JOURNAL OF MILK TECHNOLOGY

Volume 1 Number 7

NOVEMBER, 1938

Official Publication of

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

(Association Organized 1911)

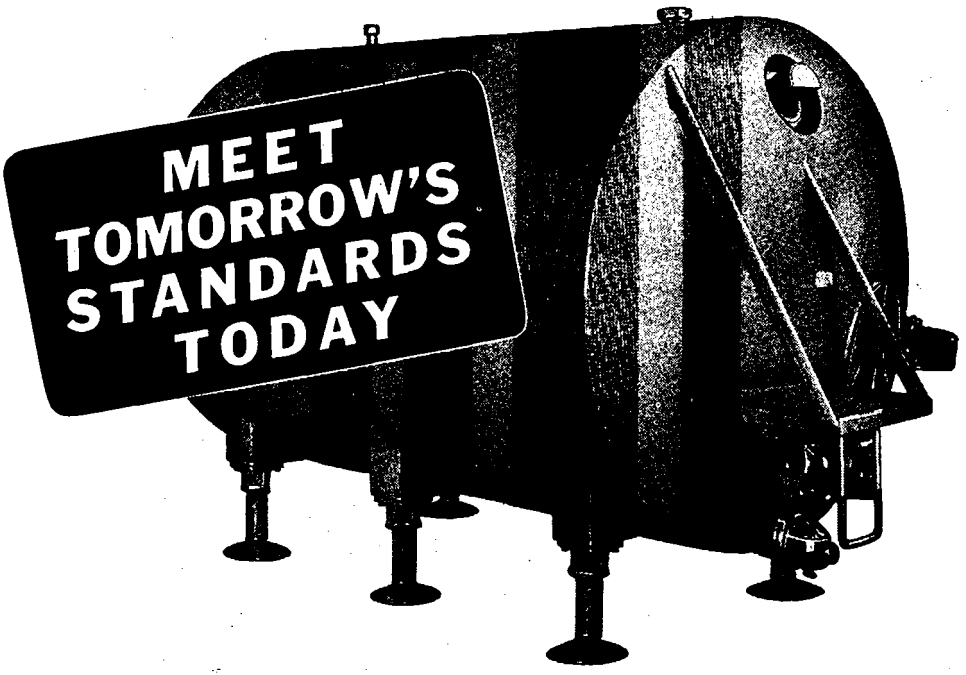
Also designated publication of

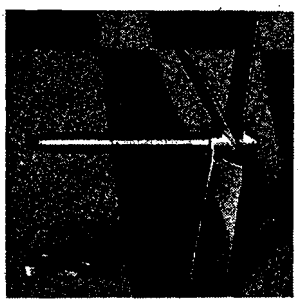
NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS

MASSACHUSETTS MILK INSPECTORS' ASSOCIATION

CENTRAL STATES MILK SANITARIANS

METROPOLITAN DAIRY TECHNOLOGY SOCIETY





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JOURNAL OF MILK TECHNOLOGY

Official Publication of

The International Association of Milk Sanitarians

(Association Organized 1911)

New York State Milk Association of Dairy and Milk Inspectors

Massachusetts Milk Inspectors' Association

Central States Milk Sanitarians

Metropolitan Dairy Technology Society

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JOURNAL
of
MILK TECHNOLOGY

Volume 1 November, 1938 Number 7

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.

The Proposed Amendments to the Constitution of the International Association of Milk Sanitarians

During the past year, five proposed amendments to the Constitution of the International Association of Milk Sanitarians were circulated among the membership by the Secretary. The first three contained provisions which were later incorporated, with additional ones, into two proposed amendments known as No. 3 and No. 4.

The Constitution of the International Association provides that at the annual meeting, a majority vote shall determine whether a proposed amendment shall be submitted to the mail ballot required for enactment. No action was taken on the first three proffered amendments because all of their provisions were covered in the more comprehensive proposal No. 4. By unanimous vote, the Secretary was instructed to submit the proposed amendment No. 3 and a revision of No. 4 to the membership for final mail ballot. The amendment No. 3 seeks to broaden the declaration as to the objectives of the Association by describing them more clearly and explicitly.

The proposed amendment No. 4 contains the following provisions: (1) there shall be two classes of members, namely, active and associate; (2) active members must possess an undergraduate degree or its equivalent, must have at least three years practical experience in milk sanitation work, must pay annual membership dues of $3, and shall have full right to vote and hold office; (3) associate members need not qualify under any professional requirements, must pay annual membership dues of $2, and may not vote nor hold office. Both groups of members will receive the JOURNAL OF MILK TECHNOLOGY without extra charge. None of these increased membership requirements are retroactive, but are to be applicable exclusively to new members.

The Constitution requires that after the Secretary has submitted the proposed amendments to a mail ballot, a majority of all the votes received shall determine

adoption. Announcement must be made at the next annual meeting. If carried, their provisions become effective at the annual meeting in October 1939. In the meantime, the qualifications and dues remain as heretofore, namely, general interest in milk sanitation and annual membership dues of $5, which includes subscription to the JOURNAL OF MILK TECHNOLOGY.

The increasing recognition now accorded milk inspection together with the vigorous growth of milk technology present opportunities as well as responsibilities to the International Association of Milk Sanitarians—organized in 1911 and long recognized as the leader in the field. Boards of health are employing more milk inspectors. Formal courses in the training of inspectors are being instituted by the control agencies as well as by the colleges. Quality control is receiving increased attention by the commercial firms. Machinery and supply interests are turning to this Association for more intensive cooperation in the design of improved equipment. State and area associations of milk inspectors and milk technology societies are being organized right and left. In all of this activity, The International Association of Milk Sanitarians has an opportunity to make substantial contributions. These wider fields of usefulness are indicated in the proposed amendment defining the objectives. The proposal to establish personnel qualifications will give professional standing to our membership and should materially assist in our educational efforts (which we hope to see develop into a broad-gauge program). The reduction in membership dues is made possible by the success of our official publication, the JOURNAL OF MILK TECHNOLOGY, and the rapidly increasing membership.

Upon receipt of the ballots which will be circulated by the Secretary, every active member is urged to exercise his legal prerogative of voting on these proposed amendments, either for or against them, and declare himself in the affairs of the Association.

J. H. S.

Area Associations Again

Ever since an editorial discussion (1) of the desirability of utilizing the JOURNAL OF MILK TECHNOLOGY as the official organ of state or area associations of milk sanitarians and technologists, there has been increasing interest manifested in these possibilities. Since then, the New York State Association of Dairy and Milk Inspectors and the Central States Milk Sanitarians have formally taken such a step. Similar action is pending in Massachusetts* and in Connecticut. One of the large southern states will soon organize a state association of its milk inspectors. Several other state associations in different parts of the country are definitely interested, and some have made more or less commitments. All look forward to use of the Journal.

