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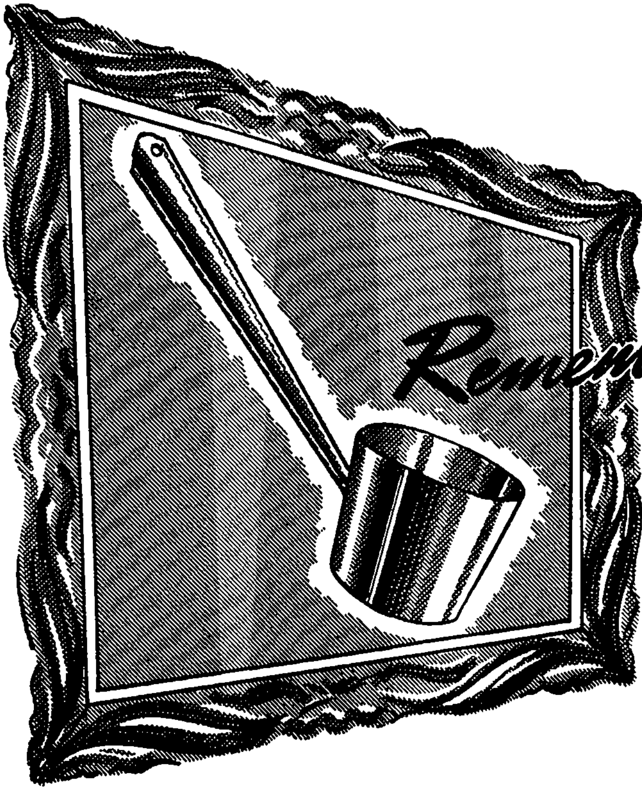

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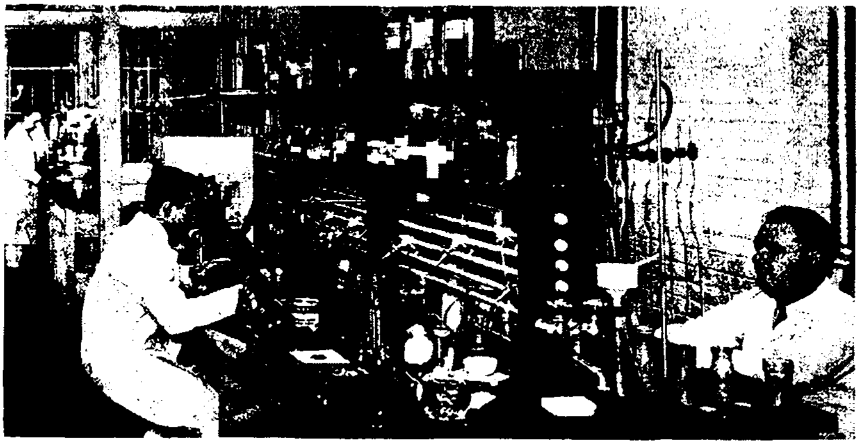

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JOURNAL OF MILK TECHNOLOGY

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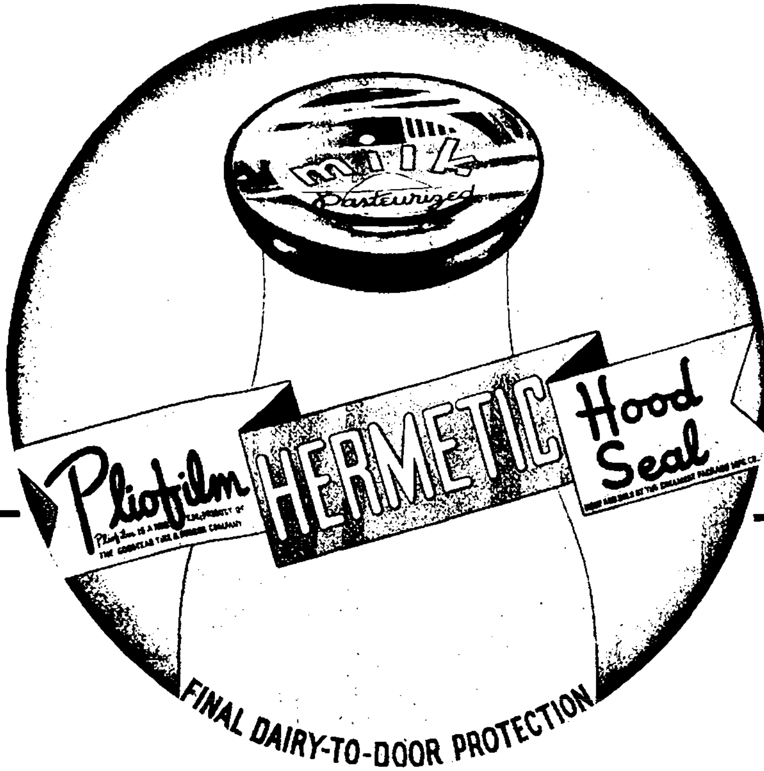

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Editorials

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

Message From President Fabian

MAY I take this opportunity to express my deep appreciation to the Association for the honor it has conferred upon me in selecting me President for this year. This Association, with three decades of service devoted to the cause of safe milk, now occupies a place in milk sanitation without parallel in the world. Every member should feel justly proud of membership in such an Association and to that end contribute toward maintaining its high standards and ideals.

F. W. FABIAN

I would also remind you at this time that we are facing one of the most difficult periods in the entire history of the Association. Priorities on essential materials such as metals considered necessary in the dairy industry, of chlorine, and many other items including man power is going to place a tremendous burden on producers and manufacturers of milk and dairy products as well as upon the milk control officials. There are a great many more circumstances and conditions, not mentioned here or even thought of at this time, which will develop during these trying times, requiring a satisfactory solution in the sanitary phases of the milk industry.

What is going to be our attitude? Are we going to become careless and indifferent and develop a slipshod policy of blaming everything on the war? When milk pails and cans develop rust spots and need retinning but there is no metal available for this purpose, shall we permit them to become dirty because it is more difficult to keep them clean and accept milk with excessive bacterial counts? When a manufacturer is unable to replace worn out machinery with new, shall we not require the old machinery to be kept clean? Shall we shut our eyes and permit the whole factory to develop slovenly habits that may take a decade to correct?

It is obvious that it will be necessary to develop an intelligent policy if we are to carry on our work successfully during the difficult times which lie just ahead. In formulating this policy, it will be well to keep several fundamental principles in mind.

1. Disease is no respecter of conditions or persons. In war or in peace, from rich or poor, disease exacts its toll. If pathogenic germs are present in sufficient numbers, they will cause disease. Therefore, every precaution must be taken to keep disease germs out of milk and dairy products, no matter what their source—animal, human or environmental.

2. Cleanliness is a habit. It isn't so much a matter of equipment as it is methods. If only poor equipment is available, more work will be necessary to keep it clean. Don't let the handicaps under which it will be necessary to work for the next few years serve as an alibi for insanitation. There is no substitute for cleanliness.

3. Common sense, the most uncommon thing of all, will stand you in good stead. Don't expect the impossible. Learn to distinguish between the essentials and non-essentials. The principles of sanitation are simple and easy of application. They don't require fine barns and elaborate equipment but rather attention to details, plenty of cold and hot water, a few simple chemicals and plenty of elbow grease.

4. The expression ***safe milk must be produced*** could well be taken as our motto at this and all times. "The show must go on" is traditional in the theatrical world despite fire, flood, and even death. Great financial and human sacrifices have been made so that the show might go on. How much more important and essential is safe milk to our civilization than entertainment. Yes, safe milk must be produced even under great handicaps, and you dairy inspectors are our first line of milk defense and must see that it is done.

F. W. F.

More Food Poisoning

THE Public Health Service has just published its second annual compilation of outbreaks of disease attributed to the consumption of food and water, occurring in the calendar year 1939.[1] The respective diseases, epidemiological data. and vehicles are presented in Table 1.

Table 2 on page 4 lists the data for the year 1939 in comparison with those of 1938.

The excess of total cases in 1938 over those of 1939 was caused by a single water-borne outbreak of 29,250 cases of gastroenteritis in one large city.

The great increase in the number of outbreaks in 1939 is attributed possibly to better reporting. Inasmuch as no reports of outbreaks of any kind are listed from 19 states, constituting about 17.5 percent of the total population, a person cannot help but wonder whether this lack of outbreaks is real or only unreported.

In contradistinction to the situation in water- and milk-borne outbreaks, over 70 percent of the food-borne outbreaks occurred in cities of over 10,000 population. The report points out that the large cities do not excel in food sanitation as they do in respect to the sanitation of water and milk.

[1] Disease Outbreaks from Water, Milk, and Other Foods in 1939. A. W. Fuchs. *Public Health Reports*, 56, 2277 (1941).

TABLE 1

FOOD POISONING OUTBREAKS

Disease	Water			Milk and Milk Products			Other Foods			Unidentified Vehicles			All Vehicles		
	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths	Outbreaks	Cases	Deaths
Botulism	..	...	..	..	...	..	9	16	7	..	...	..	9	16	7
Dysentery	3	265	0	2	324	0	2	99	0	5	916	4	12	1,604	4
Food poisoning	..	...	..	12	179	0	88	1,347	2	..	...	..	100	1,526	2
Gastroenteritis *	27	1,892	0	7	570	0	35	1,880	0	5	246	0	74	4,588	0
Paratyphoid fever	..	...	..	2	24	0	2	247	1	..	...	..	4	271	1
Scarlet fever	..	...	..	3	42	1	1	27	0	..	...	..	4	69	1
Septic sore throat	..	...	..	6	1,282	5	..	...	..	..	...	..	6	1,282	5
Trichinosis	..	...	..	..	...	..	4	30	0	..	...	..	4	30	0
Typhoid fever	13	97	3	6	51	1	5	99	1	7	41	2	31	288	7
Undulant fever	..	...	..	1	4	0	..	...	..	..	...	..	1	4	0
Not stated	..	...	..	2	33	0	2	37	1	..	...	..	4	70	1
Total	43	2,254	3	41	2,509	7	148	3,782	12	17	1,203	6	249	9,748	28

* Including diarrhea.

TABLE 2

COMPARATIVE NUMBER OF OUTBREAKS IN 1938 AND 1939

Vehicle	1939 Outbreaks	1939 Cases	1939 Deaths	1938 Outbreaks	1938 Cases	1938 Deaths
Water supplies	43	2,254	3	48	31,693	17
Milk and milk products	41	2,509	7	42	1,685	27
Other foods	148	3,782	12	70	2,247	25
Unidentified vehicles	17	1,203	6	8	882	3
Total	249	9,748	28	168	36,507	72

The incriminated foods in the food-borne outbreaks are listed in Table 3.

TABLE 3

INCRIMINATED FOODS IN FOOD-BORNE OUTBREAKS IN 1939

Kind of food	Number of outbreaks	Number of cases	Number of deaths
Crab meat	5	365	0
Fowl	7	97	0
Home-canned vegetables, fruits, fish, and meat	10	23	7
Meat and meat products	11	252	0
Miscellaneous	25	583	0
Pies and pastry	32	484	1
Pork and pork products	21	163	2
Salads	8	241	0
Sandwiches	7	181	0
Sauces and gravy	5	94	0
Kind of food not reported	17	1,299	2
Total	148	3,782	12

It is noteworthy that by far the greatest number of cases occurred in outbreaks for which the kind of food was not reported.

This large amount of illness with its attendant debility, expense, and disruption of organized effort wherever it strikes means an appreciable loss in these days of needed defense efficiency. The situation is even worse than the figures show because it seems that they do not represent all the cases that actually occur.

To anyone conversant with conditions of (in)sanitation in the general food industry as compared with those in the milk industry, a person wonders why there are not more outbreaks than there are. It is well-known that general food-handling operations are far backward in the light of present-day standards of sanitation. Sanitary piping relatively rarely is found in the general food establishment. Vermin, including flies, over-run many a plant or restaurant. Personnel uncleanness is evident on all sides. Indifferent housekeeping (behind the scenes) incriminates the management behind his white tiled "front." Ignorance of the possible microbiological hazard in the handling of foodstuffs makes infection, infestation, and contamination widely possible.

Vigilance in the practice of environmental hygiene in food industries does not make headlines but its lack often does.

J. H. S.

REGULATORY DISCRETION EMPHASIZED BY DR. PARRAN, SURGEON GENERAL

"My attention has been called to the tendency of some milk control officials to demand compliance by the dairy industry with dairy and milk plant equipment specifications which may not be too stringent in normal times but which may be unreasonable under present circumstances. I am sure this attitude is due simply to the failure to realize that the present emergency requires the fullest coöperation of milk control authorities and the dairy industry in the interest of national defense.

"The unobstructed and increasing flow of milk and dairy products is necessary for a successful defense effort. More and more of these concentrated vital foods will be needed for the military forces and defense workers at home and for export overseas. At the same time it has been necessary for the Government to place under strict control and to conserve for defense purposes certain materials used for dairy and milk plant equipment, such as aluminum, nickel-bearing steel, tin, and electric motors. Milk plants using aluminum foil must take immediate steps to obtain equipment which will provide other means of closing their bottles. Certain dairy equipment containing other restricted metals may be obtainable only in limited quantities and after considerable delay. In the meanwhile the Dairy Industries Supply Association is coöperating with the Office of Production Management in attempting to work out suitable substitutes to relieve shortages of critical materials.

"Accordingly, the path along which each milk control officer can contribute to the defense effort should be plain. A change from aluminum to other satisfactory milk bottle closures and the development of other satisfactory substitutes for dairy equipment materials should be encouraged rather than condemned. Unusual features of equipment which would require radical changes either in design or in tooling should not be specified. Immediate replacement of milk cans and milk equipment which though imperfect are still safely usable should not be insisted upon. Instead, the dealer should be assisted in determining now his future needs so that orders may be placed well in advance. All of this may be accomplished without significantly jeopardizing the essential safety of the milk supply.

"I sincerely believe that merely calling this emergency situation to the attention of health officers will elicit their whole-hearted coöperation in advancing the national defense effort.

THOMAS PARRAN,
Surgeon General.

Aspects of Public Health Legal Control of Paper Milk Containers *

C. O. BALL

American Can Company, New York, N. Y.

THE paper milk container, as it is used today, is made of virgin pulp paper board, and is heavily coated with paraffin wax. From the standpoint of method of fabrication, the containers may be grouped into three classes as follows:

1. Those that are formed and paraffined in the dairy just before filling, and require a special machine for the purpose.
2. Those that are pre-fabricated and require a special filling machine in the dairy.
3. Those that are pre-fabricated and can be filled with the use of the regular glass bottle filling machine.

There are, as yet, very few laws and regulations applying to paper milk containers. A few states, among them New York, California, and Delaware, have given official recognition to paper milk containers in the form of enabling legislation. Illinois has, in addition to an enabling act, a law imposing conditions of public health control, modeled after U. S. Public Health Service standard code.

Even in those jurisdictions in which there are regulations pertaining specifically to paper milk containers, enforcement officials are handicapped because, as yet, procedures upon which enforcement action can be based have been standardized only in part.

GENEVA CONFERENCES

The first proposals of a specific nature as to principles of sanitation and standards for regulations pertaining to paper milk containers originated in two conferences that were held at the New York State Agricultural Experiment Station, Geneva, New York, under the sponsorship of Dr. R. S. Breed on July 12th, 1937, and May 2nd, 1938, respectively. The proposals contained in suggestions to public health agencies that were published by the conferences [Breed (1937) (1938)] covered manufacture of paper container stock, processes of conversion moisture-proofing, adhesives, examination of containers, and several factors of minor nature.

Such problems as most of these matters present can be handled with little difficulty by law enforcement officials. Three of the items, however, have not submitted readily to clarification because they involve new problems. These are manufacture of the paper container stock, moisture-proofing, and examination of containers.

SANITARY CONTROL OF PAPER STOCK

In view of the uninterrupted development over a period of 50 years of sanitation control of milk distribution, into which came naturally the certification of sanitary quality primarily on the basis of bacteria count and pasteurization control, it is natural that bacteria count should occupy a prominent place in the establishment of sanitary standards for paper milk containers. Naturally, too, the first point of application of this principle is to the material of which paper milk containers are made.

It is generally agreed that paper for milk containers should be made only of virgin pulp, which is defined as material that has never been subjected

* Delivered at 34th Annual Meeting, Massachusetts Milk Inspectors Association, Worcester, Massachusetts, January 9, 1941.

to ultimate consumer use. While some people question the scientific justification of imposing this requirement onto paper milk containers, there is no need to argue about the matter since there probably is little reason, even from an economic standpoint, to advocate the use of secondary stock.

In the manufacture of paper from virgin pulp, if the paper is bleached, there are three distinct processes in each of which practical sterilization of the product takes place, or, if the paper is not bleached, there are two such processes. These, for bleached paper, are (1) the pulping process, in which the wood is heated in a chemical solution under high steam pressure, (2) the bleaching process, which is carried out with chlorine, and (3) the final drying process, in which the paper is passed over steel rollers heated to temperatures of from 230° to 270° F.

These successive sterilizing processes. combined with bactericidal influences that are purposely introduced into intervening operations in the paper making line, leave little chance for bacteria to pass through the paper-making operations alive. Some of the hardier types do survive in the finished paper, however. These thermoduric types have no importance in public health protection; nevertheless, the final bacteria count is a qualifying measure for paper stock. Control officials regard the count as indicative of the degree of sanitation maintained in the paper making operations, and all factors affecting this count are receiving a great deal of study.

PROCEDURE FOR BACTERIOLOGICAL TEST OF PAPER

In his report of the Second Geneva Conference, Breed (1938) gave an outline of the disintegration method which was recommended for determining the bacterial content of container board by stating that it "consists of re-pulping the board in sterile water by means of a sterilized beating device and plating the resulting pulp suspension according to standard bacteriological procedures." He stated further that laboratories were coöperating in the investigation of bacteriological contamination of paper board, using disintegration procedures.

Most prominent among these laboratories has been that of Breed and Sanborn at the New York State Agricultural Experiment Station. The work of this laboratory has been covered in the literature. Among other agencies that have studied these procedures is the Biological Control Committee of the American Paper and Pulp Association, which undertook in 1939 to assist in correlating the activities of various agencies engaged in these investigations and in orienting available scientific data with the purpose in mind of preparing a description of tentative procedures.

Wheaton (1941) presented data to show that the amount of dilution of pulp in the disintegrator, as well as in the agar on plates, has an important bearing on the magnitude of bacteria counts found in samples. He said that if dilution is below a certain point, not all of the colonies are detected. He advanced possible reasons for this condition. In commenting on Wheaton's paper, Breed (1941) substantiated the findings. He feels, however, that other factors than those Wheaton named may be responsible for the results.

The Biological Control Committee of the Technical Association of the Pulp and Paper Industry, a subdivision of the American Paper and Pulp Association, published a proposed method for bacteriological examination of paper. [TAPPI Biological Control Committee (1940).] Sanborn (1938) earlier outlined the same technique. The method is in agreement with the recommendations of Wheaton.

The American Public Health Association Committee on Standard Methods for the Examination of Dairy Products is working on a revision of the text of "Standard Methods for the Examination of Dairy Products" relating to tests for the sterility of milk bottles, in which is to be included a description of laboratory procedure for the bacteriological examination of paper for paper milk containers. Methods suggested by American Public Health Association enjoy the status of standard methods for the milk industry of the United States. Whether or not the method for examination of paper which will be published in "Standard Methods for the Examination of Dairy Products" will agree in its essentials with that which was published by the Technical Association of the Pulp and Paper Industry, cannot be stated at this time. If a deviation occurs, it will probably be with respect to the dilution factor. The suggested methods already published recommend the plating of 2 ml. of 1 percent suspension of disintegrated fibrous material in each Petri dish.*

APPARATUS FOR BACTERIOLOGICAL TEST OF PAPER

Every method must provide for carrying out all steps in such a way as to avoid contamination of the samples, but some tolerance may be allowed in certain details because of individual preferences of different laboratories. As to suitable disintegrating devices, for example, the TAPPI report, after naming two specific devices that have been used

* Author's Note: Eighth Edition, Standard Methods for the Examination of Dairy Products, published in October, 1941, specifies plating 10 ml. of 1 percent suspension in 3 Petri dishes.

FIGURE 1
Stevens Mixer No. 7291 With No. 5 Stainless Steel Container. Stevens Electric Company, Racine, Wis.

