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International Association of Milk and Food Sanitarians, Inc.

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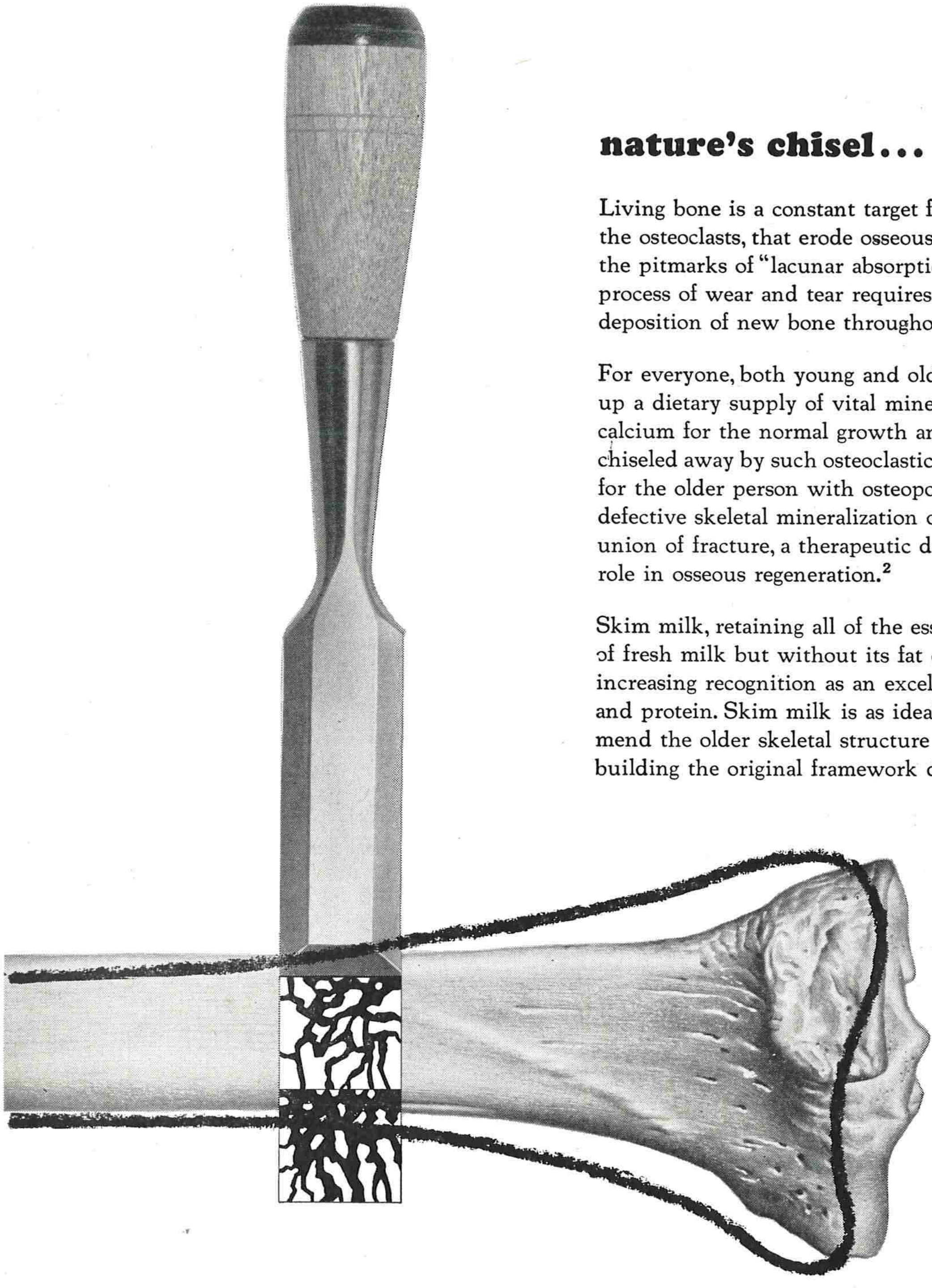

nature's chisel...

Living bone is a constant target for the chemical chisels, the osteoclasts, that erode osseous tissues and leave the pitmarks of "lacunar absorption."[1] This continuous process of wear and tear requires the formation and deposition of new bone throughout every individual's life.

For everyone, both young and old, it is necessary to keep up a dietary supply of vital minerals, particularly calcium for the normal growth and replacement of bone chiseled away by such osteoclastic erosion. But especially for the older person with osteoporosis, for those with defective skeletal mineralization or with delayed union of fracture, a therapeutic diet plays an important role in osseous regeneration.[2]

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Like other Borden food products, Borden's Starlac Non-Fat Dry Milk and Borden's Non-Fat Fluid Skimmed Milk are of the highest quality and are processed under the most hygienic conditions. The fluid Skimmed Milk, for example, like all Borden milk products, is made from the finest of fresh milk, pasteurized and processed under the most modern, hygienic conditions for improved palatability and greater nutritive value.

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The Borden Company
350 Madison Avenue, New York 17, N. Y.

[1] Swenson, P. C., and Jeffery, R. B. : G. P. 7:34 [Feb.] 1953.
[2] Stieglitz, E. J. : Geriatric Medicine, ed. 2, Philadelphia, W. B. Saunders Company, 1949, p. 697.

95% OF ALL MILK USED IN FAMOUS NESTLÉ'S PRODUCTS is filtered through *Perfection* DUBL-CHEM-FACED MILK FILTER DISCS

... *says* GEORGE L. MOSS, *Nestlé's District Field Supervisor*

... regarding our use of DUBL-CHEM-FACED milk filter discs:

We have used this disc for our patrons since they came on the market a number of years ago and we have had good results in all cases.

The disc itself is strong and does not "wash" as some other makes of discs do. The plastic faces on both sides of the disc not only filter but also reinforce the disc just as gauze on both sides does, yet gauze does not filter milk...only holds the cotton together.

Ninety-five percent of all the milk we buy is filtered through Perfection DUBL-CHEM-FACED Milk Filter Discs.

Another redeeming feature of this disc is the cost. It is much cheaper than the gauze-type disc. Since we advocate filtering not more than 10 gallons of milk through one disc, no matter what the make, we could show the dairy farmer that he really gets more for his money by using this improved disc after we decided to supply our patrons with Perfection DUBL-CHEM-FACED discs.

Yours very truly

George L. Moss, District Field Supervisor
The Nestlé Company Inc., Marysville, Ohio.

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2 - The CENTER area FILTERS...
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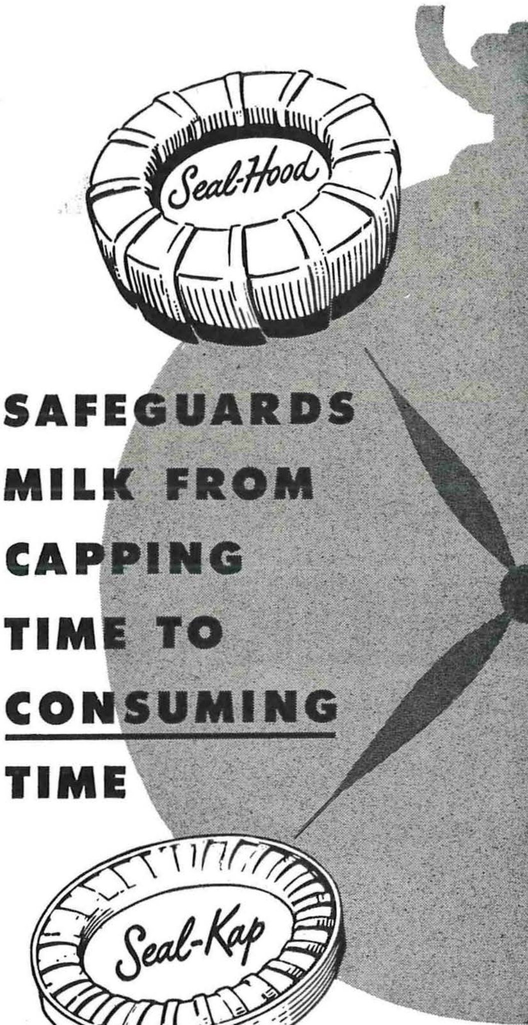

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Editorial Notes

FOOD EQUIPMENT STANDARDS

The importance of standardization is recognized by health officials throughout the United States. They realize first of all that it is economically sound for both the restaurateur and food processor as well as the fabricator of the equipment. Prior to 1948, equipment manufacturers were guided only by the comments of individual health officials as they saw need for changes in pieces of equipment. One has only to stop and think for a moment of the 1500 or more health agencies throughout the country who are involved in food inspection of one kind or another to see the difficulty fabricators would have in meeting individual ideas for different sections of the country. Accordingly, the fabricators of equipment were reluctant to change their designs unless forced to do so by individual cities or other health agencies. At times too, they faced conflicts in requests from two different health agencies who practically demanded two different pieces of equipment to comply with these individual requirements. Accordingly, progress in sanitary equipment design and manufacture was retarded.

As public health people and industry representatives started to dig into the problem, all concerned could begin to see the need for standardization. Individual opinions and differences were ironed out and recommendations were based on public health reasoning.

The labors of a great number of people are now bearing fruit in the form of printed standards which are being made available both by the National Sanitation Foundation and Baking Industry Sanitation Standards Committee. These standards represent the work of hundreds of people who have devoted an untold amount of time and effort to bring about the much desired standardization of equipment construction.

Now that the standards are here they will be of little value unless they are used as a basis for purchasing and installing equipment in new establishments as well as on a replacement basis. So far, one city has passed a law requiring that equipment being used in restaurants must meet National Sanitation Foundation standards. As each standard comes out, this city proposes to require that equipment covered by the standards meet specifications laid out therein. This is good news to those who have worked so diligently for so many years.

Those in the public health field who have had the opportunity to work with industry personnel in this program have seen industry respond readily, and in many cases such as in the case of the Baking Industry Sanitary Committee, industry has gone even further than public health people have requested. Because of the splendid cooperation they have given, it certainly behooves those in the public health field to do their share in making all of this work worthwhile. Unless these standards are put to use, they are of little value.

Annually, you are informed of the work of your food equipment committee and kept posted on those standards which have been completed. The committee's work with the Baking Industry Sanitary Standards Committee is purely consultative but has been appreciated by people concerned with baking sanitation. As to the standards put out by the National Sanitation Foundation, your Association last year endorsed standards 1, 2, and 3, recognizing that these standards if properly followed, will do a great deal to improve food sanitation. This is certainly a worthwhile program and needs the support of all the members of the Association. Your committee is endeavoring to express your opinions during these meetings with industry. In the event you have comments regarding any proposed standard the committee will welcome your suggestions. It is your collective approval of these standards which will make them function in the field.

J. H. Fritz, *Chairman*
Food Equipment Standards Committee

FOOD, ITS IMPORTANCE TO THE INDIVIDUAL AND TO THE NATION* **

Nothing surpasses food in its importance to the individual and to the nation.

The production of food from our lands, from the sea, lakes and rivers, its preparation, processing, transportation and distribution combined make food one of our largest industries, if not the largest.

It is a well-established historical fact that the origin of Canned Foods dates back to the time of Emperor Napoleon.

Scurvy and malnutrition were making serious inroads on his armed forces and the civilian population of France. The Emperor offered a prize to anyone who could devise a method of preserving perishable foods so they would keep for a reasonable time.

Nicholas Appert won the prize in 1809 by developing a method of sterilizing food in hermetically-sealed containers. This, fundamentally, is the method employed by the canning industry of today.

We have a record of canning in the U.S. as early as 1819 when Wm. Underwood of Boston packed sterilized food in sealed glass containers. It is reported that Wm. Underwood & Co. shipped pickles, catsup, sauce and jellies in sailing ships to South America and later made shipments to the West Indies and Asian markets of plums, quinces, currants and cranberries.

In 1825 a patent was granted by the U.S. Government to Thomas Kensett and Ezra Daggett for an improvement in the art of preserving. This patent referred to "Vessels of tin".

During the next 35 years the canning industry

*Excerpts from an address delivered by Roy L. Pratt, Chairman of the Board of Directors, California Packing Corporation, San Francisco, California, at the Public Conference on the Food and Drug Law, held in Los Angeles on May 15, 1954, under the joint auspices of the University of Southern California School of Law and The Food Law Institute.

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continued to develop and spread from the East Coast to the Middle West. The Civil War gave considerable impetus to this development.

In California the Franciscan Fathers had planted fruit trees near their missions, and we know, after the occupancy of California by the U.S., several orchards were set out near Monterey, San Jose and Sacramento.

The first commercial canning in California is credited to Daniel R. Provost who made a small pack in San Francisco in 1856.

From 1860 to 1900 the development of the Industry continued. Canning started in Oregon in 1874, Washington in 1877, and Utah in 1888. More firms entered the business in all areas so that by the end of the century the Industry was enjoying a youthful and robust growth.

The plants then in operation were, by today's standards, small and inefficient for the reason that practically all operations were manually performed. The packs, however, that had gained in volume found good consumer reception in our domestic as well as export markets.

With the great industrial development of the United States in the latter part of the 19th Century, the rapid growth of large industrial urban centers, and the developing technology in a young and vigorous country, the problem of a pure food law grew to be of primary economic and social significance. The struggle for the enactment of the food law is a vivid page in our history.

The management of the responsible firms of that time (as I believe that type of firm was in the majority) saw clearly the need of federal regulatory control of food packing. Those men knew if their business was to grow and prosper, their policy and also that of the industry must, of necessity, be to pack wholesome food, graded to reliable standards, in containers honestly labeled.

As proof of this statement the record shows that in 1905 a memorandum was sent to Congress, sponsored by three organizations, known as the "National Association of Packers of Pure Canned Foods", acting at a joint session with two regional groups known as the "Western Packers Association" and the "Atlantic States Canners Association", asking for a regulatory food law.

And so, when victory came with the enactment in 1906 of the Federal Food and Drug Act, it came not as a triumph of Government over business, but with the thorough-going support of the majority of businessmen who not only had recognized the necessity for the protection of their businesses from the irresponsible, but were also stirred by an awakening sense of social responsibility.

The Western Packers Association and the Atlantic States Canners Association were merged to form the National Canners Association which was formed in 1907.

The National Association of Packers of Pure Foods discontinued prior to the time the National Canners Association was organized.

The National Canners Association has now grown to be, without question, one of the country's outstanding industrial organizations with headquarters in Washington, D.C. Currently the Association consists of 816 member firms, operating 1,424 canning plants in 44 states and the territories of Hawaii and Alaska. These members pack 80% of the total pack of canned fruits, vegetables, specialties and fish.

It is significant to note that within six years the Association was able to found its own Research Laboratories. Direction of these laboratories was placed in the hands of two eminent food scientists from the U.S. Bureau of Chemistry, which was, with respect to food law enforcement, a predecessor of the present Food & Drug Administration. I refer to the late Drs. W. D. Bigelow and A. W. Bitting.

Many other important positions in the National Canners Association Research Staff, and, in fact, in the privately-owned laboratories of the Canning Industry, have likewise been filled by men whose work in food science began in the Bureau of Chemistry or the Food & Drug Administration.

It is a truism that we Americans enjoy the highest standard of living the world has ever known. The rest of the globe continues to stand amazed, not only at our tremendous productivity, but at the quality and variety of our food products. The modern market, with its breath-taking and dazzling display of foods available to the families of our country, is a Twentieth Century miracle.

Shortly after his retirement in 1951, Dr. Paul Dunbar, formerly head of the Food & Drug Administration, in addressing a meeting of this Institute, said:

"As a consumer, I know that there are available to me the most varied, the most wholesome, the purest and the most honestly labeled foods of any nation. I know that the sanitary controls maintained in our food plants are the highest in our history and that our manufactured foods are prepared with a care that equals, and often exceeds that exercised by the careful housewife in her own kitchen. When I sit down at the table, I am assured of a greater margin of safety than is enjoyed by any other country on earth."

How has this happy condition come to exist? In my opinion, it is by one of the most fruitful experiments in co-operation between business and Government which our country has known. The wise administration of a sound law, coupled with a responsible industry which has recognized, not only its legal responsibility but its social obligation for the welfare of our people, has served to raise our standards higher than those ever before achieved anywhere.

I do not mean to suggest that there are not and should not be honest differences of opinion based on deep conviction. This is as it should be in a competitive, dynamic society. Out of these differences and the challenges of sharp controversy we shall be able to distill the best of opposing views.

But these differences do not change the fundamental understanding and confidence that exists today between the food industry and those charged with the administration of the laws regulating it.

The successful growth of the Industry is ample proof of the wisdom of those men from the Food Canning Industry who, back in 1905, petitioned Congress for the enactment of a regulatory law.

The National Canners Association Research Department and the facilities of their laboratories which are, of course, maintained by the Canner Members, as well as the private research department and laboratories of the individual members, have co-operated with the Food & Drug Administration.

The 1906 Food & Drug Act was amended in 1938; it was enlarged in scope over the 1906 Act by including under its jurisdiction, cosmetics. The enactment of the new Act in 1938 was the result of approximately 32 years of experience with the operation of the first Food & Drug Act. The co-operation of Industry, Science and Law has worked.

I believe the remarkable increase in per capita consumption of canned foods proves beyond question of doubt that the Food Laws have operated for the interests of all concerned. Had this not been so, consumer interest in the products would not be what it is today.

As an example of the Food Processing Industry's interest in the improvement of food quality and consumer welfare, I believe it would not be amiss to point out to you two accomplishments voluntarily projected by a group of leading food processors, supply houses and distributors:

First—in 1941 these firms banded together and established the Nutrition Foundation Inc., which is under the directorship of Dr. Charles Glenn King. Fifty firms were founder members. The Foundation's work is in connection with basic research of Nutrition. They have accomplished a great deal.

Second—About 4 years ago, practically the same firms, in co-operation with Mr. Charles Wesley Dunn, founded the Food Law Institute, thus implementing the work of the Nutrition Foundation—the Institute dealing with Food Law—the Foundation with Food Science.

I believe we have established the importance to the Nation of our Food Laws. They are most certainly equally important as laws relating to such subjects as Real Estate, Patent, Trade Marks, Partnerships, Corporations, Banking, Maritime and others too numerous to mention.

It is a fact, however, that until the advent of the Food Law Institute, food law, as such, was not found to be included in the curriculum of Schools of Law, except in a general way. There is a real need for this special education in Food Law.

The Institute is committed to the study and teachings of our basic food law just as the Nutrition Foundation is to the basic research for Nutrition. Already courses in Food Law are given in several schools through the sponsorship of the Institute, including such institutions of higher learning as Harvard, N.Y.U., Yale, Stanford and other colleges. The University of Southern California, one of the sponsors of this Conference, maintains a regular graduate course in the Food & Drug Law, established about two years ago and underwritten by the Institute.

We need the wisdom of learned men—we need trained men and women to take our places in the business and professional world—we need the results of research in science and law which universities and institutions of higher learning are in a position to undertake. Financial and moral support by corporations, independently or collectively is, I believe, a proper charge upon industry.

The Institute has gone a long way in its four years of existance. It has already been recognized in many quarters, and appreciated by health officials everywhere and by practicing lawyers in the food field. Its beneficial effect knows no bounds and it is hoped that the Institute's influence will eventually bring about uniform Food Laws for the several States. Mr. Charles Wesley Dunn is actively engaged in the development of this needed objective.