In addition, there is an increasing number of local societies of milk technologists. These are independent groups, composed exclusively of men in the respective metropolitan areas. We know of five—Chicago, New York, Cleveland, Baltimore-Washington, and Indianapolis. Possibly there are others. These societies accord opportunity for the technical men in the local milk and ice cream industries to meet for informal discussion of technological, regulatory, strictly scientific, and other problems of current local interest. This Journal would be a convenient clearing-house for

topics and speakers, as well as informative of times and places of meetings for out-of-town visitors. The Metropolitan (New York) Dairy Technology Society has taken action, and two other of these societies have just indicated their interest in using the JOURNAL OF MILK TECHNOLOGY as their official organ.

The Executive Committee of the International Association of Milk Sanitarians has authorized the Journal management to accept group subscriptions at decidedly reduced rates from members of local associations or societies when certified by and paid through their respective secretaries. These rates will be sent to any interested organization.

Students are also included in special rates when their names are submitted by their faculty members.

The Journal of Milk Technology is increasingly serving as an integrating factor to establish contact among the numerous state and other local associations of milk sanitarians and technologists, and as a medium for stimulating interest among groups heretofore not organized. Such a publication and organization program facilitates the dissemination of the latest and soundest milk technological knowledge. When knowledge is available and interest is stimulated, there is an increasing use made of the findings of sanitary technology. This practice produces a higher quality product, better public health, and a stronger industry.

J. H. S.

(1) J. Milk Technol., March, 1938.

* The Massachusetts Milk Inspectors' Association has now taken this action.

The Central States Milk Sanitarians

We cordially welcome the Central States Milk Sanitarians into the family of official subscribers to the JOURNAL OF MILK TECHNOLOGY. We are personally acquainted with some of its fine members, have observed its officers in action, and have learned to respect their vision, their ability, and their fine personalities. The whole field of organized milk inspection and production supervision cannot but be helped and stimulated by the advent of this newly organized group of energetic and capable milk sanitarians. Already, this vigorous association has made a decided contribution to the advance of milk technology and sanitation. We applaud its fine start. We join hands in hearty fellowship. We anticipate a collaborative program of constructive accomplishment in the public service.

J. H. S.

Sanitarians from Mexico

Dr. Samuel de la Pena, Chief of Public Assistance, and Mr. Tomas Chavez, Sanitary Engineer, Mexican Public Health Department, Mexico City, attended the 1938 Convention of the International Association of Milk Sanitarians. They presented a letter of introduction from the Mexican Secretary of Public Relations. Our organization is looking forward to them presenting at the 1939 Convention a moving picture in natural colors of the production, processing and distribution of milk under the supervision of the Mexican Department of Health. The Association is pleased to welcome these new Active Members. Their affiliation with the Association is further evidence of the international interest in the program and aims of the organization.

Report of the Committee on Milk Plant Equipment and Committee on Sanitary Procedure*

W. D. Tiedeman, *Chairman*
State Department of Health, Albany, N. Y.

For several years your committee on milk plant equipment has been urging action in one form or another to crystallize official opinion as to what is desirable and satisfactory in milk plant equipment. The milk dealers and the manufacturers of machinery were quick to see the advantages of some such procedure. The chief obstacle to taking any concerted action appears to have been fear on the part of certain of our committee members that our actions might be interpreted as setting specifications and as recommendations to be incorporated into local regulations and thus conflict with the work of official health agencies.

Primarily for this reason and secondarily because of the great amount of time involved, nothing has been done toward the preparation of the manual on milk plant equipment which was proposed several years ago.

For some time past the Committee on Simplified Practice of the International Association of Milk Dealers and the Technical Committee of the Dairy and Ice Cream Machinery and Supplies Association have been cooperating in setting standards for the manufacture of sanitary fittings. About a year ago they proposed to our Executive Committee that a committee of this association be appointed to cooperate with them in a more general program of standardizing details of milk plant equipment. Consequently, President Tolland appointed a Committee on Sanitary Procedure composed of members from all parts of the country who were supposed to know and to be interested in the development of good equipment. The membership of this committee for this year is the same as that of the Committee on Milk Plant Equipment.

It has been rather difficult to get the members of the committee together as many have had to travel long distances without any assistance from the association in meeting their traveling expenses. After a rather poorly attended preliminary meeting, we were successful in getting a majority of the members to a meeting in New York City on September 22nd. Even at this meeting floods which interrupted rail traffic between Boston and New York for a few days kept one member of our committee and a manufacturer's representative from attending.

The members of the committee reached the decision that the committee did not wish to draw specifications for equipment that might be considered by health authorities as conflicting with regulations but that it was necessary and desirable for the committee to cooperate with the dealers and manufacturers in either approving or accepting standards for certain equipment or parts of equipment which it appears advantageous to standardize.

It was decided that the committee could not and would not consider the acceptance of items of equipment submitted by individual manufacturers but would consider only items submitted for standardization by the manufacturers' Technical Committee and the dealers' Simplified Practice Committee. Our committee may wish, however, from time to time to propose to the other two committees action that will lead to the standardization of certain pieces or parts of equipment.

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* Presented at the Twenty-seventh Annual Meeting of International Association of Milk Sanitarians, Cleveland, Ohio, Oct. 19-21, 1938.

The question of approval or acceptance was discussed at length. It was felt that the term "approval" might be interpreted as indicating that the millennium had been reached and that the item approved was set up as a standard for all time. If this were so, it was evident that very little if any equipment would be approved. It was agreed that the committee would "accept" certain desirable standards proposed by the manufacturers' and dealers' committees. The meaning of this acceptance is that the piece of equipment is at least as satisfactory as equipment in common use, and in the light of current knowledge and usage is of the best possible design. It is almost certain that developments will occur in the future that will make it advisable to consider the improvement of the present "accepted" standard.

The understanding is that equipment accepted as standard will meet all health department regulations. However, health departments should not require that the new standard designs be installed except as replacements become necessary. This recommendation is made because it is not the thought of the committee that all past designs are unsatisfactory but rather that the accepted designs will promote ultimate standardization on the basis of satisfactory designs. Although it is desirable that all new equipment purchased be in accordance with the accepted standard, it may take months to get new designs into production. During this interim present designs should be accepted.

There are certain general questions that should be considered by the committee at an early date. As an example, should standards be set for roughness and clearances? Should such things as knurled nuts be excluded in all equipment? There are many other general considerations. Although these matters should be considered and settled in due season, the committee feels that this should not interfere with action on current designs.

First consideration has been given to two designs for recessless sanitary pipe unions. No limitation has been placed on the kind of metal to be used. Joints may be soldered, welded, or expanded. These designs contemplate the use of fittings including valves that are threaded on all sides. One of these designs known as #12R shown in Figure 1 has been accepted. This has a ground joint without recess in which the ends of the connecting pipes form part of the ground seat. This seat is shaped in the milk plant by means of a relatively inexpensive machine. The other design is similar except the use of single service paper gaskets is required in each joint. Recognizing that there are a few places, such as suction lines, in which the use of gaskets is essential, the design shown in Figure 2 requiring the use of a gasket was also accepted. Operators should be advised to install this type of union only where the use of gaskets is essential and the single service paper gaskets are inserted before sterilization of the pipe lines. Unions containing gaskets should not be opened after sterilization for such purposes as bleeding lines.