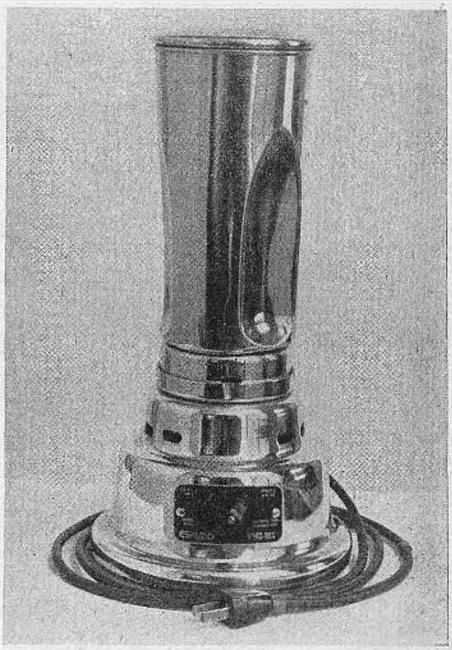

FIGURE 2
Eskimo Whiz-Mix Disintegrator, Model 515 JB with Stainless Steel Container, Bersted Manufacturing Company, Fostoria, Ohio

Courtesy of Drs. R. S. Breed and J. R. Sanborn, New York State Agricultural Experiment Station

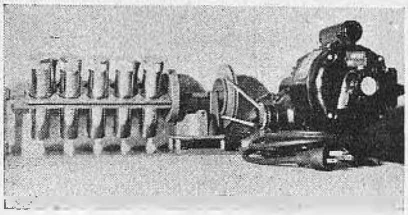

FIGURE 3
Paper Disintegrator of Ball Mill Type, in Which Ten Samples Can Be Disintegrated Simultaneously. American Can Company. 1938.

successfully, states that, "Any other type of disintegrator may be used, provided it satisfies the following conditions: (1) the paper sample is completely disintegrated within a short period of time—*e.g.,* 6 to 10 minutes; (2) asceptic technique is fully maintained during the handling and the disintegration of the sample. . . ."

The disintegrators that are named in the report are the Stevens mixer and the Bersted disintegrator, shown in Figures 1 and 2. Sanborn (1940) first published a recommendation of these devices.

A few laboratories, including our own, have used successfully a paper disintegrator of the ball mill type, which possesses the advantageous feature of being able to disintegrate many samples simultaneously. The particular machine, shown in Figure 3, has a capacity for 10 samples—one in each stainless steel cylinder. It effects complete disintegration of the samples in 40 minutes when operating at a speed of 42 r.p.m., during which the cylinders are rotated in an end over end manner. Each cylinder, when sealed with its screw top, has a volume capacity of 178 ml., and during operation each contains 45 stainless steel balls of ½ inch diameter. These balls have a total volume of approximately 57 ml. The mixture in each cylinder ordinarily consists of 1 gram of paper in 99 ml. of water although a sample of paper may be slightly greater or less than 1 gram. With each sample, the necessary amount of water is used to give the desired dilution. The interior contour of the ends of the cylinders is hemispherical to assist in the disintegration.

Notwithstanding the longer time required for disintegration of samples in this machine as compared to the mixer type of machine, our laboratory usually finds the former more convenient to use when several samples are to be handled simultaneously.

Considered on a sample-minute basis, the ball mill type of disintegrator is more costly than the disintegrators of mixer type. Considered

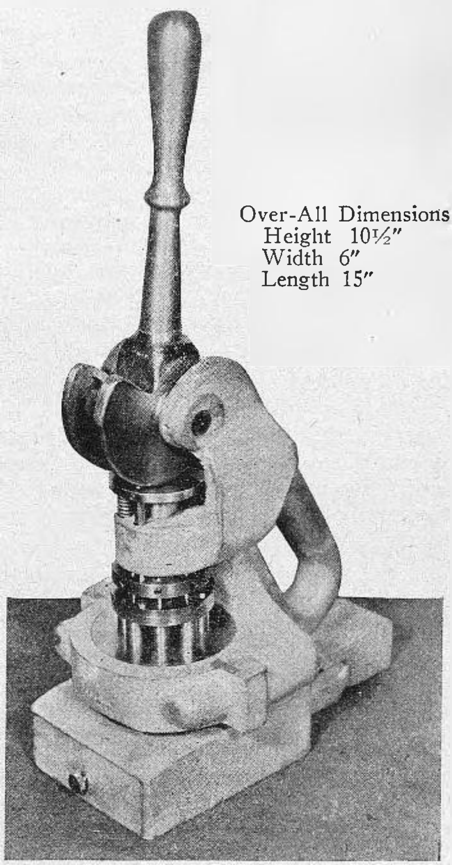

FIGURE 4
Hand Operated Multiple Punch and Die for Bacteriological Sampling of Paper. American Can Company. 1939.

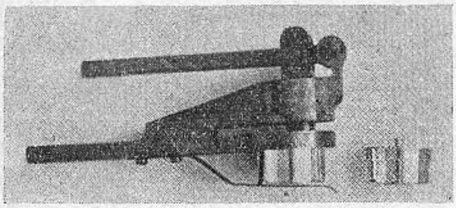

FIGURE 5
Hand Operated Single Punch and Die for Bacteriological Sampling of Paper. American Can Company. 1940.

only on the basis of capacity in number of samples handled simultaneously, however, the ball mill type of disintegrator may not be greatly out of line with other types in cost.

All proposed methods for paper testing suggest the use of scissors for cutting samples into small pieces which will disintegrate readily. Some technicians like to use punch-and-die devices for doing this part of the operation. These devices punch circular discs from the paper samples and drop them into enclosed receptacles. The devices are sterilized in advance, either by flaming the parts that come into contact with the samples or by heating the entire apparatus in an oven or an autoclave. Receptacles are sterilized in an autoclave or an oven. The two punch-and-die assemblies that our laboratories use are made of non-corrosive metal so that they withstand either hot air or steam sterilization without deleterious results.

One assembly, shown in Figure 4, has 8 punches and will cut 8 discs of 0.472 inch diameter simultaneously. Drawn tin-plate cups are used for receptacles. Upon removal from the apparatus the cups are immediately closed with friction-fit lids. This device has the important disadvantage that it is costly.

A simpler and less costly assembly than that shown in Figure 4 is shown in Figure 5. This one has only 1 punch, which is of slightly larger diameter than those of the multiple type apparatus. The receptacles for this device are of aluminum.

These punches find their most convenient application in the laboratory rather than in the paper mill, although, if a flame is available for sterilization purposes, the light-weight punch, Figure 5, is useful in the paper mill. It is not necessary to flame the punch between samplings made in close sequence unless more than 6 samples are run. Any contamination occurring during operation on this plan is within the variation in bacteria count of a sample. In a comparison of the punch method with the scissors method, no apparent difference was found insofar as contamination of the paper samples was concerned.

The principal advantage in the use of the punch over the use of scissors lies in the fact that the punch will do, with less manipulation, what the template-with-scissors method will do. In the proposed procedures by the A.P.H.A. and TAPPI committees,

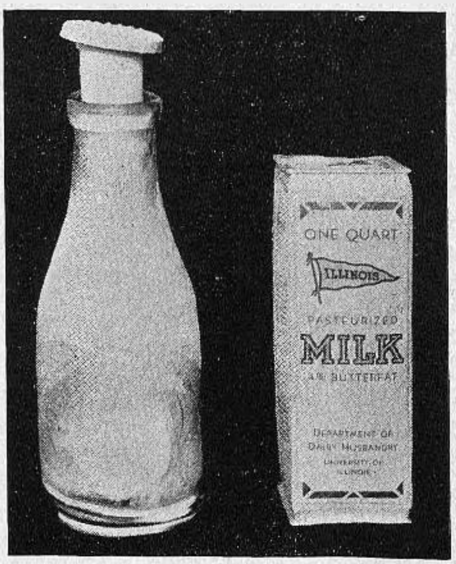

FIGURE 6
Quart Containers of Glass and Paper, Each Containing One Quart of Milk, After Exposure to —15° F. for 48 Hours. P. H. Tracy, University of Illinois. 1939.

mentioned on page 7, the template-with-scissors method of cutting is recommended because of the simplicity of the equipment required.

TOLERANCE FOR BACTERIA COUNT OF PAPER

The U. S. Public Health Service Milk Ordinance and Code, 1939, contains probablv the broadest set of specifications so far promulgated specifically applying to paper milk containers.* These specifications cover only tolerances for various factors, however; they do not take up the matter of procedures. In regard to bacteria plate count of stock from which single service containers and bottle caps and covers are made, the Code specifies a maximum of 250 colonies per gram, calculated as the logarithmic average of determinations made on "the last four consecutive samples, taken upon separate days," during a grading period, as compared to the recommendation of the Geneva Conferences of 500 colonies per gram as a maximum.†

Procedures based on the logarithmic average principle usually allow a considerable tolerance in the selection of determinations to be averaged. Regardless of the specific manner in which the principle is applied, many informed persons question whether or not a maximum tolerance of 250 colonies per gram is a practical one. Our experience indicates that this doubt is justified. Although most paper stock made for milk containers is well within this tolerance, experience of manufacturers is that, even with the exercise of all precautions that appear within reason, there are times when counts consistently exceed 250. This fact indicates that experience is not yet adequate to establish reliable correlation between sanitation in the paper mill and bacteria count of the finished paper.

Health enforcement officials customarily permit reasonable deviations from stated requirements when specific values are of no great importance, as in this case. Unusual liberality may have to be exercised, however, in the enforcement of a regulation placing a maximum of 250 on bacteria counts of paper if unjust punitive action on the basis of paper count tolerance is to be avoided, even though the logarithmic average method of computation is permitted. Establishment of a very low bacteria count maximum might result in limiting the making of stock for paper milk containers to mills that can operate exclusively on this stock. This would, of course, exclude many manufacturers from this field, because of the impossibility of devoting their mills to the manufacture of just one type of stock.

INSPECTION SYSTEM

An even more difficult problem than that of standardizing laboratory procedures for the examination of paper is that of deciding upon a practical method of exercising supervision.

Most of the converters, and, apparently, the U. S. Public Health Service, feel that paper mill practices are such as to guarantee protection of the finished paper from a public health standpoint, and that whatever significant contamination there may be must occur in the shipment of the paper to the converting plant or in the converting plant itself.

The converting plant should be under the scrutiny and control of the same health agencies which at present inspect dairies, restaurants, hotels and food establishments in the vicinity of the converting plant. This inspection would not demand any special personnel set-up, and the only special expense required would lie in labora-

* Author's Note: Prior to issuance of Standard Methods for the Examination of Dairy Products, 8th Edition 1941.

† Author's note: Standard Methods for the Examination of Dairy Products, 8th Edition (1941) states: "Paper or paper-board developing not more than 500 colonies per gram of disintegrated stock in three of the last four analyses of these products taken from different runs is generally considered satisfactory."

tory equipment for the examination of the paper stock for bacterial content and of the completed containers by rinse and other tests. The cost of this equipment is nominal.

Some persons seem to see an analogy between the relationship of cattle and dairy inspection to bacterial condition of final milk and the relationship of paper mill inspection to bacterial condition of milk in containers made of paper from those mills. There is no such analogy. Cattle and dairy inspection is necessary from a public health standpoint, owing to the fact that milk is a perishable product, combined with the fact that contamination with pathogenic organisms may be a result of the condition of the producing herd or of conditions of dairy operation. In the case of paper, the product is non-perishable, and the last process to which paper is subjected in the mill is one which provides protection against pathogenic organisms and organisms of the coliform group. Moreover, non-spore-forming pathogens could not survive on dry paper milk containers for longer than a few days, because of lack of nourishment.

Numerous investigators have reported that non-spore formers do not survive in dry state on paper. Prucha (1938) and Tracy (1939) reported that heavy inoculation of *Escherichia coli, Bacillus prodigiosus,* and *Staphylococcus aureus* survived on paper for only a few days. Wheaton, Lueck, and Tanner (1938) obtained similar results from *E. coli* and *S. aureus* on paraffined milk containers.

Insofar as protection against disease-producing microörganisms is concerned, it is as difficult, and more troublesome, to detect specific types of viable bacteria during paper mill surveys as to detect them in the finished paper, tested in control laboratories. Should such bacteria be found in a paper mill, the finding might have significance as a criterion of the state of general sanitation maintained in the mill's operations, but it would have no direct relation to either the bacteria count of the finished paper or the sanitary quality of a container made from the paper. No disease-producing germs can survive temperatures of paper dryers, so the only chance of their being present on finished paper is through subsequent contamination.

Inasmuch as the promise of benefits to accrue to the consumer in return for the expense of a special systematic paper mill inspection is so slight, it seems that the inclusion of an inspection provision in control regulations at this time would be unjustified. There seems to be no call for inspection of paper mills unless perhaps by local authorities as a part of their regular routine inspection programs.

MOISTURE-PROOFING

There have been many dissertations, oral and written, on the merits and the imperfections of paraffin as a moisture-proofing material for paper milk containers. Manufacturers of paper milk containers are fully awake to the possibilities of improvement along this line, and no material of more satisfactory general properties than paraffin will be available for very long before it is adopted by the industry.

With regard to the bacterial quality of the containers in relation to the conditions of paraffin treatment, Tanner and Lewis (1940) reviewed literature on germicidal properties of paraffin and presented much new information on this subject. Two very significant facts were discussed. One was that, in studying the germicidal effect of paraffin, one must consider the effects of physical and mechanical properties of the material upon bacteria as well as the lethal effect of heat. The bactericidal factor of imprisonment, which is effective because of the physical properties of paraffin, was discussed. This has been mentioned by other investigators, including Sanborn and Breed (1939a, 1939b), Sanborn (1940), and Mudge (1939). The other fact was that it is easy, in investigations of this nature, to lose the practical perspective and to follow a technique in the laboratory which gives results that are misleading when applied to practice. Possession of this fault seems to have been indicated by many of the investigators whose work on lethal effect of paraffin was reviewed.

After all evidence is weighed, it would seem to be open to question as to whether or not the specification of temperature of paraffin treatment on the basis of lethal value can be justified. This point is of importance because of the fact that a better container from a physical standpoint is obtained when it is made at a temperature between 160 and 170° F. than when it is made at a temperature between 170 and 190° F. The factor of imprisonment of bacteria lends weight to the argument in favor of lower paraffin temperatures, because the better the paraffin coating, the more effective should be the imprisonment of bacteria.

Sanborn and Breed (1936b) found fewer colonies in containers paraffined at a temperature of 165 to 170° F. than in containers paraffined at a temperature of 180 to 185° F. Stoltz and Armstrong (1939) found that paraffin applied to paper containers at temperatures above 170° F. did not protect the liquid in the containers from absorption by the paper as well as paraffin applied at temperatures below 170° F.

The low resistance of non-spore-forming bacteria to unfavorable conditions, discussed previously, is a factor in establishing the likelihood that the function of paraffin as a bactericidal agent on paper milk containers is a minor one. The existence of the bactericidal power of the paraffin treatment is important as a safeguard, but the fact that viable disease-producing bacteria can hardly be present in the containers before the treatment makes this power seem almost superfluous.*

EXAMINATION OF CONTAINERS

It is generally known by those closely associated with milk control work that the sterile rinse test methods designed for use when low counts are expected, which were described in the 7th edition of *Standard Methods for the Examination of Dairy Products*, had their origin in work with paper milk containers. The low bacteria counts that prevail in paper milk containers were responsible for two further new developments in sanitary control work with milk bottles—the employment of broth sterility control tests, which give results, not in terms of bacteria counts, but in terms of percentage of sterile containers, and the accompaniment of both the sterile rinse and the broth sterility tests with a control test as routine procedure, to detect the probability of laboratory contamination of samples.

Mudge and Foord (1940) first published evidence of the need for technique control for these tests; at the same time they described a "needle puncture" technique for the broth sterility test.† Use of this technique reduces the likelihood of contamination below that which is present in the broth sterility test when manipulated by the older technique.

Controls for indicating the probability of contamination are routine in our laboratories. In the execution of the technique control, every step in the manipulation of the regular test is simulated so that every chance of contamination which occurs in the regular test is duplicated. For technique control, the following procedure is carried out:

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* Author's Note: The specifications on time and temperature required in paraffin treatment of paper milk containers were removed from the model milk code of U. S. Public Health Service by the Milk Sanitation Advisory Board in July, 1941.

† Author's Note: This technique is included as a tentative alternate method in *Standard Methods for the Examination of Dairy Products*, 8th Edition 1941.

Five hundred ml. flasks are fitted with cotton plugs and sterilized for 20 minutes at 250° F. The plugs are removed, 20 ml. of sterile water is added to each flask, sterile rubber stoppers inserted, and the flasks are shaken with a circular movement 25 times. Twelve ml. of this rinse water is pipetted out, 10 ml. being spread among three Petri dishes, and the remaining 2 ml. is run into a test tube containing sterile nutrient broth to check the sterility of the pipettes. The Petri dishes are poured with 2 per cent nutrient agar then incubated at 37° C. for 48 hours. To the 8 ml. of rinse water remaining in the flask, 20 ml. of nutrient broth is added and the cotton plugs are reinserted. The flasks are then incubated. (The operation of incubating the flask containing nutrient broth was introduced in July, 1940.)

The combined sterile rinse and "intra-container" test is made by pouring 20 ml. of sterile water into a milk container, washing the interior surface of the container with the water by shaking the container 25 times through an amplitude of one foot in 13 seconds, withdrawing 10 ml. of the water by pipette and distributing it into three nutrient agar plates, adding to the 10 ml. of water in the container 20 ml. of 2 percent nutrient agar solution, permitting the agar to set in the bottom of the container, and inverting the container to prevent water of condensation from spreading colonies on the surface of the agar. The container is incubated for 48 hours.

A statistical analysis is required to set forth the implications of the data yielded by these tests, and such an analysis is being made. Interesting facts are revealed, however, by a superficial analysis of tabulated data, which are presented below. These data are from a summary report such as is made by one of our laboratories each month.

Table 1 gives a recapitulation of all examination data obtained in the laboratory between November, 1939, and December 1, 1940. Table 2 gives a similar recapitulation of all data collected since the incorporation of the "intra-container" test into the routine procedure in July, 1940.

Four observations gathered from inspection of the tables are noted:

1. In Table 2 the excess of percentage of sterile containers for the intra-container test (92.5) over percentage of sterile containers for the plate count test (87.3) is a measure of the extent of contamination that occurred in the operation of transferring water from the containers to plates minus the extent of contamination that occurred in the operation of putting nutrient agar solution in the containers.
2. Percentage of sterile samples in both the rinse and the control tests was greater in recent months than were the averages for the entire 13 month period. This might indicate a progressive improvement in laboratory technique.
3. The percentage of sterile samples in the control tests did not differ materially

TABLE 1

BACTERIOLOGICAL CONDITION OF MILK CONTAINERS, NOVEMBER, 1939–NOVEMBER, 1940

Container Rinse Test (Water)—Plate Count

Size	Number containers tested	Total number organisms present	Average number organisms per contaminated container	Percentage containers sterile
Qt.	6443	5428	4.49	81.3

Container Sterility Test (Broth)

Size	Number containers tested	Percentage containers sterile	Percentage containers non-sterile
Qt.	6501	83.9	16.1

Controls—500 ml. Flasks (Without Broth Prior to July, 1940)

Number rinsed	Total number organisms present	Average number organisms per contaminated flask	Percentage found sterile
1920	1388	4.70	84.6

TABLE 2

BACTERIOLOGICAL CONDITION OF MILK CONTAINERS, JULY–NOVEMBER, 1940

Container Rinse Test (Water)—Plate Count

Size	Number containers tested	Total number organisms present	Average number organisms per contaminated container	Percentage containers sterile
Qt.	3189	1168	2.88	87.3
Rinse Test—Intra-Container				
Qt.	3189	826	3.59	92.5

Controls—500 ml. Flasks

Number rinsed	Total number organisms present	Average number organisms per contaminated flask	Percentage found sterile
1032	574	6.83	91.8

from the percentage of sterile samples in the tests of containers. This might indicate that the bulk of the non-sterility findings in the regular tests was due to laboratory contamination.

4. The average number of organisms per contaminated sample was greater in the controls than in the tested containers. This might be accidental, or it might indicate that the controls really present greater opportunity for contamination than do the regular tests. At any rate, this feature of the data tends to strengthen the indication that most of the non-sterility results obtained in regular tests were the result of laboratory contamination.