DR. FRANK E. RICE RETIRES

Dr. Frank E. Rice, executive secretary of the Evaporated Milk Association will retire from that position on July 1, Daniel M. Dent, President of the Association, announced today. Dr. E. H. Parfitt is being named to succeed Dr. Rice. Although Dr. Rice is relinquishing the executive secretaryship, he will remain as an active consultant of the Association for at least three years, Mr. Dent said, and will have several specific assignments.

Dr. Parfitt came with the Association from Purdue University in 1938 to head up the newly formed Sanitary Standards Program. This activity has grown to the point where it has the respect of public health and food control officials everywhere. Parfitt was made assistant executive secretary four years ago.

Dr. Rice, a Hoosier by birth, schooled at Indiana University and Cornell, came with the Evaporated Milk Association in 1927. To determine the value of evaporated milk in infant feeding and to interest the medical profession in its use was one of the principal activities of the Association in those days.

Dr. Parfitt has long been prominent in the dairy industry. During the 19 years while on the staff of Purdue University he was frequently consulted by the dairy industry, city health departments and equipment manufacturers. He has published many articles in the field of bacteriology and milk sanitation.

The number one activity of the Association still is that which was provided in the by-laws — "to institute and conduct research and educational work". On the staff are 6 women, trained in home economics and journalism, 5 men with education and experience in milk sanitation, an attorney, a traffic specialist, a statistician and a research nutritionist.

Every evaporated milk manufacturer in the U.S.A. contributes to one or more of the Association programs. Active membership includes more than 90% of the volume.

FORTY-FIRST ANNUAL MEETING

HOTEL MORTON — ATLANTIC CITY, N.J., OCT. 21-23, 1954

COMPARISON OF ESCHERICHIA COLI AND STREPTOCOCCUS FAECALIS AS A TEST ORGANISM TO DETERMINE THE SANITARY QUALITY OF FOOD[1] PART I

C. H. Allen[2] and F. W. Fabian[3]
Department of Bacteriology and Public Health
Michigan State College, East Lansing, Michigan

Since the discovery of the role that bacteria play in disease, a search has been made for a suitable organism that would be indicative of dangerous bacterial contamination in food. Early work with pathogenic bacteria indicated that they would not be suitable to serve this purpose since they were hard to isolate, were too fastidious, and died off quickly under conditions favorable for keeping food. For these and other reasons the search turned to other bacteria associated with pathogenic bacteria but which were hardier and easier to work with and identify. Fullfil'ing these requirements were two organisms, E. coli **and** Strept. faecalis; **normal inhabitants of the intestinal tract and associated with many pathogenic bacteria especially the enteric bacteria which are responsible for many food outbreaks. Today the presence of moderate numbers of these organisms is not considered a sure sign of dangerous contamination but rather of possible contamination. Their presence indicates that a search for the cause of the contamination should be made.**

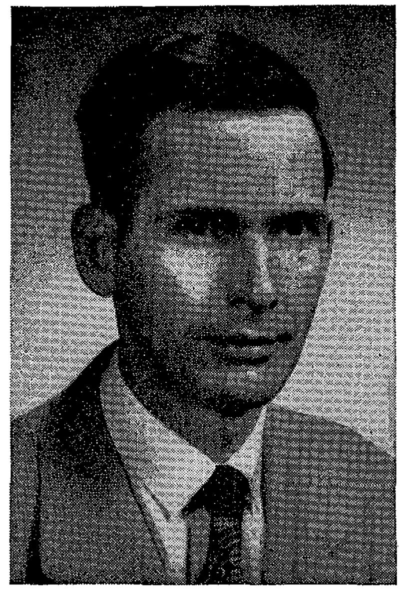
The need for a bacteriological test for the sanitary condition of food has long been recognized. Early investigators searching for such a test recognized certain merits in the normal inhabitant of the intestines, *Escherichia coli*. This organism, while normally not pathogenic, was sufficently hardy to survive a variety of physical and chemical conditions so as to make it of value as a test organism. As data on food-borne infections and epidemics accumulated it became apparent that many of them were directly traceable to contamination of the food by pathogenic, enteric bacteria such as the paratyhoid, typhoid, paradysentery, and dysentery groups.

It was found that bacteria gained entrance to the food in a variety of ways such as through water, soil, food handling by people sick with an intestinal disease, or by healthy carriers, or by those careless in their personal habits, or by flies, insects, and rodents. Since many of the enteric pathogens were none too hardy after they left the body and some of them were difficult to grow on many media or could not compete with other organisms on artificial media, it became apparent that the more robust *E. coli* was more nearly the perfect test organism than any of the others found in the intestine.

Later, complications arose when it was discovered that a closely associated organism, *Aerobacter aerogenes*, was also found in the intestines, in water, and in food. This difficulty was overcome when methods were found to distinguish between the two different organisms. It was also found that the normal habitat of the *Aerobacter* group was in the soil and on foods rather than in the intestine.

One of the more recent criticisms of *E. coli* as an index of contamination is its hardiness, a factor which previously recommended it. Some advocate a less viable organism, which is also an inhabitant of the intestine, *Streptococcus faecalis*, as a better index of contamination since its presence is indicative of present or more recent contamination.

The present study was to determine the viability of *E. coli* and *Strept. faecails* on various foods having a different nutritive and chemical composition, a wide range of pH values, different consistencies, and moisture content. Such a study should help to determine the suitability of each to serve as a satisfactory test organism for food contamination.



C. Henry Allen graduated with an A.B. degree from Albion College, Albion, Michigan, with major in chemistry and biology. He received his M.S. degree in 1951 from Michigan State College where he majored in bacteriology and food technology. He then was employed as a bacteriologist for the Gerber Products Co. at Fremont, Michigan, where he is at the present time. He served in the Army Air Corps from 1941-1945. He is a member of Sigma Xi.

Literature Review

No attempt has been made to review in this paper all of the literature since it has become so voluminous that such a review would be out of place here. However, a few references are given to outline briefly the role which the two organisms studied here have played as a sanitary index to potability of water and the sanitary quality of food.

Some bacteriological work had been done in the years preceding 1902 along sanitation lines, but it was not until after this that Papastiriu[28], Prescott[29], Winslow and Walker[38], Fromme[13], Rogers, Clark, and Evans[33], and many others had published work on lactose fermenting organisms that interest began to grow in *Escherichia coli* as a test organism for the sanitary quality of water and milk. Concurrent with this interest, however, there were developed new media and methods which showed that the lactose fermenting organisms were a heterogeneous group comprising many organisms not associated with the intestine and of doubtful sanitary significance. For example, Rogers, Clark, and Evans[34] claimed through investigation that bacteria identical with the colon type frequently appeared on grains, fruits, and grasses. Koser[17] used simple nitrogen compounds for utilization by microorganisms as a differential method of identification. The work of Rogers,

(Received for publication, March 23, 1954).

1. Journal article No. 1621.
2. Bacteriologist, Gerber Products Co., Fremont, Michigan.
3. Professor of Bacteriology and Public Health.

Clark and Lubs[35] further stimulated interest in the coliform group. Levine, Weldin, and Johnson[20] were also working on differentiating between coli-like organisms. Chen and Rettger[4] identified *B. aerogenes* and *B. coli* in their soil relationships. These and other workers showed that the lactose fermenting organisms could be divided into the organisms whose habitat were in the colon of man and animals, and those whose habitat were in soil, grains, fruits, and grasses. To complicate the picture further, certain sporogenic bacteria and yeasts found in nature also fermented lactose. A tremendous amount of work has been done to differentiate or suppress these various groups by using various media.

Where it is the aim of water technicians and sanitary engineers to eliminate every trace of contamination with fecal material of which *E. coli* is the indicator, the presence of this organism in milk must be viewed in a different light. Although it is recognized that it is practically impossible to keep raw milk free of *E. coli*, the contamination of this product after pasteurization should lead to serious suspicions of improper technique or equipment somewhere in the plant.

Although Washburn[37] reviewed the history of frozen and iced products, and Buchan[2] made a complete bacteriological study of English ice cream plants finding large percentages of coliform organisms, the attention paid to their sanitary qualities seemed to have been embryonic until the 1930's. Fabian[6], Jenkins[16], Fabian[7], Fabian and Coulter[8], Newman and Reynolds[25], Brannon[1], Smallfield[36], and Prucha[31], noted the significant facts: (a) that coliform organisms will appear in the manufactured product if not eliminated in the dairy product, (b) that a pasteurizing temperature of 65.5°C was better than 62.8°C for 30 minutes, (c) that the protective action of fat and sucrose were slight, (d) that checks for *E. coli* should be instituted to check plant procedures, and (e) that additives to ice cream mix should be watched since coliforms entered through the addition of nuts, coloring matter, flavors, and fruits.

Fabian[9] discussed the error of manufacturing the mix one place and freezing elsewhere. Fountain service at the retail level was also found to be a source of coliform contamination as were glassware, dippers, syrups, spoons, and dipper water as studied by Fabian and Hook[10, 11]. Work done on factory packed ice cream showed that 25 percent of the samples tested were outside of the safety standards of ten organisms per ml of sample. Many other types of frozen desserts had high coliform count, many being of the fecal type.

Pecan meats were found by Ostrolenk and Welch[27] to be heavily contaminated with coliform organisms which originated from pickers' hands, picking tables, and picking pans.

Faville, Hill and Parish[12] found bacteria to be the predominating microorganisms present in concentrated orange juice, and that they died out quickly during storage. *E. Coli* was significantly reduced in numbers at low temperature storage.

As a result of over a half century of intensive study by a great many workers, the significance of the colon group as a sanitary index has been greatly modified. For example, Prescott, Winslow, and McCrady[30] felt that in water analysis the presence of moderate numbers of coliform organisms should not be considered a sure sign of dangerous pollution but rather should serve as an indication of possible pollution, and search for the source should be the prime factor. Coliform organisms, when present, however, did present a reasonably accurate index of the amount of pollution. Levine[21] stated that to select the colon group as a sanitary index of the potability of water and food-borne enteric disease is untenable today since the reasons for doing were predicated on the fact that typhoid fever, a disease peculiar to man, was the primary water-and-food-borne disease. To support this thesis he gave the following reasons;

(a) Recognition of non-lactose fermenting bacteria of the genera *Salmonella, Shigella,* and possibly *Proteus* and *Pseudomonas,* as inciters of enteric disease.

(b) Demonstration of the presence of viruses of poliomyelitis and infectious hepatitis in stools (the transmissibility of the latter by water and of typhus fever by ingestion).

(c) The antagonistic effects of some strains of *Shigella* and *Salmonella* against coliform bacteria which may interfere with the detection of the latter.

(d) Reports of greater resistance of the viruses and some strains of *Salmonella, Eberthella,* and *Shigella* to chlorination than are some strains of the colon group.

(e) Records of outbreaks of enteric disease associated with the consumption of treated waters which presumably were potable on the basis of the coliform index.

(f) The presence of some varieties of coliform bacteria in waters which by other criteria are suitable, satisfactory, and apparently safe supplies, serve to raise questions as to whether the incidence of the coliform group of bacteria is an adequate sanitary index and whether this index needs be supplemented by other criteria, particularly when dealing with unfiltered or treated stored waters and other beverages. Much basic research needs to be carried out before adequate answers to these queries can be given.

Although the significance of the streptococci as sewage organisms was not established with the same definiteness which marks our knowledge of the coliform group, these bacteria had been isolated so frequently from polluted sources and so rarely from normal waters that it seemed reasonable to regard their presence as indicative of pollution. Originally reported by Laws and Andrews[18], their importance was not emphasized until Houston[15] laid special stress upon the fact that streptococci and staphylococci seemed to be characteristic of sewage and animal waste. Laws and Andrews[18] believed that they were more truly indicative of dangerous pollution, since they were readily demonstrated in waters recently polluted and seemed altogether absent in waters above suspicion. Horrock[14] found these organisms in great abundance in sewage and in waters which were known to be sewage polluted, but which contained no trace of *E. coli*. He found by experiment that *E. coli* gradually disappeared from specimens of sewage kept in the dark at the temperature of an outside veranda, whereas the commonest forms which persisted were varieties of streptococci and staphylococci. Mallmann and Litsky[22] believed that enterococci would appear to be good indicators of public health hazards from sewage in soils and on vegetables. They found that the streptococci died out of soil samples much more quickly than did *E. coli*, and *Strept. faecalis* persisted longer than *S. typhosa*.

Burton[3] suggested that the enterococci might prove superior to the coliform organisms as an index of fecal contamination in frozen foods as fecal streptococci were most likely to survive the storage temperature, although the coliforms seemed to be the best test before freezing and storing.

Mallmann and Seligmann[23] stated that media for streptococci detection should be selected so that a clouding of the liquor would be indicative of the presence of streptococci. Lack of comparative studies did not permit an accurate determination of the best medium. Limited studies, however, indicated that azide dextrose broth was superior to lactose broth, *Strept. faecalis* broth (SF), or azide broth. Azide dextrose broth has the property of inhibiting the gram-negative bacteria. Mallmann and Litsky[22] used various azide broths and SF broth in their tests of soils for the presence of enteric organisms. They believed azide dextrose broth superior to other azide media and noted, that, as some spore forming gram-positive rods grow in this medium, Gram stains were necessary for accurate determination.

Foods contain not only nutritive elements for microorganisms, but inhibitory agents in the form of salt, sugars, and organic acids. Many of these agents have long been recognized. Vinegar (acetic acid) and sour milk and sauerkraut (lactic acid) have been used as natural preservatives since ancient times. The specific action of the acids, as summarized from the work of Reid[32], Nunheimer and Fabian[26], Levine and Fellers[19], Erickson and Fabian[5], and McCulloch[24] may be due to one or more of the following: (a) the effect of the hydrogen ion concentration, (b) the effect of the characteristic anion, (c) the effect of the undissociated molecule, and (d) the effect of surface tension.

Cultures Used

Escherichia coli strains *communior, communis,* and 0-111 were obtained from the Michigan State Health Laboratory, Lansing. Strain 0-111 is of noteworthy importance in that it is credited with causing the often fatal infant diarrhea. Culture ATCC 9637 was obtained from the American Type Culture Collection, Washington, D.C. A strain of *E. coli* which had been isolated from the rumen of the cow was obtained from our department. Other strains of *E. coli* were isolated and purified from human feces and water samples. The culture from the human source was assigned the number HS-04. The culture obtained from water was assigned the number w-52950.

All strains were rechecked before using by the dilution plate method using eosin-methylene blue agar and transferring single isolated typical colonies to lauryl tryptose broth. All transferred colonies were gas positive in lauryl tryptose broth and staining showed all organisms to be gram-negative short rods.

Viability of the *E. coli* was built up by seven daily consecutive transfers into a peptone broth base which consisted of: beef extract—3 gm, peptone—5 gm, lactose—5 gm, water—1 liter. The last broth culture of the daily transfers served as the inoculum to test the viability of the different strains in the foods studied.

Strept. faecalis cultures 1325 and 6057 were obtained from the American Type Culture Collection, Washington, D.C. These cultures were inoculated into semisolid preparations of tryptose blood agar base which was made up as follows: beef extract—3 gm, tryptose—10 gm, sodium chloride—5 gm, agar—7 gm, water—1 liter. Before inoculating into food, the organisms were transferred daily for five days into broth made according to the above formula by eliminating the agar.

Part II will appear in a subsequent issue.

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BEHAVIOR OF A HEAT RESISTANT FOOD SPOILAGE SPORE FORMING ANAEROBE INOCULATED INTO SOILS[1, 2, 3]

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The heat resistance of putrefactive spore-forming anaerobes isolated from experimental soil plots was relatively low and not significantly influenced by different fertilizer treatments. The spores of Putrefactive Anaerobe No. 3679 retained their high heat resistance when they were inoculated into the test soils and were subsequently recovered several months later.

The purpose of the present investigation has been to observe the influence of environmental conditions and fertilizers on the heat resistance characteristics of "putrefactive anaerobes" naturally present in soils and a heat resistant putrefactive anaerobe inoculated into these soils. Such organisms are important as causes of spoilage in underprocessed low acid canned foods. This study was initiated with a full realization of the impossibility of achieving a satisfactory degree of control and elimination of sources of variation. In recognition of these problems, the term "observations" is an apt one to describe the results obtained. In spite of the inherent problems associated with such work, the results obtained do provide information on the behavior and thermal resistance of the spores of putrefactive anaerobes normally and artificially present in soils.

Experimental Methods and Results

Organism used. Putrefactive anaerobe (PA 3679) was obtained from the Research Laboratories of the National Canners' Association as described by Desrosier and Esselen[1].

Soils. Through the cooperation of the Agronomy Department, University of Massachusetts, experimental soil plots were made available. These plots had been maintained on different fertilizer treatments for a period of 58 years (table 1). The particular soils listed in the table were selected to observe the effect of nitrogen, potassium, and phosphorus (the commonly employed fertilizers) on the heat resistance of the organism indicated. These soils may be described as fine, sandy Merrimac loam, deposited from the top area of a glacial lake. The depth of the loam was approximately 10 inches. Soil drainage was good.

Due to the fact that a building was proposed for the location of the soil plots, it was necessary to remove the top soil from its original area and prepare test plots. For this purpose, sections of tile drainage pipe 2 feet long and 2 feet in diameter were set into the ground. Top soil to a depth of 7 to 8 inches was removed from the original plots and transferred into the pipes.

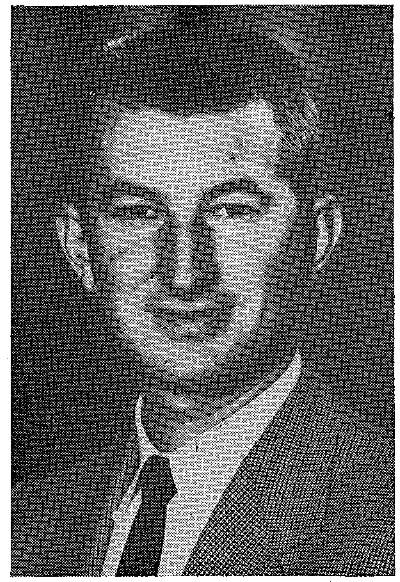
A third portion of each test soil was brought into the laboratory, and a quart home-canning-type glass container was filled with each of the soils, respectively, and sealed. The samples were then heated for an hour and a half in an autoclave at 121° C to sterilize the soils. The samples were stored at room temperature. A sample of each soil was taken, both from those in the field and those in the laboratory, and the putrefactive anaerobes present were determined, as will be described later.

Preparation of spore and vegetative cell suspensions. Spore suspensions of putrefactive anaerobes were prepared as described previously by Desrosier and Esselen[1]. To prepare a large volume of vegetative cell suspensions, the same procedure was followed, except that the final lot of inoculated medium was incubated at 32° C for one week only. At the end of this period a microscopic examination indicated that a very high percentage of the cells were in the vegetative form. When counted by the dilution method, the suspension was found to contain 200,000,000 cells per ml.

Inoculation of soils. The soil plots were arranged in 2 rows of five tiles per row in the field. The row of tiles downslope from the other was used as the inoculated plots to prevent a drainage effect and possible contamination on the control areas. An inoculum of 300 ml of the vegetative suspension, already described, was applied to each of the five plots, designated for inoculation.

The third sample of soil, previously sterilized, was also inoculated with the vegetative suspension of the test organism. One hundred ml of the suspension per jar of these soils were inoculated. The moisture content of these soil samples was increased to 26.5 percent, and remained constant throughout the study, as the containers were covered.

