators and Milk Distributors

The Thirtieth Annual Conference for Vermont Dairy Plant Operators and Milk Distributors is scheduled for October 17 and 18.

The principal speaker of the two-day conference, according to Dr. Hugh Riddell, chairman of the department, will be Dr. G. Malcolm Trout, professor of dairying, Michigan State College. Dr. Trout has done much research work on milk flavors and homogenized milk, and has written and lectured extensively on these subjects. These are the titles of his talks before the Burlington meeting.

Other subjects of leading interest to be discussed are concentrated milk, labor utilization in milk plants, factors in the proper application of coliform test to pasteurized milk and cream, and good housekeeping in milk plants. The annual dinner will be on Thursday, October 18.

O. M. CAMBURN
Director



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From the moment the woodman's axe bites into the selected tree, the paper used in the Canco single-service milk container is strictly controlled.

Only clean, specially prepared pulp is used and every stage of its manufacture into paper is subject to careful supervision and inspection.

As a result, the Canco single-service milk container is a virtually sterile package for carrying milk to the consumer.

And, having accomplished this all-important purpose, the Canco container is never used again!

You public health officials helped develop this method of milk distribution. American Can Company is proud to have taken a part in bringing the public the purest possible milk.

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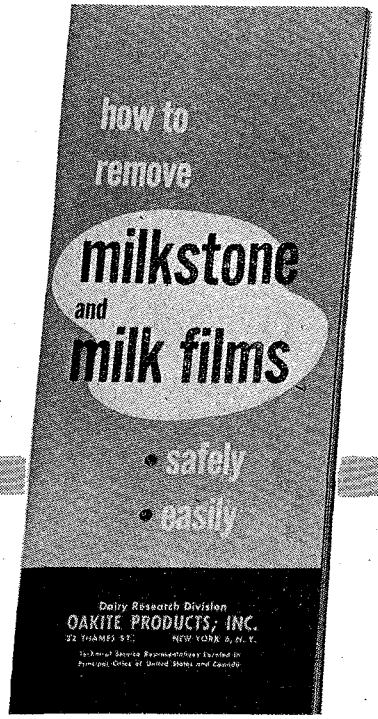

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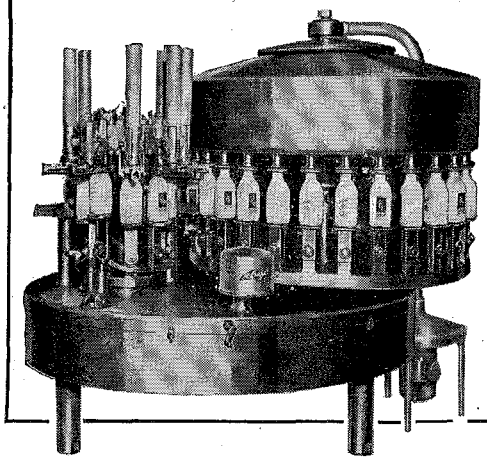
How close does your filler come to these *average* Cemac figures?



CREAM LINE MILK	135 BPM
HOMOGENIZED MILK	130 BPM
CHOCOLATE MILK	125 BPM
20% CREAM	120 BPM

These are only *rated* capacities for Cemac 28 . . . they are exceeded in many dairies from coast to coast.

What you see on the chart above are speeds we know Cemac 28 will attain. But there are many Cemac owners who are finding this filler regularly exceeds them. It's easy to realize the balanced production these dairies are getting. With all types of products coming down the line at such speeds... production keeps moving throughout the plant. None of the other machinery has to slow down because of the filler... the dairy operator gets his money's worth from all his equipment throughout the daily run.