DIFFICULTIES FROM MILK FOAMING

Tracy (1938) named a number of advantages and disadvantages of paper containers from the standpoint of plant operation, based on his own observation. He expressed one of the disadvantages as "foaming of milk (particularly homogenized milk) making it difficult to seal the package without getting milk on outside of container."

The present high rate of increase in the use of homogenized milk has focused attention on this problem of foaming during filling. Our technicians, in collaboration with those of milk distributors, have found that foaming trouble can be entirely relieved by eliminating aeration of milk in the flow systems of the pasteurizing and bottling plants. Some distributors had never before realized at how many points their milk was taking in air in flowing from the pasteurizer to the filler. For example, whenever a cooler trough or a surge tank is permitted to drain empty, or whenever a pump is operated at greater capacity than a feed line is capable of supplying, air is drawn into the milk and is responsible for foaming at the filler. The trouble is eliminated by introducing level control in the various units of the flow system and eliminating unbalanced conditions at pumps.

FROZEN MILK

One important advantage of paper containers was demonstrated by Tracy. When milk freezes in a paper milk container, the seal of the container is not broken. Through Dr. Tracy's courtesy, his demonstration of this fact is illustrated by a photograph in Figure 6. A one-quart glass bottle and a one-quart paper container, filled with milk, are shown after having been held at a temperature of —15° F. for 48 hours. Distention of the sides of the paper container provided increased container capacity when the milk expanded in freezing.

SUMMARY

Standards for regulations pertaining to paper milk containers have been in the process of development since 1937 when the first of two conferences was held at the New York State Agricultural Experiment Station, Geneva, New York. In 1940, the Biological Control Committee of the Technical Association of the Pulp and Paper Industry published a proposed method for bacteriological examination of paper and the American Public Health Association Committee on *Standard Methods for the Examination of Dairy Products* reported that it was studying laboratory procedure for the bacteriological examination of paper. Apparatus required for this test is comparatively simple and inexpensive.

Because of insufficient dissemination among health officials of facts pertaining to the establishment of reasonable tolerances in respect to bacteria counts of paper, a tendency of some agencies has been observed toward establishing unreasonably rigorous standards. The number of organisms in paper used in containers is of little significance in the protection of public health, and the relationship between paper mill sanitation and the number of bacteria in finished paper has not been definitely established. Every possible means of putting dependable information into the hands of health officials should be employed so as to preclude the establishment of regulations that would burden the industry with unwarranted expense or possibly lead to the exclusion of excellent paper mills from the manufacture of paper stock for milk containers.

Because of inherent inaccuracies in laboratory methods of determining bacteria counts and because bacteria counts are not directly significant in public health protection, some public health officials are placing increasing emphasis on control from the standpoint of types of bacteria. The use of bacteria counts as the basis of public health regulations led to the ironing out of inaccuracies in the counts by the application of various types of mathematical treatment. This is a perfectly reasonable procedure, since, fundamentally, counts are mathematical, but not sufficiently precise to warrant the stressing of individual counts in connection with rigid standards. Treatment by the method of logarithmic average is probably the fairest manner of dealing with such data.

There are many indications that the maintenance of a special sanitary inspection system for paper mills would not be beneficial to the industry and would merely introduce an unjustified item of cost to be borne by the consumer. Converting plants are under the scrutiny and control of the health agencies which inspect dairies in the vicinity of the converting plant.

It is doubtful that the specification of temperature of paraffin treatment of milk containers on the basis of lethal value can be justified. Investigators have found that paper milk containers paraffined at a temperature of 165 to 170° F. are better than containers paraffined at a temperature of 180 to 185° F.

Data show that, in the interpretation of results from the testing of containers for sterility by the rinse technique, laboratory contamination is responsible for a large proportion of the positive findings.

Acknowledgment

The author wishes to express his thanks to Dr. R. S. Breed, New York State Agricultural Experiment Station, Geneva, for permission to use the photographs, Figures 1 and 2; to Professor P. H. Tracy, University of Illinois, for permission to use nhotograph, Figure 6; to Dr. F. F. Fitzgerald, Director of Research, American Can Company, for helpful suggestions; and to Mr. D. C. Foord, American Can Company Research Department, for data.

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A Discussion of Mastitis*

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I. Introduction

For a number of reasons the occurrence of mastitis in our dairy herds is becoming more widely recognized as of primary significance. It has been estimated that from 15 to 40 percent of the dairy cows in this country have this disease in some degree, and that it robs the dairy industry of more than one-sixth of its potential production (1). To the farmer this may mean reduced production, rejection of his market milk, and even actual loss of his animals. To the milk dealer it means the necessity of continual scrutiny of all submitted milk, and of rejection of contaminated batches, in order that quality standards may be maintained. To the public it means an impairment in the quality and acceptability of an essential foodstuff, and an actual hazard to health. Although most of the microörganisms associated with bovine mastitis are not pathogenic to humans, it has been demonstrated that a relation exists between such infections and some cases and even epidemics of septic sore throat and other milk-borne diseases. Especially hazardous is the careless human infection of the bovine udder with organisms which are pathogenic. This justifies the increasing vigilance of public health officers in this regard (12). It will always be true that safeguarding the actual production of the milk is preferable to any dependence on pasteurization or other processes for safety.

This problem is one, therefore, which affects directly nearly every member of our population. In this paper an attempt will be made to summarize some of the general facts about mastitis, to indicate briefly some of its results, its diagnosis, and its treatment, and to present these items in a form useful to people supervising the production and handling of milk. The protection of milk consumers rests in the hands of the dairymen, the veterinarians, and the various handlers of milk, all of whom continue the progress already made.

II. What Is Mastitis?

The term mastitis comes from the Greek, and means an inflammation of the breast. In the dairy industry, mastitis usually means an infectious disease of the bovine udder, manifested by acute or chronic inflammation. It is caused by the invasion of the bovine teat and udder by one or more types of microörganisms, to produce a condition commonly designated as "garget." A very large proportion of all mastitis cases are due to the presence of *Streptococcus agalactiae,* and this is said to be the only organism capable of producing contagious mastitis. However, several other genera and species have been shown to be present in mastitic udders. These include *Streptococcus dysgalactiae, Streptococcus uberis, Streptococcus faecalis,* staphylococci, *Escherichia coli, Cornyebacterium pyogenes,* and others. In some instances severe bruises or other injuries may give rise to inflammation of the udder and other symptoms of mastitis without showing the presence of infections.

* Note: This paper attempts a constructive survey and review of some recent work, and presents concepts of the cause, cure, and prevention of mastitis. It is presented as a service to the dairy industry, whose coöperation with veterinarians will hold this disease under control.

The Infective Process

Many attempts have been made to produce mastitic infection by feeding virulent strains of such organisms, or by injecting them into the blood stream. In no case have these attempts succeeded. The condition has been artificially produced by introducing suspensions of bacteria into the teat canal beyond the meatus of the teat. Even here low concentrations of active organisms are less effective, and the disease is produced by a single inoculation only when high concentrations are used. It is believed (8) that normal milk contains some natural substance capable of inhibiting bacterial growth, and that this material is able to care for minor invasions, but fails in the face of large numbers of organisms.

The weight of evidence, therefore, indicates that all such infections enter the udder from the outside. The organisms are carried on bedding, on the hands of careless milkers, on the teat cups of milking machines, or on other surfaces, so as to be deposited at the opening of the teat canal. Entrance may be effected by the suction within the teat on the relaxation interval of the milking process or by some other mechanism. Entrance is facilitated if the spincter muscle be relaxed so as to close the teat incompletely, or if there occur any injury such as a wire cut or a bruise with breaking of the skin.

The Mechanism of the Infectious Process

Just what happens after the organisms become well established in the udder is not entirely clear, but certain symptoms of the disease contribute some understanding. A major result seems to be a marked alteration in the permeability of the tissues which normally separate the blood stream from the mammary gland. It must be remembered that anything taken from this gland was brought to it in some form in the blood stream. In the blood stream are found the amino acids, polypeptides, and simple proteins which later are to form casein and the other milk proteins. In the blood stream also are found those fats and phosphatids which are to be converted to butter-fat, and the salts and water which appear in the milk. In the normal udder all these materials pass the tissue barrier and appear more or less altered in the milk. In badly infected udders there is an abnormal conversion of the milk components in the udder so that mastitic milk shows a lower than normal lactose and casein content, and a higher chloride content. In such udders, the salts from the blood stream pass the barrier in quantities larger than normal so that the chlorides may be estimated by the titration test, and the other (buffer) salts by their effect on the acidity of the milk. In normal milk the pH is about 6.4–6.6 (the pH of colostrum is somewhat lower), while the pH of cow's blood is about 7.4. One of the manifestations of severe mastitis is a rise in pH, so that milk with pH 6.7 is questionable, and pH 6.8 and above is usually rated as mastitic.

The defenders of a healthy body against infectious organisms are the white blood cells, or leucocytes. The blood stream carries millions of these cells to the focus of infection, and there they tend to kill or neutralize the bacteria by (a) actually engulfing them (phagocytosis), or (b) by the formation of chemicals which kill them. Similarly a bacterial invasion of the cow's udder brings a flood of leucocytes to do their job. They pass through the barrier and often appear in the milk as flocs or clumps.

It is of interest to note that very often a high bacterial count in mastitic milk is not accompanied by, but is followed by a high leucocyte count. In other words, there is a definite lag in the assembly of the protective forces, and, although in the usual case the bacteria counts and the leucocyte counts vary from comparatively low (but still above the normal level) to very high, the health forces are later in arriving on the scene.

In addition to these effects, the bacterial invasion brings about a generalized reaction in the udder similar to that of a carbuncle. As this inflammation spreads, there is production of mucous material and of dead tissue cells in the milk. There is also, an increase in the connective tissue between the glands, and a change of the soft spongy gland tissue into a hard and "meaty" scar tissue which rapidly loses its capacity to produce milk. Such an udder is said to be "indurated."

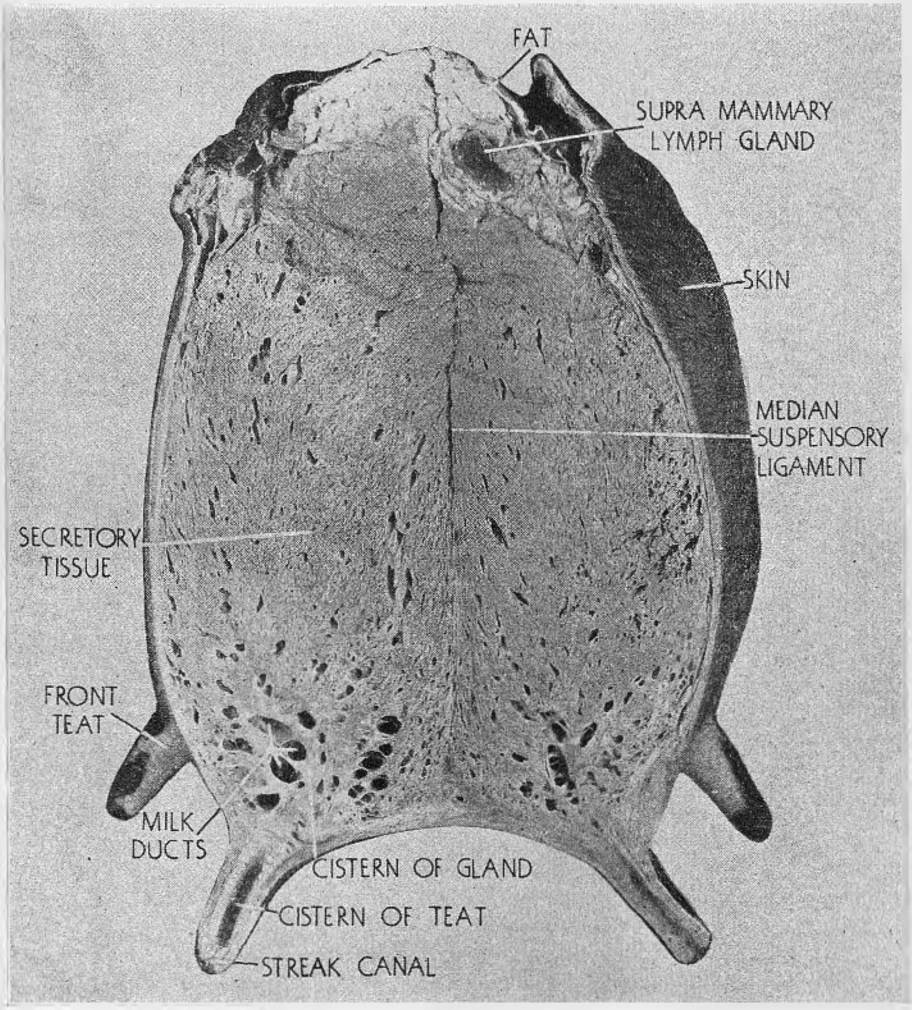
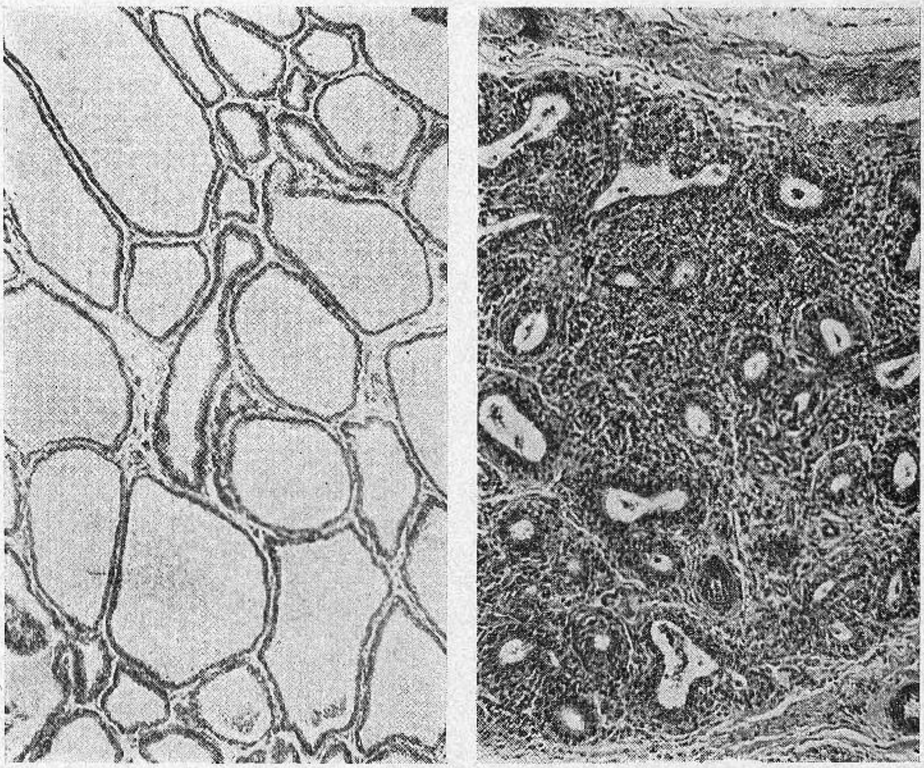


FIGURE 1

Cross Section of the Rear Quarters of A Cow's Udder.

From "The Comparative Anatomy of Mammary Glands" by C. W. Turner.

Another evidence of the increased permeability of this barrier is seen in the report (5) that skim milk from infected quarters gave the precipitin reaction with cow serum, indicating an increased amount of blood serum proteins in the milk. It thus becomes clear that in severe cases of mastitis the barrier permits the passage of abnormal amounts of salts, proteins, and leucocytes, whose presence may be used in the detection of the disease. This has been stated in a recent paper in these words: "Since some of these constituents (chlorine, lactose, casein) may be derived directly from the blood by diffusion through the cell membranes, while others must be synthesized in the mammery gland, it appears as though in mastitis there must be a change in the synthetic and secretory mechanisms of milk secretion as well as an increase in the permeability of the cell membranes" (14).



(a) normal *(b) mastitic*

Figure 2. Udder Tissue

Normal Udder Tissue (Left) and Chronic Mastitic Udder Tissue (Right). Note Conversion of Soft Milk—Producing Tissue into Meaty, Fibrous Tissue.

Courtesy of the College of Agriculture, University of Maine.

The Forms of Mastitis

The course of mastitis may follow two rather distinct forms which seem to depend on the general health of the cow, treatment, virulence of the infection, and other factors. In the less common *acute* form, a severe case of mastitis develops quickly, the infected quarters become swollen and painful, and there is a sudden decrease in milk flow, accompanied by chills and fever. The cow may be "off-feed," the infected quarters often become dry, contracted, and hard. The infected tissue may "slough" so that the animal actually loses one or more quarters, and the death of the animal is not an unknown sequel (16).

The swelling mentioned above should not be confused with the normal swelling or "caking" of the udder just prior to and immediately after parturition, for this is usually an edematous swelling under the skin, caused by disturbed circulation of the blood from the pressure created by the new milk flow.

More often the development of the *chronic* form of the disease may continue undetected through several months or years, until much of the gland tissue is replaced by useless scar or fibrous tissue. In many cases the teat canal is involved, and scar tissue develops until the canal is partially or completely closed. Surgical intervention provides temporary relief, but mastitis has been cured only rarely up to now. In both forms of the disease, the presence of bacteria, leucocytes, and abnormalities may usually be demonstrated in the milk. Either form may change into the other.

III. How Is Mastitis Detected?

Physical Methods

Several physical methods will detect advanced stages of mastitis. A physical examination of the udder involves the observation of abnormal shapes or unsymmetrical quarters, as well as of any possible injuries or non-functioning quarters. A careful feeling and kneading (palpation) of the milked-out udder may reveal hard fibrous quarters, lumps or swellings, and "spider" or obstruction in the teats. This physical examination is extended to the milk when clumps, clots, flakes, or strings may appear in the fore-milk, and be caught on the fine-mesh wire or black cloth strainer cover of the strip-cup. These appear to consist of mucus, tissue cells, and masses of leucocytes. The daily use of the strip-cup in their detection is a practical and reasonably sensitive test for advanced cases of mastitis—the very least that should be done by every producer. Milk that appears bloody, brown, or otherwise discolored indicates mastitis, except in a fresh cow or one with injuries. Such milk often has a bitter or salty taste, and is usually badly contaminated with microörganisms, so that it is unfit to enter the market. Making a record of recurrent positive findings in the strip-cup test will often betray the incidence and development of mastitis in a cow before any gross external changes are apparent.

Chemical Tests

For those cases in which the udder and milk appear normal, somewhat more sensitive chemical tests have been proposed.

1. Brom thymol blue is an organic dyestuff which is yellow at pH 6.0 and blue at pH 7.6, and which is widely used for the detection of mastitis. When a solution of this indicator is added to normal milk, the color becomes yellow to light green, while a grass green or blue color indicates mastitis. While this test is not valid on cows recently freshened nor on cows in the last stages of lactation, it is widely used in conjunction with the strip-cup. In all such tests, each quarter should be sampled separately.

2. Methylene blue is a dye which is reduced to a colorless form in solutions in which there is a deficiency of dissolved or loosely combined oxygen. Since bacteria have the power of producing such conditions, the rate at which a milk-methylene blue mixture loses its color permits an estimate of the bacterial population. In most cases a bleaching in less than 3.5 hours is taken as an index of excessive contamination of the milk.

3. Titration with silver nitrate will reveal abnormally high concentrations of the chlorides responsible for the salty taste. As in the acidity test above, individual cows show rather wide variations. Recently a test depending on electrical conductivity has been proposed to detect excessive salt concentrations.*

* See this JOURNAL, 3, 314 (1940).

4. Catalase is an enzyme capable of catalyzing the decomposition of hydrogen peroxide. In infected udders leucocytes or other blood bodies rich in catalase are more abundant, and it is claimed (12) that the determination of catalase activity will detect more than 80 percent of all mastitis cases.

5. Rennet is an enzyme capable of coagulating milk, and has been used by Hadley (2) to detect mastitis. In mastitis the lowered casein content, the higher percentage of non-casein proteins, the higher pH, and the higher salt concentration of the milk all tend to retard the coagulation by rennet. The reliability of this simple test is said to be comparable to that of the indicator and chloride test (12).

6. The Whiteside test is one of the more recently proposed methods. A modification proposed by Murphy and Hanson (11) involves the mixing of one volume of Normal (4%) sodium hydroxide with 5 volumes of fore-milk. When drops are mixed 20 seconds on a glass plate, normal milk remains unaffected, while mastitic milk shows a coagulation which is proportional to the degree of infection. In a 3+ reaction the system first forms a viscid mass and then breaks up into a slightly opaque fluid and a precipitate composed of large particles or a solid mass of scum-like nature, while the maximum test (4+) is characterized by a thick viscid mass that does not break up. Refrigeration of the fore-milk samples reveals 20 to 40 percent more reactions as compared with the fresh samples. An extensive series of tests indicated that the correlation of this test with the leucocyte count is better than with the organism count (11).