Sampling the soils. Soil samples were taken on November 8, 1948 (prior to inoculation), December 21, 1948, March 10, 1949, and June 28, 1949. Samples were obtained by means of a trowel for the field



Norman W. Desrosier completed his Ph. D. in food technology, University of Massachusetts, 1949, and was Assistant Research Professor there, 1948-1949. He then was appointed Assistant Professor, Department of Horticulture, Purdue University, 1949-1951, Associate Professor, 1951-date, and Chairman, Food Technology Committee, Graduate School.

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[1]Contribution No. 839. Massachusetts Agricultural Experiment Station.

[2]Presented at Meeting of Connecticut Valley Branch, Society of American Bacteriologists, Smith College, Northampton, Mass., April 18, 1952.

[3]Received for publication, March 10, 1954.

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TABLE 1.—FERTILIZER TREATMENTS GIVEN THE TEST PLOTS OF SOIL[1]

Plot No.	Type of treatment	Amount added (pounds)	Remarks
2	Lime	14	as CaO
3	Lime	14	as CaO
	Potassium	21	as KCl
4	Lime	14	as CaO
	Phosphorus	14	as $Na_3PO_4 - 12H_2O$
5	Lime	14	as CaO
	Nitrogen	21	as $NaNO_3$
11	Lime	14	as CaO
	Potassium	21	as KCl
	Phosphorus	14	as $Na_3PO_4 - 12H_2O$
	Nitrogen	21	as $NaNO_3$

[1]Plots were 14 feet wide and 200 feet long. Fertilizer applied in spring of year, commencing 1890. Data obtained from the Agronomy Dept., Mass. Agr. Expt. Sta., Amherst, Mass.

samples, and a spatula for the laboratory samples. The surface of the test plot was cleared, and a vertical section extending from the surface of the ground to a depth of 6 or 7 inches was removed.

Estimation of spore content of soil samples. After the moisture contents had been determined, the soils were diluted 1:10 (dry basis) with water. These dilutions were heated at 100° C for ten minutes to destroy vegetative cells, and cooled. Decimal dilutions up to 1/1,000,000 were prepared. Aliquots of these dilutions were then inoculated into freshly heated liver broth, and the tubes were stratified with non-nutrient agar. The tubes were incubated at 32° C for one week. At the end of this period, the highest dilutions of soil evidencing positive growth of the putrefactive anaerobes were used as cultures for the preparation of spore crops. The results of the spore counts for each of the samples taken are listed in table 2. It was realized that as many spores present in the control soil were also present in the inoculated soils.

PREPARATION OF SPORE CROPS FROM SOIL ISOLATES

Preparation of spore crops from soil isolates. The highest dilution of the soil sample in the preceding section, showing positive growth, was used as an inoculum to prepare spore crops for the thermal death time studies.

Heat resistance studies of the cultivated spores. The heat resistance of the spores of the putrefactive anaerobes isolated from the soils were determined by the multiple tube thermal death time technique described previously. (Desrosier and Esselen[1]) The spore crops were counted by means of the shake agar method. One ml portion of the spore suspensions were then inoculated into 99 ml of neutral phosphate buffer solution (pH value 6.95), to obtain a concentration of 10,000 spores per ml of the buffer. Two ml of the inoculated buffer solution were introduced into the thermal death time tubes, and the procedure was as previously described.

Treatment of data. A logarithmic order of death was assumed and

TABLE 2.—PUTREFACTIVE ANAEROBIC SPORES PRESENT PER GRAM OF SOIL (DRY BASIS)

Soil No.	Control sample in field	*Spore counts/gram sample dry weight*[1] Inoculated sample in field	Inoculated sample in laboratory
		Sample Collected — November 8, 1948	
2	10	----------	----------
3	10	----------	----------
4	10	----------	----------
5	10	----------	----------
11	100	----------	----------
		Sample Collected — December 21, 1948	
2	10	100,000	1,000,000
3	5	100,000	1,000,000
4	5	100,000	1,000,000
5	10	100,000	1,000,000
11	10	100,000	1,000,000
		Sample Collected — March 10, 1949	
2	5	100,000	1,000,000
3	5	1,000	100,000
4	5	100,000	1,000,000
5	5	100,000	100,000
11	10	10,000	10,000
		Sample Collected — June 28, 1949	
2	10	100,000	10,000
3	5	10,000	100,000
4	5	1,000	100,000
5	10	1,000	10,000
11	10	10,000	1,000

[1]These are approximate counts determined by method of multiple dilution. The highest dilution with positive growth was utilized for spore crop development. Samples reported were triplicate results.

Table 3.—Thermal Resistance Data of Putrefactive Anaerobe Inoculated into and Isolated from Soils

Soil	Fertilizer	D 225F	D 235F	D 240F	D 245F	D 250F	z
			Control (field plots)				
2	Lime	9.8	1.85	0.95	0.61	0.26	16.5
3	Lime plus K	10.8	2.34	1.28	0.81	0.34	17.2
4	Lime plus P	10.1	1.87	0.98	0.75	0.43	20.4
5	Lime plus N	13.1	1.88	1.46	1.08	0.47	21.4
11	Lime plus NPK	13.1	2.62	1.55	1.22	0.57	21.3
			Inoculated (field plots)				
2	Lime	19.5	3.92	2.72	1.96	0.90	21.0
3	Lime plus K	15.2	3.32	2.33	2.10	0.91	25.1
4	Lime plus P	16.1	3.91	3.05	2.41	1.22	25.9
5	Lime plus N	19.6	4.16	3.37	2.43	1.20	21.3
11	Lime plus NPK	8.7	3.68	2.83	2.17	0.99	21.1
			Inoculated (sterile soil in laboratory)				
2	Lime	12.1	3.48	2.60	1.66	0.96	21.4
3	Lime plus K	10.9	3.77	2.42	1.82	0.96	20.2
4	Lime plus P	12.1	4.11	2.42	1.68	1.09	19.9
5	Lime plus N	14.1	4.06	2.83	1.48	0.87	19.2
11	Lime plus NPK	14.1	4.24	2.70	1.82	1.04	20.5

D = Calculated time in minutes required for destruction of 90 percent of spores at given temperature.
z = Slope of thermal death time curve (number of degrees F required for curve to traverse one log cycle).

the thermal resistance data were treated as described by Desrosier and Esselen[1] using the method described by Stumbo, Murphy, and Cochran[2]. The data obtained are summarized in table 3. These data represent D values calculated for organisms isolated from the soils in December 1948 and March and June 1949. A statistical analysis of the data indicated that no significant difference existed in the heat resistance of the organisms isolated at different times from the same soils. Likewise, the fertilizer treatment given the soil appeared to have no significant effect on the heat resistance of the putrefactive anaerobes obtained therefrom. However, the difference in heat resistance of the spores from soils inoculated with PA3679 as compared with that of the spores of putrefactive anaerobes from uninoculated control soils was highly significant at the 0.01 level.

Discussion and Summary

The putrefactive anaerobic spore populations of the control and the inoculated soils are listed in table 2. It was apparent that all the isolated spores from any one soil were probably a heterogeneous group of putrefactive anaerobes, and not necessarily the organism inoculated into the soils. Undoubtedly many strains of the organism were present, and, for this reason, the results obtained have added significance. The natural soils under investigation, however, contained up to 100 spores per gram of sample. The populations of the organism introduced into the soils appeared to decrease in numbers during the period of observation, from 100,000 down to 1,000 to 10,000 spores per gram, as determined by multiple dilution. The sterilized, inoculated soil in the laboratory exhibited the greatest decrease, notably the soil No. 11, containing the completely fertilized soil.

The most striking difference between the inoculated and the control soils was the low heat resistance and small number of the isolates from the latter. The occurrence of spoilage organisms in the soil, and on the produce grown in such soils, with heat resistance in the range herewith reported, would in part explain the apparent success of some home canners with the boiling water bath processing of low acid foods. It is of interest to note that Tischer and Esselen[3] were able to isolate from spoiled home-canned vegetables organisms with *F* values of putrefactive anaerobes with heat resistance characteristics comparable to those of 2.1 to 4.5, and *z* values of 15.5 to 17.5 isolated from the fertilized control soils in the present study. These observations provide further evidence that pressure processing of vegetables is necessary as a safe home-canning practice.

These observations are of interest in relation to food processing in that it would appear that the heat resistant spore forming organism studied (P.A. 3679) retained its heat resistance when inoculated into soils which had been given different fertilizer treatments. The presence of such organisms in the soil serves as a potential source of contamination of produce grown thereon. The various fertilizer treatments employed had no significant effect on the heat resistance of the spores recovered from the test soils. Likewise in the control uninoculated soils, regardless of their fertilizer treatments, the putrefactive spore-forming anaerobes present were of essentially the same heat resistance. Their F values (destruction time at 250° F) ranged from 0.37 to 3.1 minutes as compared to F values of approximately 5.0 to 6.2 minutes for putrefactive anaerobe spores from the inoculated soils. These limited observations suggest that environmental factors such as type of fertilizer treatment have little or no effect on the heat resistance of putrefactive anaerobe types of spoilage organisms present in the soil.

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FARM BULK MILK HANDLING*

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This article is based largely on a paper presented by the author to the Orange County, New York, milk sanitarians and guest farmers. The purpose of the talk was to give a general picture of the bulk handling situation with emphasis on facts of interest to New York State producers.

The economic aspects as they affect the hauler, dealer and producers are briefly reviewed. Producers are informed and advised concerning some of the engineering aspects of bulk cooling. The effect on milk quality is discussed and the advantages and disadvantages of bulk tanks for the farmer are summarized.

The first calibrated farm bulk cooling tank was introduced by the Lucerne Milk Company, Oakland, California, in November, 1941.**

The first farm tank in New York State was installed on the Hedge Farm at Pine Plains in April of 1948 by Bryant and Chapman – R. G. Miller and Sons. The milk on this route went into Hartford, Connecticut.

The first every-other-day bulk pick-up system in New York State was started by Green's Dairy in Schenectady in May of 1952.

Today, there are at least 10,000 farm tanks in the United States and at least 400 in use in New York State.

Tank Manufacturers

Surprisingly enough there are about 125 companies who are building tanks or plan to build tanks.

Below is a list of companies that I know have tanks on the market.

1. Cherry-Burrell Corporation, 501 Albany Street, Little Falls, New York.
2. The Creamery Package Manufacturing Company, 1243 West Washington Boulevard, Chicago 7, Illinois.
3. Dairy Equipment Company, Department A-3, 1444 East Washington Avenue, Madison, Wisconsin.
4. Damrow Brothers Company, 196-234 Western Avenue, Fond du lac, Wisconsin.
5. DeLaval Separator Company, Poughkeepsie, New York.
6. Esco Cabinet Company, West Chester, Pennsylvania.
7. Girton Dairy Equipment Company, Millville, Pennsylvania.
8. Groen farm tank distributed by West Dairy Equipment Company, 356 Willard Avenue, Elgin, Illinois.
9. Haverly Electric Company, Inc., Syracuse 4, New York.
10. C. E. Howard, Corporation, 9001 Rayo Avenue, South Gate, California.
11. McHale Manufacturing Company, 3200-20 Mines Avenue, Los Angeles 23, California.
12. Mojonnier Brothers Company, 4601 West Ohio Street, Chicago 44, Illinois.
13. Package Machinery Company, East Longmeadow, Massachusetts.
14. Purity Manufacturing Company, Inc., Cattaraugus, New York.
15. Emil Steinhorst Corporation, 612-616 South Street, Utica 3, New York.
16. Sunset Electric Company, 300 Westlake North, P. O. Box 3148, Seattle 14, Washington.
17. Tolan Machinery Company, Inc., Port Street, Port Newark, New Jersey.
18. Valco Manufacturing Company, 3470 Randolph Street, Huntington Park, California.
19. Wilson Refrigeration, Inc., Smyrna, Delaware.
20. Zero Manufacturing Company, Washington, Missouri.

More new makes will be on the market soon.

Tanks manufactured by Numbers 3, 6, 13, and 19 are cooled by the ice-bank system. With Numbers 1, 11, and 18, chilled water or direct expansion cooling is optional. Manufacturer No. 9 sells three types—ice-bank, direct expansion, and semi-direct expansion. The remaining tanks are cooled by the direct expansion method.

Economic Aspects

Concerning the Hauler

A tank truck costs more than its counterpart for carrying cans but it can haul a greater payload, and in some cases, make more than one trip per day.

Assistant Professor R. P. March received his B. S. degree in Dairy Manufacturing at the University of Massachusetts in 1944. After two years in the U. S. Marines he entered the graduate school at Cornell University, and in 1948, upon the completion of his studies for the M. S. degree, took charge of the One Year Curriculum in Dairy Manufacturing and Marketing, teaching a majority of the dairy subjects. Recently he has devoted much of his time to extension work pertaining to bulk milk handling in New York State and to research problems connected with bulk tanks.

A report by Nelson[1] shows considerable savings in hauling rates. Tank trucks in Oregon ranging in size from 1,200 gallons to 1,700 gallons have shown savings in transportation costs varying from 11 to 15 cents per hundredweight. The average distances these trucks traveled was 62.3 miles with an average of only 6.5 stops. Some of the organizations used 2,100-gallon and 2,500-gallon trucks traveling an average of 77 miles with stops numbering from 8 to 13. These routes reported a hauling rate reduction of from 18 to 20 cents per hundredweight.

However, as Nelson states early in his paper, each tank truck route has replaced four can routes in most areas of their state, resulting in more milk per load and more intensive use of equipment.

According to a Washington[2] report, it costs about the same to operate a 1500-gallon tank truck

*Paper submitted April 15, 1954.

**Reported by O. A. Ghiggoile, Chief of the Bureau of Dairy Science, Dept. of Agric., Calif., in a letter dated November 20, 1952, to E. S. Guthrie, Cornell University.

as it does to operate a van-type truck designed to haul 1500 gallons in 40-quart cans.

In New York State some haulers have not been able to lower their hauling rates, probably because they have more stops than stated above, less intensive use of their equipment, and not a complete every-other-day farm pick-up schedule.

Again, with reference to a west coast study, Clarke[3] reports that tank truck pick-up is more economical than the can method if for a 3000-gallon route at least 130 gallons can be picked up per collection, for a 2000-gallon route at least 120 gallons can be picked up per collection, and for a 1000-gallon route at least 100 gallons can be picked up per collection.

Coming closer to home, Mr. A. C. Fisher[4] reported the following in a paper presented at the Northeastern Dairy Conference in 1952: " . . . . . . we would now consider it practical and economically sound for a producer of 6 to 8 cans to install a tank. We also know that it is practical to consider every-other-day pick-up at the farm. If such a practice is put into effect we could then consider from the trucker's standpoint, picking up a 3- or 4-can producer on an every-other-day basis and make it practical to stop for that amount. On producers of a lower volume than this, of which we have many in Connecticut, we are about to try a method which may or may not be practical. We expect to supply the 1- and 2-can producers, located in an area where tank pick-up is to become the rule rather than the exception, with stainless steel 40-quart cans which they will use in their regular can coolers as they have been doing at present. On the days of pick-up at the farm of their neighbor who owns a tank, they will transport their milk to that neighbor's milk house, where it will be measured and sampled by the truck driver in the tank after picking up the tank's original contents. This plan could also be put into effect in the case of a producer situated so as to be inaccessible to the tank truck. This contemplated action has the tentative approval of our state authorities in Connecticut, and may or may not be an answer for small producers. Only a trial will tell us."

With tank pick-up the caliber of the truck driver becomes very important. He must be a licensed "weigher" and sampler, have some of the qualifications of a competent fieldman, and lastly be a capable truck driver.

Concerning the Dealer

Obviously, the dealer can obtain his greatest savings only when he can completely eliminate the receiving of milk in cans. He may have some saving in cooling costs or other savings if tank pick-up eliminates over-time on the receiving deck or the necessity for expanding the receiving room.

The Oregon paper by Nelson[1] states that plant savings can range from 2 cents per hundredweight when receiving 3000 cans per day to 4 cents per hundredweight when receiving about 600 cans per day if complete conversion to tank pick-up is made.

An article[5] in the *Milk Plant Monthly* by Hall of Michigan gives the total costs of receiving and cooling milk in a very efficient one man operation as follows:

Quantity of milk received daily (pounds)	Total receiving costs per cwt (cents)
20,000	7.4
40,000	4.4
60,000	3.3
80,000	3.0
100,000	2.7

In the 1953 February issue of the *Southern Dairy Products Journal*, an article by A. A. McArthur states that savings from 8 to 20 cents per hundredweight are possible.

The dealer or the producer will have some loss unless the tanks are properly calibrated. The farmer's milk is measured on a volume basis but the dealer must pay for it on a weight basis. Reports indicate that calibrations have been fairly accurate. Mr. P. C. Farrar of Hillcrest Dairy, Worcester, Massachusetts, has stated* that it is unusual for their weights to be off more than 6 or 8 pounds per tanker. A dairy plant in one of the major New York State cities has had up to a 1.2 percent loss of milk on a tank truck shipment due to a difference between the milk receipts left the farmers and the actual pounds of milk weighed in at the plant, but this was an exceptionally high loss.

Some people have shown concern about the errors which may result when measuring milk with a stainless steel rod because of volume changes with a change in milk temperature or because of variations in weight with a change in fat test of the milk. These errors, however, are extremely small, less than the allowable error in the measuring rod as permitted by 3-A Standards for Bulk Cooling Tanks.

Concerning the Producer

In many cases the demand for farm tanks has stemmed straight from the producer, perhaps for such reasons as his desire to have the milk measured, sampled, judged, and purchased on the farm, to improve milk quality, and to increase his income.

A reasonable example of costs and savings for a 7- to 10-can producer is given in Mr. Fisher's talk referred to earlier in this paper.

He recommends a 150-gallon tank for this producer. If the tank is filled on an average to 65 percent of its capacity, it could be amortized over a five-year period at the cost of 14 cents per hundredweight. If this producer had a can cooler, amortization would cost him 6 cents per hundredweight, or an increase of 8 cents per hundredweight for the tank.

Fisher of General Ice Cream Corporation and officials of the Connecticut Milk Producers Association have estimated that Connecticut producers will save 4 cents per hundredweight in volume, 4 cents per hundredweight in fat and 2 cents per hundredweight can expense, or a total of 10 cents per hundredweight. This would more than make up for the 8 cents additional cost for the tank.

The bulletin by Nelson referred to earlier in this paper shows substantial savings for the Oregon producer with a tank as compared to one with a can cooler. The range was from $103 per year for the 10-cow herd to $1,681 per year for the 100-cow herd. These savings resulted from reduced labor and reduced handling rates. These Oregon farmers had to spend a significant amount of time handling, rinsing, and cleaning cans and cleaning a surface cooler. This took much more time than washing a tank every other day. New York

*Statement made by Mr. Farrar when serving on a bulk milk panel at the Milk Industry Foundation's 46th Annual Convention, Boston, Mass., October 23, 1953.

State producers, however, do not have to wash their milk cans nor do they have surface coolers to clean and as explained earlier many New York State truckers have not been able to cut their handling costs significantly.

Nevertheless, bulk tanks are feasible for many farmers in this state because of the savings listed below.

1. Savings in volume of milk may easily equal about 4 cents per hundredweight. At Cornell we have a loss of about 0.4 pound of milk per can of warm morning milk and about 0.6 pound per can of cold night milk. In our plant we have a slow, careful dumping operation. A commercial receiving operation may easily lose one pound per hundredweight because it is not economically feasible to dump cans as slowly and methodically as is done in our small plant.