Figure 3 shows how tees, crosses, and valves for use with these accepted standards are to be threaded on all ends but is not correct as to other detail.

Figures 4 and 5 show the details of the standard for #2-C ninety degree bends for the accepted type of sanitary pipe union. These designs were accepted. The bends are so designed that they can be easily cleaned with a brush and that the cleanliness of all the inner surface may be determined by visual examination.

These designs of course are subject to continued observation. Only experience in their use can determine how successful they will be. Like all equipment, proper installation and care in handling is essential.

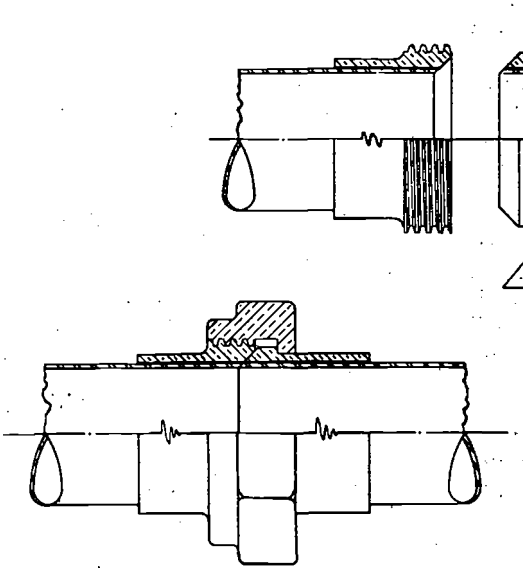
Although the Technical Committee submitted another design for what is known as a solderless union, your committee referred this back to them with the suggestion that they select one of these unions upon which to standardize. If word should be forthcoming shortly that the solderless type is their choice,

FIGURE 1

RECESS SANITARY UNION NO. 12 R

(SCALE ½)

Proposed by Dairy and Ice Cream Machinery and Supplies Association



This portion of union may be coupled to threaded end of any sanitary fitting of corresponding size and thread.

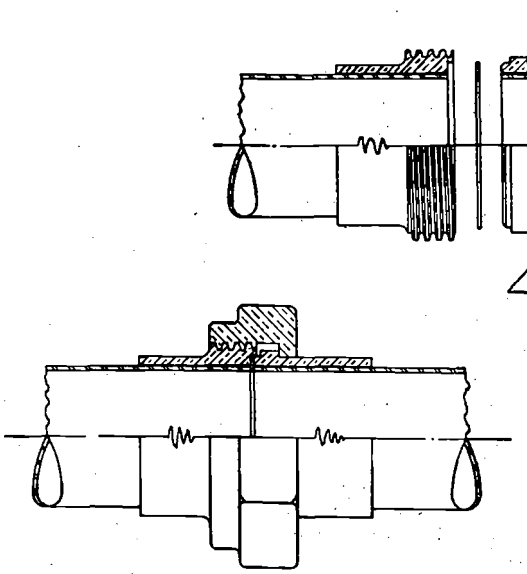
Recessless ferrule is soldered to pipe with end of pipe projecting slighily through ferrule. End of pipe and ferrule are then faced flush with facing tool.

All dimensions are I. A. M. D. Standards.

FIGURE 2

RECESSLESS SANITARY UNION NO. 12 R. G.

(SCALE ½)



This portion of union may be coupled to threaded end of any sanitary fitting of corresponding size and thread.

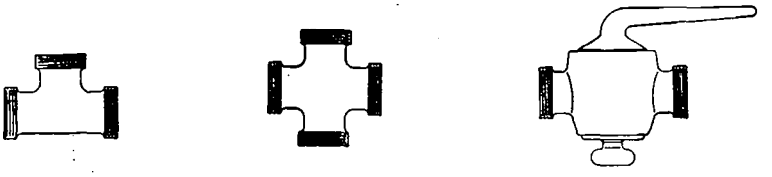
Recessless ferrule is soldered to pipe with end of pipe projecting slighily through ferrule. End of pipe and ferrule are then faced flush with facing tool.

All dimensions are I. A. M. D. Standards.

FIGURE 3

SANITARY FITTINGS FOR USE WITH SOLDERLESS AND RECESSLESS SANITARY UNIONS

(SCALE 1/4)

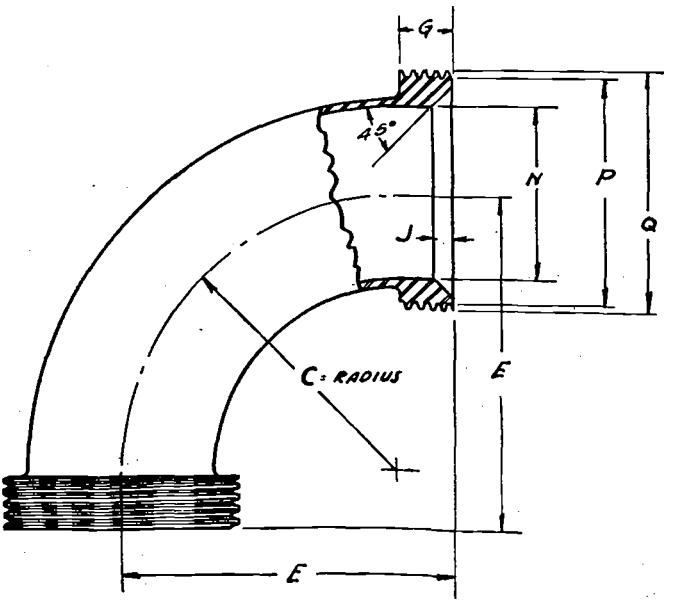


No. 7 Tee *No. 9 Cross* *No. 10-C Valve*

FIGURE 4

PROPOSED NO. 2-C BEND GROUND SEAT SANITARY FITTING

(SCALE 1/2)