7. In the Hotis test 0.5 ml. of a 0.5 percent solution of bromcresol purple is added to 9.5 ml. of milk. This is also an indicator of acidity (yellow pH 5.2—pH 6.8 purple) but, when used with sodium azide or other added materials, its action involves other factors. After incubation of the initially purple solution for 24 hours, various types of bacteria are recognized by people skilled in the test. Some of the reactions observed depend on the development of acidity, while others involve the appearance of canary yellow or other colored spots, flakes, or precipitates. This test is considerably more than a chemical test, and represents a simplified cultural test of growing usefulness not only in detecting mastitis, but also in determining the classification of the causative organisms.

Microscopic Examination of Milk

In the view of many able investigators the most reliable detection of mastitis is by microscopic examination and bacteriological culture studies. This involves the examination of the milk for leucocytes, epithelial cells, mucus, and microörganisms. The presence of more than 500,000 leucocytes per ml. is usually indicative of an udder abnormality and possibly mastitis. The presence of large numbers of long chain streptococci in aseptically drawn milk is correlated with a test for their possible pathogenicity by the degree of hemolysis of areas surrounding colonies inoculated on defibrinated horse or rabbit blood agar. Colonies showing a wide zone of hemolysis may be of human origin, and cows giving off these types should be eliminated (13). Little (7) records 2,163 examinations of the fore-milk of cows affected with subclinical mastitis, finding that plating the fore-milk in blood agar and direct leucocyte counts are more efficient in detecting infection than either pH or the chloride test. Such tests need to be repeated at regular intervals (11), since in cases of known mastitis the counts of such cells and of such organisms vary independently (and often oppositely) from relatively low to very high values. The skilled veterinarian is often of valuable assistance in such tests, and in some areas can use some facilities of city and state laboratories.

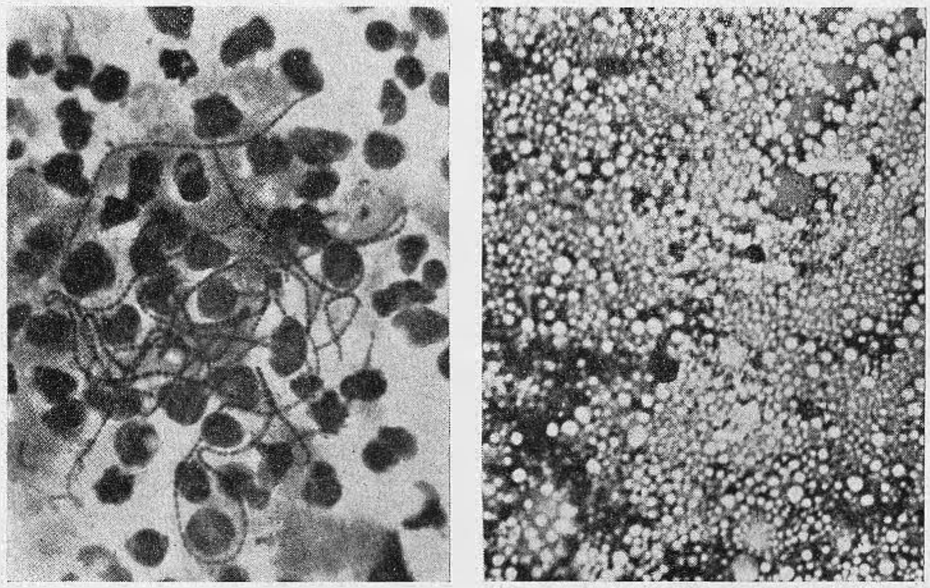
It appears that no single test so far proposed is completely dependable in the detection of mastitis (4), and real progress may be made if students of the problem realize that one may test relatively low. A few hours later milk from the same quarter may show a much lower organism count but a very high leucocyte count. In view of this it is not surprising that two tests which depended on these factors

FIGURE 3. BARN TEST
Two Widely Used Simple Tests for the Detection of Mastitis.
Courtesy of the College of Agriculture, University of Maine.

for the organisms or for their effect, but that a given sample of milk will not always react to both tests with the same sensitivity. Thus it seems that often when the bacteria count is high, the leucocyte count may be should not give strongly positive indications on the same sample. One must distinguish clearly between the infection itself and mastitis, the disease or body reaction set up by the infection, and must bear in mind the possibilities that an established infection may not be continuously demonstrable, that a pathogenic organism may elicit varying inflammatory responses, and that other factors such as lactation periods, illness, injury, etc., may produce false positive reactions by certain tests. A clearer understanding of the fundamental basis of each test will make unnecessary much of the discussion aimed to demonstrate that one test is better than another. Each of them has certain advantages, but none can be relied on to give a sure answer on one sample of milk; repeated testing is necessary.

In most barns mastitis will continue to be detected and cows will continue to be segregated or condemned as a result of the use of palpation, the strip cup, and possibly bromthymol blue, together with the observation of one or more of the following symptoms (1):

(a) Milk contains flakes, clots, ropy or purulent masses, and becomes watery or straw-colored in appearance.
(b) Quarters become light, blind, or atrophied.
(c) Udders become indurated (partially filled by scar tissue).
(d) Milk has a rancid odor and a salty taste.
(e) Milk, after standing several hours, shows a waterlike area just below the cream line, with a small volume of cream formed.



(a) mastitic milk *(b) normal milk*

FIGURE 4.

Appearance of Milk Samples

Courtesy of the College of Agriculture, University of Maine.

IV. How Mastitis May Be Cured

At present an acutely infected cow is treated by the removal of various unsanitary or unhealthy conditions which seem to predispose the animal to be attacked by the organisms always present. Such conditions (1) are said to include: mechanical injuries, heifer and calf sucking, overfeeding (especially of grain), insufficient bedding and damp floors, sudden exposure to cold rain, drafts, low temperatures, careless and incomplete milking, excessive milking machine pressures, poor sanitation, old age, drying off, improper stripping, and certain stages of lactation.

Positive measures may include: reducing the feed, milking out the udder every two hours, application of cold compresses for 48 hours followed then by hot compresses, support and gentle massage of the udder. Some veterinarians choose to administer laxatives or other drugs. All such methods are largely palliative—aimed to supplement and to bolster up the animal's natural defenses. Several attempts to employ vaccines have been unsuccessful (3). Basic factors in the picture seem to be the general resistance of the animal and the number and virulence of the bacteria that gain entrance to the teat canal.

Recently there have appeared promises of effective action against the cause of mastitis. Some success has been reported for sulfanilamide in acute stages. Various materials such as gramicidin, acriflavin, tryptaflavin, and Novoxil (9, 10) have shown splendid effectiveness against organisms causing mastitis. The Novoxil of Squibb seems to be particularly useful, and is reported (6, 15) to have destroyed the infection in 82 percent of the infected cows and in 88 percent of the infected quarters. Some of the therapeutic agents are especially effective against certain organisms, so that identification must precede medication. Mastitis is a preventable disease, and these recent tests indicate that it may soon be classed as a curable disease.

V. How Mastitis May Be Prevented and Controlled

The wide prevalence and the importance of mastitis makes this the most important section of this discussion. While the cure of an infected cow belongs clearly in the hands of a skilled veterinarian, the day to day supervision and study by dairymen are required to control the incidence and spread of infection. By observation of the cows, their udders, and their milk, these men will learn to detect the signs of the disease discussed above. A thorough knowledge of the factors in the case will enable them to prevent potential losses, and to produce superior quality milk by adherence to the preventive and control methods described.

Replacement animals and cows that have calved recently should always be carefully examined before their admission to the herd. Cows offered on the market are likely to be low producers or mastitic or both. A thorough examination by a veterinarian should be followed by a quarantine from the rest of the herd until repeated examinations reveal no signs of infection.

The secretion of individual quarters of the udder should be examined at regular intervals by the strip-cup, or the bromthymol blue test, or both. Cows secreting abnormal-appearing milk or milk that reacts to either of these tests should be segregated from the herd immediately. Badly infected animals should be eliminated immediately.

Cows with a vaginal discharge are dangerous in the possibility of such discharge contaminating the teats and udder. Isolation pens for such animals should be used until they are disposed of or returned to the herd. Such pens should be thoroughly cleaned and disinfected after each use. Cows showing flakes or other abnormalities in the strip-cup test should be suspected. Cows free of suspicion in regard to infection should be milked first, and those of suspected or known infection placed at the end of the line to be milked last.

Stable sanitation should include clean dry floors (the use of crushed limestone, superphosphate or lime has been suggested), ample supplies of clean bedding to minimize contact with the floor, clean and whitewashed walls and ceilings, adequate light and ventilation. All these retard the development of most organisms associated with milk.

Proper sanitary precautions during the actual milking operations will probably be the most important factors in prevention and control. Organisms may be carried from an infected udder to a clean one on the hands of milkers, on teat cups of milking machines, on contaminated floors and bedding, on dirty cloths used to wash and dry the udders, or on teat plugs and tubes. Udders should be kept clipped, and just prior to milking should be cleaned thoroughly with a germicidal solution containing 200–300 p.p.m. of available chlorine (as hypochlorite, etc.). When paper towels are not employed, individual cloths that have been boiled and then soaked in the chlorine solution are advised. The fore-milk from each quarter should be drawn in the strip-cup for examination. This milk is inferior in quality, and must be disposed of so that it cannot carry infection.

After milking each cow, the milker's hands should be washed in soap solution and dried with a clean sterile towel. When a machine is used, the teat cups should be rinsed in a chlorine solution after each cow is milked. In the presence of known infection, rinsing of the teat cups and dipping the cow's teats in a chlorine solution should be mandatory. Under no conditions is wet hand milking to be tolerated.

The drying-off of a cow is best accomplished by reducing the feed and continued complete milking out. Intermittent or incomplete milking should be avoided (16). Cows should be protected from severe climatic changes. Sucking habits of calves, and the use of milking tubes or teat dilators are likely to injure the delicate udder tissues.

Overfeeding and high grain rations were listed among the predisposing factors to be guarded against. The recently calved cow should be carefully inspected before her return to the herd.

While many of the precautions listed above may seem burdensome, the careful and intelligent milk producer realizes that in his hands rests the responsibility for supplying to consumers a product that is above suspicion. The elimination of mastitic infection from a herd is now possible, and will pay dividends in increased produciton of higher quality milk. The dairy industry has much to gain from continued efforts designed to win increasing public confidence in and acceptance of this basic food commodity—pure milk.

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Report of the Committee on Sanitary Procedure International Association of Milk Sanitarians for 1941

BECAUSE manufacturers of equipment are feeling the effect of the "all out" defense effort, the recent activities of this committee in the standardization of new devices for equipment have been somewhat curtailed. The production of standardized dairy and milk plant equipment has continued and in fact must be moderately expanded to meet the ever increasing demands for milk and milk products as vital foods. In addition to the needs of our armed forces and our defense workers for these energy building foods is the increased need for milk products for "lease-lend" aid. However, both health officials and manufacturers should coöperate during the national emergency in holding in abeyance the production of new milk equipment devices involving retooling or an increased use of important defense materials. Furthermore, your committee urges the coöperation of the members of this association and other milk control officials with the Dairy Industries Supply Association in an extensive program of conserving vital materials by curtailing their use, and in the selection of satisfactory alternative less critical materials wherever necessary.

Perhaps this is an opportune time to review the progress of the committee in recent years and to plan new developments to be turned into steel when and if the time comes to "beat our swords into plowshares."

In reviewing the report of this committee, then called the "Committee on Dairy and Milk Plant Equipment," of eight years ago we read:

"Your committee believes that much could be gained if some organized group of milk control officials, preferably a committee of this organization, could confer with manufacturers of dairy and milk plant equipment and gradually develop models that will be generally acceptable. Manufacturers have invited the criticisms of individual health departments but there has been no general attempt at standardization."

The report went further to suggest coöperation in this work with committees of the International Association of Milk Dealers and of the Dairy Industries Supply Association.

The coöperative idea took time to take root and the work of the committee for the following few years was devoted to experimenting with the drawing of specifications covering such items as inlet and outlet connections to pasteurizers or holders. It was felt that this was one method of crystallizing official opinion as to what constituted satisfactory equipment. There was some opposition to this procedure from those who felt that the specifications constituted a form of ordinance or would be incorporated in ordinances.

Finally in the fall of 1937 plans were completed for setting up a coöperative program between (1) this committee under its present name *i.e.* "Committee on Sanitary Procedure," (2) the Technical Committee of the Dairy Industries Supply Association, and (3) the Simplified Practice Committee of the International Association of Milk Dealers.

It has been evident from the start that the three associations have a community of interests in this project. The manufacturers are interested in standardizing equipment to avoid duplication of stocks, to permit mass production, and to satisfy their customers. The dealers are interested in standardized equipment so that they can buy with the confidence that they are getting the best designs available, that the equipment they buy will be readily cleanable, that it is not likely to affect the flavor of the milk, that it is most likely to pass sanitary inspection, and because of reduced cost and more prompt delivery resulting from quantity production. The official in charge of milk sanitation is interested because this program simplifies his work by giving him the opportunity of securing the considered judgment of other experienced men as to the acceptability of equipment from a public health standpoint and it relieves him of the necessity of requiring the replacement of unsatisfactory new equipment after it has been installed.

As soon as this program was instituted the three committees started work on standardizing important sanitary features of design and critical measurements of parts of equipment, starting with those in which the need for standardization was most apparent.

Each item "accepted" by the committees as a current standard may be considered as representing the best sanitary construction practical at the time.

It is recognized that improvements will be possible in the light of new developments. However, it is expected that each standard will continue in effect for a period of years and that there will be sufficient notice of proposed changes to minimize losses resulting from obsolete stocks.

The items that have been accepted by the three committees have been called "Three Association Standards." These have been reported by the committee from year to year and illustrated in the JOURNAL OF MILK TECHNOLOGY. A list of these items for the first three years, that is, up to and including the last annual report of the committee, is as follows:

1. 12-R recessless pipe union........ (a)
2. 12-RG gasketed recessless pipe union (a)
3. 7 tee threaded on all ends to receive 14-R ferrules with 13-H union nut .... (a)
4. 9 cross threaded on all ends to receive 14-R or 14-RG ferrule with 13-H union nut................ (a)
5. 10-C valve threaded on all ends to receive 14-R or 14-RG ferrule with 13-H union nut........... (a)
6. 2-C bend .... (a)
7. 2-CG gasketed bend.............. (a)
8. Type RN indicating thermometer fitting for tanks and vats*.... (a)
9. Type RN indicating thermometer fitting for pipe lines*.......... (a)
10. Type RN recording thermometer fitting for tanks and vats*.... (a)
11. Type RN recording thermometer fitting for pipe lines*......... (b)
12. Removable nut type RN indicating thermometer fitting for tanks and vats .... (b)
13. Removable nut type RN indicating thermometer fitting for pipe lines (b)
14. Removable nut type RN recording thermometer fitting for tanks and vats .... (b)
15. Removable nut type RN recording thermometer fitting for pipe lines (b)
16. 2-F bend (male and female)...... (c)
17. 2-FG gasketed sanitary bend (male and female).................... (c)
18. 13-H hex nut.................... (c)
19. 32-15 reducer .... (c)
20. 32-15 G gasketed reducer.......... (c)
21. 14-R ferrule..................... (c)
22. 14-RG gasketed ferrule............
23. 15-R ferrule..................... (c)
24. 15-RG gasketed ferrule............ (c)
25. 16-A cap........................ (c)
26. 16-AG gasketed cap..............
27. Flanged stem indicating thermometer for insertion through vat covers .... (c)
28. Flanged stem recording thermometer for insertion through vat covers .... (c)
29. Sleeve type adapter for adjusting the elevation of thermometers inserted through covers.......... (c)
30. Umbrella type adapter for adjusting the elevation of thermometers inserted through covers......... (c)
31. Thermometer adapter No. 1 for pipe lines...................... (c)
32. 3 in 1 fitting for installing recording thermometer and controller bulbs in tanks and vats............. (d)
33. 3 in 1 fitting for installing recording thermometer and controller bulbs in pipe lines.................. (d)
34. Position of handle in 3 way valves—Standard 11-c valve. "The handle shall point in the direction of flow with the flow entering at the side opening." .... (d)

* Substitute a standard hex nut for that shown in illustration.

(a) See *J. Milk Technol.*, 1, No. 7, November 440 (1938).

(b) *Ibid.*, 2, No. 2, March, 92–93 (1939). Note standard hex nut.)

(c) *Ibid.*, 3, No. 2, March–April, 65–71 (1940).

(d) *Ibid.*, 4, No. 4, July–August, 214–217 (1941).

During the past year the committee has held meetings in New York, Philadelphia, and Pittsburgh. The specifications for Sanitary Motors have been completed as shown in the attached draft and passed on to the Simplified Practice Committee of the International Association of Milk Dealers for their consideration. Even after acceptance by the other two committees, we must bow to defense needs and await a more opportune time for the industry to place these motors in production.

In view of practical working difficulties that have been experienced during the year in the metal industry, the committee reconsidered last year's action in standardizing the size of holes in strainers, and adopted a new standard given below. Other matters considered included acceptable tolerances on pipes and ferrules. Large differences in diameter result in undesirable and sometimes troublesome pockets.

Considerable work was done by the committee and more especially by a subcommittee to standardize the smoothness of the so-called number 4 finish on stainless steel sheets and tubes by various manufacturers and at various times by the same manufacturers. The completion of this work must necessarily be held in abeyance until the defense emergency is over.

The acceptances of the past year make the following additions to the list already given:

35. Specifications for sanitary motors.
36. Homogenizer pressure gauge—Flanged coupling.
37. No. 5 dual ferrule for indicating and recording thermometer.
38. No. 6 dual ferrule for indicating and recording thermometer.
39. Metal strainers are to have holes 3/32″ in diameter in metal not thicker than 1/16″ with selvedge edges of one half inch or more, *i.e.* no perforations within 1/2″ of the edge of any perforated sheet.
40. Tolerances of +.002″ and —.008″ are permissible in sanitary tubing of 1″ to 3″ in diameter and of +.002″ and —.013″ in sanitary tubing of 3½″ to 4″ in diameter.

Tolerances of +.002″ and —.000″ are permissible as applied to the "T" dimensions on 3-A standard drawings for 14-R, 15-R, and 15-RG fittings.

It should be noted that final action has not as yet been taken by the other two associations on items 35 and 36. Such action is necessary before they become 3-A standards.

There has been quite a general acceptance of 3-A standards. We are sorry to admit that there is more general acceptance of the standards on the part of manufacturers and dealers than on the part of health officials. However, your committee recognizes that a greater effort should be made to keep health officials posted on both new and old developments. A current project is to make white line drawings of each accepted item available to health officials on request. It is recognized that accepted standards may not always represent ideal equipment. They do represent what in the considered judgment of the committee is the best sanitary construction that is practically obtainable under present conditions. With this explanation of the program, your committee again would strongly urge all milk sanitation officials to coöperate to the fullest extent by recognizing accepted standards.

All of the items accepted are now in production. However, we wish again to repeat the request to milk sanitarians not to demand the replacement of a serviceable and otherwise satisfactory item with a new standard item until it needs replacement, also not to require the new standard item in new installations until a reasonable time has been allowed to get the item in production.

This is especially necessary as a matter of coöperation in the defense program. Every effort should be made to permit the greatest utilization of equipment and containers commensurate with safeguarding the public health as a means of conserving materials which we are told are vitally needed for defense.

Your committee recommends that

work on this program be continued with the fullest coöperation. Without such coöperation this work is almost useless.

W. D. TIEDEMAN, *Chairman.*
C. B. DALZELL
W. D. DOTTERRER
H. C. ERIKSEN
M. R. FISHER
A. W. FUCHS
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SPECIFICATIONS FOR SANITARY MOTORS ADOPTED APRIL 8, 1941 BY THE COMMITTEE ON SANITARY PROCEDURE OF THE INTERNATIONAL ASSOCIATION OF MILK SANITARIANS AND A COMMITTEE OF THE NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION, PROPOSED FOR A 3A STANDARD

It is the sense of this Joint Committee that these specifications shall be considered acceptable until urgent necessity indicates the desirability of change as decided upon by formal action of such committee.