2. Savings in fat may range from 0 to 5 cents per hundredweight. (Greater than 5 cents per cwt. savings have been reported). The difference of 0.2 pound between the 0.4 and 0.6 stated above represents cream which has stuck to the shoulders of a cold can. This cream, testing about 25 percent fat means a loss of .05 percent fat per can of cold milk. Commercial plants may average higher losses than this especially in winter. In many areas of New York State morning milk is not cooled so there would be no significant fat loss in these warm cans.

3. Savings by elimination of cans is often quoted as 2 cents per hundredweight.

4. Some producers have received 10 cents per hundredweight as a bonus or premium for their tank milk, especially from plants which have been able to switch to 100 percent bulk pick-up.

5. Some producers have had their hauling rates reduced.

Additional benefits that should not be overlooked by the farmer are: satisfaction of having milk measured, judged, and sampled on the farm; elimination of can handling; the pride of ownership of a stainless steel tank in place of the shabby cans; less danger of rejections; and lower bacterial counts in properly handled milk.

ENGINEERING ASPECTS

All bulk tanks sold in this country today should meet the requirements of the 3-A Sanitary Standards for Holding and/or Cooling Tanks. These standards published in the 1953 July-August issue of the *Journal of Milk and Food Technology* are formulated by the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., the United States Public Health Service, and the Dairy Industry Committee. They cover minimum standards for design, construction, and performance of farm bulk milk tanks.

Before buying a tank one should be sure it meets the 3-A Standards and the state and local health department requirements.

On February 1, 1954, the New York State and New York City Departments of Health published a list of manufacturers whose farm tanks were approved for use in this state.

The 3-A Standards require that the milk be cooled to 50° F within the first hour after the completion of milking and to 40° F within the second hour. New York State and New York City Health Departments require that the milk be cooled to 45° F within one hour after the completion of milking. Most tanks are cooling much more rapidly than this, but some of the reports of extremely fast cooling rates are attributable to cooling only a very small quantity of milk in proportion to the maximum rated capacities of the tanks.

Tanks may be designed either to cool one-half their volumetric capacity of milk at one time for use on daily pick-up routes or to cool one-fourth their volumetric capacity of milk for use on every-other-day pick-up routes. A producer should not make the mistake of buying a tank designed soley for use on an every-other-day route and then use it to capacity as a daily pick-up tank. Under such a circumstance the tank simply could not cool rapidly enough.

There are two general types of tanks on the market today, the direct expansion tank and the ice-bank tank. Both can be designed to do an excellent job of cooling milk.

The direct expansion tanks in general require about 1 horsepower of compressor motor size for each 50 gallons of milk to be cooled *at one milking*. For example a 200-gallon tank from which the milk is to be picked up daily should have a 2-horsepower compressor motor, or a 1-horsepower compressor motor if every-other-day pick-up is anticipated.

In general, ice-bank coolers have compressor motors that are about one-third as large as those on direct expansion tanks, but these units run for a much longer time to store their refrigeration in the form of ice. This type of tank also has a water circulating pump with a 1/4 to 1/3 H.P. motor not found on direct expansion makes, but this cooler has a smaller power demand at any given time and also cannot freeze milk.

Direct expansion tanks will not freeze milk if properly designed and operated. They require slightly less power per given volume of milk cooled.

Each type has its own merits so before purchase of any tank the producer should carefully consider the advantages and disadvantages of both types in the light of his specific circumstances, keeping in mind the importance of good design, good construction, good performance and the need for satisfactory future service on the tank.

The refrigeration system on a bulk tank may have one of three types of condensers, air cooled, combination air-water cooled, or completely water cooled. The last two types are more efficient than the first.

For satisfactory performance of air cooled units, adequate ventilation is imperative. This subject is discussed in detail in *Cornell Bulletin* 899 entitled "Bulk Cooling and Storage of Milk on the Farm."

In winter the water connections to combination air-water condensing units should be disconnected and the unit carefully drained, or if not disconnected, protected from freezing. The straight water cooled units must be protected from freezing.

Proper wiring and correct overload protection for each motor is very important. This subject is also discussed in Bulletin 899.

MILK QUALITY

If milk is cooled slowly or not at all, poor, insanitary handling methods are easily revealed, but in the author's opinion this does not justify poor cooling of milk. The ideal is proper handling methods followed by very fast cooling. In bulk handling, one approaches the latter, and this fast cooling does help to keep bacteria counts down. So, in general, it is not difficult for a producer to keep his bacteria count well below 50,000.

However, some farmers who produced high count milk in the past are still producing unacceptable milk after changing to a tank. One report of some tank milk produced last August showed a plate count of 180,000. This is much too high. Dirty milking equipment and improperly cleaned tanks especially in warm weather, or cows with mastitis at certain stages, or improper operation of the tank may be the cause of these high counts.

Tanks should be thoroughly rinsed immediately after emptying and washed as soon as possible. In this state cold water under pressure and not less than 15 gallons of water at not less than 140° F must be available in the milkhouse at the time of washing the tank. (New York City Health Department requires hot water under pressure).

Milk low in bacteria count can still be of poor quality due to off-odors. It was mentioned earlier that truckers should first qualify as competent fieldmen. Truckers should not fail to smell each tank of milk. A driver may become careless in this respect because most of the tanks of cold milk will have very little odor. But occasionally an odor is so intense that it is obvious if any effort is made to detect it. It is not common, but tank loads of milk have been rejected for such odors as skunky, onion, garlic, silage, and sweet odor.

Another problem that should be mentioned in connection with bulk tanks in churning, or the appearance of tiny butter particles in the milk. This trouble was more common in some of the earlier tanks, especially those with high speed agitators. Recently the author examined the milk with a strainer dipper in 29 tanks in eastern New York. No evidence of churning was found in any of these tanks. There were some flakes in every single tank regardless of make or type but most of these so-called "flakes" were foam particles and a few, ice particles. When pressed between the fingers they reverted to ordinary milk. The author found some cream flakes in a few tanks. These cream flakes were greasy when rubbed between the fingers but they were not butter particles. This does not mean, however, that churning does not occur occasionally, for it can under such circumstances as: (1) abnormally slow cooling as caused by slippage of the compressor belt, loss of refrigerant, lack of cooling water for condenser, or poor ventilation of condenser; (2) agitator running all night because it was accidentally left on manual control; or (3) addition of warm milk to an unagitated tank of milk which has formed a cream layer.

Churning is undesirable because it makes it very difficult to take a representative sample for the fat test and it causes a cream plug on the top of bottled milk and cream.

One more difficulty that may be found in some farm tanks is freezing of the milk. Freezing can occur in most direct expansion tanks under certain circumstances, such as: (1) if a small quantity of milk is poured into an excessively precooled empty tank; (2) if the agitator is left off while the condensing unit is running; (3) if the tank is accidentally left on manual control and the milk is cooled below its freezing point; (4) if the thermostatic control fails to shut off the compressor; or (5) if the thermostatic control is set too low.

Freezing may cause some destabilization of the milk and when thawed, flakes of curd and butter particles may appear. This is especially true if a high percentage of the milk is frozen.

Summary

1. When properly established, the tank truck method of picking up milk is better and cheaper than the can method.

2. When the dealer completely eliminates can receiving he can realize a significant saving.

3. For the Producers:

Advantages:

(a) Satisfaction of having milk measured, judged and sampled on the farm.

(b) A saving in milk volume of about 1 pound per hundredweight or 4 to 5 cents per hundredweight.

(c) A saving in fat of 0 to about 5 cents per hundredweight.

(d) Reported savings of 2 cents per hundredweight by elimination of cans.

(e) Possibility of receiving a premium.

(f) Possibility of reduction in hauling rates.

(g) Possibility of saving in labor.

(h) Elimination of can handling.

(i) Better quality milk if properly handled.

(j) Possibly more room in the milkhouse, especially for the larger producers.

(k) Highly adaptable to pipe line milkers.

Disadvantages:

(a) High initial outlay for tank.

(b) Not as great a saving in dollars for most of the New York State producers as indicated by many reports.

(c) Freezing in some tanks if improperly operated.

(d) More difficult to cool milk in case of power outage.

(e) May require:

(1) New milkhouse or extensive modification.

(2) Extensive rewiring.

(3) Improvement of farm driveway to handle tanker.

(4) Installation of hot and cold water facilities in milkhouse.

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PRACTICAL SANITARY ASPECTS OF BULK MILK DISPENSING

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Many sanitation problems have accompanied the rapid growth of the bulk dispensing method of serving milk.

This article deals with some of the current problems which have been observed by sanitarians in the field and their practical solution.

Until such time when sanitary equipment standards and timeproven operating and handling procedures are developed, the suggestions here should be of immediate practical value to the many sanitarians who are responsible for milk dispensing operations at the present time.

The number of cafeterias, restaurants, and similar food establishments adopting the bulk dispensing method of serving milk is increasing rapidly. Since this method of milk distribution is still in its infancy—and subject to growing pains—there are many problems to be overcome with respect to sanitation requirements. Fortunately, these problems are not insurmountable and can be overcome by cooperation of all concerned—the dispenser manufacturers, the milk processors, the food establishment operators, and the regulatory agencies.

The bulk milk dispensing system of merchandizing offers some distinct advantages for the dairy industry. In general, it is more economical. Also, most people find milk more palatable when served very cold, and consumers generally obtain it that way from a bulk dispenser. This has been attested by food establishment operators who claim milk sales have been increased after installing a bulk milk dispenser. This being true, bulk milk dispensing is no longer a fad; it is here to stay. It becomes the sanitarian's responsibility to recognize that this revolutionary method of milk distribution appears to be another important advance by the dairy industry in recent years which might well rank with such things as pipe line milkers, permanent pipe lines, cleaning in place, farm holding tanks, tank truck pick-up, and others. Therefore, sanitarians should be interested in understanding the practical aspects of the problems which might be encountered in their daily work.

Because of the rapid development of the bulk system of dispensing milk the answers to all of the many problems, unfortunately, are not readily available. But until such time when sanitary equipment standards and time-proven operating and handling procedures are developed, the suggestions here may be of some immediate practical value to the many sanitarians who are responsible for milk dispensing operations in their areas at the present time.

SANITATION PROBLEMS

In general the sanitation problems of bulk milk dispensing are the same as those of handling milk in any other recognized manner. It is still a matter of using clean utensils kept in good repair, clean handling of both containers and milk, and proper protection of the contents from contamination and adulteration until the milk is consumed.

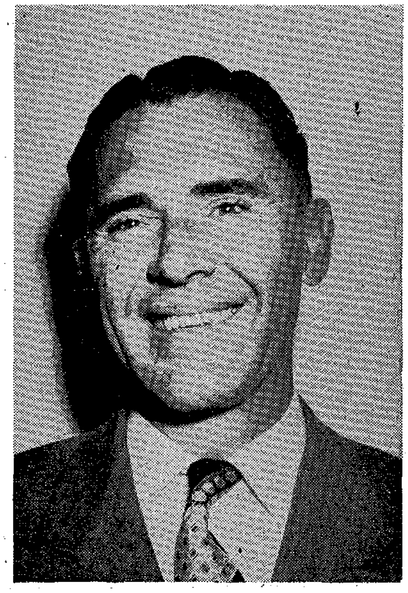
Sanitation problems frequently occur during bulk milk dispensing operations because of number of people and materials involved. Problems occur during this operation as the homogenized milk is processed and placed in a can at the plant, carried by plant personnel to the food establishment, and placed in an approved dispenser in such manner that the personnel of the food establishment can withdraw the contents without disturbing the container.

TYPE OF CAN

The cans used generally are 2½, 5, or 10,-gallon size. At the present time most milk cans in use are of the tinned variety. Few stainless steel cans are in use today. The use of stainless steel, however, should be encouraged for very practical reasons. Close examination of some of the cans in current use reveal that the cans have been subjected to severe abuse. From a sanitation point of view most cans do not compare well with glass bottles or paper cartons used for distributing the final pasteurized product.

In most food establishments a greater number of cans of milk are delivered than may be placed in the dispenser. The extra full cans of milk usually are stored in an adjoining walk-in type refrigerator. When the cans in the dispenser are replaced, the empty cans are held at room temperature until they are picked up later by the person who delivered the milk. During this time the cans are held at temperatures favorable for acid-producing organisms to grow readily in the small amount of milk that remains in the can. Since acids attack the tinned metal cans we may assume the cans will not remain in a suitable sanitary condition for very long.

One solution to this problem has been to keep the cans refrigerated at the food establishment until they



Mr. Samuel O. Noles is milk consultant with the Florida State Board of Health. He graduated from the University of Florida, majoring in dairy products manufacturing. He received his M.P.H. from the School of Public Health, University of Minnesota. He has done public health work in municipal and state levels and was in meat and dairy inspections for four years in the U. S. Army during the World War II. He is a member of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, National Association of Sanitarians, Florida Public Health Association, and other organizations.

*Submitted February 10, 1954.

Rinsing Returned Cans.

are picked up. Immediately upon return to the plant the cans should be thoroughly washed. Also, each can should be checked carefully while being washed, eliminating from use those cans which have broken seams or rust spots. As these cans are replaced with those of the stainless steel type, the problem will be significantly reduced. To hasten the solution to this problem it may be well to consider the possibility of condemning any unsuitable types of cans for bulk milk dispensing, including tinned cans.

Washing of Cans.

Cleaning and Sanitizing the Can

When cans are to be used the next day after return to the plant, they should be re-washed and sanitized just prior to use. Final sanitizing should be done just before the cans are filled with milk. But the question is, what method should be used for washing and sanitizing?

Attempts to clean and sanitize cans in conventional rotary or straight-away can washers have proven unsatisfactory. Adequate cleaning and removal of soil is not always obtained. Such cans cannot be sanitized properly. Also, the cans which are to be filled with pasteurized milk might be washed in can washers previously used for cans which contained raw milk.

A hand cleaning and sanitizing method which has been found satisfactory for both cans and lids is as follows: (1) Thoroughly rinse the cans with tap water. (2) Hand-brush in sink of warm water containing a good cleaner, or use a mechanical-powered can brush which is preferred for hard-to-clean cans. (3) Rinse in hot water in a second sink. (4) Sanitize in a third sink with a suitable sanitizing agent equivalent in bactericidal action to a solution containing not less than 100 ppm available chlorine.

The nipple on the bottom of the can must be thoroughly brushed with a proper size brush. A further precaution is to have a steam jet arrangement at the end of the third sink for one-minute steaming of each can and lid. To insure adequate steaming a rotary hand valve is recommended instead of a foot-pedal valve which might tend to influence the operator to cut short the length of time of the steaming operation. Thorough steaming is excellent insurance for complete sanitization.

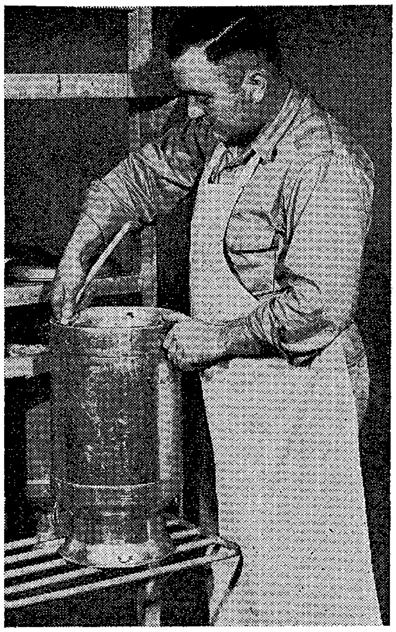
Rolling Can Rack

The plant engineer can easily fabricate a useful can rack from galvanized pipe. The size will depend upon the number of cans, and the width and height of doorways. The rack may be mounted on wheels for easy moving. As soon as the returned cans are washed they may be inverted on the rack for draining and storage. The rack of cans may be rolled to the various stations as required for washing, storage, re-washing, sanitizing, and filling. A strong shelf, 18 inches from the floor, may be mounted on one end of the rack to be used later for holding cans during the filling operation.

Attaching the Rubber Tubes

The rubber tubes through which the milk is dispensed should be cut with a blade having a sharp cutting edge which has been carefully sanitized. For cutting, the tube should be placed on a metal table which has been recently sanitized. The glacine wrapper on the dispensing tube should be allowed to

Sanitization of Cans.



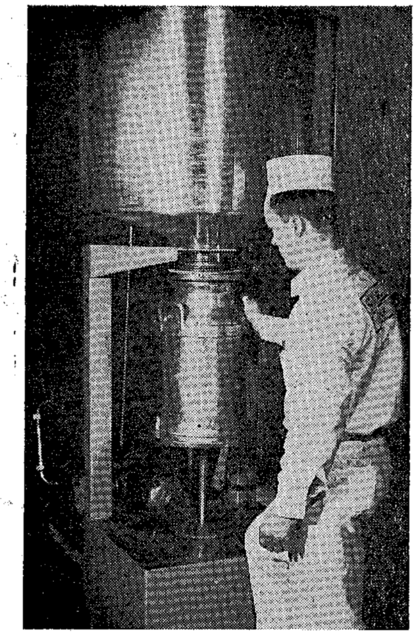
Fitting of Tubes.

remain intact on each of the tube halves. Immediately after the can is sanitized the rubber tube should be placed on the nipple of the can and secure in the clamp on the bottom of the can. The can then may be set down on the can-holding shelf of the can rack. Place the sanitized lid on the can to await being filled.

FILLING THE CANS

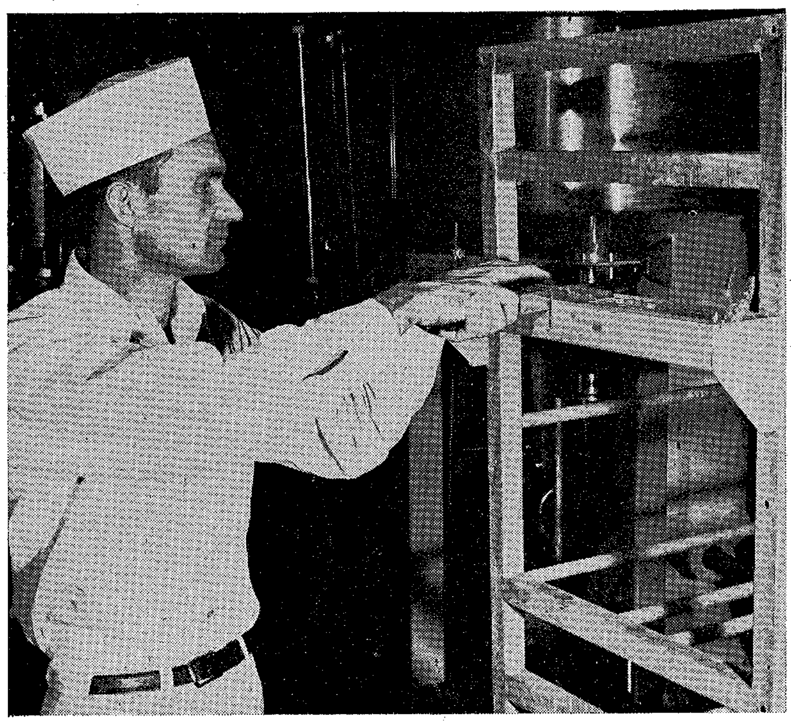
There is greater variation in methods of filling cans than in any other phase of the entire operation. The filling of these cans—being a hand operation—is a departure from the usually accepted and approved practices considered necessary for complete protection of pasteurized milk. Possibly it is a concession made by regulatory officials for lack of anything better. Every possible precaution should be observed during the filling operation.