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Cemac VACUUM MILK FILLER

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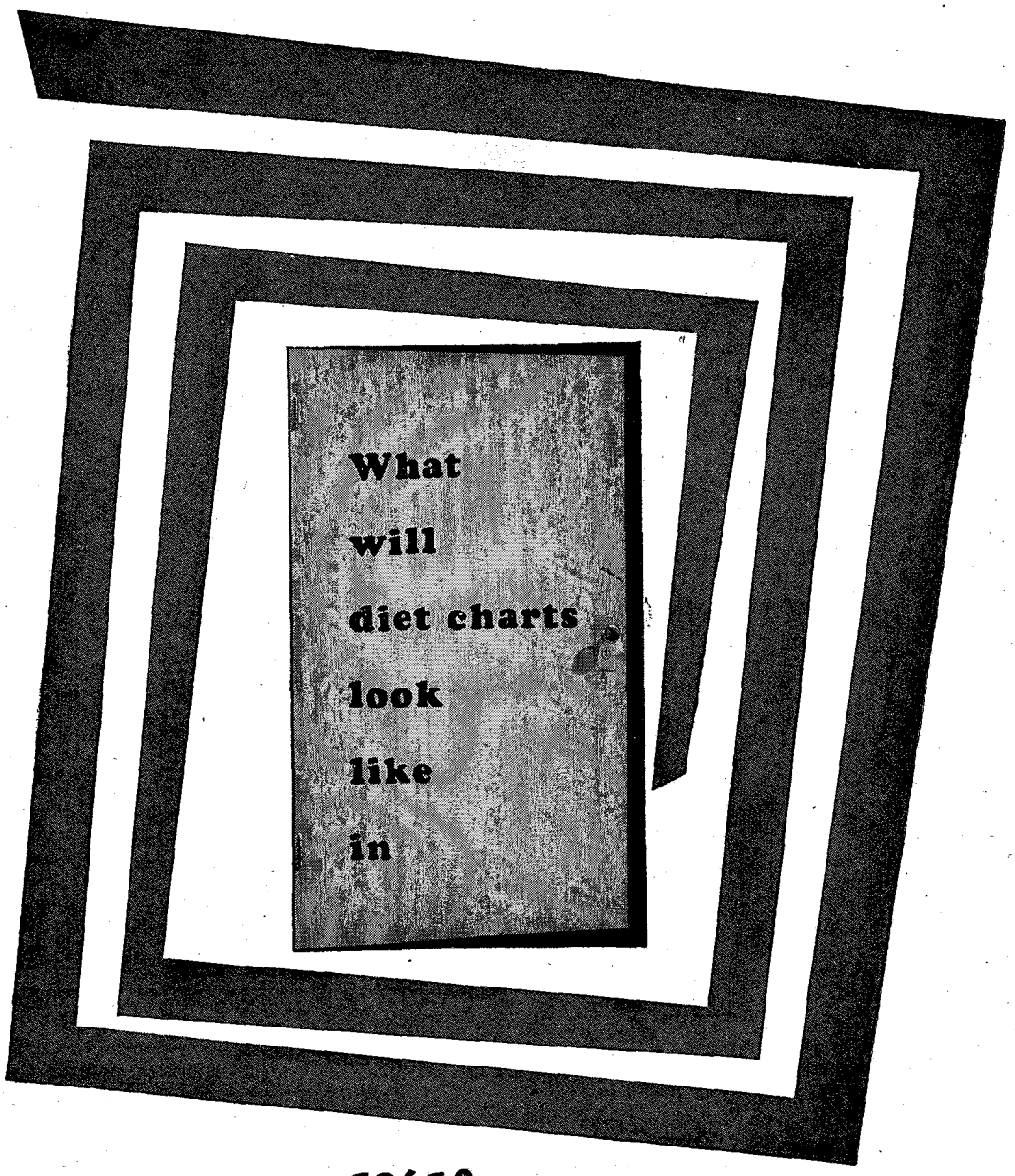
. . . AND REMEMBER, THE GREATEST COMBINATION OF THEM ALL IS CEMAC AND THE DACRO P-38 CAP!



1961?

The question was posed recently by a medical student while visiting Borden Research Laboratories. He said: "During the past ten years, clinicians have come to think of the physiological function of individual amino acids rather than of proteins as a group...fats, too, are thought of in terms of their component fatty acids. Will this trend continue? What will diet charts look like in 1961?"

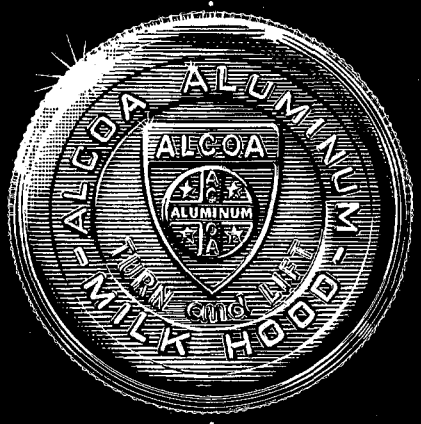
Borden scientists, who recently developed Bremil, the fatty acid and amino acid patterns of which approximate closely those of human milk, supplied the answer. "Research in this direction is gathering momentum," they said. "It is being pursued vigorously, not only in Borden Laboratories, but in many others as well. There is every indication that ten years hence, diet charts will place greater emphasis than ever on the role of basic food elements in body chemistry."

Physicians and dietitians know that diet charts are the blueprints for maintaining health, and for building a new generation, sound and strong. Borden food products of *today* reflect recent developments in Borden's continuing research in nutrition, which, for example, played an important part in the isolation of riboflavin. Borden food products of the *future* will certainly incorporate further advances in nutrition. They will figure prominently in the diet charts of 1961... and of 1971, too.

BREMIL Powdered Infant Food; BORDEN'S Beta Lactose; BIOLAC infant food; DRYCO infant food; KLIM powdered whole milk; MERRELL-SOULE Powdered Skimmed Milks; MULLSOY hypoallergenic food; BORDEN'S Evaporated Milk; STARLAC non-fat dry milk; Instant Coffee; Fresh Milk; Ice Cream and Cheese are among the fine food products of

The *Borden* Company

350 Madison Avenue, New York 17, N. Y.



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- Fresh, sparkling "Cellophane" Hoods protect the inner seal of safety . . . safeguard the vital finger-grip area.
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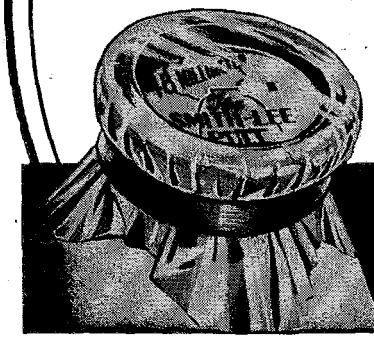
- Nationally approved by health authorities!