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

A. OBJECTIVE

These specifications apply to motors possessing sanitary features, fitting them for use in connection with sanitary equipment operated in milk and food processing establishments.

The purpose is to specify a design which can be: (a) readily mounted in a sanitary manner on food and milk processing equipment, (b) easily maintained in a clean and sanitary condition, (c) enclosed in a manner to prevent the entrance of vermin and the escape of oil or grease, and (d) practical from the standpoint of maintenance of bearings, windings, and lubrication.

B. SCOPE

1. *Types of Motors.*
Horizontal and vertical 2-bearing standard motors and standard gear head motors.

2. *Ratings and Frame Sizes.*
The ratings covered by these specifications are fractional horsepower motors and integral horsepower motors in NEMA* frames.
Ratings 1½ h.p. 1800 r.p.m. and smaller shall be of the totally enclosed, non-ventilated type, while ratings 2 h.p. at 1800 r.p.m. and larger may be of the totally enclosed, non-ventilated type or splash proof motor with perforated metal screens over all openings.

C. ELECTRICAL DESIGN

1. *General.*
In electrical design, these motors shall conform to NEMA standards.

2. *Temperature Rise.*
Temperature rise shall be in accordance with NEMA standards as follows: Totally enclosed, non-ventilated motors—55° C. rise, continuous duty. Splash-proof motors — 50° C. rise, continuous duty.

D. MECHANICAL DESIGN

1. *Dimensions.*
All motors shall conform to NEMA standardized dimensions.

2. *Frame.*
The frame shall have a smooth external surface without fins,

* National Electric Manufacturers' Association.

multiple ribs, pockets, crevices, sharp corners, or roughened surfaces resulting from molding or machining operations. A readily cleanable radius shall be provided at all corners.

The feet of the frame or gear case shall have flat bottom surfaces without pockets or recesses. If the motor is to be mounted on a flat surface, the entire bottom of the frame shall be machined in the same plane as the feet, otherwise the bearing surface for mounting shall be limited to the feet and/or any web connecting them. Webs between the feet shall be machined in the same plane as the feet. Foot design shall be suitable for mounting on studs.

Except in the case of motors designed for mounting on a flat surface with the entire bottom of the frame machined in the same plane as the feet, all mounting shall be such as to provide a minimum clearance of 4″ beneath the portion of the frame extending between the feet.

All ventilating openings shall be shaped to permit the use of removable screens of the same construction as specified under "End Shields."

Terminal leads of totally-enclosed, non-ventilated motors shall be sealed vermin tight with a suitable compound where they pass through the motor frame. The seal around the terminal leads of splash-proof motors shall be vermin tight and such as to prevent the ready entrance of moisture from the ventilating air stream into the conduit terminal box.

If drainage holes are provided in the bottom of the frame, they shall be screened with the same material as described under "End Shields."

3. *Insulation.*

   All motors shall be provided with moisture resisting insulation.

4. *End Shields and Attached Gear Housings.*

   End shields, gear housings, and other motor attachments and accessories shall have a smooth exterior surface without fins, pockets, crevices, sharp corners, or roughened surfaces resulting from molding or machining operations. A readily cleanable radius shall be provided at all corners. If holes are required for plugs, gauges, etc., or for cap screws or through bolts securing end shields, raised bosses shall be provided in place of depressions of any kind. Convex surfaces shall be provided as necessary to avoid the accumulation of dirt or liquid matter when mounted in either the horizontal or vertical position.

   Ventilating openings in end shields, gear housings, etc., shall be effectively screened against the entrance of vermin. The screens shall be reasonably tight fitting. They shall be located so as to be readily removable for cleaning. The screens shall be constructed of non-corrodible perforated metal with perforations not over 3/32″ in diameter.

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

   Vents for gear housings or where otherwise required shall be of the normally closed type, opening only when air in the gear casing expands by heat. Such vents shall prevent entrance of water or liquid into the gear case.

5. *Bearings.*

Sleeve, ball, and roller bearings are acceptable. Bearings shall be mounted to permit easy replacement. In all cases the bearings shall be designed so as effectively to prevent leakage of oil or grease to the exterior. Seals shall be provided to close shaft openings in end shields or gear cases. Such seals shall be designated effectively to prevent leakage of oil or grease during ordinary operations.

All fittings, plugs, gauges, etc., provided to facilitate inspection, lubrication, and cleaning of bearings and housings, or for other cause, shall be of non-corrodible metal or suitably plated effectively to resist corrosion, and shall be fitted when installed to avoid exposed threads. Plugs with straight threads arranged for fitting tightly against a shoulder are required. Grease cups of the screw down pressure type are considered unsatisfactory..

6. *Fittings and Accessories.*

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

Conduit terminal boxes shall either (1) fit tightly against the motor frame so that no open crack or crevice is formed or (2) shall be mounted so that the back of the box is at least ¾″ from the motor frame to permit cleaning behind the box. The nipple or spacer between the terminal box and frame shall have no exposed threads.

(b) *Grease or Oil Fittings.* (See 5 "Bearings.")

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

(d) *Vents, Plugs.* (See 4 "End Shields" and 5 "Bearings.")

(e) *Other Small Parts.* All external small parts, such as cap screws, crown nuts, etc., whether mentioned in other paragraphs or not, shall be of non-corrodible metal or suitably plated so as effectively to resist corrosion.

7. *Finish and Color.*

Finish shall be light color, of baked or air dried enamel or lacquer, or of chrome plate or unplated polished dairy metal. If enamel or lacquer is used, aluminum color is preferable. If chrome plate is used, castings of brass or bronze are required until a satisfactory method of chrome plating cast iron or other materials is developed and demonstrated.

8. *Name Plates.*

Motors conforming to these minimum sanitary specifications should bear a nameplate of stainless steel, chrome-plated brass, or other accepted dairy metal with the words "3A SANITARY MOTOR" prominently displayed. The nameplate shall be shaped to fit the frame, eliminating open cracks or crevices.

The Navy Milk Supply

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THE mission of the Medical Department of the Navy is "to keep as many men at as many guns as many days as possible."

One can readily appreciate the connoted implication of preventive medicine in this statement. We all are cognizant of the rôle that milk can play in the dissemination of the following communicable diseases: typhoid, paratyphoid, septic sore throat, scarlet fever, diphtheria, undulant fever, and tuberculosis. Ample statistical data is on file to substantiate the involvement of milk in the spread of these diseases. It can readily be appreciated that in order to maintain a high efficiency of Navy personnel, a program of milk control at shore establishments, particularly, must be undertaken.

As in the civilian population, naval officials recognize the importance and value of milk in the daily diet. On the station at Corpus Christi, every man is given a bowl of milk at breakfast to which he may add a cereal of his choice from a wide assortment of individual packages. Or, if he chooses, he may utilize his serving simply as a beverage. Milk is also available at the ships' service stores at all hours, where it is dispensed in the original containers. Evaporated milk and powdered milk are also important items. These products are used extensively in the bakery and in the galleys in the preparation of other items of the menu. Aboard ship these milk products assume an even more important rôle, since storage space and refrigeration are factors to be dealt with.

This paper will be limited to a discussion of supervision of the product commonly known as "market milk" for shore establishments. The Navy standards for fresh milk are essentially the same as the requirements of Grade A Pasteurized milk as defined in the United States Public Health Service Standard Milk Ordinance, namely, that the milk shall be properly produced, properly pasteurized, have a minimum butter fat content of 3.25 per cent, be delivered at a temperature of 50° F. or below, and the bacteria count not to exceed 30,000 per cubic centimeter.

It is understandable that the Navy cannot maintain a staff of sanitarians to supervise the production and processing of a sizeable municipal milk supply, and there is no reason why it should, especially where a competent, full-time public health department is functioning. For example, in Corpus Christi, the City has adopted the U.S.P.H.S. Standard Ordinance, and has a department of health with a milk sanitation division which coöperates with the State Department of Health in grading the raw milk supply and also supervises and inspects regularly the milk plants.

Navy regulations require the Medical Officer of each shore establishment to make a monthly sanitary report to the District Commandant, which embraces, among other items, pertinent data on the food supply of the station involved. In keeping with this requirement, the Station Medical Officer has established a Sanitary Division with a sanitary officer at its head, who, in addition to carrying on routine sanitary activities, also acts as liaison to the local, state, and Federal official agencies. This policy affords a very close coöperative relationship on matters of public health and particularly food control, between the station involved and civilian authorities. It is through these channels that a cross-section of the sanitary quality of the milk-producing farms is ascertained.

We are concerned in problems of local milk sanitation from the following standpoints:

1. The milk supply for the Navy personnel proper.
2. The milk supply for the families of the officers and enlisted personnel.
3. The milk supply of the Ships' Service Stores through their restaurants and soda fountains dispensaries.
4. The milk supply at the local groceries, restaurants, soda fountains, and school cafeterias frequented by Navy personnel and their families.

In the aforementioned items of involvement of the milk supply, our interests are divided into two major classifications: (1) On station requirements, and (2) On shore implications.

Many of the officers and enlisted personnel maintain quarters on shore and of necessity purchase provisions and food supplies from local establishments. In this connection an educational program must be undertaken by the Sanitation Division of the Medical Department of the Navy to familiarize these individuals with the quality particularly of the milk supply in the local community in order that they may avail themselves of a safe product in their purchases of food commodities.

Such a program has been undertaken at the Naval Air Station in coöperation with the local City-County Health Department, in order that Navy personnel can be the beneficiaries of such inspections and investigations. It is fair to assert that this program not only has been profitable to our own personnel but has been and continues to be a powerful factor in the general improvement of community sanitary standards.

With establishment of a large Naval Base such as the one at Corpus Christi, the influx of large numbers of construction workers, in addition to thousands of Navy men and their families, there is naturally created a problem of adequate milk supply. The Medical Department has recognized this demand and through its liaison activities with the local public health authorities is sponsoring the adoption of the Standard Milk Ordinance in municipalities adjacent to the Naval establishment. A dual interest is involved in this undertaking: namely, (1) To increase the number of municipalities functioning under a uniform milk program, and (2) The establishment of a desirable and acceptable reservoir that can be called upon in the event of seasonal shortage or other emergencies.

There are only two major milk companies serving the metropolitan area of Corpus Christi and the Naval Air Station. It is significant that routine samples taken over a period of several months show the benefits of combined naval and municipal coöperation in the supervision of the local milk supply. Sanitarians of the Medical Department meet the delivery trucks when they arrive at the station, and samples are taken at every point where milk is unloaded. Temperature checks show that it is below the maximum allowed, and laboratory determinations for butter fat and bacterial content show that the milk is well within the limits prescribed by the Standard Milk Ordinance. It may be correctly said that a quality product is consistently available.

Corrosion Tests on Acid Cleaners Used in Dairy Sanitation*

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Alkalies and alkaline buffer salts have been practically exclusively used as dairy detergents. Recent developments, however, have indicated that they can no longer claim preeminence in this respect (see papers elsewhere by author). In fact, there is much evidence that alkaline compounds are responsible for many of the quality failures in present-day sanitary practice. By way of illustration, we would refer to the matter of effective can washing, as there is an overwhelming abundance of evidence to indicate that the familiar 5-, 8- and 10-gallon milk or cream can is frequently a source of serious and far-reaching quality defects in a variety of dairy products.

Investigation has revealed that most mechanically cleaned cans have an unmistakable inoculation of proteolytic and oxidizing types of bacteria; that such microörganisms are found most abundantly in the cans cleaned last in the day's run whenever alkaline cleaning compounds were used. Further studies indicated that these bacteria were being developed in the cleaning solution in spite of temperatures as high as 170° F. and alkalinity as strong as pH 10.

As the day's operation continues, sufficient protein accumulates in the can washer to increase the film-forming properties of the cleaning solution. The film thus formed appeared to cling to the metal surface in spite of the subsequent hot water and steam rinses and hot air blasts. It also retained the undesirable proteolytic bacteria and protein food material for the bacteria in sufficient concentration to make trouble if the can became moistened before again being filled with milk or cream. In fact, sometimes even dry cans inoculated the milk with bacteria which imparted bitter and often stale flávors to the fresh cream or milk contained in them.

A satisfactory acid cleaning product which apparently meets the essential requirements for dairy sanitation has been developed and is already being used extensively. As has been previously reported by the author and his associate (Parker and Shadwick, *American Butter Review,* June, 1941), milk and cream transport cans subjected to the cleaning action of even dilute solutions of Mikro-San, as this product is known commercially, were thoroughly cleansed, and freed of water spots or milkstone deposits. Alkali-formers and proteolytic and oxidizing types of bacteria were conspicuous by their relative absence from such cleansed cans even after they had been moistened with sterile water and incubated for 48 hours. Other workers have had similar experiences. The remarkable results obtainable with this newly developed acid cleaner have already led to revisions in can washing practice as evidenced by the new construction and improved operation of equipment introduced to the industry by a leading equipment manufacturer. This new detergent is reliably re-

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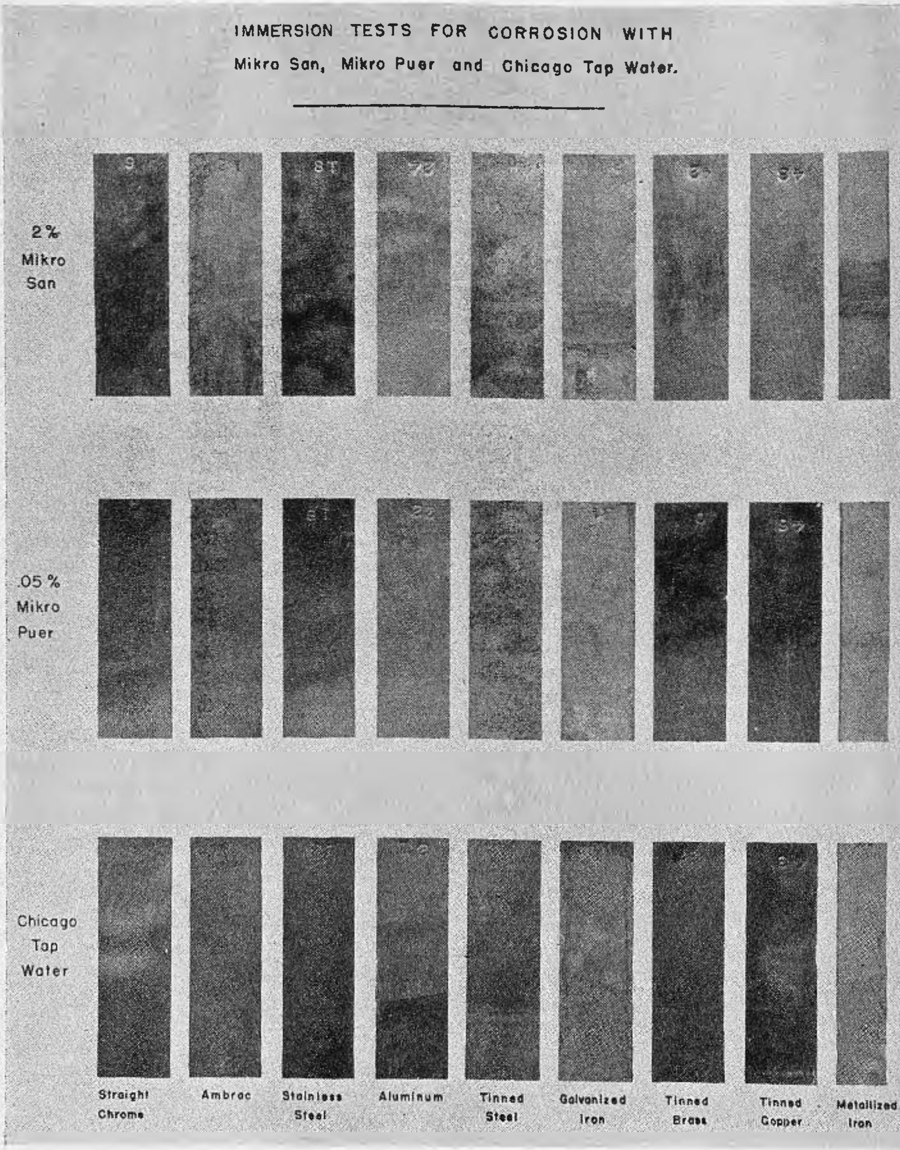

ported to be a non-toxic mixture of certain organic acids, specific wetting agents, corrosion inhibiter, and a microstatic agent. It is used in the strength of 8 ounces of product to 60 gallons of water.

We have previously reported on the microbiological and chemical factors involved in dairy detergency (Parker, *Food Industries,* Oct., 1940). One of the major objections to the use of acid compounds in dairy detergency heretofore has been their corrosive action upon dairy metals. Therefore, we are taking this opportunity to present data on this aspect of the problem.

EXPERIMENTAL

This experiment embraces a laboratory study of the corrosive effects of an acid cleaning product known commercially as Mikro-San, an acid sterilizing product known commercially as Mikro-Puer (upon which we hope to report subsequently and separately), and Chicago tap water. The laboratory tests included nine different metals such as are normally used in the construction of can washers and dairy processing equipment as well as that used in the construction of the milk transport cans themselves. The metals were used in the form of strips 5 inches long and 1½ inches wide and were as follows:

Straight chrome	Galvanized iron
Ambrac	Tinned brass
18/8 Stainless steel	Tinned copper
Aluminum	Metallized iron
Tinned steel	

The test solutions consisted of a 2 percent aqueous solution of Mikro-San (the greatest concentration recommended by the manufacturer for cleaning purposes), a 0.05 percent aqueous solution of Mikro-Puer, and controls in Chicago tap water inasmuch as it constituted the vehicle or solvent of these two acid compounds.

In all cases beakers with cover glasses were used and each beaker contained 100 ml. of the liquid under test. This made possible submersion of each strip so that an area of approximately 6 square inches was subjected to possible corrosive action. Prior to their immersion in the test solutions, each strip was cleaned by washing in a dilute solution of Mikro-San. They were then rinsed thoroughly in warm water, wiped dry, and dried in a vacuum oven before weighing. After immersing the strips in the respective test liquids, the solutions were heated to 180° F., then allowed to cool to room temperature, and left undisturbed until 72 hours had elapsed. At the end of the test period, the metal strips were removed, and again washed, rinsed, dried, and weighed as before. The strips were examined for visible corrosion and discoloration, then mounted and photographed. (See Figure 1.) The changes in weight (either loss or gain in milligrams) as well as the observed effects of the corrosion tests are tabulated in Table 1.

TABLE 1

CHANGES IN WEIGHT AND APPEARANCE* OF METAL STRIPS IN TAP WATER AND ACID SOLUTIONS: PARTIAL IMMERSION

	Mikro-San		*Mikro-Puer*		*Chicago Tap Water*	
Metals	*Mgm.*	*Appearance*	*Mgm.*	*Appearance*	*Mgm.*	*Appearance*
Straight chrome	—1.2	O.K.	—1.5	O.K.	—0.4	O.K.
Ambrac	—7.1	c/t	—1.3	c/t	—0.7	t
18/8 Stainless steel	+4.3	O.K.	0.0	O.K.	0.0	O.K.
Aluminum	+3.5	t	+3.7	c	—2.4	ttt
Tinned steel	—15.5	c/tt	+1.7	t	+5.3	cc/ff
Galvanized iron	—66.0	cc	+10.4	ccc/f	—4.2	ccc/ff
Tinned brass	—1.2	c/t	—0.5	c	0.0	O.K.
Tinned copper	—6.2	cc/t	—0.4	t	0.0	t
Metallized iron	—66.8	cc/t	+13.2	O.K.	+21.3	ccc/fff

— Loss in weight
+ Gain in weight
* O.K. – no change in appearance
c – slightly corroded
cc – corroded
ccc – heavily corroded

t – slightly tarnished
tt – tarnished
ttt – heavily tarnished
f – slight white film
ff – white film
fff – heavy white film

DISCUSSION OF RESULTS SHOWN IN TABLE 1.