Any method which exposes the milk to possible contamination should be avoided. Cans should not be filled by lifting them up to the nipple leading out of the trough from cooler boards. They should not be filled by using badly pitted aluminum releaser pipes placed on a valve of the bottle filler. They should not be partially filled with a short nipple, followed by dipping off the foam, and then completing the filling using a pitcher or pail of some type. Filling several cans at a time and permitting them to sit open until the foam is dipped off or settles and then refilling them should be avoided. Such careless methods of filling cans do not afford the maximum protection which should be achieved.



Filling of Cans.

Some plants are using a procedure which affords about as much protection as possible with the hand-filling method. In this procedure a valve with the elongated can-filling nipple is used which reaches to the bottom of the can. Such arrangement reduces foaming to a minimum and permits complete filling at one time. A plastic or stainless steel drip-diverting apron is used on the valve. Such apron completely covers the top of the can and protects the milk from drippage and foreign materials. This apron is located on the elongated nipple not more than four inches above the top of the can during the filling operation. As soon as the can is filled, the nipple is raised and the can moved to one side of the can shelf, which is large enough to hold two cans. The can is covered immediately with a parchment and the lid is pressed on tightly. Be sure the parchment paper used to cover the top of the can has a hole approximately one-eighth inch in diameter in the center. Such parchment papers can be purchased with the hole already punched in them. A hole is necessary to permit air replacement of liquid as the milk is drawn out of the dispenser. Without a hole in the parchment the milk may not flow out of the tube satisfactorily.



Cutting of Tubes.

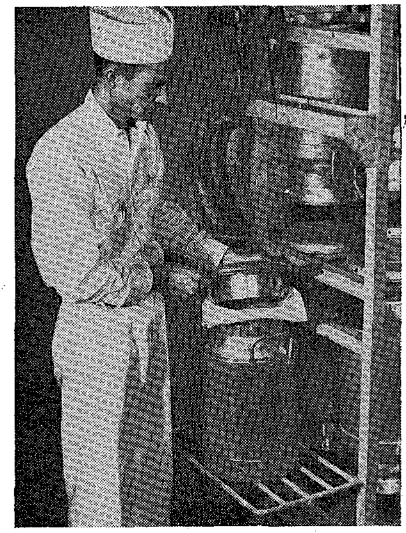
STORAGE AND HANDLING

After the cans are completely filled they should be placed immediately in a refrigerator and kept below 40° F until placed in the dispenser. Plant and food establishment cold-room temperatures should be checked frequently to insure that they are being maintained at 40° F or lower. Dispenser temperatures should be set at 36° to 38° F. Each time the can is set down, in the plant refrigerator, on the truck, in the refrigerator at the food establishment, and in the dispenser itself, the can should always be placed on a clean surface. This is important in preventing the contamination when the dispensing tube is placed in position for use in the dispenser.

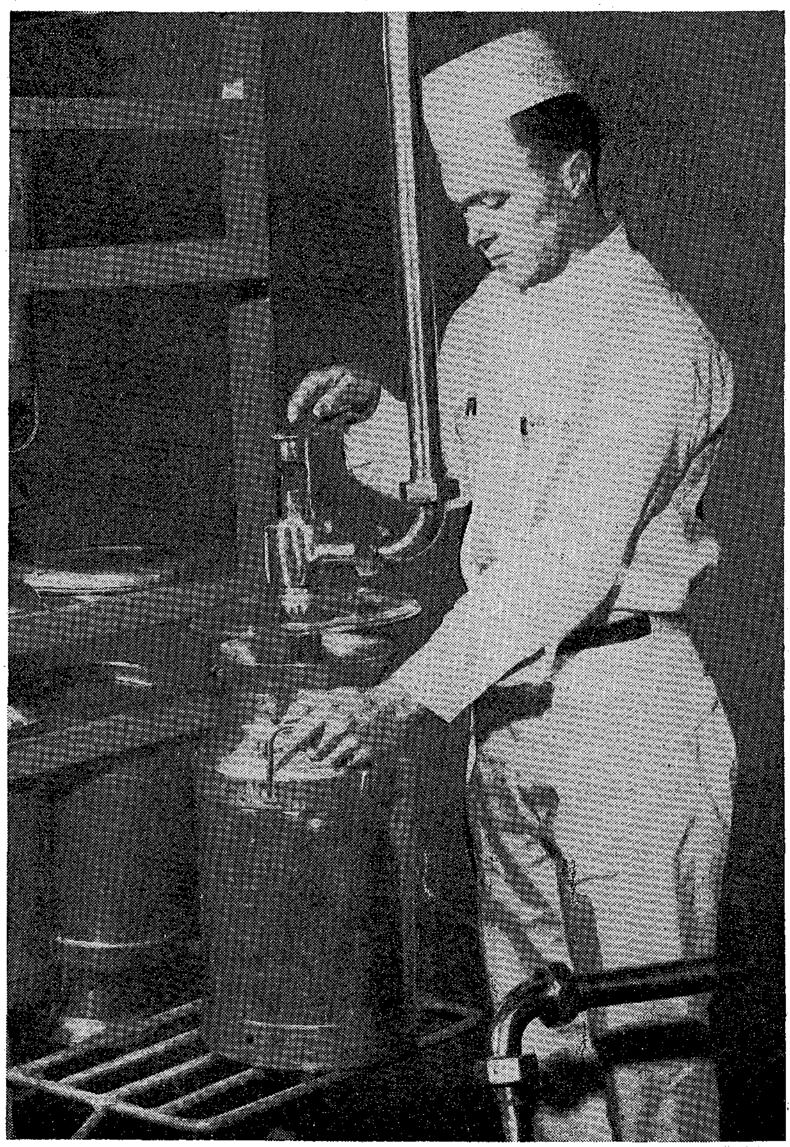
SEALING THE CAN

Each can of milk should be sealed with two wire seals on opposite sides of the can lid before leaving the plant. Sanitarians are advised to reject any milk found in a can if either seal has been broken. This is necessary for the protection of both the dairy operator and the consumer. Generally operators of food establishments would not tamper with the contents of these cans of milk. But at least one case has been observed in which an operator was mixing homogenized milk and reconstituted nonfat milk together which was being sold as whole milk. So it seems essential that the cans are sealed at the plant and remain sealed until returned to the plant.

A tag should be placed on each can bearing the name of the processor, identification of the contents, and date the milk was placed in the can. The milk should be completely used within four days after the date on the tag or should be removed from the dispenser. Dairy plant operators should avoid delivery of too much milk to a given establishment at one time. The use of dispensers should be permitted only in establishments which handle sufficient volume of milk to warrant the use of a dispenser.



Sealing of Cans.



Filling of Cans (Continued).

DISPENSING PRECAUTIONS

There are precautions to be observed in the dispensing of the milk at the food establishment. Employees should be instructed thoroughly on how to avoid contamination of the tube with their fingers. The dispensing tube should be firmly pulled through the valve, after which the valve should be seated and lifted several times. This procedure is necessary so that the tube becomes fixed in the proper position and will not later tend to draw back into the valve. The tube should be cut with a sharp cutting edge of a clean cutting instrument. A good procedure is to keep a supply of new razor blades near the dispenser and use a newly unwrapped one each time, discarding after a single using. The end of the tube should be cut off exactly one-fourth inch from the valve. It is not desirable to cut too close to the valve, allowing the milk to come into contact with the valve. On the other hand, if the tube is too long, there is greater possibility of external contamination. Warming on the end of an excessively long tube end may permit microorganism growth. It is claimed that flies

TABLE 1—INFLUENCE OF SANITARY PRACTICES ON THE PLATE COUNTS OF BULK DISPENSED MILK

	Poor sanitation practices		Good sanitation practices	
Sample No.	Standard plate count per ml	Coliform per ml	Standard plate count per ml	Coliform per ml
1	6,300	0	4,200	0
2	38,000	0	<3,000	0
3	64,000	0	<3,000	0
4	68,000	200	<3,000	0

will not land on a cold tube but will alight on a tube which has been permitted to become warm.

Manufacturers of dispensers would do well to redesign dispenser valves with a protective shield over the end of the tube which would automatically move aside as the milk is withdrawn. After an empty can is removed from the dispenser the inside of the cabinet and the dispensing valve should be cleaned and sanitized before the next can of milk is placed into the cabinet.

A recent investigation indicates the value of careful consideration of the above details by food establishments. It was observed that one food establishment was more careful about its care and attention to sanitation details than was the other. The 5-gallon cans of milk being delivered to the two establishments were from the same processor. Laboratory samples were collected from both establishments on the same days, and the cans had the same date tags. In table 1 are listed the bacteriological results obtained during a two-week period.

SUMMARY

Careful consideration of dispenser manufacturers, milk processors, and food establishment operators is needed to solve the problems which might occur through the use of bulk milk dispensers for the distribution of milk. Each has a specific responsibility to put into practice the best known materials and methods considered essential for the sanitary handling of milk, and to comply with all known regulations, requirements, and accepted procedures. The sanitarian's responsibility is to educate, encourage, execute, and enforce suitable sanitary methods and procedures that will promote public health for the safety and welfare of mankind.

COMPARISON OF ESCHERICHA COLI

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OAKITE PUBLISHES MAINTENANCE CLEANING GUIDE

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THE TEMPERATURE VARIATION OF THE SPECIFIC GRAVITY OF RECONSTITUTED SKIM MILK.*

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The specific gravity of R S M at various concentrations and temperatures has been studied. A general formula correlating the results has been derived:
$L = (4.259 - 0.00113t - 0.000050t^2)\,TS - (1.249 + 0.0282t + 0.0046t^2)$
Temperature correction values for various concentrations as well as simple routine methods for the estimation of total solids content of R S M are described.

INTRODUCTION

Densimetric methods are widely used in the food industry for estimating the concentration of dissolved substances in solution[5]. In order to apply the same method to the estimation of total solids (T S) content in reconstituted skim milk (R S M), its specific gravity has recently been studied in this laboratory[2]. Since this study was made at one constant temperature only (15.5° C), data for the temperature correction had to be provided before the method could be put into general use. The present paper deals therefore with the temperature variation of the specific gravity of R S M of 7-30% T S, in the range of 10°-40°C., which is the range generally encountered in dairies. For measurements outside this range, the temperature correction values may be estimated by extrapolating the results presented in this paper.

Experimental

The experimental methods were essentially the same as previously described[2], with one important change. Previously, the T S percentage was calculated from the amount of skim milk powder dissolved and from the specific gravity of the solution. In the present work, T S were determined by drying at 98-100°C., according to the method of A.O.A.C.[1]. A slight modification was necessary, however, since most of the solutions analysed were more concentrated than normal fluid milk: smaller quantities of R S M than that recommended by the A.O.A.C. had to be used, so that the final quantity of dry matter would not exceed 300-350 mg. When the weight of dry matter is greater, there are difficulties in drying and the results are less accurate.

Constant temperature water baths accurate to ± 0.1° C. were used.

Commercial spray dried skim milk powders obtained from seven different producers were used for the preparation of the solutions: four of these were tested at all the temperatures; the other three, at 15.5° and 30° C. only.

Measurements were made in duplicate and the means taken. The difference between parallel estimations of specific gravity was usually less than 0.1 L (an accuracy of 1 : 10.000), while for the T S it was less than 0.5% (calculated on dry matter weight).

Specific gravity data are given in lactometer degrees L*, as calculated from the specific gravity relative to water at 15.5° C. The change in volume of the pycnometers at the other temperatures was determined experimentally and taken into account in the calculation of the specific gravity.

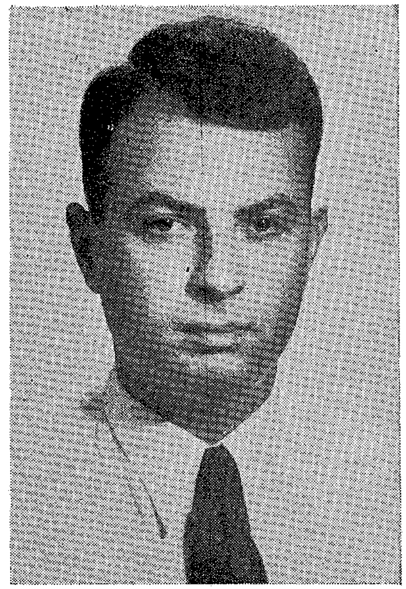
Results and Discussion.

Equations for the "best" lines fitting the data obtained were calculated according to the method of least squares as outlined by Snedecor[6]. These are given in Table 1. The range of T S concentration is 6 – 30% at each temperature.

A single equation relating the specific gravity of R S M to the concentration *and temperature* has been derived from the equations given in Table 1. Here t stands for temperature in ° C.

$$L = (4.259 - 0.00113t - 0.000050t^2)\,TS - (1.249 + 0.0282t + 0.0046t^2).$$

The slight difference between the equations at 15.5° C in this paper, and those in the previous one, is apparently due to the different methods used for T S estimation (see Experimental). We consider the present equations to be more reliable.



Dr. Nathan Sharon was born in 1925. In 1950, he graduated from the Hebrew University, Jerusalem, with M.Sc. degree in biochemistry, and his Ph.D. degree from the same University in 1953. After serving for a year with the Scientific Department, Israeli Ministry of Defense, he entered in 1949 the Dairy Research Laboratory, Agricultural Research Station, Rehovoth. Dr. Sharon published papers on dairy chemistry, reaction of sugars and amino acids, and antibiotics. He is now working in the Department of Biophysics, The Weizmann Institute of Science, Rehovoth, Israel.

While the main source of variation lies in the differences among milk powders used[2], the temperature coefficient for the various powders is fairly constant. This may be clearly seen from Fig. 1, which represents the variations of the difference between specific gravities at 15.5° C. and 30° C. of R S M made from various samples of milk powders.

Fig. 2 represents the variation of specific gravity of R S M with temperature at several constant concentrations, as calculated from the equations of Table 1. Similar curves were obtained for single solutions as well.

While the temperature variation is not linear, for most purposes it may be considered as linear in the range of temperatures studied. The mean temperature correction of L for 1° C. has been calculated and

*This work was carried out under a grant of the Food Division, Ministry of Commerce and Industry, Government of Israel.

*L = 1000 x specific gravity – 1000.

TABLE 1.—EQUATIONS FOR THE RELATION BETWEEN L AND T S AT VARIOUS TEMPERATURES

Temp. ° C	No. of measure-ments	Formula for calculating L	Standard error of L	Formula for calculating T S	Stand-ard error of T S
10	21	4.287TS-2.20	1.21	0.233L+0.54	0.28
15.5	49	4.236TS-2.40	1.19	0.236L+0.60	0.28
20	21	4.221TS-3.68	1.74	0.236L+0.92	0.41
25	21	4.196TS-4.84	0.58	0.238L+1.16	0.14
30	39	4.181TS-6.47	0.43	0.239L+1.11	0.10
35	21	4.152TS-7.86	1.17	0.240L+1.92	0.28
40	21	4.138TS-9.67	1.19	0.241L+2.36	0.29

is given on the right coordinate of Fig. 1.

In practice it is more convenient to have a temperature correction for % T S. This is given in Figure 3.

Usually, however, approximate temperature corrections may be used, as given in Table 2.

TABLE 2.—APPROXIMATE TEMPERATURE CORRECTION VALUES.

Range of L	Correction for 1° C T S	L
up to 55°	0.07%	0.30
55 — 85	0.08%	0.35
85 — 120	0.09%	0.40

Since the reference temperature is 15.5°C., the values presented in Table 2, multiplied by the temperature difference from 15.5° C. must be *added* when measurements are made *above* this temperature, and *subtracted* when measurements are made *below* 15.5° C.

The results presented in this paper may be used in dairies for the routine estimation of total solids of R S M in any one of the following ways:

(1) Specific gravity may be measured with a simple hydrometer, and the T S calculated according to one of the formulas given in Table 1. The appropriate temperature correction can then be made, according to Table 2. One may also use the conversion table of specific gravity into % T S given in the appendix of this paper.

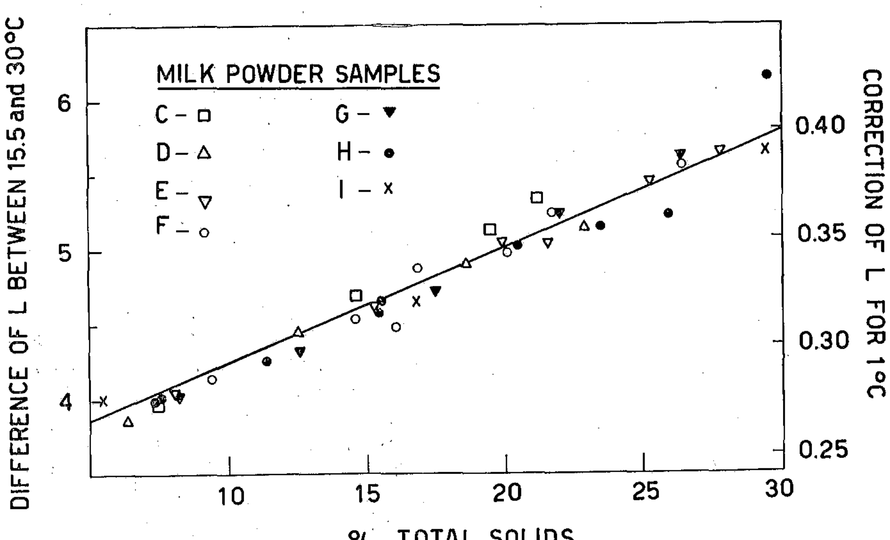


Figure 1.—Change of specific gravity with temperature between 15.5 and 30° C (Scale on left) and 1° C (Scale on right).

(2) A hydrometer especially constructed for the estimation of T S in R S M may be used. This hydrometer reads the % T S *directly*. Fig. 4 shows a drawing of a hydrometer of this kind, which is now being introduced into the dairies in Israel.

After reading the results on this hydrometer, the appropriate temperature correction is made (Fig. 3 or Table 2).

(3) An improved lactometer will include a thermometer at its upper part. This thermometer will be calibrated to give the temperature correction for % T S directly, instead of giving temperature degrees.

In addition to the practical implications of this work, it is of interest to calculate the specific gravity of the T S in solution, as the results given hitherto in literature are based mainly on the limited range of concentrations found in fluid milk. Table 3 gives the apparent specific gravity of T S at several concentrations. Calculations were made according

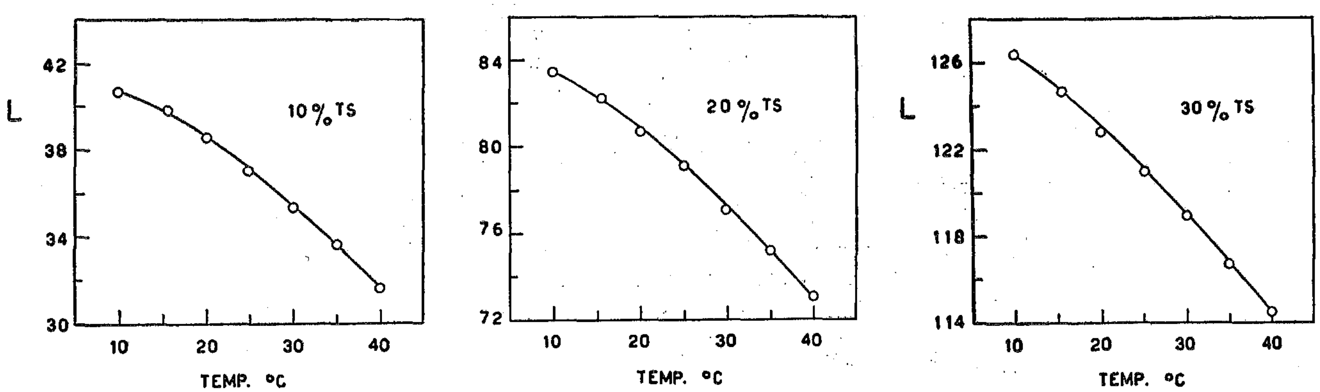


Figure 2.—Temperature variation of specific gravity at 10%, 20% and 30% total solids.