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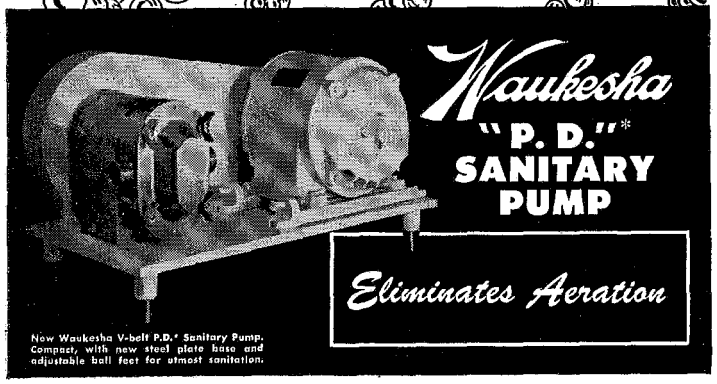
But NOT in MILK



New Waukesha V-belt P.D.* Sanitary Pump. Compact, with new steel plate base and adjustable ball feet for utmost sanitation.

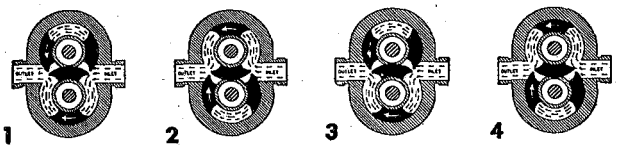
You'll get *no bubbles, no aeration, no agitation* in your product when you use the new Waukesha Sanitary Pump.

Your product comes *out* exactly as it goes *in.* With Twin-Impeller type of pumping, no air can be taken in, nor can bubbles form in the product pumped. The slow, gentle, positive, smooth, pulsation-less flow protects the quality and consistency of your product.

MORE NEW WAUKESHA FEATURES . . .

New One-Piece O-Ring Sanitary Seal • Corrosion-Resistant "Waukesha Metal" throughout • Time-Saving Sanitation, no cracks or crevices inside or *outside* • Adjustable ball feet with higher floor clearance • Positive Displacement pumping, no aeration • Available in V-belt (illustrated), Shiftspeed, and Reeves or U. S. Variable Speed Models — all with or without the Vented Cover.

CHECK THIS PRODUCT-FLOW DIAGRAM . . .



Sketches show the position of Twin Blade Impellers at each quarter revolution. Note four large chambers draw in and discharge four *full* loads at every revolution. No possibility of agitation or aeration.

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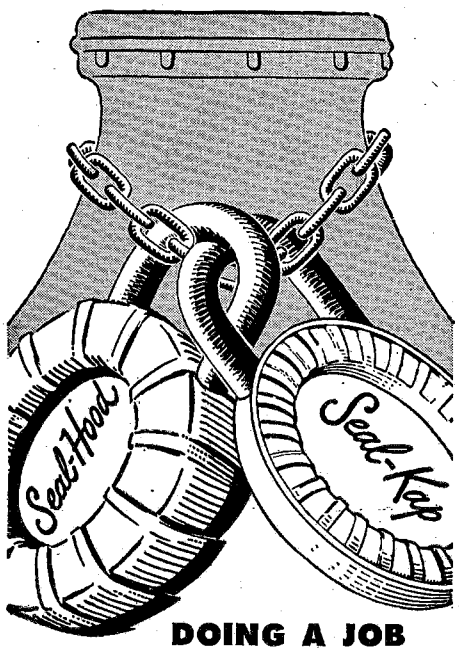
Write for the complete story on the NEW Waukesha P. D.* Sanitary Pump.

*P. D.-*Positive Displacement for smoother flow*

Waukesha 100% SANITARY PUMPS

Dependable Product of a Responsible Manufacturer



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Completely—

Many bottle caps serve equally well in guarding milk against contamination until it reaches the consumer. But none offer more complete protection *after delivery* than Seal-Hood and Seal-Kap.

Both closures are easily removed. No special tool or prying fork is required. The hand need never touch the pouring lip. And once removed, both Seal-Hood and Seal-Kap snap snugly back on, as often as necessary, for maximum protection till the bottle is emptied. Being one-piece caps, they also obviate the tendency to discard a separate hood.

In every respect . . . wherever they're used . . . Seal-Hood and Seal-Kap are doing a job of protecting milk—*completely*. (And dairymen like the single-operation *economy* of these two closures.)

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CULTURE MEDIA
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BACTO-TRYPTONE GLUCOSE EXTRACT AGAR
is recommended for use in determining the total bacterial plate count of milk in accordance with the procedures of "Standard Methods for the Examination of Dairy Products" of the American Public Health Association.

Upon plates of medium prepared from Bacto-Tryptone Glucose Extract Agar colonies of the bacteria occurring in milk are larger and more representative than those on media previously used for milk counts.

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