In comparing the results of these tests with similar data reported by Hunziker, Cordes, and Nissen [*J. Dairy Sci.*, 12, 140–179, and 12, 252–284 (1929)] one is immediately impressed with the relatively mild corrosive effects of Mikro-San, Mikro-Puer and Chicago tap water compared with the various mineral and organic acids and particularly the various washing powder solutions. It must be kept in mind that Hunziker and his co-workers did not use as drastic a heating factor as we employed in any of their tests. It is also interesting to note, for example, that Chicago tap water was relatively more corrosive to aluminum than either the 2 percent Mikro-San or the 0.05 percent Mikro-Puer solutions. Tinned copper or tinned brass were not affected by either Mikro-San or Mikro-Puer to anything like the degree that the acids or alkaline washing powders were, as reported by Hunziker and co-workers. Even tinned steel fared better in exposures to Mikro-San and Mikro-Puer than to the reported alkaline washing powders when all the factors are considered. Miko-San apparently is more active in its solvent action upon galvanized iron and metallized iron than most alkalies would be. Yet, compared with the mineral and organic acids studied by Hunziker and co-workers, Mikro-San compares most favorably indeed. Mikro-Puer in the concentration used did not appear to affect metallized iron and compared more favorably than did the Chicago tap water itself.

Thus, it would appear from the results of our tests as described above that Mikro-San and Mikro-Puer will be found to compare most favorably with alkaline cleaning compounds in its corrosive action upon the type of metals usually encountered in dairy practice.

Acknowledgment

We are indebted to the Creamery Package Manufacturing Company of Chicago, Illinois, for the metal strips, and to the Rex Company, formerly the P. W. Bonewitz Chemical Company of Burlington, Iowa, for the samples of Mikro-San and Mikro-Puer used in our experiments herein described.

Promotional Work in Milk Control

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IN our approach to the subject of milk control, and in our efforts to provide our communities with high quality safe milk, it sometimes seems that we concern ourselves almost wholly with factual aspects to the neglect of a study of methods of selling our work to the industry and community.

Year after year, we go to state, regional, and national conferences and present technical papers on design of equipment, new microscopic procedures, paper containers, frozen desserts, oxidized flavors, milk-borne outbreaks, and numerous other subjects. We learn many things of a technical nature but we do not learn procedure in adapting this new knowledge to our own uses. We learn the WHAT but not the HOW.

The milk sanitarian is given a law or an ordinance to enforce. Armed with authority and a technical knowledge, he goes forth with energy and enthusiasm to "clean up the milk supply." Too often, he gives orders with an approach that seals his doom. By his approach, he may antagonize, breed resentment, disrespect, lack of confidence, and revenge.

Do we take it for granted that all sanitarians have the tact, the diplomacy, and the persuasive qualities to get the coöperation of the industry? Or do we expect him to be a blood-and-thunder inspector, putting such fear into the dairyman that he will not dare to violate the law?

Perhaps in some sections, the dairymen are so motivated by public welfare that they rally around, enthusiastically buy the new equipment, and adopt new procedures for the benefit of public health. Or, is it possible that many return home from these conferences and just let things slide with the line of least resistance?

These are problems of vital importance and certainly perplex the best of sanitarians.

The dairyman is confronted with such stern realities as poor collections, chiseling competition, paying bills, and making the business return a profit. His first interest, and that of his employees, is usually self-interest and economic security. How can he best make money? Protect the public health? Yes, in a vague sort of way. Certainly he does not want to injure anyone. But he feels that he has been doing all right by the public. He has never had any trouble. People are satisfied with his milk. And besides, he cannot see any need for a lot of these things. They would be all right if he could afford to do them.

What approach can the sanitarian make to get the response of the industry and the public? Certainly better results are obtained by leading than by driving. The same approach will not, of course, work in all cases, but certain principles are fundamental.

The foremost of these principles is that of reaching the industry through its own interest, namely, milk sales. For example, the sanitarian may say to the industry, either individually or as a group, in a meeting, somewhat as follows:

"We feel that you of the industry and we of the health department, have the same objective, namely, more and better milk. Since we have the same objective, why can't we sit down and work things out together for our mutual benefit? A good milk ordinance, well enforced, is one of the best protections legitimate industry can have.

We all know that there are some conditions that should be improved. Let's clean up our dairy farms, remodel our plants, and get new equipment where needed. Let's put some consumer appeal into our farms and milk plants, improve our methods and our products to the point where we will have something to talk about. Then, we of the health department will be the first to go on the front page and tell people how good the milk is. Let's fix our places up so that we can have open house and invite people out to see them. We will get a caravan of town people, consisting of representatives of the chamber of commerce, civic clubs, women's groups, newspapers and their photographers, and let them see what we have to offer. If we have things looking as they should, every visitor will become a free salesman. We can have a parade and end up at a platform on Main Street, where the school band will draw a crowd, while the civic groups congratulate the city fathers and the town on having a milk supply equal to the best in the state."

This kind of an approach makes the industry realize that it does have a common interest with the health department, and that the sanitarian is really trying to be helpful and constructive.

When it comes to the individual items of construction, equipment and methods of a particular dairy farm or milk plant, the same principle appears. Instead of giving the public health reason why a thing should be done, give a sales reason for doing it. For example, if the barn floor is dirty, the sanitarian might say to the farmer, in substance:

"You know, John, one of the biggest factors in consumer resistance to milk is off-flavors and odors. Warm milk absorbs flavors and odors very quickly. Dirty barn floors, poor ventilation, straining in the barn etc., imparts off-flavors to the milk and injures milk sales.

"This is one of the reasons why children push the glass of milk away and say: 'Mother, I don't like this milk. It doesn't taste good.'

"Not only that, but when friends, relatives or other visitors stop out and things have a bad appearence, it discourages milk consumption. Many people in town were reared on the farm, and do not drink milk because of some of the conditions they remember. However, if these same people should come out here and see the barn painted or white-washed, well lighted, ventilated, and the floor swept white with lime, the good appearance would make them want to drink milk. A dilapidated milk house, with broken screens and junk and rubbish piled around, destroys consumer confidence and injures milk sales. A neat, painted milk house, with proper wash vats and storage racks, free from flies, and a few well-placed shrubs to take the place of the usual rubbish, helps to build milk sales by building public confidence.

"Every food product is trying to crowd its way on to the dinner table. Radio programs, newspapers, magazines, and food stores are filled with appeals to use this product or that. And, no matter how much money we have, we can only eat one dinner. If milk is to maintain its proper share of the space on the dinner table, it must be produced and handled under proper sanitary conditions, and then its virtues properly and adequately presented to the consumer. This can best be done by the dairy industry and health department working together as a team."

Various other approaches are sometimes made as occasion requires. A dairy farmer may have a fine herd of pure bred cattle, but otherwise is poorly situated in regard to buildings, equipment and sanitary conditions. An appeal may be made to his pride. It is unfair to this fine herd of cattle, and to his own reputation, not to have surroundings comparable to their quality.

A number of enterprising distributors of milk, both raw and pasteurized, have capitalized on the "open house" method of building sales. They "sell 'em" by seeing how things are done. A woman prominent in P.T.A. circles or other club work, with a gift for meeting people, is employed as hostess on certain days. Arrangements are made to bring civic clubs, church groups, mothers' clubs, school classes, and others to visit the plant or farm. Not only the appearance must be good, things clean and in order, but the hostess will point out such things as thermometers and thermometer charts, covered ports, cooler and bottler, drip diverting aprons, the importance of proper valves, convenient hand-washing facilities with individual towels, covered waste cans and many other little items of care—all for the consumer's benefit. This not only builds confidence among the visitors, but gives them a realization of the expense involved in getting a good bottle of milk to the doorstep. It helps them to realize that it requires more than a cow and bucket to make a dairy.

Before leaving they may be served a choice of milk, buttermilk, chocolate milk, or ice cream.

This has been found to be an effective way to build sales. This is true only if the plant and the product are right.

To prepare properly his plant and product for the open house program, he needs to do the things required by the sanitarian. By increasing the consumption of good milk, it helps to further the objective of both the health department and the industry.

It is a sound approach to milk control when the sanitarian, as he calls on a milk plant or dairy farm, says to himself:

"Suppose this dairyman were the milk sanitarian and I the dairyman. How would I like him to approach me? How could he best get my cooperation in the things he wants done?"

Treating all dairymen alike, showing no partiality, is paramount. Nothing so destroys confidence in the sanitarian as making special concessions to certain dairies.

Likewise, the sanitarian should not let himself hold a grudge. Even though he has had difficulty with a dairyman or feels that the dairyman has treated him unfairly, the sanitarian should treat him as though nothing had ever happened. Find something good about the dairyman to compliment before making a criticism.

The sanitarian who accepts a sack of potatoes from a farmer or accepts milk, cream, or other favors from a distributor is jeopardizing his own chance for success. Helping himself to the ice box is not the best policy.

It is important to have ample consumer backing and support for the milk ordinance. Sometimes it is difficult to get and keep this support without putting fear into the minds of consumers that the milk may not be safe, and thus discourage consumption. For the sanitarian to issue a statement to the press that "the milk supply is rotten," or some other such expletive, and that we must have a new milk ordinance, is certainly a negative approach and one which is not likely to bring the best results.

In promoting a milk ordinance or milk sanitation program it is very important to sell it to the industry first. When its value has been properly presented to them, there have been cases where they have offered to pay forty, fifty, and even one hundred percent of the cost of maintaining inspection.

Women's groups, such as the P.T.A., Women's Clubs, League of Women Voters, and others have at times been very helpful.

Such a program has been used in our state, not only to increase milk consumption, but to help in securing the coöperation of the industry in our sanitation program and to popularize milk control work among consumers.

Developments in the Pasteurization of Churning Cream*

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The purpose of pasteurization of a dairy product is (1) to destroy any disease-producing organisms that might possibly be present, and (2) to improve the keeping quality of the product. The satisfactory accomplishment of these objectives requires definite standards. Those for the destruction of possible contaminating pathogenic organisms have been established by the public health authorities and long have been widely recognized. These are the same for all products. The standards for the keeping quality of products vary according to the product considered. These latter standards have not been well established in all cases. For example, in the pasteurization of churning cream, the tendency has been to increase the pasteurization temperatures above those formerly thought sufficient in order to improve the keeping quality of butter. The pasteurization standards for keeping quality are of primary interest to the manufacturer.

In the past, it has generally been considered that bacterial destruction is the criterion of proper pasteurization. This is undoubtedly true in the case of a short-lived product such as market milk where the expected life is only a few days. In this instance it so happens that pasteurization sufficient to assure destruction of pathogens is also adequate to assure satisfactory keeping quality. The prominence given milk pasteurization by public health and other officials has led to an erroneous conception of what constitutes adequate pasteurization for other products. Products that have a longer life expectancy than milk will require more drastic pasteurization treatment.

Methods Used for Cream Pasteurization

The deterioration of butter is caused by many agents. Those agents having catalytic action, such as enzymes, are the most important. Butter usually does not spoil because of bacterial growth. On the contrary, many investigations have shown that the number of bacteria decreases as the butter is held. The pasteurization standards to improve the keeping quality of butter should be based then upon the treatment necessary to inactivate the enzymes that might be present in the cream and cause deterioration in the butter. The inactivation of enzymes requires more drastic treatment than does bacterial destruction. For example, it is stated that some enzymes such as lipase, peroxidase, galactase, and some protease are not inactivated until temperatures of around 175° to 180° F. are reached. This has brought about the realization that the pasteurization standards in the past have been inadequate to give maximum keeping quality to butter.

The butter industry has attempted many means of securing higher pasteurization temperatures without injuring the cream, to the detriment of the resulting butter. The earliest pasteurization method, namely, the flash method, was used for churning cream, but fell into disrepute in the

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industry because of lack of fixed standards and suitable controls. The holding method was later developed, and this method has increased in use gradually until a few years ago it was used almost universally for all dairy products. The standards for the holding method of pasteurization have been based largely upon those developed for market milk, with the degree of bacterial destruction taken as an index of the adequacy of the treatment. The butter manufacturers have realized that they get better results if they use higher temperatures than those for market milk. However, it is difficult to get sufficiently high temperatures to obtain the maximum benefits with the holding method because of intense localized heating resulting in scorched cream. The holding method of pasteurization is still the one most widely used for churning cream, but probably is not doing the best job of pasteurization that it is possible to obtain.

Film-heating flash pasteurizers have come back into use to a certain extent. They will attain satisfactorily high temperatures for enzyme inactivation, but have not found extensive favor in the butter industry. They are being used to an increasingly greater extent in market milk as short-time high-temperature pasteurizers. Higher temperatures than those used for market milk in this type of pasteurization are necessary for churning cream. The film type of flash pasteurizers at the high temperatures necessary for churning cream do not operate as successfully as might be desired because of the tendency of cream to adhere to the equipment, the sluggishness of flow of viscous cream, and the necessity of a high heat differential between the cream and the heating surface.

In the methods discussed above, the cream is heated by a transfer of heat from a hot metal surface to the cream, *i.e.* the heating surface is always at a higher temperature than the cream. Lately there have been developed and projected methods in which the cream is never in contact with a metal surface that is warmer than the cream. These methods accomplish the heating by direct injection of steam or by means of passing an electric current through the milk or cream. The electrical resistance of the liquid causes the temperature to rise when the current is passed through. The steam-injection method is being used more and more extensively for churning cream. The electrical method has not been used for this as yet but offers excellent possibilities.

STEAM INJECTION AND VACUUMIZATION

The steam injection systems operate on the following principles: Live steam is injected directly into the cream. The condensation of the steam liberates the latent heat of vaporization, thereby heating the cream and, incidently, also diluting it to a certain extent. If the cream is then subjected to vacuum, the heating period can be kept at a minimum because the vacuum will cool the cream almost instantly. Thus, it is possible to secure high temperatures for a very short period of time, bringing about enzyme inactivation without the development of an excessive cooked flavor in the cream. The vacuum cooling also removes the water of condensation or the dilution caused by the injection of the steam. By careful control of the temperature of the cream at the time it comes to the steam injection mechanism and the temperature of the cream as it comes from the vacuum chamber, it is possible to control accurately the volume of cream. In other words, if the ingoing and outgoing cream differ in temperature only by the amount that results from the heat lost or gained from the room, the amount of water evaporated will be exactly equal to the amount injected. This means that it is easy to control the test of the cream in the steam injection systems. The vacuumization also removes volatile flavors from the cream. Indeed, some of the machines have been developed and are promoted chiefly for their value in removing undesirable flavors.

With the steam injection system, there are the two main dangers to be guarded against. The first is scorching the cream through excessive local heating at the point of contact where the steam enters the cream. The other one is homogenization or shattering of the fat globules which may occur from the sudden explosion of the hot cream under pressure in the vacuum chamber. This partial homogenization may result in high churning losses. Excessive local heating is avoided by the careful introduction of the steam. Some of the systems introduce the steam into a chamber in which the cream is protected from direct contact with the steam jet by means of baffles. This results in extending the steam over a larger cream surface and helps to prevent excessive local heating. Partial homogenization is avoided by using a two- or three-stage vacuum and by causing the cream to enter the vacuum chambers in such a way that it does not make violent contact with the surface of the chamber, in some instances entering in a spiral, swirling fashion. In practice, the first compartment will have a vacuum of 6 to 8 inches, the second will have a vacuum of 14 to 18 inches, and the last compartment will have a vacuum of 26 to 28 inches. The users of some of these machines are quite enthusiastic in their praise and claim results superior to other methods both for fresh butter and for storage butter.

Electrical Heating

The electrical method of pasteurization was one of the first of the high-temperature short-time methods used for milk. The principle of the operation is that milk or cream offers resistance to the passage of an electric current and thus, if the milk is subjected to an electric potential, heat is generated. In practice, milk is allowed to flow between two electrodes forming a connection in the electrical circuit. As the current passes, the milk becomes warm. The ultimate temperature reached is controlled by regulating the voltage, the rate of milk flow, or both. Theoretically, heating by means of an electrical current should be the ideal method of heating for pasteurization. The liquid is never in contact with a surface at a higher temperature than the liquid. On the contrary, the heat flow is the other way, that is the milk will have to heat the surface over which it flows. Also, there is no possibility of localized heating providing the milk flow is uniform, because all portions are heated from within rather than from external application.

The electrical method of pasteurization fell into some disfavor after its introduction because of certain control difficulties in satisfying public health authorities. However, interest is being revived in this method. There is a commercial apparatus on the market being used today for high-temperature short-time pasteurization of milk. This consists of a milk chamber with electrodes forming two sides of the chamber. The milk passes between these electrodes and is heated when the electrical current is applied. Usually, the milk is forewarmed before it comes to the pasteurizer and so the milk is raised only about 30° in the pasteurizer.

Some experimental apparatus has been described which in some features seems to offer advantages over that now used commercially. In this experimental apparatus, the electrodes are embedded in a smooth vitreous surface so that the whole resembles in many respects a surface cooler. A number of electrodes are used, one above the other, and they are connected in parallel. The milk is applied to this surface in a thin film and flows over the electrodes by gravity, making electrical contact between each pair as it flows. This flowing film can be deposited directly from the heater onto a cooler so that it is instantaneously cooled. The investigators claim adequate bacterial destruction, no development of cooked flavor at temperatures of 180° F., and quick heating. They have calculations to show that milk pasteurized at 180° F. is above 145° F. for a period of time less than one second. If satisfactory controls can be worked out, this should become a popular method of pasteurization.

ENZYMIC INACTIVATION

The adequate pasteurization of churning cream requires more than bacterial destruction. Sufficiently high temperatures must be used to insure inactivation of harmful enzymes. The pasteurization standards for churning cream therefore must be somewhat higher than those of market milk. It is not possible to say from present knowledge accurately what the standards should be. It seems definite that for instantaneous heating or heating approaching instantaneous, a minimum temperature of 185° F. should be attained. In order to inactivate the more resistant enzymes by the holding method, it appears that 165° F. for 30 minutes should be regarded as a minimum and possibly this is too low. The present trend is toward developing equipment that will secure these higher heat treatments without injuring the quality of the resulting butter.

The fact that enzyme inactivation is the goal sought in pasteurizing churning cream raises the question as to the best time to pasteurize in order to secure maximum benefits. Unquestionably, the sooner the cream can be pasteurized the less opportunity there will be for enzyme action to occur. This fact often has not received due consideration. Newer knowledge of the extremely rapid action of some enzymes, notably lipase, has shown the necessity of pasteurization as soon after separation as possible. In creameries separating whole milk at the factory, this can and should be done as soon as the milk comes from the separator. Waiting the time necessary to collect a vat of cream before pasteurizing may be the difference between first quality butter and rancid butter in the case of cream containing active lipase. Of course, this is not practical for farm separation. However, the author wishes to emphasize the importance of prompt pasteurization and to call attention to the need—not yet fully recognized—of equipment suitable for pasteurizing cream directly from the factory separator without having to wait to collect a large quantity. This type of pasteurization is particularly desirable in regions where seasonal rancidity is a problem.

Diseases and Ailments of Dairy Cattle With Which the Milk Inspector Should be Acquainted*

ANDREW W. UREN
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DISEASES which may be transmitted from the dairy cow to man immediately concern several groups of workers: the physician, the veterinarian, the laboratorian, the health official, the producer, and the consumer. Each is engaged with a different phase of the problem and views the subject from a different angle. It cannot be denied that greater progress could be made if all would try to find a common meeting ground where each might understand the problems of the other.

The diseases that are known to be transmitted from the udder of the cow through the milk to humans are: tuberculosis, foot-and-mouth disease, undulant fever, milk sickness, actinomycosis, septic sore throat, diphtheria, scarlet fever, and food poisoning.

TUBERCULOSIS

The tubercle bacilli usually enters the milk through two avenues. The first is directly from an infected udder. In the early stages there are no clinical symptoms that would lead one to suspect infection of the udder, yet the milk may be heavily seeded with the tubercle bacilli. In the later stages, the udder may develop acute symptoms of mastitis and the normal appearance of the milk may be changed.

The second avenue of entrance of the bacilli to the milk is through cow dung. The material that is coughed up by a cow with pulmonary tuberculosis is swallowed and passes out with the droppings. Contamination may also take place by way of the bile in generalized tuberculosis of the liver. The amount of fecal matter which milk may absorb without showing any sign of such pollution is quite large. Milk from tuberculous cows, therefore, is always a potential source of danger.

The danger of human infection with tubercle bacilli in milk may be eliminated by two methods, both of which are in operation. The first of these is by the use of the intradermal tuberculin test and the slaughter of all reacting animals. This method has not only been of value to the consumer, particularly in rural districts, but has been of great economical value to the producer in eradicating the disease from herds and preventing a heavy loss in valuable animals that fall victims to the disease every year.

The second is the fairly simple and economical method of pasteurization.

FOOT-AND-MOUTH DISEASE

Man may become infected with foot-and-mouth disease by eating or drinking raw milk products from infected cows. The disease is not present in cattle in this country, however, and is only mentioned here as one of the diseases affecting milk cows that can be transmitted to man.