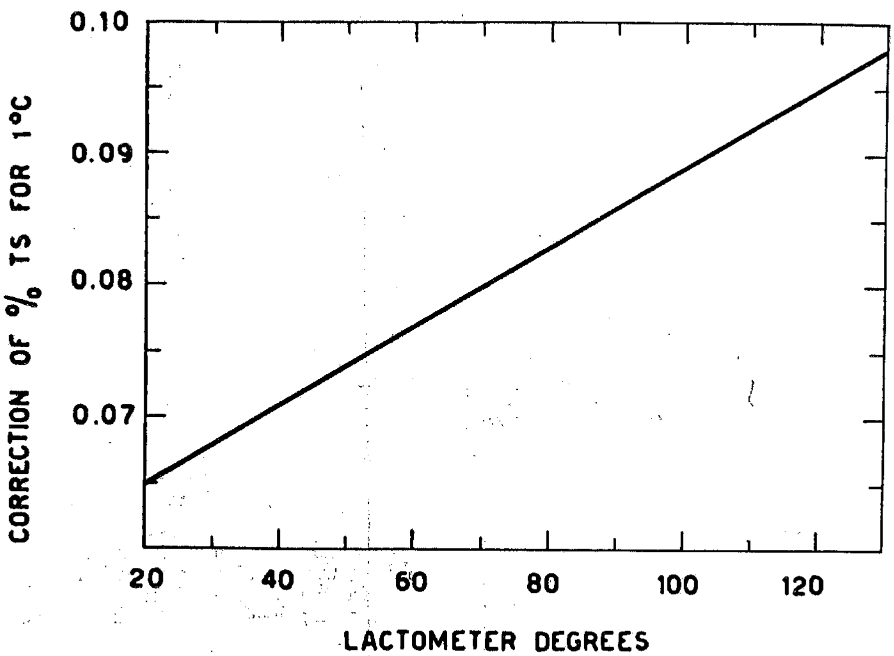


Figure 3.—Temperature correction of % total solids for 1° C at various lactometer degrees.

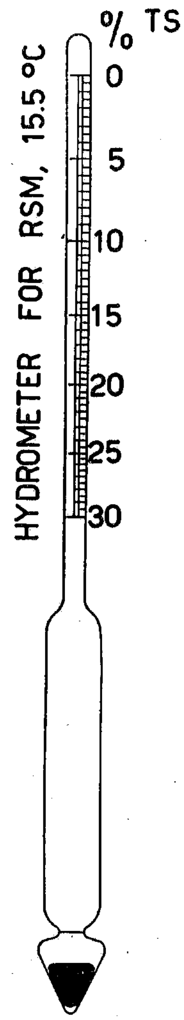


Figure 4.—A hydrometer for estimating total solids percentage in reconstituted skim milk.

to the relation given by Fleischmann[4]. For the case of skim milk a simple transformation of his equation gives:

$$n = \frac{D \times TS}{100 - D\,(100 - TS)}$$

where: n = specific gravity of T S in solution (in this case T S = S N F).

D = specific gravity of R S M

TABLE 3.—APPARENT SPECIFIC GRAVITY OF TOTAL SOLIDS IN SOLUTION AT 15.5° C

Total solids content (% T S)	Specific gravity n
10	1.635
15	1.625
20	1.615
25	1.605
30	1.595

These values agree with the values given in literature[3]. The change of n with concentration is to be expected, since complex solutions such as those of milk powder, do not exhibit an ideal behaviour.

APPENDIX

TABLE FOR CALCULATING TOTAL SOLIDS (TS) OF RECONSTITUTED SKIM MILK FROM SPECIFIC GRAVITY (DEGREES L) AT 15.5° C (60° F).

L	% TS	L	% TS	L	% TS
26	6.74	62	15.23	98	23.73
28	7.21	64	15.70	100	24.20
30	7.68	66	16.18	102	24.67
32	8.15	68	16.65	104	25.14
34	8.62	70	17.12	106	25.62
36	9.10	72	17.59	108	26.09
38	9.57	74	18.06	110	26.56
40	10.04	76	18.54	112	27.03
42	10.51	78	19.01	114	27.50
44	10.98	80	19.48	116	27.98
46	11.46	82	19.95	118	28.45
48	11.93	84	20.42	120	28.92
50	12.40	86	20.90	122	29.39
52	12.87	88	21.37	124	29.86
54	13.34	90	21.84	126	30.34
56	13.82	92	22.31	128	30.81
58	14.29	94	22.78	130	31.28
60	14.76	96	23.26	132	31.75

Temperature corrections to be made according to Table 2 in the paper.

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MILK and FOOD SANITATION

RECOMMENDATIONS ADOPTED BY 1954 NATIONAL CONFERENCE ON TRICHINOSIS

Chicago, Illinois, March 1, 1954

I. Public Health

A. The *recommendations of* 1952 *Conference,* concerning Public Health, are approved with the following additions:

1. Besides the research problems enumerated, research should be undertaken also on the role of rats and other animals in the transmission of trichinosis.

2. Much remains to be learned regarding trichinosis and its scope, and legislatures should be asked for funds for the study and control of this disease. Nevertheless, this Conference feels it is not necessary to postpone vigorous action toward control and possible eradication of trichinosis.

B. *Further recommendations.*

1. The American Medical Association and the Conference of State and Territorial Health Officers are urged to adopt measures to stimulate better reporting of cases of human trichinosis in all areas of the United States.

2. Cooperation should be stimulated between state and local health departments, departments of agriculture and livestock sanitary commissions and corresponding Federal agencies in obtaining enforcement of existing laws requiring the cooking of garbage that is to be fed to hogs. While all but 7 states now have laws or regulations, enforcement of these laws or regulations at present is inadequate.

3. Because of the advantage of having up-to-date information concerning the incidence of trichinosis in man, and in view of a decreased incidence of trichinous infection encountered in swine, the United States Public Health Service is requested to repeat the random survey of human trichinosis carried out by that agency between 1936 and 1941.

II. Animal Health

A. Review of *recommendations of the* 1952 *Conference,* relating to animal health, indicates that much progress has been made to date. (Due credit must be given to organizations and persons primarily concerned with vesicular exanthema in hogs, for adoption of legislation requiring the cooking of garbage that is to be fed to hogs.

1. Instead of only a few states with regulations or legislation concerning the cooking of garbage fed to hogs, today 41 states have such regulations or laws.

2. The recommendation "that the respective states allow the sale of garbage-fed hogs for slaughter only at a federally inspected plant or plant having equivalent inspection," has since been adopted by the Federal government.

3. The recommendation "that no indemnity be paid for losses from animal diseases at piggeries where raw garbage is fed." has since been adopted by the Federal government and by most states.

4. Research on the comparative value of feeding hogs cooked garbage and raw garbage has been undertaken at Iowa State College, University of California, and by the Los Angeles Livestock Sanitary Board.

B. *Further recommendations.*

1. Swine diseases transmitted by garbage include animal vesicular diseases, hog cholera, brucellosis, salmonellosis, tuberculosis and trichinosis. The Conference reiterates its 1952 statement in urging all states to adopt regulations requiring the cooking of garbage and offal that is to be fed ot hogs, with the exception of states that may wish to prohibit the feeding of any garbage.

2. States that have adopted laws relating to the cooking of garbage, before granting licenses to cook garbage, should require all piggeries to have approved cooking equipment which shall be demonstrated by the piggeries to be efficient. Licensure should be granted annually and should be dependent on compliance with sanitary regulations. The location and operation of all piggeries should comply with all local and state public health laws, and all piggeries should be subject to public health inspections regarding health matters, including control of rodents, flies, drainage, odors and noise.

3. State Colleges are urged to give short courses for garbage feeders to demonstrate standards of construction, operations and maintenance of equipment and facilities. These courses should acquaint farmers with the dangers of feeding raw garbage and the benefits to be derived from feeding cooked garbage and offal. It is also urged that conferences be held with County Agents to acquaint them with the principles of garbage feeding and with its dangers and benefits.

4. The Federal government is urged to require that all garbage removed from Federal installations be cooked adequately before being fed to hogs.

5. The Conference recommends the prohibition of any type of garbage feeding in those states or areas of the country in which garbage feeding has not been made a general practice.

6. Research on animal serology should be pursued in an effort to obtain an adequate diagnostic method for trichinosis.

7. A study of the garbage-feeding laws of various states should be made by the Continuing Committee on Trichinosis.

III. Legislation

1. Inasmuch as 41 states have already adopted legislation regarding the proper cooking of garbage fed to hogs, the remaining states (Arkansas, California, New Jersey, New Mexico, North Dakota, Rhode Island and Vermont), as well as any of the 41 states whose present laws or regulations require strengthening, should enact appropriate legislation requiring that all garbage or kitchen waste be treated by heating, at least to 212° F for 30 minutes, before it is fed to swine, or should adopt some other measure that will be equally effective in the control of livestock disease and thereby protect public health.

2. State legislation relative to the cooking of garbage fed to hogs should be strictly enforced with an adequate staff of field and administrative personnel.

3. All states that have not already done so, should enact laws, patterned after the regulations of the Meat Inspection Service of the U.S. Department of Agriculture, which will require meat processors to carry out proper processing procedures in the manufacture of pork products customarily eaten without cooking.

4. Legislation should be enacted by the states and for municipalities defining "hamburger," "ground beef," and similar comminuted meat products to prohibit the inclusion of any quantity of pork in such products.

5. Legislation should be enacted requiring every retail store selling meat or meat products to post one or more signs reading "Cook pork thoroughly" or bearing equivalent language.

6. Legislation should be enacted prohibiting the grinding or comminuting of pork in the same equipment used for comminuting beef lamb or other meats.

IV. Education

1. Efforts should be intensified to achieve the recommendations relating to education, adopted by the 1952 Conference.

2. Efforts should be made to reach additional target audiences in broad and new areas in the general population, including school children, homemakers, organizations and groups of men, women's clubs, women's publications, magazines and trade publications, church groups, restaurant operators, and cooks and other food handlers, especially in small restaurants, restaurant systems and cooking schools.

3. It is urged that booklets of instruction on proper cooking of pork be issued with licenses to food handlers and restaurants, and be distributed also by food inspectors of local health departments. In this program, cooperation should be sought from the National Restaurant Association, hotel associations and caterors' associations.

4. It is recommended that an article be prepared for Today's Health, a publication of the American Medical Association, on the proper handling and preparation of pork, and that reprints be made available at cost, through the help of the Association of State and Territorial Health Officers, the U. S. Public Health Service, and local health departments.

5. Placards for butcher shops, reading "Cook pork thoroughly," should be prepared and distributed by U. S. Public Health Service, U. S. Department of Agriculture and/or State Health Departments.

6. It is urged that the Health Education Section of the American Public Health Association and the Association of State and Territorial Health Officers, inform local health officers regarding their responsibilities in control of trichinosis.

Continued on Page 229

AN ECONOMIC ANALYSIS OF THE BULK MILK COLLECTION SYSTEM*

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Greater investments in farm storage and refrigeration equipment are necessary for farmer participation in a bulk milk procurement program. Economies in operational costs are effected in the collection and receiving point procedures which more than offset the relatively greater costs of farm bulk storage and refrigeration. Marked economies may be secured by increasing the relative utilization of the capacity of the storage facilities. Receiving room costs per hundredweight of milk under a 100 percent bulk procurement operation are significantly lower than a 100 percent can system.

Cost efficiencies which may be effected under a bulk milk handling program are closely associated with (a) average daily volume per producer, (b) sound route planning (proper route length and route volume), (c) frequency of collection, and (d) securing a proper technical balance in the equipment necessary to service the route.

Introduction

Bulk handling of milk from farm to receiving point is increasing in importance in all major milk producing areas in the United States. This innovation was initiated and expanded because its proponents believed that (a) it would result in lower milk collection and receiving costs, and (b) a higher quality of milk would be secured and maintained. A prompt and uninterrupted movement of milk from the farm to the city processing plant is essential for the maintenance of high quality standards. This system of moving this high quality, perishable food product requires costly inputs of labor, equipment, and other operational costs. Therefore, any innovation that promises lower milk-handling costs becomes a matter of primary concern to producers and handlers of milk.

Since the introduction of the bulk milk procurement system, there has been an increasing demand by milk industry people for comparative cost information (bulk vs. traditional 10-gallon cans). The important questions are:

1. Will the adoption of the bulk procurement system result in decreased operational costs?

If the answer to the above is in the affirmative, then

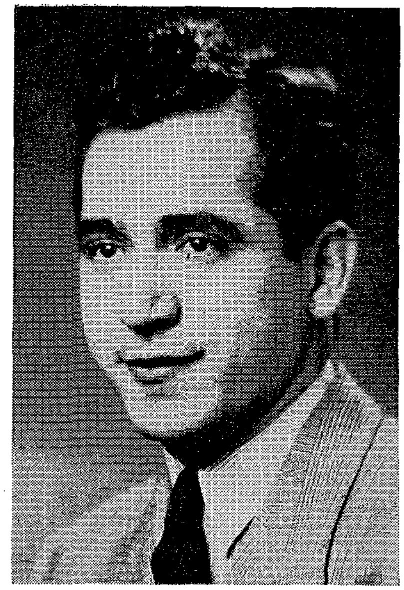
2. What combinations of inputs of labor, equipment, power, and route lay-out will result in the lowest practical cost?

It is expected that some variations from the cost rates employed in this study will exist in other areas. However, the physical and economic relationships are the important considerations. The costs presented in this paper are those that existed in western Washington during 1952. In this area, the climate is relatively mild throughout the year and the county roads (farm to market) are at least macadamized, but in all cases the roadbed is structurally strong. When the cost rates applicable in other areas are substituted for those employed in this study, the general cost relationships between the bulk and can systems of milk procurement should be similar to those found in western Washington.

Methodology

Cost data were secured from milk handlers employing both bulk and can systems of milk procurement, and from dairy equipment firms operating in the area. Time requirement data for both methods of milk collection were obtained by accompanying the drivers on their routes and timing their operations with a stop-watch. Other data essential to the cost analysis of both systems were secured at the same time.

Most of the cost relationships were developed by using the budgetary approach. Collection cost components were categorized as (a) farm storage and refrigeration, (b) truck operation, (c) receiving room, and (d) route labor. These costs were determined for specifically defined route conditions, such as (a) the number of shippers served on a particular route, (b) volume per shipper and total volume of milk to be collected, (c) the distance to be traveled in servicing the route, and (d) frequency of milk collection for any particular milk procurement route.



E. L. Baum received the B.S. degree in Agriculture from Cornell University in 1942. During World War II he served as a combat infantry officer. He received the M.S. and Ph.D. degrees from Iowa State College, June 1947, and March 1949, respectively. Work conducted at Iowa State College emphasized dairy marketing and pricing problems. He has been a staff member of the Department of Agricultural Economics at the State College of Washington since July 1949. Since that time, he has been in charge of research in dairy economics. A major share of their efforts have been in the economic evaluation of technological innovations in the dairy industry which are designed to effect major economies in procurement, processing and distribution of milk and milk products.

D. E. Pauls, Supervisor of Field Studies, has been on the staff of the Department of Agricultural Economics since 1948. He has participated in various production and marketing projects in the dairy field.

Interest charges on the unamortized portion of investment in equipment were computed at the rate of 4½ percent. Charges appropriate to the area for taxes, licenses, and insurance were also included in the cost analyses.

The hourly wage rate paid to drivers of milk pick-up trucks and receiving room workers was $1.74 per hour. An additional amount was added to this rate since, ordinarily, a driver receives a two weeks' vacation with pay per year during which a relief hauler must be hired. Consequently an adjusted wage rate of $1.81 per hour was used to

*Scientific Paper No. 1232, Washington Agricultural Experiment Stations, Pullman. Project No. 965.

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TABLE 1.—PURCHASE AND INSTALLATION COSTS, INVESTMENT PER HUNDREDWEIGHT OF CAPACITY, AND DAILY FIXED COSTS OF VARIOUS SIZES OF FARM STORAGE AND REFRIGERATION UNITS, WESTERN WASHINGTON[a]/

Capacity of farm storage tank	Total cost	Cost of refrigeration unit	Cost of storage tank	Investment per cwt. of capacity	Daily depreciation, interest, insurance, and repair costs
gals.	dollars	dollars	dollars	dollars	cents
100	1873	401	1472	217.79	47.5
150	2070	433	1637	160.47	52.4
200	2190	516	1674	127.33	56.0
300	2502	574	1928	96.98	63.8
400	2845	638	2207	82.68	72.5
500	3112	668	2444	74.33	79.9
600	3421	764	2657	66.28	88.2
700	3650	809	2841	60.58	94.0
800	4288	848	3440	62.33	109.3
900	4605	915	3690	59.54	116.2
1000	4853	915	3938	56.40	124.4
1500	5929	1197	4732	45.93	149.7
2000	7019	1197	5822	40.81	181.7

[a]/Costs based on data secured from Interstate Dairy Supplies, Inc., Seattle, Washington; Creamery Package Manufacturing Co., Seattle; Monroe Dairy Machinery Co., Inc., Seattle; Western Dairy Equipment Co. Inc., Portland, Oregon; Rathke and Co., Seattle; Professor W. H. Johnson, State College of Washington, Pullman.

allow for the additional cost. No allowances were made for overtime.

FARM STORAGE AND REFRIGERATION COSTS

Bulk Procurement Program

The equipment on a dairy farm essential in a bulk milk procurement system consists of a storage tank and a refrigeration unit. These form an integrated unit for the purpose of cooling and holding the milk at the desired temperature.

The depreciation rate of the storage tanks is based on an expected life span of 20 years. No allowance was made for repairs since, barring accidents, there were no indications that repairs would be needed. A 20-year life expectancy also served as the basis for depreciating the refrigeration unit. The 20-year life span is, however, conditioned by repair and overhaul charges amounting to a yearly average of 3½ percent of the original purchase and installation price.

Investments in farm storage tanks of various capacities, refrigeration units, and their installation costs are presented in table 1. If milk is collected on alternate days (as practiced in most areas where the bulk collection system is in use), the costs will be those of units twice as large as required for a daily collection program.

Can Procurement Program

The equipment necessary for the refrigeration and storage in a can procurement system consists of a storage cabinet and a refrigeration unit forming, together with the cans, an intergrated storage and refrigeration unit.

Except for the original purchase and installation costs, the rates for life expectancy and for repairs charged to can cabinets and refrieration units were identical with those charged to tank units. These are presented in table 2. The cost of the cans on a unit basis and on a hundredweight of capacity basis are presented in table 3. Where double sets of cans are used, the costs will be twice the amount given.