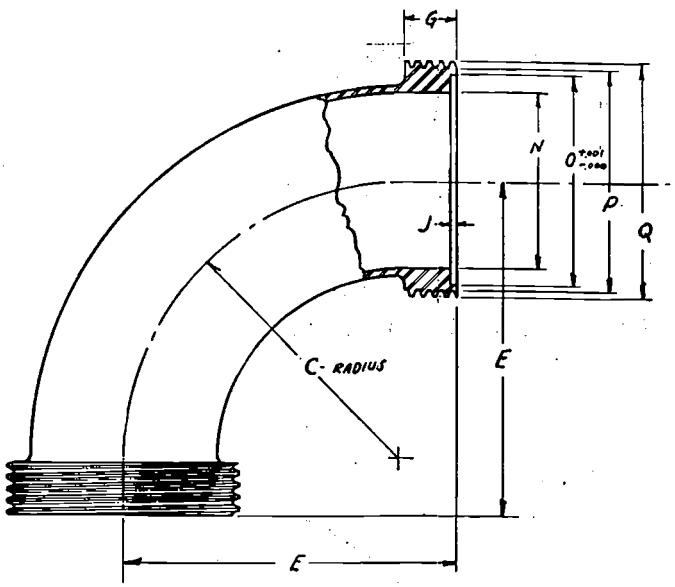


SIZE	TUBE GAGE	ACME THDS. IN.	C	E	G	J	N	P	Q
1"	18	8	1½"	2"	9/16"	3/16"	.902"	1.317"	1.462"
1¼"	18	8	2¼"	2 7/8"	5/8"	3/16"	1.402"	1.849"	1.994"
2"	16	8	3"	3 23/32"	23/32"	7/32"	1.870"	2.381"	2.526"
2½"	16	8	4"	4 27/32"	27/32"	¼"	2.370"	2.913"	3.058"
3"	16	8	5"	5 29/32"	29/32"	¼"	2.870"	3.445"	3.590"

FIGURE 5

PROPOSED GASKET TYPE NO. 2-C SWEEP ELL FOR FLANGED SANITARY PIPING

(SCALE ½)



SIZE	TUBE GAGE	ACME THDS. IN.	C	E	G	J	N	O	P	Q
1"	18	8	1½"	1⅜"	½"	.062"	.902"	1.219"	1.317"	1.462"
1½"	18	8	2¼"	2¾"	½"	.062"	1.402"	1.750"	1.849"	1.994"
2"	16	8	3"	3 9/16"	9/16"	.062"	1.870"	2.250"	2.381"	2.526"
2½"	16	8	4"	4 21/32"	21/32"	.062"	2.370"	2.750"	2.913"	3.058"
3"	16	8	5"	5 25/32"	25/32"	.062"	2.870"	3.312"	3.445"	3.590"

this committee will consider that union. Otherwise the recessless union will remain the accepted standard.

New designs were also submitted for indicating and recording thermometer connections to tanks or vats and to sanitary pipe lines. The designs were accepted after making some minor changes such as a requirement that joints in the thermometer assembly be brazed or acceptably closed. An unusual feature common to these designs is that the large union nut is completely removable to facilitate washing. Figures 6 and 7 show the accepted designs for attaching indicating thermometers to vats and pipe lines respectively. Figures 8 and 9 show the similar accepted designs for attaching recording thermometers. The standard 4 in 1 connection shown in Figure 8 is not accepted. Although this is the most practical thing now available, it is felt that some necessary improvement should be made before the committee should be asked to pass on a new standard to replace this.

Your committee is pleased to report this material progress. The committee

FIGURE 6

PROPOSED 3A TYPE R. N. INDICATING THERMOMETER FITTING FOR TANKS AND VATS

(SCALE ½)

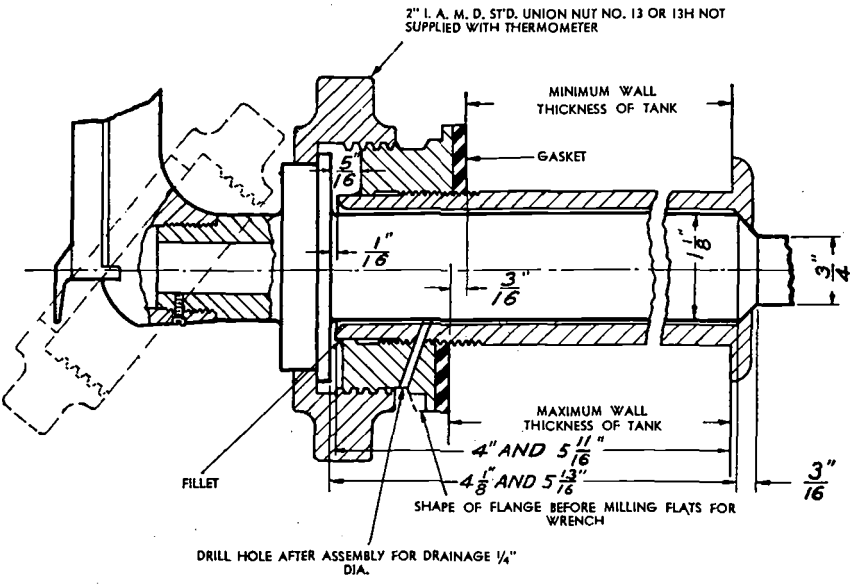


FIGURE 7

PROPOSED 3A TYPE R. N. INDICATING THERMOMETER FITTINGS FOR PIPE LINE

(SCALE ½)

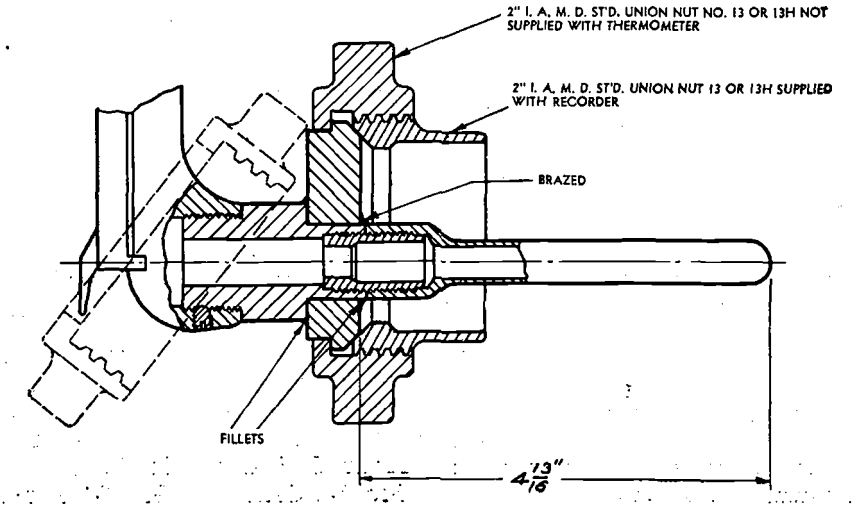


FIGURE 8

PROPOSED 3A TYPE R. N. RECORDING THERMOMETER FITTING FOR TANKS AND VATS

(SCALE ½)