UNDULANT FEVER

Evidence of the importance of the brucella abortus organism to human infection is accumulating every day. There are three strains of the organisms, namely, *Brucella melitensis* found in goats, *Brucella abortus* in cattle or the bovine strain, and the porcine strain of *Brucella suis* in hogs.

The *Brucella melitensis* infection in humans is only of importance in the southwestern part of the United States near the Mexican border. There is some difference of opinion as to the extent of human infection with the

* Presented at Annual Milk Control Short Course, University of Missouri, April 30, 1941.

bovine strain. The number of cases of human infection being diagnosed by doctors recently indicates that it is more common than ordinarily realized.

The porcine strain of *Brucella suis* is very pathogenic for man and a high incidence of the infection has been shown in packing house workers that slaughter and process pork products.

The incidence of the disease is higher in rural communities than in cities where most of the milk consumed is pasteurized.

TREMBLES IN CATTLE (MILK SICKNESS IN HUMANS)

Trembles and milk sickness are names both of which are used to designate a disease affecting both animals and man. The disease is caused by certain poisonous plants, white snakeroot and rayless goldenrod. These plants contain a poisonous substance known as tremetol that has been proven to be the cause of the disease.

The rayless goldenrod or jimmy weed does not grow in Missouri, but white snakeroot is found in this state. The plant reaches the height of about three feet and is found growing only in shaded wooded areas. It has clusters of small, bright, white blossoms that appear during September and October. The plant stays green later in the fall than any other weed and is more apt to be eaten by cattle during droughts than at other times.

The outstanding symptoms of white snakeroot poisoning in livestock are periods of severe trembling, constipation, depression, collapse, and death. The temperature is normal or only slightly elevated. The excretion of acetone through the lungs gives rise to a peculiar odor on the breath of milk-sickness patients.

Milk capable of causing the disease in humans may be secreted by an apparently healthy cow. There are several cases recorded in which persons who drank the milk became sick and died before the cows showed any symptoms of trembles.

Outbreaks of milk sickness have usually occurred on isolated farms where the family has been drinking milk from a few cows. The disease is unknown in cities and larger towns where mixed milk supplies dilute the tremetol to a degree that is not dangerous.

The disease has caused death in cattle in three counties of the state in the past two years.

ACTINOMYCOSIS

Actinomycosis is a chronic infectious disease caused by *Actinomycoses bovis* of the ray fungus group. While no portion of the body is immune from invasion, the head and neck are most often affected, giving rise to the name "lumpy jaw".

The disease is not contagious. It is thought that most infections take place as a result of traumatism caused by the penetrations of the tissue by the beards on the heads of tame and wild cereal grains and grasses.

Lesions of the mammary gland are rare and when they do occur are frequently mistaken for tuberculosis. The disease of the human is similar in most respects to that in cattle. The manner of infection is often in doubt. Ewing, who collected records on 100 cases in the United States in 1902, could find no evidence of infection from animal to man either through milk, meat or by accidental inoculation.

SEPTIC SORE THROAT

Septic sore throat is caused by *Streptococcus epidemicus.* The organism is principally a human pathogen, but it may set up a focus of infection in the udder of the cow from whence it is transmitted back to man by way of the raw milk supply. It has been demonstrated that streptococci of human origin may cause mastitis in the cow without any external symptoms of infection in the udder.

The usual source of infection of the cow's udder with streptococci is from some milker that is a carrier of the germ. There are several other types of streptococci that are capable of causing mastitis.

A great deal of research work has been done on the bacteriological detection and control of the contagious form of mastitis caused by *Streptococcus agalactiae*. Some of the more practical and important points of view expressed by the workers on infection of the udder are: (1) mastitis caused by *Streptococcus agalactiae* is a strictly contagious disease, (2) *Streptococcus agalactiae* is an obligatory parasite and under natural conditions the habitat is the udder and its secretions, (3) the disease can be detected by the bacteriological examination of the secretions from individual cows and controlled by disposal or segregation of the infected animals, (4) that efficient hygienic measures should be carried out during milking to prevent the spread of infection from cow to cow, (5) that it is advisable to make replacements in these herds from home-grown heifers free of infection, (6) in certain instances udder infusion with some suitable medication is helpful in the eradication of the infection of mild cases.

A herd of animals was assembled in 1930 at the Department of Animal Pathology of the Rockefeller Institute of Medical Research in order to have normal animals available for experimental purposes. Young calves born at a nearby farm, none of which had suckled their dams, were immediately taken to the Institute and fed 1,200 cc. of normal cow serum in place of colostrum for protection against infection with *E. coli*. These animals were raised on whole milk and completely segregated from other cattle.

In 1931, when the 9 heifers and a bull were about 6 months old, they were turned out in a paddock under natural conditions with no restriction as to breeding. At parturition each cow was confined in a shed for about a week, and the quarters that were not suckled by her calf were then milked out once daily to eliminate the colostrum. The reason for milking them at this time was that after certain quarters began to secrete milk, the calves would no longer suckle the quarters still containing the colostral fluid. When the cows were released the calves suckled for at least 6 months, and at no time were the dams again confined unless injured or indisposed.

The herd now consists of approximately 30 to 35 animals of which 20 are breeding cows, including 5 of the original group of females. These animals have never been fed grain or silage. In the warmer months they have sufficient pasture for maintenance, but during the winter they are fed a good grade of alfalfa hay and occasionally mangels.

After the young animals started to calve, milk samples from each one were occasionally subjected to a complete laboratory examination. Since early in 1938, at the fifth or sixth day of confinement the milk from each quarter of each cow has been examined bacteriologically before she has been placed with the other animals. In no instance during a period of 9 years has *S. agalactiae* been identified in any sample of milk examined. Occasionally *S. uberis* and *Staph. aureus* have been cultivated from the milk.

Dr. Ralph B. Little of the Rockefeller Institute has this to say regarding this herd, "It would seem that under natural primitive conditions when cows are not exposed to infection by stable confinement under modern dairy conditions or forced to produce a maximum milk yield for 10 or more months of each lactation, nature can preserve the usefulness of the udder for the purpose for which it was originally developed. This suggests that the present demands placed on the dairy cow may be conducive to certain physiological changes which render the gland more susceptible to infection."

DIPHTHERIA

There are a few reports of cows with sores on the teats or udder from which the diphtheria bacilli have been recovered. Investigation of these cases have revealed that the animals had been infected by human carriers.

Milk inspectors should not overlook the possibilities of animals being responsible for outbreaks of diphtheria in raw milk districts. The fact that the lesions are on the outside of the udder should make it relatively easy to find the infected cow. Infections of the udder or true cases of mastitis with the diphtheria organism have not been found and it is not known whether they occur under natural conditions or not.

SCARLET FEVER

Scarlet fever is primarily an infectious disease of man caused by *Streptococcus scarlatinae*. Cows may become infected from human sources and pass the disease back to man through the milk. In recent years several epidemics of scarlet fever have been traced to cows that had mastitis due to the *Streptococcus scarlatinae*.

Dr. Paul B. Brooks, Deputy Commissioner of Health of New York, states, "We have milk-borne outbreaks of septic sore throat or scarlet fever quite regularly in this state—all of them, however, upstate, as we say, because here in New York City, where practically all of the milk is pasteurized we apparently do not have them. We find some compensation for the disgrace of having these epidemics in the satisfaction arising from the belief that we are now discovering and tracing most of them to their original sources. From this study we have obtained information of importance. The states that are letting the milk-borne epidemics of these diseases go undiscovered, I have no hesitation in saying, are missing a lot of fun, to say nothing of the opportunity to do something for public health.

"Our experience and that of others have led us to several important conclusions. One of these is that nearly all extensive milk-borne epidemics, of septic sore throat, and many lesser ones, together with many of scarlet fever, are traceable to milk from cows with mastitis. Nowadays, when we fail to locate a cow we suspect that something has been overlooked. However, our veterinarian-epidemiologist, Dr. Graves, has developed such an eagle eye, figuratively speaking, that he seldom misses the cow if he gets on the job before she has been sent to the abattoir. Of course, we never conclude that the accountable cow has been found until his observations have been confirmed by laboratory findings."

FOOD POISONING

Food poisoning in its technical sense is confined to certain infections and intoxications associated with specific bacteria.

Milk and milk products have frequently been proven to be the source of food poisoning. In most cases contamination of the milk took place after it was drawn from the udder of the cow.

Dr. David J. Davis, Dean of the College of Medicine, University of Illinois, cites an outbreak of about 250 cases of food poisoning that occurred in a school in Tennessee. The outbreak was traced to 2 cows supplying the school with milk. Both animals were suffering with a staphylococcus mastitis. It has not been shown as yet that a definite specific variety of staphylococci are responsible for the outbreak.

* * *

From the information at hand we may conclude that the udder of the cow may be the natural habitat for the bovine strain of the tuberculosis bacilli and *Brucella abortus*. Milk from animals infected with either of these organisms can be made safe by pasteurization, and that both of these diseases can be eradicated from herds by tests that are known to be accurate. It can also be concluded that the organisms of septic sore throat, diphtheria, and scarlet fever can invade the udder of the cow, that the source of such infections are human carriers, and that in raw milk districts the cow may be the source of infection in epidemics of septic sore throat, diphtheria or scarlet fever.

Legal Aspects

Operation of City Sewage Disposal Plant Not Enjoined *

(Texas Court of Civil Appeals; *Mitchell et al.* v. *City of Temple et al.*, 152 S.W.2d 1116; decided June 11, 1941, rehearing denied July 2, 1941.) A suit was brought against the city of Temple and certain of its officers to abate, by injunction, and as a nuisance, the operation of the city's sewage disposal plant. The suit was for injunction only and not for damages. It was alleged that the plant and the sewer pipe leading from the city into it constituted a nuisance in that (1) obnoxious and repulsive odors, permitted to escape from the plant, came into the houses of the plaintiffs, and (2) because of leaks in joints of the sewer line, sewage was permitted to escape therefrom and to seep into the wells of some of the plaintiffs, thus rendering the water unfit for use, and, in addition, to seep into the nearby ravines and cause the breeding and collection of mosquitoes and flies and obnoxious odors.

The trial court denied a temporary injunction and, on appeal to the court of civil appeals, the plaintiffs in the main contended that, under the evidence adduced by them, they were entitled to the injunction prayed for to abate such nuisance as a matter of law.

The appellate court said that the granting of a temporary injunction was vested largely in the discretion of the trial court and that in the instant case the evidence was conflicting both as to the nature and extent of the odors from the plant and as to whether or not whatever leakage or seepage there might originally have been at the joints in the sewer line had been corrected and no longer existed. It was stated to be now well settled that, on the issue of a temporary injunction in such cases, the trial court was entitled to take into consideration the question of comparative injury or "balancing of the equities" and that, if granting the injunctive relief would work a greater hardship and injury upon the public than would result to the plaintiff by denying the relief, the court was clearly authorized to deny it. "The general rule," said the court, "seems to be that if public necessity, public health and convenience outweigh any resulting private injury, or if granting the writ will cause great harm to the public, the writ will be refused." In affirming the judgment of the trial court the appellate court said that, even if the testimony of the plaintiffs were taken as true and without contradiction, it was manifest that a much greater injury would be inflicted upon the people of the city of Temple, shown to have a population of 15,000, by completely enjoining the operation of its sewage disposal plant than would result to the plaintiffs from a refusal to enjoin the plant's operation. "They [the plaintiffs] undoubtedly have an adequate remedy at law by way of damages."

* *Pub. Health Repts.*, 56, 2275 (1941).

Possession of Unwholesome Poultry Held Violative of Sanitary Code *

(New York Court of Appeals; *People* v. *Swift & Co.*, 35 N.E.2d 652; decided June 12, 1941.) In November, 1939, inspectors of the New York City Health Department made a routine visit to a place of business maintained by the defendant company in Brooklyn. After finding the food on the main floor, the salesroom, to be in satisfactory condition, they went to the cooler in the basement where poultry was kept awaiting removal to the salesroom and there found at least 22 pieces of poultry, weighing approximately 120 pounds, which were unwholesome. This poultry had not undergone all of the three inspections which the defendant conducted before selling or offering for sale.

The witnesses for the defendant testified that poultry was inspected when it was delivered to the defendant and again when it was sent from the basement cooling room to the main floor for sale. Both of these inspections were merely on a sampling basis, that being the custom of the trade. Three to five boxes were examined out of a lot which might range from 25 to 400 boxes, the examination consisting of removing the top cover of the box and looking at the breast of the chicken. Only if the breast revealed a condition which aroused suspicion did the examination go beyond this. Mold on the backs or sides of the poultry would escape detection. The defendant explained that the unwholesome condition of the poultry condemned escaped its attention because the mold was on the so-called hips of the chickens. The third and last inspection was made by the customer at the time that he bought the poultry, this inspection involving the opening of all boxes. However, at times—although the defendant insisted that such occasions were rare—this

* *Pub. Health Repts.*, 56, 2143 (1941).

final examination was omitted and, according to the court, apparently depended entirely upon the wishes of the customer, when present, rather than the protection of the public.

The city sanitary code provided, among other things, that no poultry which was not healthy, wholesome, or safe for human food, or that died by disease or accident, should be brought into the city or held, kept, offered for sale, or sold as food (sec. 163). There were other provisions that food in the possession of a dealer in food should, prima facie, be deemed to be held, kept, or offered for sale as food (sec. 138), that the presence of food in any part of the establishment should be deemed prima facie evidence of its use for human food (sec. 148, reg. 23), and that food which had become unfit for human consumption should be kept separate from other foodstuffs which were held, kept, and offered for sale, marked "condemned," and removed daily (sec. 148, reg. 27).

In the trial court there had been a judgment of conviction for violation of section 163 of the sanitary code. The appellate division of the state supreme court had reversed this judgment, dismissed the information, and remitted the fine.[1] On appeal by the people the court of appeals said that the trial court had pointed out that the inspections employed were inadequate to reveal unwholesomeness, while the appellate division had reversed upon the ground that, while it was true that the poultry was intended to be sold, it was also equally true that it was not to be sold if it had been found by the defendant or the customer to be unwholesome. The question presented to the court of appeals was whether a judgment of conviction for the possession for sale of decomposed and unhealthy food kept in a storeroom from which salesmen replenished stock for sale in New York City could be reversed solely on the ground that the defendant had acted in good faith.

In concluding that the order of the appellate division should be reversed and the judgment of the trial court affirmed, it was stated that the method of inspection employed by the defendant would not necessarily have revealed the unhealthy condition of the poultry and that in such case there was a violation by the mere holding for sale of the food upon the premises even though it might be that a buyer would inspect before buying or that the poultry would be reinspected by the defendant. "We have here, therefore, a clear violation of the sanitary code, secs. 163, 138, 148, reg. 27."

The concluding portion of the opinion read as follows:

The danger to human life and health from unwholesome food is so great that the courts generally have treated food differently from most other products. It has been placed in the same category as drugs, poisons, and other instrumentalities which, if they are negligently dealt with, are ordinarily certain to affect seriously the public health and safety. The good intentions of the defendant would matter very little to consumers who might consume this poultry. Food laws are designed primarily, not for the punishment of the dealer, but for the protection of the consumer. In this field of law, the obligation to beware is on the seller rather than the buyer. Lack of proof of guilty intent does not satisfy that obligation.

Ice Cream License Refused to Fictitious Manufacturer *

(Simco Sales Service of Pennsylvania, Inc. v. Lower Merion Board of Health, Landis et al.) The Board of Health refused to issue a license to a vendor of ice cream when he elected to substitute the name of the actual manufacturer of the product printed on the container for the name of an assumed or fictitious manufacturer. The Board held that no such plant existed and that therefore no license to manufacture could be issued to a non-existent plant or manufacturer.

It is interesting to note that in reviewing this case, the Court took the position that the sole purpose of the vendor in adopting or assuming a fictitious name was that of concealing from the public the actual name of the manufacturer of the food product, and further that the public had a right to know the name of the company manufacturing the dairy product.

In the testimony which was developed, it was pointed out that food manufacturers, if permitted to operate under their own name and in addition several assumed names, would print some labels with their own name as manufacturer and the other labels with the names of the various assumed names as manufacturers. Thereby, one of the prime factors operating to assure high sanitary standards and to protect quality would be removed since the manufacturer without jeopardizing his reputation and good name could market an inferior product, possibly of a less sanitary character, under an assumed name so long as no serious difficulties resulted.

Should serious complaint arise or epidemic disease occur, the disrepute of the manufacturer could be lost immediately by merely placing the same product on the market the next season under some other adopted name.

G.W.G.

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[1] See *Pub. Health Repts.*, April 18, 1941, p. 858.

* *Montgomery County Law Reporter*, 57, 331 (1941).

New Books and Other Publications

The Market Milk Industry, by C. L. Roadhouse and J. L. Henderson. New York: McGraw-Hill Book Co., New York, 1941. 624 pp. $5.00.

This text is prepared for college juniors or seniors who already have completed a first course in market milk, and also for those who have had some experience in the industry. The authors have aimed to cover the theoretical and practical phases of market-milk production, and the processing of related products, some of which are of recent origin, together with laboratory methods of control. Much of the treatment should be valuable to milk-plant operators, dairy inspectors, and producer-distributors.

The wide scope of the coverage does indeed give the student a broad perspective of the milk industry, but the necessarily brief treatment given many of the subjects minimizes its value to persons actually out in the industry. The book is useful as a text for advanced students of the milk industry for indicating the content of the field. It carries between four and five hundred references to the supporting literature but a dearth of references for more extensive sources of information.

One wonders why the subjects of vitamins A and D are discussed even to the extent of presenting structural formulae whereas the widely used Connecticut system of sediment standards is not mentioned. Nothing is said about the significant deaeration of milk in relation to flavor and conservation of vitamin C. However, these may be considered minor matters of judgment because in writing any elementary text, the great problem of the author is to decide what to leave out in order to keep the book down to the proper size. The text matter is excellently and conveniently arranged for classroom work.

Industrial Instruments for Measurement and Control, by T. J. Rhodes. New York: McGraw-Hill Book Co., 1941. 573 pp. $6.00.

The subject of instrumentation is relatively new, and only in recent years has found its way into engineering curricula. Increasingly, industry is developing its control of operations by the use of such automatic apparatus. The problems attending the design, installation, and maintenance of instruments is as important to successful plant operation as those of plant design, construction, and operation.

This book is intended for use as a textbook for the formal study of the subject of instruments and automatic control in engineering schools, and as a practical reference book for those concerned with instrument and control problems in industry. No effort has been made to include all the available types of instruments but only those which clarify the theory or problem under consideration. The text is illustrated by 282 figures, usually as line drawings of instruments or schematic diagrams of layouts or circuits. Most of the mathematical development requires no greater knowledge of mathematics than trigonometry, algebra, and logarithms, although the subjects of high-temperature pyrometry and automatic-control theory do use some calculus.

Food technology is increasingly utilizing the practices of chemical engineering. Here is an important field clearly and broadly covered.

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Association News

Chicago Dairy Technology Society

At the December meeting of the Chicago Dairy Technology Society, Major J. H. White spoke on "Interesting Developments in the Feeding of Soldiers." New officers were elected for the ensuing year.

At the January meeting, Dr. Ralph Hussong spoke on "Some Technical Problems of the Butter Industry."

P. H. TRACY,
Secretary.

Connecticut Association of Dairy and Milk Inspectors

In the interest of National Defense, the Dairy and Food Commissioner, Mr. James B. Lowell, is sending out the following questionnaire:

Maximum capacity of pasteurizing plant in quarts of milk (24-hour basis)...............

Number of qualified pasteurizing machine operators...............

Number of pasteurizing vats...............

Availability of any auxiliary power in the event of failure of electric service. Yes....... No.......

If so, what is the nature of this auxiliary power ....

....

....

Do you have available for use in case of emergency any:
Tank trucks. No. ....
Delivery trucks. No. ....
Other forms of transportation
Kind .... No. ....

The annual meeting of the Association was held at the Hotel Bond, Hartford, on January 13. The topics on the program were as follows:

"Significance of Thermoduric Organisms in Pasteurized Milk," Carroll J. Keating, State Dairy Inspector.

"Some Administrative Aspects of Milk Inspection Services," M. A. Pond, Assistant Professor of Public Health, Yale University.

"Factors Causing and Method of Preventing Milk Stone Formation," H. D. Baker, Technical Service Department, Diversey Corporation.

"Safeguarding the Milk Supply of the City of Waterbury," Dr. E. J. Godfrey, Health Officer.