TABLE 2.—PURCHASE AND INSTALLATION COSTS, INVESTMENT PER HUNDREDWEIGHT OF CAPACITY, AND DAILY FIXED COSTS OF VARIOUS SIZES OF CAN STORAGE CABINETS AND REFRIGERATION UNITS, WESTERN WASHINGTON, 1952[a]/

Capacity of can storage cabinet	Total cost	Cost of refrigeration unit	Cost of storage cabinet	Investment per cwt. of capacity	Daily depreciation, interest, insurance, and repair costs
gallons	dollars	dollars	dollars	dollars	cents
30	418	233	185	161.97	12.0
40	438	244	194	127.33	12.6
60	509	284	225	98.61	14.6
80	595	332	263	86.51	17.1
120	666	371	295	64.54	19.1
160	776	427	349	56.40	22.2
240	886	487	399	42.91	25.4

[a]/Costs based on data secured from Creamery Package Manufacturing Co., Seattle, Washington; International Harvester Co., Seattle; Standifur Refrigeration Service, Pullman; Monroe Dairy Machinery Co., Inc., Seattle; and Professor W. H. Johnson, State College of Washington, Pullman.

TABLE 3.—ANNUAL CAN COST PER 10 GALLONS AND PER HUNDREDWEIGHT OF MILK, WESTERN WASHINGTON, 1952[a]/

Item of cost	Cost per 10 gallons	Cost per hundredweight
	dollars	dollars
Repairs	0.92	1.07
Depreciation	0.90	1.05
Interest	0.20	0.23
Taxes and insurance	0.20	0.23
Total	2.22	2.58

[a]/Costs based on data secured from Whatcom, Skagit, Snohomish, Dungeness-Sequim Dairymen's Associations in Washington; and Dairy Cooperative Association, Portland, Oregon.

FARM STORAGE AND REFRIGERATION COSTS AT VARIOUS LEVELS OF CAPACITY UTILIZATION

The costs of storing and maintaining milk at proper temperatures in the tank and can on the farm for various unit sizes and levels of capacity utilization are presented in tables 4 and 5. Can storage and refrigeration costs at lower levels of capacity are appreciably lower than comparable farm tank costs.

TABLE 4.—TANK STORAGE AND REFRIGERATION COSTS PER HUNDREDWEIGHT OF MILK FOR VARIOUS SIZES OF UNITS AT DIFFERENT LEVELS OF CAPACITY UTILIZATION, WESTERN WASHINGTON, 1952[a]/

Size of storage and refrigeration unit	Level of capacity utilization (percent) 25	37.5	50	75	100
gallons	cents	cents	cents	cents	cents
100	44.8	30.1	22.7	15.4	11.6
150	33.1	22.3	16.8	11.4	8.7
200	26.6	18.0	13.6	9.3	7.1
300	20.4	13.8	10.5	7.2	5.6
400	17.5	11.8	9.0	6.2	4.8
500	15.5	10.5	8.0	5.6	4.3
600	14.3	9.7	7.4	5.2	4.0
700	13.1	8.9	6.8	4.8	3.7
800	13.3	9.1	7.0	4.8	3.8
900	12.6	8.6	6.6	4.6	3.6
1000	12.2	8.3	6.4	4.5	3.5
1500	9.9	6.8	5.2	3.7	2.9
2000	9.1	6.2	4.8	3.4	2.7

[a]/Adjusted to alternate day pick-up of milk at the farm.

Partial use of milk refrigeration storage facilities on the farm is associated with higher costs per hundredweight of milk. Marked economies are secured by greater utilization of given capacities for both types of farm refrigerated storage facilities. If farm facilities are expected to be used at or near 100 percent of capacity, and an increase in milk production is highly probable, it would be less costly in the long run to install the next larger-sized storage unit than is needed at the time of installation.

TOTAL TRUCK OPERATING COSTS PER ROUTE MILE

Total truck operating costs, like the costs of farm storage and refrigeration equipment, were determined after an analysis of each component making up the total. These costs, presented in table 6, amount to 14.93 cents per mile for the 1500-gallon tank truck and 14.09 cents for the can pick-up truck. The two items, *fuel and lubricants* and *garage and repairs*, represent the highest components of total costs. Any efficiencies resulting in lesser route mileage and lower repair and garage needs would materially reduce procurement costs. Careful route planning and proper vehicle care cannot be overstressed.

RECEIVING ROOM OPERATION COSTS

Contrary to a frequently voiced opinion, receiving room costs are not eliminated (or nearly so) under a bulk collection program. If receiving room costs are considered as those outlays necessary for receiving milk at a plant, the experiences of the handlers in western Washington indicate that bulk receiving room costs run 38.4 percent of a can operation. The larger portion of the reduction in costs is due to the elimination of the can weighing and washing equipment. With the elimination of this equipment, other costs associated with its use (labor, power, cleaning supplies, taxes, etc.) are either eliminated or reduced. On the other hand, much of the labor normally performed in a can receiving operation is transferred to the farm and to the collection route and must be considered when comparing the costs of the two systems. Taking samples, determining weight of milk from depth in farm tank, washing farm tanks and truck tanks require expenditures for labor and material. Administration and clerical costs, field expense, and general overhead apply in varying degrees to both systems. The costs of both can and tank receiving room operations thus considered are presented in table 7.

COLLECTION ROUTE TIME REQUIREMENTS

Driving Time

The time in which the driver of a milk collection truck can travel the length of his route depends on the distance between shippers, rate of truck speed, physical condition of the road, and traffic density. A certain amount of time is lost getting a truck under way, making turns, and slowing down for stops. The relationship between distance per shipper and rate of truck speed (miles per hour) is of the modified exponential form; i.e., truck speed increases at a decreasing rate as the distance between milk shippers increases. Variable driving speeds associated with variable distances between shippers were used throughout this study in computing total route collection time requirements.

Loading Time—Bulk System

The time required to load milk from farm tanks to collection tanks on trucks falls into two categories. The first, composed of such "fixed" operations as determining weight of milk, agitating, sample taking, making and unmaking connections, etc., required an average of 8.5 minutes (variation between 5.8 to

12.9 minutes). The second category, variable time, is the time the pump is in operation transferring the milk from the farm tank to the truck tank. These pumping rates averaged 488 pounds per minute (variation between 412 to 555 pounds per minute).

Loading Time — Can System

The time required to load cans is associated mainly with the number of cans collected on the route. Approximately 82 percent of the variance in total loading time (unloading empty cans and loading full cans) was associated with the number of cans handled. The average loading time (including incidental operations and unloading of empty cans) averaged 0.38 minute per can. The fixed time, which consists of getting off and on the truck, averaged approximately 0.7 minute per stop.

Unloading Time — Bulk System

The time required for unloading at the plant averaged approximately 20 minutes in preparation for unloading each load of milk (two or three per day), and 90 minutes for washing, sterilizing the tank, disassembling and assembling the pump for each day's operation. The average rate of the flow of milk from the tank truck to the receiving vat was 517 pounds per minute.

Unloading Time — Can System

Similar observations on can unloading time indicated an average waiting period of 15 minutes before unloading and an average of 0.24 minute each can unloaded and reloaded empty for return to the producer.

EFFECT OF VARIATIONS IN ROUTE CONDITIONS ON TOTAL COSTS PER HUNDREDWEIGHT — 1500-GALLON BULK TRUCK VS. CAN PICK-UP TRUCK SYSTEM

The cost relationships among the factors developed in this report are presented below. The route specifications indicated are used to show their effect on total costs per hundredweight of milk handled (farm storage and refrigeration, truck operation, receiving room, and route labor).

Effect of Variations in Average Daily Volume Per Shipper

Costs per hundredweight of milk under the daily can collection operation are lower than costs under the alternate day tank collection system when the daily volume per shipper is less than the "break-even" point of 140 pounds. Beyond this point, total costs per hundredweight of milk under the tank collection system are lower. These costs decrease (throughout the range studied) as the daily volume per shipper increases and the number of shippers decreases (fig. 1). At an average daily volume of 200 pounds per shipper, the costs per hundredweight of milk are 51.5 and 46.7 cents for the daily can and alternate day tank collection systems. At an average daily volume of 500 pounds per shipper, these costs are 45.0 and 28.9 cents, respectively.

The relatively lower handling costs per hundredweight of milk associated with the alternate day tank collection system result from:

a. Lower truck operating costs, since the tank truck will travel only one-half the distance of the can truck to secure equal volumes of milk.

b. The lower receiving room costs associated with a tank system.

c. Lower route labor costs per hundredweight of milk, since driving, loading, and unloading time are reduced sufficiently to result in lower total time for the route.

d. The fact that although farm storage and refrigeration costs under the tank system are higher, they do not exceed those of the can system sufficiently to raise the total tank system handling costs

TABLE 5.—CAN STORAGE AND REFRIGERATION COSTS PER HUNDREDWEIGHT OF MILK, VARIOUS UNIT SIZES AND LEVELS OF CAPACITY UTILIZATION, WESTERN WASHINGTON, 1952

Size of storage and refrigeration unit	Level of capacity utilization (percent)				
	25	37.5	50	75	100
gallons	cents	cents	cents	cents	cents
30	21.2	15.5	11.8	8.7	6.6
40	16.7	12.2	9.3	6.9	5.7
60	13.8	10.0	7.7	5.9	4.8
80	11.9	8.6	7.0	5.3	4.5
120	9.4	7.1	5.7	4.4	3.8
160	8.4	6.3	5.2	4.1	3.6
240	6.9	5.3	4.5	3.6	3.2

TABLE 6.—SUMMARY OF TRUCK OPERATING COSTS PER ROUTE-MILE, WESTERN WASHINGTON, 1952[a]

Item of cost	1,500-Gallon tank truck		Can pick-up (van type) truck	
	cents	percent	cents	percent
Fuel and lubricants	5.10	34.16	5.22	37.05
Tires	1.51	10.11	1.49	10.58
Depreciation	2.52	16.88	1.88	13.34
Interest	0.64	4.29	0.41	2.91
Garage and repairs	4.08	27.33	4.29	30.45
Insurance	0.30	2.01	0.25	1.77
Taxes and licenses	0.78	5.22	0.55	3.90
Total	14.93	100.00	14.09	100.00

[a]/On the basis of 23,725 route-miles per year.

TABLE 7.—ANNUAL AVERAGE RECEIVING ROOM COSTS PER HUNDREDWEIGHT OF MILK, CAN VS. TANK, BY ITEM OF COST, WESTERN WASHINGTON, 1952

Item of cost	Can operation		Tank operation	
	cents	percent	cents	percent
Field expense	1.67	7.23	1.45	16.35
Labor	8.59	37.19	1.33	14.99
Factory expense	3.97	17.19	0.78	8.79
Administrative and clerical	4.64	20.09	4.02	45.32
General overhead	4.23	18.30	1.29	14.55
Total	23.10	100.00	8.87	100.00

per hundredweight of milk higher than those incurred in a can operation.

The manner in which the components of these costs change is presented in figure 2. The results of this analysis indicate that the economies in collection costs, when the daily volume per shipper is large, are achieved, first, through lowering the time requirements because of less total fixed time associated with fewer stops, and greater truck speed associated with greater distance between stops. The second reason for a lowering of total handling costs is the economies associated with larger farm storage and refrigeration units.

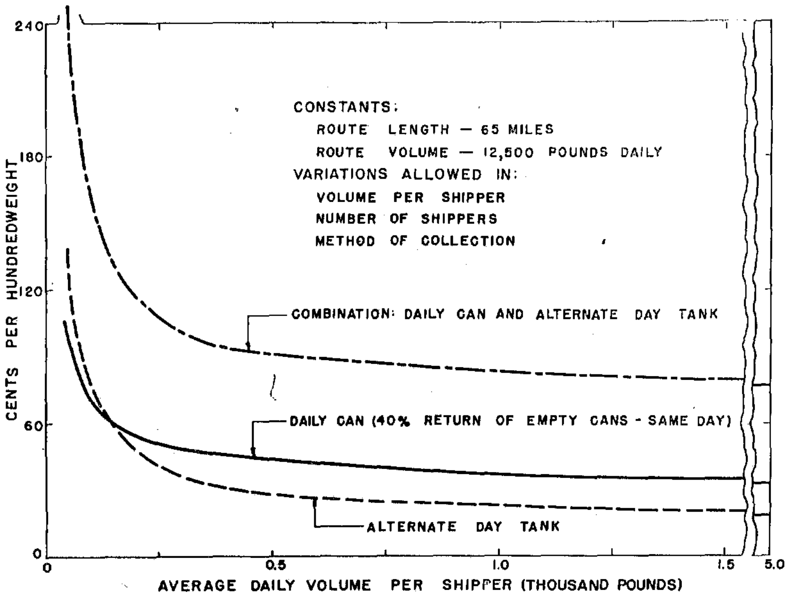

Figure 1.—Effect of variations in average daily volume per shipper (route length and volume constant) on milk collection and receiving costs.

Effect of Varying Frequency of Collection

Given the constant route conditions presented in figure 3, and varying the frequency of milk collection by 1-day increments, lower collection and receiving costs per hundredweight of milk are secured by the tank (bulk) collection of milk in each case. An increase in the time interval between collections necessitates greater investments in farm storage and refrigeration equipment. This policy would result in higher fixed costs on the farm. Since the total amount of milk handled each day at the receiving point would not be affected, receiving room costs per hundredweight of milk ought to remain the same. The distance traveled to collect a given amount of milk decreases with each day

pick-up of milk in cans is used. increase in the collection time interval; hence, truck operation costs per hundredweight of milk would decrease. The shorter route length associated with a given volume of milk and the decrease in the total fixed time required to service fewer stops result in lower route labor costs.

The analysis comparing daily can pick-up of milk and alternate day, every third day, and every fourth day, indicates the lowest cost of collection and receiving per hundredweight of milk is secured when the alternate day

A similar comparison made for tank pick-up systems indicates every third day pick-up to have the lowest cost per hundredweight of milk. Beyond these points, the increase in farm storage and refrigeration costs offsets any savings gained by the other factors. The relative component and total costs for the tank and can systems for each frequency of milk collection are presented in figure 3.

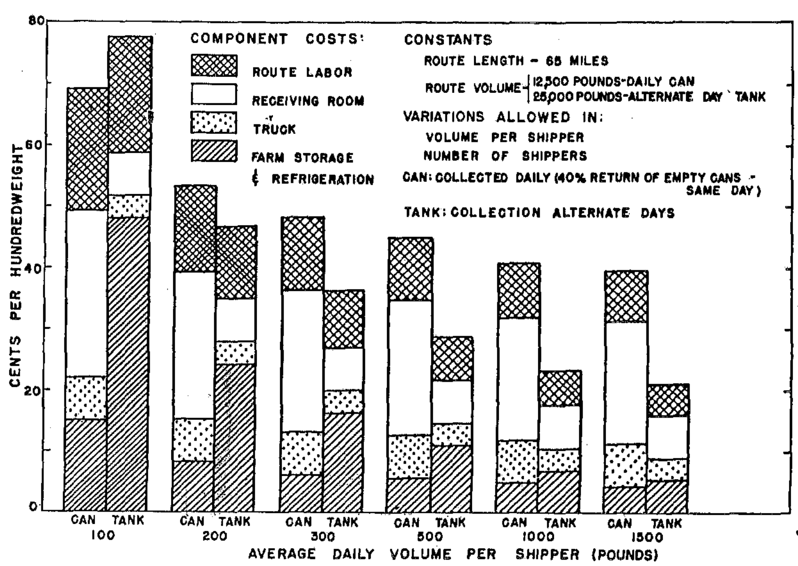

Figure 2.—Effect of variations in average daily volume per shipper (route length and volume constant) on the component costs of milk collection and receiving.

Effect of Variations in Route Conditions on Time Requirements and Costs—2,500-Gallon Tank vs. Can Pick-Up Truck System

The previous comparative analyses were based on a 1,500-gallon tank truck servicing a 65-mile route on alternate days, and a daily can pick-up operation servicing the same route. These route specifications were chosen because they were most representative of present conditions. Some milk handlers have supplemented their fleet of 1,500-gallon tank trucks with 2,500-gallon tankers. These larger collection vehicles are expected to service larger routes. The planned changes are expected to result in lower collection costs on certain routes only. Therefore the 2,500-gallon tankers would be used only to service routes where their operation would result in lower costs.

An advantage of using a larger tank truck would be the resulting lower truck operation and route labor costs for routes having daily

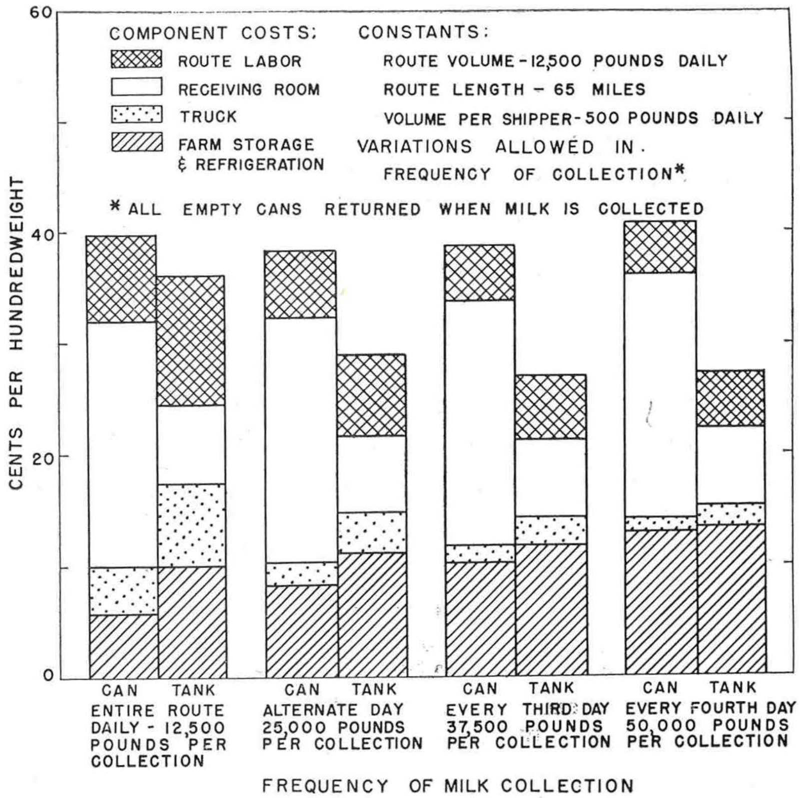

Figure 3.—Effect of varying frequency of milk collection (can vs. tank) by 1-day intervals on collection and receiving costs.

volumes of milk in excess of volumes normally collected by a 1,500-gallon tanker. Also, the use of the larger tank truck ought to result in lower costs where it is necessary to travel long distances to and from the receiving point to service a route having an average daily volume of approximately 10,500 pounds of milk. In effect, this condition increases route length and makes two separate hauls with a 1,500-gallon tank servicing the given route on alternate days too costly.

The cost of operating a 2,500 gallon truck was 19 cents per route mile. There was no appreciable difference in the driving speed and the time required to wash and sterilize the tank, pump, and related equipment between the larger and smaller tank trucks.

A comparison of costs between the larger bulk tank and the typical can pick-up truck on a relatively long route is presented in figure 4.

Comment on Interpretation of Results of Study

The comparisons of costs between bulk and can procurement systems presented above have been made with definitely defined route conditions. It would be an error to assume bulk costs to be lower than can costs when the former are based on routes collecting milk from the larger producers and the latter on routes from the smaller producers. (See figure 1) Again, a fair comparison between the two methods cannot be made if a system of routes under can procurement is so planned as to result in more than minimum travel for the return of empty cans. Furthermore, it would be an error to conclude that costs would be reduced by collecting a portion of the milk in cans and the balance in bulk trucks if such a mixed operation results in unused equipment, cross hauling, and an increase in labor requirements. The comparisons presented in the foregoing were made on the assumption that the handler was organized for and employing either method of collection to the exclusion of the other. The effect that such a mixed system would have on costs is indicated in figure 1.