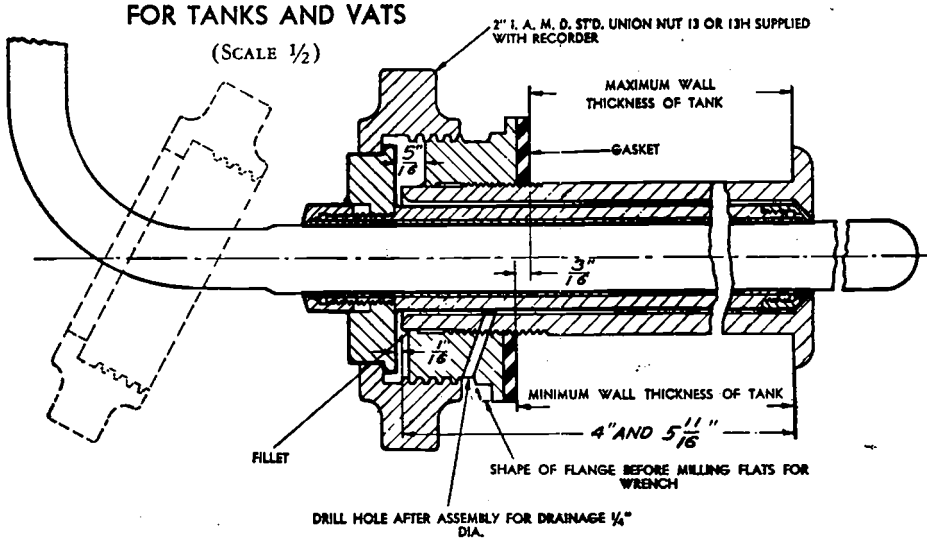
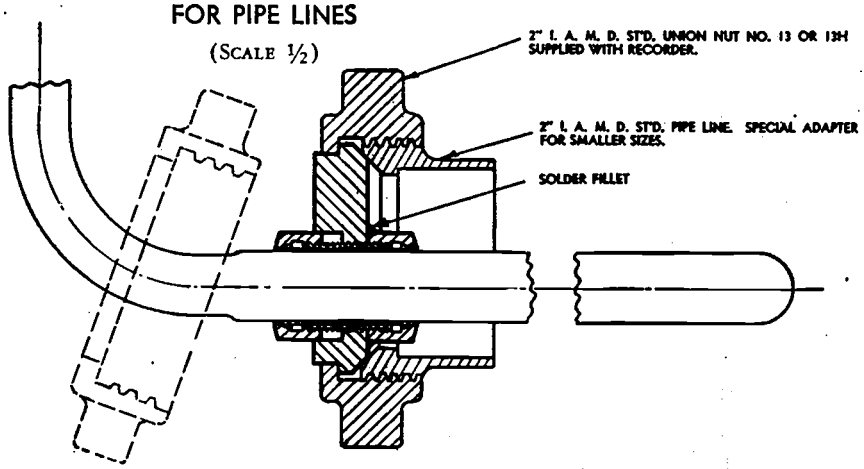


FIGURE 9

PROPOSED 3A TYPE R. N. RECORDING THERMOMETER FITTING FOR PIPE LINES

(SCALE ½)



intends to schedule two or three meetings during the course of the year in so far as is possible in connection with other meetings which members will be attending.

We earnestly seek your cooperation in accepting in your official capacities standards such as those just described that bear committee acceptance.

Committee on Sanitary Procedure

W. D. TIEDEMAN, *Chairman.*

C. A. ABELE	RALPH E. IRWIN
LOOMIS BURRELL	JOHN A. KEENAN
W. D. DOTTERRER	PAUL F. KRUEGER
H. C. ERIKSEN	M. E. PARKER
LESLIE C. FRANK	SOL PINCUS
GEO. W. GRIM	GEO. W. PUTNAM

An Evaluation of the Various Procedures For Making Phosphatase Tests

L. H. Burgwald and E. M. Giberson*

Department of Dairy Technology, Ohio State University
Columbus, Ohio

Before the development of the phosphatase test, there was no satisfactory nor accurate method for determining whether milk had been heated to the proper temperature and held for the proper length of time, or whether properly pasteurized milk had been contaminated with raw milk after pasteurization.

Formerly the only way in which health officials could have been absolutely certain that milk was being properly pasteurized would have been to station an inspector in each plant during the entire operation to take the time and temperature of each vat of milk, and make certain there were no leaky valves on any of the vats.

Today with the phosphatase test, it is possible for any control laboratory to determine whether any given sample of milk has been properly pasteurized or not. The laboratory tests will detect a discrepancy of as little as five minutes in holding time, one degree in temperature, and as little as one tenth percent added raw milk. This test is based on the inactivation of the enzyme phosphatase in milk during pasteurization. The degree of inactivation is measured by adding a definite quantity of milk to a large excess of a phosphoric ester, and then incubating a definite period of time. During the incubation, the enzyme hydrolyzes the phosphoric ester, liberating phenol. At the end of the incubation time, the hydrolysis is stopped, and the amount of phenol liberated is readily determined quantitatively by the use of Folin's reagent or B.Q.C. solution.

There are also some rapid field tests, but these are not quite as sensitive as are the laboratory tests.

The phosphatase test was first applied to milk for determining pasteurizing efficiency by Kay and Graham (1). Gilcreas and Davis (2) were the first to publish results of the test in this country. They used the same test as Kay and Graham except that they made a set of color standards for comparison instead of using the Lovibond tintometer which Kay and Graham used. Scharer (3) next modified the test, shortening the laboratory test, and also developing a rapid "field test". These are known as the New York City Laboratory Test and the New York City Field Test, respectively.

Kay and Graham and Gilcreas and Davis used Folin's reagent for indicating the amount of phenol liberated; while Scharer used 2.6 Dibromoquinonechloroimide Solution (B.Q.C.).

Kay and Graham report milk to be underpasteurized when it develops more than 2.3 Lovibond blue units.

Gilcreas and Davis' standards are based on mg. of phenol liberated, per 0.5 ml. of milk. A sample of milk developing a blue color greater than that for the 0.04 mg. phenol standard would be considered underpasteurized.

Scharer's standards are based on p.p.m. of phenol. The amount of color produced by 0.001 mg. phenol per 5 ml. of solution. Thus, a phenol standard containing 0.5 p.p.m. phenol would contain 0.0025 mg. (2.5 gamma) of phenol in 5 ml. or 2.5 units of color. When using this test a sample of milk heated to

* The authors wish to acknowledge indebtedness to Mr. T. V. Armstrong of the Department of Dairy Technology, Ohio State University, for the assistance given in making many of the tests. Presented at the 27th Annual Meeting of the International Association of Milk Sanitarians, Cleveland, Ohio, October 19-21, 1938.