"Milk Control in the Defense Program," A. W. Fuchs, Senior Sanitary Engineer, United States Public Health Service.

H. C. GOSLEE,
Secretary-Treasurer.

New York State Association of Milk Sanitarians

Plans are being formulated for the next annual meeting of the New York State Association of Milk Sanitarians which is scheduled to be held at the DeWitt Clinton Hotel in Albany, New York, on September 23, 24 and 25, 1942.

Mr. Russell I. Prentiss of the Massachusetts Commonwealth Department of Agriculture, Boston, Mass., has invited Mr. Tiedeman to represent New York State at a meeting to be held at Worcester, Massachusetts, on January 8, 1942, to discuss plans for forming an organization comprised of state officials whose duties primarily are the inspection of milk or of dairy farms. The purpose is to secure greater uniformity in milk sanitation requirements between neighboring states.

W. D. TIEDEMAN,
Secretary-Treasurer.

Philadelphia Dairy Technology Society

At the opening meetinø on October 4, Mr. Clement S. Brinton of the United States Food and Drug Administration spoke on "Consumer Protection by the United States Food and Drug Administration." On November 11, Dr. D. K. O'Leary of the DuPont Company explained "Yeast and Mold Control." On December 9, Dr. H. A. Trebler of the Sealtest Laboratory in Baltimore gave the group pointers on "Cleaning of Dairy Equipment." Dr. T. C. Buck, at the meeting on January 13, discussed "Coliform Organisms in Dairy Products."

Meetings are held in Houston Hall, University of Pennsylvania, on the second Tuesday of each month. Membership has been increased to 79, of which 15 have been added within the last two months. The last meeting was attended by 59 members.

W. S. HOLMES,
Secretary-Treasurer.

RIBOFLAVIN REQUIREMENT FOR ENRICHED FLOUR POSTPONED TO JULY 1, 1942

Federal Security Administrator Paul V. McNutt has postponed to July 1, 1942, the effective date of the mandatory riboflavin requirement in the definitions and standards of identity for enriched flour, enriched bromated flour, enriched self-rising flour, and enriched farina. All the other provisions of the definitions and standards of identity for these products, published in the Federal Register of May 27, 1941, will become effective on January 1, 1942.

In taking this action Mr. McNutt made the following statement:

"A thoroughgoing canvass recently has been made of the present and prospective production of synthetic vitamins, including riboflavin. At the present time the supply of riboflavin, in forms suitable for addition to enriched flour and like products, is not sufficient to permit the production of such foods on a scale which would meet current demands. Riboflavin will become increasingly available in the first half of 1942, and it appears that by July 1 there will be adequate supplies for the enrichment program. In the light of this situation I am postponing to July 1, 1942, the effective date of the mandatory riboflavin requirement in the definitions and standards of identity for enriched flour, enriched bromated flour, enriched self-rising flour, and enriched farina."

Administrator McNutt's order concerning riboflavin is published in the Federal Register of December 3. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

DR. KEENAN RESIGNS FROM WHITING

Dr. Keenan, an active member of the International Association of Milk Sanitarians for many years and an Associate Editor of the JOURNAL OF MILK TECHNOLOGY, has resigned from the Whiting Milk Company of Boston. He is continuing his former studies of medicine in Chicago, and is Medical Director of the Carnation Milk Company.

In March, 1936, Dr. Keenan came to the Whiting Milk Company as head of the laboratory and Director of Quality and Sanitation. In June, 1939, he was elected Assistant Secretary of the corporation, and held that office until November, 1941, when he was elected Vice-President. In November, 1940, he was made Director of Plant Operations.

He assures us that he will continue his interest and activity in the work of the Association.

Engineering Features of Pasteurizing Plants and Equipment. G. A. H. Burn. *Canad. Pub. Health J., 32,* 199–207 (April, 1941). *P. H. Eng. Abs.* xxi, Mi, 59.

The priniciples of good engineering practice are important in the design, construction, and operation of pasteurizing plants. Not only must the plan of the building be carefully worked out, but also the materials used in construction should be selected on the basis of their utility.

Equipment should be properly designed if it is to serve its purpose effectively. Features that are commonly found to be defective in pasteurizing equipment of the "holding" type are: (1) Inlet valves; (2) cold pockets; (3) outlet valves; (4) air and foam heating facilities; (5) recording thermometers; and (6) control of heating medium. These defects have been eliminated on a great deal of the newer equipment and can usually be remedied in older installations.

Efficient operation requires constant attention to all the various details involved in the cleansing and sterilizing of processing equipment and containers and depends largely on the caliber of the operating personnel.

M. A. POND

New Members

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

ACTIVE

Andersen, Johannes, Milk Inspector, 1612 Franklin St., Keokuk, Iowa.
Boisvert, Oscar, Department of Agriculture, Parliament Buildings, Quebec.
Bushong, Rex D., Director, Bureau of Sanitary Engineering, Memphis Health Department, Memphis, Tenn.
Cardona, Dr. H. V., Department of Health, Fort Worth, Texas.
Dodge, H. E., State Dairy Commissioner, State House, Topeka, Kan.
Eckloff, Russell A., Dist. Sanitarian, New Hampshire State Board of Health, 105 Main St., Berlin, N. H.
Garrett, W. H., Milk Sanitarian, 2556 Rogers St., Fort Worth, Tex.
Icenhower, E. A., 1220 S. New Haven St., Tulsa, Okla.
Keenan, J. A., Jr., General Laboratories Div., Pennsylvania Salt Mfg. Co., 2633 Chamberlain Ave., Madison, Wis.
Kloker, Norman F., Dairy Inspector, St. Louis Board of Health, St. Louis, Mo.
Kroger, Dr. H. J., Box 96, Vandalia, Ill.
Lyman, Charles, Milk Inspector, City Hall, Atchison, Kan.
Marker, Walter A., 2548 N. W. 18th St., Oklahoma City, Okla.
Taylor, M. C., Route 3, Box 316, Tulsa, Okla.

ASSOCIATE

Alley, Willett M., N. Y. State Dept. of Health, Buffalo, N. Y.
Aylesworth, Rolland, Sheffield Farms Co., Norwich, N. Y.
Babelay, E., Route 6, Knoxville, Tenn.
Bailey, Fred S., Grover Farms, Grover, Pa.
Baselt, Fred C., American Can Co., 230 Park Ave., New York, N. Y.
Brintnall, C. E., Dairymen's League, Morrisville, N. Y.
Burrows, O. K., Cherry-Burrell Corp., Chicago, Ill.
Campbell, Boyçe N., District Milk Sanitarian, State Board of Health, Russellville, Ark.
Coblentz, Wesley S., City Building, Topeka, Kan.
Cochran, C. W., Madill, Okla.
Coddington, Henry, Spencer Dairy Service, Homer, N. Y.
Cowdrey, J. R., City Building, Topeka, Kan.
Day, E. K., Atlanta Health Department, City Hall, Atlanta, Ga.
DePasquale, John L., Department of Health, Buffalo, N. Y.
Donovan, F. J., Milk Sanitarian, State Dept. of Health, City Hall, Webster City, Ia.
Dunn, Earl J., Westmiller Dairy & Farm Prod. Co., Cohocton, N. Y.
Eldred, Benedict, M. H. Renken Dairy, Frankfort, N. Y.
Eldred, Grover C., M. H. Renken Dairy, Frankfort, N. Y.
Ellmers, Dr. Gordon R., Dairyman's League, Bogota, N. J.
Erhard, Peter S., 5006 Avenue N., Galveston, Tex.
Fansher, F. E., Manhattan, Kansas.
Farley, J. W., Cherry-Burrell Corp., Cleveland, O.
Fischer, E. J., N. Y. State Dept. of Health, Burlington, Vt.
Flake, J. C., Sanitary Standards, Evaporated Milk Ass'n., 307 N. Michigan Avenue, Chicago, Ill.
Frasch, H. H., Nat'l Carbon Co., 3920 Normandy St., Dallas, Tex.
Gardner, Paul R., City Dept. of Health, Olean, N. Y.
Gelbhar, Alvin, Cushing, Okla.
Gustafson, A. C., The DeLaval Separator Co., New York City.
Hancock, R. N., County Sanitarian, McAllen, Tex.
Hardy, W. R., Sanitary Engineer, City Health Dept., Fort Worth, Tex.
Hart, Dr. F. L., Veterinarian, 605 Utah St., Hiawatha, Kan.
Held, Milton E., Senior Milk Sanitarian, City Health Department, Sioux City, Iowa.
Herron, W. P., President, Pure White Dairy Co., Box 1921, Tulsa, Okla.
Higgins, S. M., 902 Parkview, Dallas, Tex.
Jensen, Carl R., 713 C St., Silver City, New Mex.
Jermain, William S., Sparks Dairy Inc., Buffalo, N. Y.

Jones, D. W., State Health Department, Little Rock, Ark.
Karr, Ray T., Superintendent, The Borden Sales Company, Inc., 1500 Ryan St., Lake Charles, La.
Keenan, J. A., Jr., Pennsylvania Salt Mfg. Co., 2633 Chamberlain Avenue., Madison, Wis.
Lacerre, Gerald M., N. Y. City Health Department, New York City.
Lewis, John, Rosasco Creamery, Candor, N. Y.
Lundgren, John, 111–21 124th St., South Ozone Park, L. I., N. Y.
Lyman, Charles, City Hall, Atchison, Kan.
MacKenzie, F. B., Director of Research, Carnation Co., 2344 N. Oakland Ave., Milwaukee, Wis.
McAndrews, H. G., 422 Chartres St., New Orleans, La.
McCoy, W. C., Jim Wells County Health Unit, Alice, Tex.
McGill, Roger L., Sealright Co., 1808 Carey Place, Oklahoma City, Okla.
Maguire, Walter, Walter Maguire Co., Inc., 330 W. 42nd St., New York.
Malatesta, Fred, Creamery Package Mfg. Co., Chicago, Ill.
Marsh, Ernest A., Dairymen's League, Hyde Park, N. Y.
Martin, George R., Associated Dairies, Ltd., 405 West 8th Ave., Vancouver, British Columbia.
Messerschmidt, Bernice, Director, State Coöperative Laboratory, City Hall, La Crosse, Wis.
Miller, R. N., International Harvester Company, Snyder, N. Y.
Mimm, James M., Tri-County Dairy Company, Honey Brook, Pa.
Miner, George R., Manager, The Borden Sales Company, Inc., 1500 Ryan St., Lake Charles, La.
Murdock, Delane, Check Tester, Federal Milk Market Adm., 5216 Cornell Ave., Chicago, Ill.
Nichols, E. Roy, 307 Peck Ave., San Antonio, Tex.
Nickel, Vernon, Washington, Mo.
O'Danial, Victor, 1139 Garvin Place, Louisville, Ky.
Patterson, Dewey, Box 63, Nacogdoches, Tex.
Petersen, Westy, M. H. Renken Dairy Co., Painted Post, N. Y.
Quillin, Frank, 300 East Oakhill, Knoxville, Tenn.
Reiger, Herbert A., The Diversey Corp., Johnson City, N. Y.
Richards, George F., Production Supervisor, Golden Guernsey, Inc., 6840 Wisconsin Ave., Bethesda, Md.
Richards, W. F., S. M. A. Corporation, Mason, Mich.
Rink, Clare W., The Diamond Alkali Company, Glenolden, Pa.
Rogers, Harold L., Sheffield Farms Co., Portlandville, N. Y.
Russell, John L., Box 1, Effingham, Ill.
Shea, Joseph H., Health Inspector, Department of Health, 125 Worth St., New York City.
Sherwood, R. P., Milk Sanitarian, Wichita Falls, Tex.
Slocum, Warren H., Bausch & Lomb Optical Co., Rochester, N. Y.
Small, Carlton, N. Y. State Dept. of Health, New Milford, Pa.
Starkie, C. E., City Hall, San Angelo, Tex.
Starnes, Dr. M. B., Veterinarian, City Health Department, Dallas, Tex.
Stewart, B. L., 712 N. Louisville St., Tulsa, Okla.
Stewart, W. R., The DeLaval Separator Company, Batavia, N. Y.
Stolper, Ernest G., Arden Farms Dairy Company, Arden, N. Y.
Strodel, Normal J., Strodel's Dairy, Buffalo, N. Y.
Stryker, LeRoy, Dairymen's League, Box 102, Flemington, N. J.
Stull, Norman C., Sheffield Farms Company, Groton, N. Y.
Summe, John J., Plant and Production Manager, Summe & Ratermann, 224 East 20th Street, Covington, Ky.
Thayer, Lance, Thayer Dairy, East 6th St., Clare, Mich.
Van Gundy, Dan, Wellington, Kan.
Warden, H. C., City Department of Health, San Antonio, Tex.
Warner, Carlos H., Jr., Queensboro Farm Prod. Co., Canastota, N. Y.
Weaver, Z. A., Sheffield Farms Company, Coburn, Pa.
Webb, Tom, Pet Milk Company, Fremont, Ohio.
Weber, William A., Buffalo City Health Department, Buffalo, N. Y.
Winslade, Dr. W. A., St. Louis Health Dept., 816 Centerville Ave., St. Louis, Mo.
Woodward, H. L., City Administration Building, Fayetteville, Ark.
Wright, S. Chester, R. F. D. 5, Bloomington, Ill.
Zimmerman, Harlie F., Divisional Sales Manager, Jersey Creamline, Inc., 324 West 23rd St., New York City.

CHANGES IN ADDRESS

*Alexander, Wade F., *Canisteo* instead of Hornell.
Barnhart, John L., now, 820 DeKalb St., Norristown, Pa.
*Beckler, Philip A., *85 Spruce St., Oneonta,* instead of Chatham.
Buckley, E. J., *80 Centre St., New York City* instead of Amsterdam.

Burkhardt, R. C., *Madison County Department of Public Health, Huntsville, Ala.*, instead of Tuscumbia, Ala.

Butterworth, T. H., *Supervisor of Milk Sanitation, Department of Public Health, City Hall, Houston, Tex.*, instead of San Antonio, Tex.

*Cheney, J. B., *Cherry Valley* instead of Oxford.

*Corash, Paul, *805 St. Marks Ave.* instead of 55 Parade Place.

*Creighton, S. H., *Springville, N. Y.*, instead of Buffalo.

Dorcas, M. J., *159 Stanford Drive, Berea, Ohio,* instead of Cleveland.

*Eastman, G. H., *Portville Dairy Products Co., Portville, N. Y.*, instead of Keystone Dairy Co., Portville.

Ettman, H. L., *1831 Olive St.*, instead of 1819, St. Louis, Mo.

*Fennimore, J. E., *Dairyland Milk & Cream Co., 55 Elm St., Delhi, N. Y.*, instead of Deansboro.

Freeman, Professor T. R., now Dairy Products Laboratory, University of Florida, Gainesville, Fla.

*George, A. David, *Arkport, N. Y.*, instead of Webster Crossing.

Hart, R. W., *P. O. Box 1332, Tampa, Fla.*, instead of Albany, Ga.

*Heffernan, F. P., *Fabius, N. Y.*, instead of Burlington, Vt.

Ihlenfeldt, Walter, now, Universal Dairy Products, Denton, Md.

Keenan, J. A., *Carnation Milk Co., Milwaukee Gas & Light Bldg., Milwaukee, Wis.*, instead of Newton Center, Mass. (Boston).

Kihlstrum, E. E., *407 Stolp Ave., Apt. 31, Syracuse, N. Y.*

*Kloser, G. G., *516 Jackson Ave., Utica, N. Y.*, instead of Susquehanna, Pa.

Miller, M. M., *U.S.P.H.S., District No. 2, Bethesda, Md.*, instead of Washington, D. C.

*Newkerke, F. A., *Orange County Dairy Laboratory, Middletown, N. Y.*, instead of N. Y. City Department of Health.

Parfitt, E. H., *Evaporated Milk Assn., 307 N. Michigan Ave., Chicago,* instead of West Lafayette, Ind.

Presler, D. J., *Shushan, N. Y.*, instead of Cambridge.

Sawyer, A. B., Jr., *981 S. Third St., Louisville, Ky.*, instead of 500 Fehr Avenue. Louisville.

Sayman, F., should be

*Seymour, F., *Crowley Milk Co., Candor, N. Y.*, instead of Camden.

Smith, Gail A., *701 Bethune, W., Detroit, Mich.*, instead of Columbus, Ohio.

*Smith, S. Emerson, *18-B Jewett Place, Utica, N. Y.*, instead of Goshen.

*Springstead, Carl, *Ayrault Ave., Fairport, N. Y.*, instead of Clinton.

*Stull, S. R., *308 Second St., Towanda, Penn.*, instead of Belleville, N. J.

*Widland, Myron A., *10 W. Wooster St., Danbury, Conn.*, instead of Springfield, Mass.

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*Associate members.

RESIGNED

Bell, Stanley C., Bloomington, Ill.

Brew, J. D., Knoxville, Tenn.

Fitzgerald, F. F., American Can Co., New York, N. Y.

Franklin, W. B., 5607 Carberry Ave., Oakland, Cal.

Hudon, M. H., Department of Agriculture, Quebec, Canada.

Klauber, Dr. Harry, Dairy Farm Inspector, Trenton, Mo.

O'Connor, Hugh J., New York, N. Y.

Stearns, M. E., Springfield, N. Y.

Stengle, George E., Jacksonville, Fla.

DECEASED

Arrell, J. T., Dairy Farm Inspector, Health Department, Hamilton, Ontario.

William Warren Eason, City Health Department, San Antonio, Texas, has moved and left no address. If any member knows his address, please communicate with C. Sidney Leete, Secretary-Treasurer, International Association of Milk Sanitarians, Inc.

MORE DAIRY EQUIPMENT RECOMMENDED FOR FARMS

The Department of Agriculture has recommended to defense officials that increased amounts of dairy equipment be made available to farmers next year, M. Clifford Townsend, director of the Office of Agricultural Defense Relations, told the Wisconsin Farm Bureau Federation.

Speaking at Madison, Wisconsin, Townsend said the Department is "particularly anxious that all possible steps be taken to facilitate the expansion of dairy farming called for in the Food for Freedom program."

"We are convinced," Mr. Townsend said, "that dairy farmers should have adequate machinery and equipment both to assist in the increased production of milk and also to replace workers who have entered industry and the armed services. The Office of Production Management shares this point of view, and has already issued a special order to enable the immediate production of 1,340,000 milk cans. We also have received the coöperation of the OPM in facilitating priority action on milking machines.

"The general average for production of new farm machinery for next year has been tentatively established by the Supply Priorities and Allocations Board at 80 percent of 1940 tonnage, but percentages for different types of machinery vary considerably within the over-all scale. We have recommended that the new production level of dairy machinery be much higher than the general level, plus adequate supplies of repair and replacement parts.

"The Department of Agriculture is also seeking to stimulate programs to train less skilled farm hands for dairy work. We also have pointed out to the proper authorities the value to the defense program of skilled dairy workers who might be subject to call into the armed services.

"Going even further, the Department is acutely aware of the necessity of proper facilities to process, package, transport, and store dairy products, and is working daily with the Office of Production Management on the supply and priorities problems involved. We do not want the farmer to produce larger quantities and then have the commodities backed up on the farm for lack of proper facilities for processing. We are carefully surveying the industry for both capacity and the need of supplies in 1942."

"Dr. Jones" Says—*

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

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

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

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

Paul B. Brooks, M.D.

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

Index to Advertisers

Application for Membership

....194........

TO THE INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, INC.:

Application for ☐ Active ☐ Associate Membership (See reverse side of Sheet)

(Membership includes subscription to Journal of Milk Technology)

Name ....

Address (mailing) ....

PRESENT POSITION

Title .... Length of Service ....

Organization ....

PREVIOUS POSITION

Title .... Length of Service ....

Organization ....

Title .... Length of Service ....

Organization ....

GIVE FOLLOWING INFORMATON

Education: Name Schools attended	Years of Attendance	Graduate	Degree
College	....	....	....
University	....	....	....
Technical School	....	....	....
Other	....	....	....

Give additional information you desire to have considered

....

....

....

Application endorsed by

Active or } ....
Associate member } ....

Mail this application and annual dues, $3.00 Active, $2.00 Associate, which includes $1.00 for subscription to Journal of Milk Technology:

C. SIDNEY LEETE, *Secretary-Treasurer,*
International Association of Milk Sanitarians, Inc.
State Department of Health, Albany, N. Y.

Active Membership open to Government Officials and Employees.

Associate Membership open to Members of Industry and others.