Summary

Greater investments in farm storage and refrigeration equipment are necessary for farmer participation in a bulk milk procurement program. Economies in operational costs are effected in the collection and receiving point procedures which more than offset the relatively greater costs of farm storage and refrigeration. Marked economies may be secured by greater capacity utilization for both types of farm refrigerated storage facilities.

Receiving room costs per hundredweight of milk under a 100 percent bulk procurement operation are significantly lower than under a 100 percent can system.

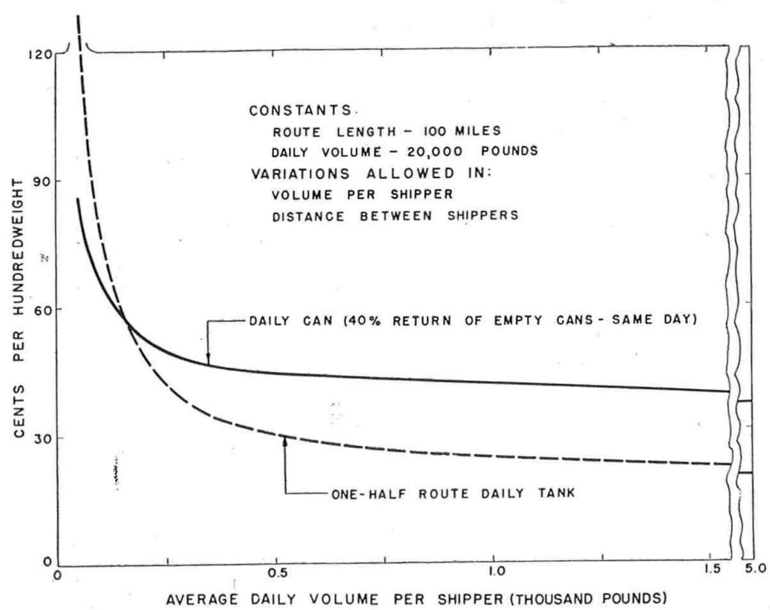

Figure 4.—Effect of variations in average daily volume per shipper on total handling costs per hundredweight of milk.

Operational costs under various route conditions indicate lower costs per hundredweight when all milk is collected on alternate days by farm tank pick-up trucks relative to the daily procurement of milk in conventional 10-gallon cans. Given a Grade A milk collection route having a daily volume of 12,500 pounds and 65 miles in length, lower operational costs per hundredweight of milk are indicated when the average daily volume per shipper is in excess of the break-even point of 140 pounds. The relatively lower per unit costs are indicated for the alternate day tank collection system result from (a) lower truck operating costs, (b) lower route labor costs, and (c) lower receiving room costs which more than offset the relatively higher unit costs of tank storage and refrigeration.

Cost efficiencies which may be effected under a bulk milk handling program are closely associated with (a) average daily volume per producer, (b) sound route planning (proper route length and route volume), (c) frequency of collection, and (d) securing a proper technical balance in the equipment necessary to service the route.

The analysis for the route having a daily volume of 20,000 pounds of milk and 100-mile length (serviced by a 2,500-gallon tank truck vs. a van type can pick-up truck) similarly indicates relatively lower costs for the tank milk handling system when the average daily volume per shipper is in excess of the break-even point of 160 pounds of milk. An advantage of using a 2,500-gallon tank truck relative to a 1,500-gallon tank truck would be the resulting lower truck and route labor costs for routes having daily volumes of milk in excess of volumes normally collected by a 1,500-gallon tanker. Also, the use of the larger tank truck would result in lower costs where it is necessary to travel long distances to and from the receiving point to service a route having an average daily volume of approximately 10,500 pounds of milk.

RECOMENDATIONS ADOPTED BY 1954 NATIONAL CONFERENCE ON TRICHINOSIS

Continued from Page 222

7. The Conference urges its Sponsors and the Continuing Committee to concentrate their efforts on the methods and types of education that seem hopeful of realization.

8. County Agents and Extension Workers are urged to continue to instruct, and intensify their efforts in persuading individual farmers to exclude raw pork scraps and offal from the feed of swine.

V. Research

A. *Wildlife survey.* Inasmuch as the sylvatic* occurrence of *Trichinella spiralis* probably plays an important role in the life history of this parasite it is highly desirable to obtain information concerning instances of trichinosis in wild animals, including the rat. It is recommended that an appeal be made to organizations and groups of workers who are accustomed to examine wild animals, including the U.S. Fish and Wildlife Service, various biologic survey groups, the American Society of Parasitologists and the American Society of Mammologists, and through these agencies to their members, to examine, wherever possible, any wild animals and to report their findings to the Continuing Committee on Trichinosis. Proper technics of direct compression and digestion methods of examination of muscle tissue should be made available to these various groups.

B. *Cost of gamma irradiation of pork.* Investigations of gamma irradiation of pork have now progressed to the point where it is necessary to develop realistic estimates of cost on the commercial use of this process. It is, therefore, recommended that the Atomic Energy Commission be requested to consider the possibility of making an actual cost study of this process in what might be considered a good-sized pilot plant. It is recognized that until some realistic costs are determined that further work in this field will be confined purely to scientific problems.

1. In developing these costs it is suggested that attention also be given to the increased shelf-life of meat exposed to irradiation, to the investment for the original plant, and to the cost of operation of such a plant.

2. Whereas the observed effects of irradiation on *Trichinella spiralis* may be valid as indicated by experimental feeding of white rats, it is recommended that these studies be extended to determine if the effects are also valid when irradiated trichinous pork is fed to a large animal, such as the hog, and to a primate, such as the common laboratory monkey.

3. Whereas present findings indicate that gamma irradiation of trichina larvae reduces the severity of enteritis produced by the worms, it is recommended that a thorough study be conducted on the effect of irradiation of trichinous meat on the enteric phase of the disease.

C. *Immunologic aspects of trichinosis.* It is recommended that the United States Department of Agriculture conduct experiments on immunity, using the hog as the test animal. Inasmuch as immunity in rats to fatal trichinosis can be induced by feeding small doses of non-irradiated larvae, as well as by feeding larvae that have been sexually sterilized by irradiation, studies should be carried out to determine if such immunity can be imparted to hogs and to primates.

VI. Organization

A. The objectives of the Conferences are:

1. To promote the control of human trichinosis with a view toward its eradication in the United States, and

2. To cooperate with organizations and other agencies and groups in programs allied to the control or eradication of trichinosis.

B. The following results have been achieved since the 1952 Conference was held:

1. Regulations or laws requiring the cooking of garbage have been adopted in 41 states. (See reference to vesicular exanthema, in Section IIA.)

2. The active interest in the control of trichinosis by Public Health organizations and workers has been secured.

3. Representatives of national organizations having widely divergent field of interest have sat together and discussed mutual problems for the public good.

4. The objectives and the work of the Conference have been sponsored by leading national organizations, and have come to the attention of the American public.

C. The Conference endorses the work of the Continuing Committee and recommends:

1. Maintenance of the Continuing Committee with one representative designated by each sponsoring organization.

2. Determination by the Continuing Committee of methods of financing its organization.

3. The time and place of the next Conference shall be determined by the continuing Committee after consultation with the Sponsors.

(* A bubonic plague transmitted by fleas from wild rodents now reported as spreading eastward)

NEW BREAD-MAKING PROCESS ANNOUNCED

A new bread-making process, which it is hoped will increase the use of nonfat dry milk solids in the baking industry, was announced at the annual meeting of the American Dry Milk Institute in Chicago.

Primary gain is the elimination of the sponge operation in bread baking, which will save the baker money, time and space in his operation.

The patented process will be known as the "ADMI Stable Ferment Process," according to Dr. B. W. Fairbanks, director of the American Dry Milk Institute, who reported the development at the meeting in the Edgewater Beach Hotel.

The ferment is essentially a homogeneous mixture containing water, yeast, yeast food, malt, salt, sugar and nonfat dry milk solids. Only natural fermentation products—no chemical additives—are used throughout.

Continued on Page 231

Association News

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NEW BREAD MAKING PROCESS

Continued from Page 229

Bread may be as individual as the baker may desire. Due to the flexibility of the process, he may modify the characteristics of his bread, making formulary adjustments at the dough stage.

The finished loaf is uniform with respect to volume, symmetry, break-and-shred and crust color. The interior of the loaf has a soft, well-developed texture with a pleasing flavor and appetizing aroma.

No elaborate special equipment is necessary under the ADMI-developed process. Fairbanks noted that size or capacity of the equipment depends on the number and size of doughs processed in the individual bakery.

He reported on successful tests of the process in three outside laboratories, in addition to the work performed by ADMI's own researchers. The Central Grocer's Baking Company of Montevideo, Minnesota, has been producing most of its bread under the ADMI method since January.

In Gastonia, North Carolina, the Holsum Baking Company has installed equipment for the process. The Research Laboratories of National Dairy and Bowman Dairy Company have given the method a thorough test.

Roland Aaker, the Montevideo, Minnesota baker told the dry milk meeting that he is convinced that the ADMI Stable Ferment Process uniformly produces a better loaf of bread, more economically, than the old sponge process. "Since going on the ADMI Stable Ferment Process," he says, "our bread has scored consistently higher when examined by an outside laboratory."

The process may be used for white bread, whole wheat bread, rye, bread, raisin bread and all types of rolls.

Among the advantages listed by Fairbanks are these:

1. It eliminates the setting of individual sponges and the troublesome variations which may occur in the sponges.

2. It releases valuable floor space. Space ordinarily allotted for fermentation rooms can be used for other purposes such as the addition of a sweet goods line.

3. Processing time is reduced depending on the situation in individual plants.

4. Various types of bread may be made, from the balloon type to the compact one. Other yeast-raised bakery products can also be produced under the process.

5. The process eases the work load. Ferment for a full day's production of yeast-raised products may be prepared at one time, storing the excess ferment for use on the following day.

6. Uniformity of the finished product is assured. Closer control results in uniform bread from batch-to-batch and day-to-day.

7. The process minimizes waste. Greater flexibility permits the production department to bake specifically to order.

8. Trough - greasing operations are eliminated.

The American Dry Milk Institute has offered a brochure which describes the new process. It may be secured at the organization's office, 221 North LaSalle Street, Chicago 1, Illinois.

LETTER TO THE EDITOR*

H. L. Thomasson, Executive Secretary—Managing Editor
International Association of Milk and Food Sanitarians, Incorporated
Post Office Box 437
Shelbyville, Indiana

Dear Mr. Thomasson,

This letter will have reference to your letter of the 7th of May, 1954 in which you stated you would be pleased to have our Association write-up. I am most happy to accomodate you with the following contents.

Previously, there has never been, to our knowledge, under the Bureau of Indian Affairs, any Sanitarians employed in the Health Departments. For this reason we consider ourselves pioneers in this new field, so far as the Indian Service is concerned. The first class of Sanitarians was graduated in 1952 consisting of twelve Indian boys, coming from Montana, Arizona, New Mexico, South Dakota, North

*Editors Note: This letter was so interesting we thought our members would like to read it, too.

Dakota and Minnesota. After these boys completed their training at Phoenix, Arizona, each boy was located at an Indian Reservation. During that year these twelve boys started the first organization known as the 'American Indian Sanitarians Association.' The officers were Joe Medina, President; Julius Thunder, Vice-President; Richard Teboe, Secretary and Treasurer. This association had not yet formed their constitution nor had they their by-laws.

Then in the year 1953, when the second class, which consisted of ten boys, coming from Montana, Arizona, New Mexico and South Dakota, went to Phoenix, Arizona, for training, both classes were permitted to meet and discuss actual problems of each individual reservation. This first meeting threw a little light on the dynamic job ahead of us. We had yet to realize that we were not going to be greeted with flying colors on our reservations; we were over-enthusiastic and expected to change the environment of the Indian entirely overnight. We should have known better. Along with our Sanitation measures and practices, to cope with this problem, a *great deal* of health education is needed. Resultingly, a new organization was formed, along with new officers and a constitution and by-laws. The newly elected officers were Joe Medina, President; Richard Teboe, Vice-President; Willis Titla, Second-Vice-President; Frank C. Estes, Secretary and Treasurer; Mike Ford and Louis Zimmerman, Auditors. However Richard Teboe and Louis Zimmerman are no longer with us since they are in the service of our country.

In our first meeting it was voted that we retain our first name of 'American Indian Sanitarians Association.' I might also mention one thing significant about the organization. Only persons that are interested in the objects of the association and are engaged as a Sanitarian in the Bureau of Indian Affairs or Agency thereof, or research or educational endeavors related to this field of endeavor, are eligible for membership. Also, one of the qualifications to gain entrance to this training course is being an Indian and having the knowledge of the Indian language.

After forming the new organization we became affiliated with the International Association of Milk and Food Sanitarians, Inc. as of June 23rd, 1953.

One of the benefits of the association is its monthly reporting system. Each Sanitarian submits his monthly report to the Secretary & Treasurer and he in turn amalgamates them into one narrative report and submits them to each member and honorary member. It is a tedious job re-writing reports. Officers this year have not changed since we have not yet had our annual election of officers. It is believed that another class will be held at Phoenix, Arizona, this summer, for Sanitarians.

We, the Indian Sanitarians, are now beginning to realize, after a few difficult years out in the field, that as money is the root of all evil, so is Environmental Sanitation the root of healthful living. The Indian Service finally reached bottom in conquering the high mortality rate among the American Indians by introducing this Sanitation program. I think we could use more Sanitarians because it will take a period of years to really see what is being accomplished.

It has given me great pleasure giving you this information because I am proud to be a part of this association. We received the cards safely and also the boys have been receiving their Publication regularly because if they weren't they would have written and told me.

Last year I was not able to make it to Aberdeen, South Dakota, for the South Dakota Association of Sanitarians' annual meeting in which I had intended to meet you personally. This year while I am able to attend the one in Sioux Falls, South Dakota, they inform me that you probably would not be there. It would be awfully nice to see Mr. Egan and Mr. Borches once again, perhaps I may this summer when we go to Phoenix, Arizona.

Will be looking forward for this write-up in the Journal.

Cordially yours,
Frank C. Estes
Secretary & Treasurer
A.I.S.A.

PROPOSED APHA REPORT ON CONTROL OF INTERSTATE MILK

The committee on Administrative Practice on Interstate Acceptance of Milk of the American Public Health Association has made the following recommendations:

1. Recognition be given to the acceptance, on the basis of certification, of milk supplies that are under the full-time supervision of a municipal, county, or state agency.

2. Actual certification be made by a designated state rating officer of the shipping state.

3. The source of supply be under routine laboratory control approved by the shipping state and in conformance with APHA Standard Methods for the Examination of Dairy Products.

4. The U. S. Public Health Service Milk Ordinance and Code or its equivalent be used as the basis for rating milk supplies.

5. The rating procedure used be that outlined in the U.S. Public Health Service recommended Milk Sanitation Rating Method.

6. The U. S. Public Health Service make check ratings on a periodic basis, and, in addition upon request, for purposes of verification of the ratings and laboratory procedures of the shipping state.

7. The shipping state reports results of ratings to the U.S. Public Health Service for publication and dissemination. The receiving state reports to the shipping state and to the U. S. Public Health Service instances in which any question of sanitary quality is involved. These may be changed in the light of whatever presentations may be made by the membership.

VERMONT DAIRY PLANT MEETING

Vermont Dairy Plant Operators and Managers Association Annual Meeting and Conference, will be held October 13-14, 1954, at University of Vermont, Burlington, Vt.

OCTOBER DAIRY INDUSTRY MEETINGS ANNOUNCED

Dairy industry people from all over the world will have an opportunity to view and study the broad range of dairy progress in the United States of America in one brief period next October, according to an announcement by Lester Olsen, President of Dairy Industries Society, International, 1108 16th St., N.W., Washington 6, D. C., U.S.A.

The Society is a world-wide body of men and women interested in the development of all phases of dairy enterprise in all lands.

Olsen points out that for the first time dairy people from all countries will be able in a brief four-week period to see examples of a whole continent's many-sided dairy resources and to examine closely into cattle care; the production, handling, transportation and processing of milk; the manufacture of dairy products, and the distribution and merchandising of milk and dairy foods in all their forms.

Three of the world's greatest dairy gatherings and demonstrations, encompassing all phases of the industry, will be held in the United States during the four-week period.

The National Dairy Cattle Congress takes place in Waterloo, Iowa, October 2 to 9. This event comprises the official National shows of the Guernsey, Holstein, Brown Swiss and Ayshire breeds, and nation-wide shows of other dairy breeds. The National Intercollegiate and National 4-H Judging Contests, as well as the National Future Farmers of America dairy cattle and dairy products judging contests, are also held at this event. An extensive farm equipment exposition is featured.

The International Dairy Show occurs in Chicago, Illinois, October 9 to 16. At this are featured the official National shows of Jersey and Milking Shorthorn breeds. Additionally, several thousand head of all breeds of purebred dairy cattle from the United States and Canada will be exhibited. There will be displays of many new types of dairy farm equipment, feeds, and other products and services for the dairy farmer. Collegiate and 4-H Judging Contests are also featured here. Daily entertainment is to be furnished by a world championship rodeo.

The Dairy Industries Exposition takes place in Atlantic City, N. J., October 25 to 30. This is the largest regularly-held single-industry Exposition in the world; some 400 firms which supply and equip the dairy industries will present displays. The Collegiate Students' International Contest in Judging Dairy Products occurs here. Data on 3-A Sanitary Standards for dairy equipment will be available.

Concurrent conventions or special meetings will be held in Atlantic City by dairy industrial and scientific organizations, including National Association of Retail Ice Cream Manufacturers, International Association of Milk and Food Sanitarians, Dairy Industries Society, International, Milk Industry Foundation, Dairy Suppliers Foundation, International Association of Ice Cream Manufacturers, Evaporated Milk Association and National Ice Cream Mix Association.

Dairy Industries Society, International representatives will be on hand to welcome visitors from other countries to inspect many types of dairy farms, including prominent purebred dairy cattle herds, and dairy factories, and to study husbandry, milk production, milk processing, dairy products manufacture, and milk and dairy products marketing and distribution practices.

"Some visitors will have time for or interest in perhaps only one or two of the Shows," says the DISI President's announcement. "Travel and tour details can be readily accommodated to such instances.

"The first of the events occurs in one of the nation's great agricultural regions. The second is placed in the incessantly active mid-western metropolis, Chicago, the nation's air and rail travel center. The third is at a famous seashore site, close to the world ports of New York City and Philadelphia.

"Dairy Industies Society, International is interested in stimulating the greatest possible spread of understanding of all phases of dairying and dairy industrial activity everywhere," says Olsen. "It encourages international attendance at all major dairy gatherings, no matter in what countries held."

He urges everyone outside the U.S.A. interested in all or parts of the October North American schedule of events to communicate with the office or correspondent nearest to him of Thomas Cook & Son, Inc., international operating travel agent, which will handle details of transportation and between-show tours.

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Desires position as Chief Sanitarian of Milk and Food Division. Excellent references. Prefer Midwest location.

Box 437, Shelbyville, Indiana

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41ST ANNUAL MEETING—INTERNATIONAL ASSOCIATION MILK AND FOOD SANITARIANS, INC.

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The 1954 Annual Meeting of the International Association of Milk and Food Sanitarians, Inc. is meeting in Atlantic City October 20th to 23rd, with Headquarters and all meetings in Hotel Morton.

I am planning on attending. Please reserve for me the accommodations as checked:—

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Breakfast	$1.00	Dinner	$2.00
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*Send all reservations direct to Hotel Morton.

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