TABLE 1

Comparison of Kay & Graham, Gilcreas & Davis, and Scharer's Laboratory Tests (Laboratory Pasteurized Samples)

Temp. °F.	Time-Min.	% raw added	K. & G. L.B.U.	G. & D. mg. phenol per 0.5 ml. sample	Sch. Lab. Test Units	
141	30		>8.0	>.15	15.0	
142	30		7.0	.15	7.5	
143	30		2.5	.04	> 2.5	<5.0
143.5	20		4.3	.12	7.5	
143.5	25		2.75	.05	5.0	
143.5	30		1.7	.02	2.5	
143.5	30	.1	2.95	.05	7.5	
143.5	30	.2	4.05	.09	10.0	
143.5	30	.5	>8.0	>.15	20.0	
142.0	20		>8.0	>.15	17.5	
142.0	25		8.0	>.15	10.0	
142.0	30		5.2	.12	5.0	
142.0	40		2.4	.04	> 2.5	<5.0
143.0	20		7.5	.15	10.0	
143.0	25		5.0	.12	5.0	
143.0	30		2.5	.04	> 2.5	<5.0
143.0	40		1.7	.02	2.5	

143° F. for 30 minutes should not develop more than 2.5 units of color.

COMPARISON OF LABORATORY TESTS

A comparison of the results obtained by these three tests on some laboratory pasteurized samples are given in table 1. Samples were pasteurized in sealed tubes with a preheating time of 3 minutes.

Methods followed in making the tests are given in the references cited (1) (2) (3).

Controls were run in every instance.

Results show that all three methods detected with approximately equal accuracy underpasteurization when using the following standards for pasteurization at 143° F. for 30 minutes.

Kay and Graham test—2.3 or less Lovibond blue units (L.B.U.).

Gilcreas and Davis—0.04 mg. phenol or less per 0.5 ml. of sample.

Scharer's (N. Y.) Lab. Test—2.5 phosphomonoesterase units.

All of the tests detected milk which had been heated to only 142° F. for 30 minutes, milk which had been held for only 25 minutes at 143° F., and milk which had been heated to 143.5° F. for 30 minutes to which as little as 0.1 percent raw had been added.

The fact that the samples which had been heated to 143° F. for 30 minutes showed 2.5 L.B.U. may possibly be accounted for by the fact that the preheating time was only 3 minutes, whereas in plant practice the preheating time is usually 15 to 20 minutes.

Table 2 shows a comparison of the three tests on some plant pasteurized samples. One of the authors was present during the entire time, checking pasteurizing temperatures and holding times and taking the samples.

The capacity of the vats were 300 gallons, and the preheating time varied from 18 to 20 minutes in bringing the temperature of the raw milk from 62-72° F. to the pasteurizing temperature. The samples were taken from the pasteurizing vat with a clean sterile dipper into clean sterile 25 ml. vials, and placed immediately in ice water.

The history of the samples were unknown to the person performing the tests at the university laboratory.

These results are on samples taken on several days.

As in the case of the laboratory pasteurized samples shown in Table 1, the three methods are almost equally effective in determining underpasteurization.

TABLE 2

Comparison of Kay & Graham, Gilcreas & Davis, & Scharer's Laboratory Tests Using Both Color Standards and Photelometer

(*Plant Pasteurized Samples*)

Temp. °F.	Time Min.	% raw added	K. & G. L.B.U.	G. & D. mg. phenol per 0.5 ml. milk	Sch. Lab. Test Units	N. Y. Lab. Test Photo. Read.	N. Y. Lab. Test Equi. in p.p.m.	Kay & Graham Test Photo. Read.	Kay & Graham Test Equi. L.B.U.
143	30		2.55	.04	>2.5<5.0	55.0	.90	44.5	2.10
143	30		2.25	.04	>2.5<5.0	53.5	.95	43.5	2.15
143	31		1.85	.02	2.5	60.5	.70	52.5	1.60
143½	30		2.00	.03	>2.5<5.0	54.5	.90	51.5	1.65
143½	30		2.10	.03	2.5	60.5	.70	50.0	1.70
143½	30		1.70	.02	2.5	60.5	.70	59.5	1.25
143½	30		1.85	.02	2.5	65.0	.50	56.0	1.40
143½	30		1.85	.02	2.5	60.5	.70	58.0	1.30
143½	30		1.90	.02	2.5	59.5	.70	60.0	1.20
143½	31		1.70	.02	2.5	60.0	.70	56.5	1.40
143½	31		1.85	.02	2.5	64.0	.60	55.5	1.45
143½	32		1.80	.02	>2.5<5.0	57.0	.80	51.5	1.65
143½	33		1.95	.03	2.5	61.0	.70	55.5	1.45
143½	38		1.80	.02	2.5	62.0	.65	64.0	1.00
144	30		1.50	.015	>2.5<5.0	55.0	.90	61.5	1.15
144	30		1.65	.02	>2.5<5.0	56.5	.85	58.0	1.30
144	30		1.50	.01	>2.5<5.0	59.0	.75	61.0	1.15
144	30		1.55	.015	2.5	60.0	.70	59.0	1.25
144	30		2.35	.04	2.5	56.5	.85	46.5	2.05
144	33		1.60	.02	2.5	58.0	.80	58.0	1.30
144	35		1.70	.02	2.5	63.0	.60	61.0	1.15
144	36		1.50	.02	2.5	59.0	.75	61.0	1.15
143	15		>8.00	>.15	20.0	23.5	3.00	4.5	8.00
143	20		5.20	.12	10.0	39.5	1.50	17.5	4.50
143	25		3.15	.09	5.0	52.5	1.00	33.0	2.75
143	30		2.55	.04	>2.5<5.0	55.0	.90	44.5	2.00
143	30	0.1	2.65	.05	>2.5<5.0	54.0	.95	40.0	2.30
143	30	0.2	3.50	.09	5.0	51.0	1.05	30.0	2.90
143	30	0.5	6.00	.14	12.5	37.0	1.75	13.5	5.00
143	15		>8.00	>.15	15.0	28.0	2.25	3.0	>8.00
143	20		5.90	.12	7.5	41.5	1.50	13.0	5.00
143	25		3.40	.06	>5.0<7.5	49.0	1.10	31.5	2.85
143	30		2.25	.04	>2.5<5.0	53.5	.95	43.5	2.18
143	20		4.00	.09	7.5	52.0	1.00	22.0	3.65
143	25		2.65	.05	5.0	59.0	.75	37.5	2.40
143	30		1.85	.02	>2.5<5.0	60.5	.70	52.5	1.60
143½	15		7.00	.15	12.5	34.0	1.90	10.5	5.50
143½	20				10.0	41.0	1.50		
143½	25		2.35	.04	5.0	52.0	1.00	42.5	2.22
143½	30		2.10	.03	2.5	60.5	.70	50.0	1.70
143½	15		8.00	.15	12.5	29.5	2.10	6.5	7.00
143½	20		3.50	.09	7.5	49.5	1.10	29.5	2.95
143½	25		2.00	.03	5.0	57.0	.85	47.0	2.00
143½	30		1.70	.02	2.5	60.5	.70	59.5	1.25
143½	25		2.60	.04	5.0	54.5	.90	37.0	2.40
143½	30		1.95	.03	>2.5<5.0	61.0	.70	55.0	1.45
143½	30	.1	2.45	.04	5.0	60.0	.70	38.0	2.35
143½	30	.2	3.5	.09	5.0	53.5	.95	29.0	3.00
143½	30	.5	5.5	.12	10.0	47.0	1.25	16.0	4.60
144	15		>8.0	>.15	10.0	41.5	1.50	5.5	7.50
144	20		4.05	.11	7.5	49.0	1.10	25.0	3.40
144	25		2.40	.04	>2.5<5.0	54.0	.95	41.0	2.25
144	30		1.65	.02	2.5	57.0	.85	54.0	1.50
144	30	.1	2.90	.06	5.0	46.5	1.25	37.5	2.40
144	30	.2	3.85	.09	7.5	43.0	1.50	26.0	3.30

The Scharer Laboratory Test seems to be off somewhat if we consider the standard of 2.5 units or 0.5 p.p.m. of phenol as indicating proper pasteurization. According to our findings it more properly should be considered as less than 5 units or 1.0 p.p.m. of phenol. The difference in our result and Scharer's, however, may have been due to the difference in sensitivity of the B.Q.C. solution used.

The standards were made according to directions given by Scharer (3) and were allowed to stand in refrigerator for one hour before using.

According to the results as shown in Table 2, the Kay and Graham test using the Lovibond tintometer indicated 3 samples out of 29 as underpasteurized which were properly pasteurized. It detected 26 as underpasteurized out of 26 which were underpasteurized. It even detected samples held at 144° F. for 25 minutes or less and the addition of as little as 0.1 percent added raw milk.

Using the Gilcreas and Davis color standards, no samples were found underpasteurized which according to treatment had been properly pasteurized. However, 4 samples out of 26 were indicated to have been properly pasteurized which had not been. Two of these samples had been heated to 143.5° F. for 25 minutes, one to 144° for 25 minutes, and the other had been heated to 143.5° F. for 30 minutes to which 0.1 percent raw milk had been added.

Scharer's (N. Y.) Laboratory Test (using 2.5 units as indicating proper pasteurization) indicated 11 out of 29 samples as underpasteurized which had been properly pasteurized. If we used less than 5 units as the standard, no properly pasteurized sample would have been indicated as improperly pasteurized. Using 2.5 units as the standard, no improperly pasteurized sample would have been indicated as properly pasteurized and if less than 5 units were taken as the standard, then 1 out of 26 improperly pasteurized samples would have been indicated as properly pasteurized; this would have been a sample which had been heated to 143° F. for 30 minutes to which 0.1 percent raw milk had been added.

In addition to these tests reported in Tables 1 and 2, 80 other samples of plant pasteurized milk which had been held at an average temperature of 142.95° F. for 36.4 minutes developed an average of 1.685 Lovibond blue units by the Kay and Graham test. Only 3 of the samples developed more than 2.3 L.B.U. The treatments they had received were as follows:

Temperature °F.			Holding	Lovibond blue
Initial	Final	Average	time (min.)	units
142.5	141.5	142.0	31	2.8
143.5	142.5	143.0	35	2.35
143.0+	142.0+	142.5+	32	2.5

Table 3 shows the results obtained on some samples plant pasteurized by the high temperature short time holding method. All tests except Scharer's N. Y. Laboratory Test showed all samples to

TABLE 3

High Temperature, Short Time Holding 160.5° F. *for* 16+ *seconds*
Samples Taken at a Commercial Plant at 30 *minute Intervals During the Process*

Sample	N. Y. Lab. Test		Kay & Graham Test		Gil. & Davis mg. phenol per	New York Field
No.	Units	Phot. Read.	L.B.U.	Phot. Read.	0.5 ml. sample	Test
1	>2.5<5	67	1.2	66.5	.01	<.2
2	2.5	73	1.2	64.0	.015	<.2
3	2.5	72	1.1	66.0	.01	<.2
4	>2.5<5	71	1.15	64.5	.01	<.2
5	2.5	71.5	1.2	63.5	.01	<.2
6	2.5	71.5	1.2	62.5	.01	<.2
7	2.5	72.0	1.2	64.5	.01	<.2
8	2.5	73.5	1.15	64.5	.01	<.2
9	2.5	69.5	1.2	63.5	.01	<.2
10	2.5	72.0	1.2	62.0	.01	<.2

be properly pasteurized. This test showed 2 samples to be underpasteurized if we used 2.5 units as the standard; if we used less than 5 units as the standard, all samples would have been indicated as properly pasteurized by this test also.

SCHARER'S (N. Y.) FIELD TEST

The method for the older field test is given in the reference No. 3. During this past year Scharer (6) has published an improved rapid field test, which in principle is the same as the older test with the exception that after the development of the blue color, 2 ml. of normal butyl alcohol (neutral) are added to the test tube. The tube is inverted slowly at least ten times and allowed to stand. The alcohol should separate clearly and should extract the indophenol formed by the test. The color in the alcohol layer is compared with permanent standards against an opaque milk glass plate to diffuse light through standards and sample.

Instructions for making standards are as follows:

Permanent color standards

A. Color solution, red. Dissolve 59.59 grams of $CoCl_2.6H_2O$ in distilled water. Add 1 percent of HCl by weight and dilute to 1 liter.

B. Color solution, blue. Dissolve 62.43 grams of $CuSO_4.5H_2O$ in distilled water. Add 1 percent of HCl by weight and dilute to 1 liter.

C. Color solution, yellow. Dissolve 45.05 grams of $FeCl_3.6H_2O$ in distilled water. Add 1 percent of HCl by weight and dilute to 1 liter.

Prepare permanent color standards corresponding to 0.2 percent and 0.5 percent raw milk added to pasteurized milk by combining the quantities of color solution A, B, C, indicated in the table and diluting to 5 ml. with distilled water in each case.

PREPARATION OF STANDARDS

Added Raw Milk	Color Solution		
	Red	Blue	Yellow
Percent	(A)	(B)	(C)
0.2	0.4	1.5	0.5
0.5	—	1.65	0.6

The appearance of any blue or blue-green in the alcohol layer is indicative of improper pasteurization. In the absence of a properly pasteurized sample of milk to be used as a control, a boiled milk may be substituted. The use of buffered substrate and B.Q.C. in tablet form simplify the test.

Instructions are as follows:

The Improved Rapid Field Test for Efficiency of Pasteurization of Milk and Cream, developed by Harry Scharer (6), New York City Department of Health.

Reagents

The buffered substrate (white) tablet contains the phenyl-phosphoric ester, magnesium to catalyze the enzyme reaction, and adequate buffer to make 50 ml. of the buffered substrate solution, sufficient for ten tests.

The BQC (yellow) tablet contains 2.6 Dibromoquinonechloroimide and a stabilizer, sufficient for 30 or more tests. These tablets should be kept under refrigeration if possible. The buffered substrate tablets available commercially may develop varying amounts of phenol under conditions of storage and with exposure to light or heat. Since the extraction technic is extremely sensitive, it is necessary to work with a phenol-free substrate; therefore, the following procedure is utilized to remove any phenol and is recommended in all cases:

Crush buffered substrate tablet in test tube, dissolve in 5 ml. of distilled water. Add 2 drops of BQC solution. Allow five minutes for color development, then extract the indophenol with 2 to 2.5 ml. of normal butyl alcohol. Allow to stand until alcohol layer has separated at top of tube. Remove alcohol layer with medicine dropper and discard. Dilute remainder of solution to 50 ml. This solution is then phenol free.

Dissolve the BQC tablet in 5 ml. of 95% ethyl or methyl alcohol. DO NOT USE A DENATURED ALCOHOL. Transfer to dropping bottle delivering 50 drops per ml.

Technic

Add ½ ml. of sample to 5 ml. of buffered substrate. Shake briefly. Incubate for 10 minutes in a water bath at 98° F. (If no water bath is available, incubate in pocket for somewhat longer period.) Remove from bath, add

6 drops of BQC solution. Shake well immediately.

Properly pasteurized milk will be a gray or brown. Properly pasteurized cream will be a gray or white. Raw milk or cream will be an intense blue. The appearance of any blue is indicative of improper pasteurization; the degree of intensity of color being proportional to the seriousness of the condition.

After development of color as above, add 2 ml. of normal butyl alcohol (neutral*). Invert the test tube SLOWLY at least ten times and allow to stand. Rapid inversion will result in formation of an emulsion. The alcohol should separate clearly and should extract the indophenol formed by the test.

Compare the color in the alcohol layer with the permanent standards against an opaque milk-glass plate, to diffuse light through standards and sample.

The appearance of any blue or blue-green in the alcohol layer is indicative of improper pasteurization. In the absence of a properly pasteurized milk to be used as a control, a boiled milk may be substituted.

Precautions

All equipment should be thoroughly washed and rinsed before re-use. Avoid the use of phenolic resin bottle closures anywhere in the test: the BQC reagent is sufficiently sensitive to demonstrate the leaching of phenol from the resin by water.

Both solutions decompose with age and should be stored under refrigeration or prepared shortly before use. A few drops of chloroform will preserve the buffered substrate.

Comparison between the improved test and the Kay and Graham test are shown in Table 4. Results show that the field test is not quite as sensitive as the laboratory test. It detected 0.1 percent added raw milk in only 1 out of 4 trials. It detected 0.2 percent and 0.5 percent added raw milk in each instance. It was unable to detect milk heated to 143.5° F. for only 25 minutes; however, it did detect milk heated to 143.5° F. for 20 minutes.

By further comparison on 60 samples of unknown treatment using buffered substrate and B.Q.C. in tablet form and in powdered form (all reagents were phenol free), we noted that the following number of samples in each instance were interpreted as underpasteurized. Results are compared with the Kay and Graham test.

	Older field test	Improved field test.	K.&G. test
B.Q.C. tablets	7	25	44
B.Q.C. powder	11	35	44

TABLE 4

A Comparison Between the Kay and Graham Test and the Improved New York Field Test. The Kay and Graham Test Was Read with the Tintometer and a Photelometer

Sample No.	Kay & Graham Lov. Units	Kay & Graham Photel-ometer	Imp. Field Test	Kay & Graham Lov. Units	Kay & Graham Photel-ometer	Imp. Field Test	Kay & Graham Lov. Units	Kay & Graham Photel-ometer	Imp. Field Test	Kay & Graham Lov. Units	Kay & Graham Photel-ometer	Imp. Field Test
Treatment:		143.5° F. 30 M.			.1% Raw			.2% Raw			.5% Raw	
1*	1.75	1.6 PPM	<.2	2.45	3.0 PPM	<.2	3.1	3.95 PPM	=.2	5.6	8.0 PPM	<.5
2	1.8	2.2	<.2	2.8	3.85	<.2	3.85	5.4	sl>.2	6.1	8.7	=.5
3	1.55	2.0	<.2	2.5	3.75	<.2	3.55	5.35	> .2	—	—	—
4	1.7	2.4	<.2	2.9	4.0	>.2	3.7	5.55	>.2<.5	—	—	—
Treatment:		143.5° F. 30 M.			143.5° F. 25 M.			143.5° F. 20 M.				
3	1.55	2.0	<.2	2.1	2.8	<.2	3.6	5.5	>.2<.5			
4	1.7	2.4	<.2	2.55	3.2	<.2	3.6	5.5	>.2<.5			

* Heated at 143° F. for 37 minutes.

* The usual grade of normal butyl alcohol can be neutralized by the addition of 0.1 to 0.2 ml. of N/10 NaOH, per 100 ml. of alcohol. Some lots of the alcohol may require five times this amount. The hydroxide should be added until the alcohol yields a light blue color when tested with Bromthymol Blue. This precautionary step is only necessary when the acidity of the alcohol is high, which might then change the extracted indophenol blue to a red color.

These results show that there is a difference in the sensitivity of the B.Q.C. indicator. (The reagents were kept in the refrigerator at all times, and solutions were made up fresh daily just before use.) They also show that the new or improved Field Test is much more sensitive than the old one. We have shown that the Kay and Graham test is very accurate in detecting underpasteurization. We can assume that the Improved Field Test is not quite as sensitive as the laboratory tests.

These results and conclusions were obtained using Scharer's standards equal to 0.2 percent and 0.5 percent added raw milk. In our tests we found it difficult in a few instances to interpret the color developed in milk. It sometimes had a slight greenish or yellowish tinge which we interpreted as properly pasteurized when it probably should not have been so interpreted. This probably accounts for the fact that the test was slightly less effective or less sensitive than the laboratory test. It is well to mention, however, that in no instance was a properly pasteurized sample interpreted as improperly pasteurized by this method.

APPLICATION OF THE PHOTELOMETER TO THE PHOSPHATASE TEST

The Kay and Graham test and the New York Laboratory Test require that colorimetric comparisons be made when reading the former with a tintometer or with the Gilcreas and Davis standards and the latter with the New York laboratory phenol standards. A mechanical means of measurement would eliminate possible errors in the ordinary colorimetric comparisons and possibly enable more accurate readings to be made. Tracy and Hahn (4) have applied mechanical measurement to the New York Laboratory test. They used a photo-electric eye in their study.

In our work an instrument operating on the same principle was calibrated for both the Kay and Graham test and the New York Laboratory test. A number of samples were tested by the former test. The instrument used was a Cenco photelometer furnished by the Central Scientific Company. Its operation is based upon the relation of the concentration of a substance in solution to the light transmission factor of the solution. The three essential parts of the photelometer are the optical system, the absorption cell and light filter, and the electrical measuring system. A light source of constant intensity is required and is obtained by means of a constant-wattage transformer. A photronic cell and a microammeter furnish the means of measurement. An orange spectral filter was used for this work. The instrument was set at 100 for double distilled water, and the deflections from 100 read on the microammeter.

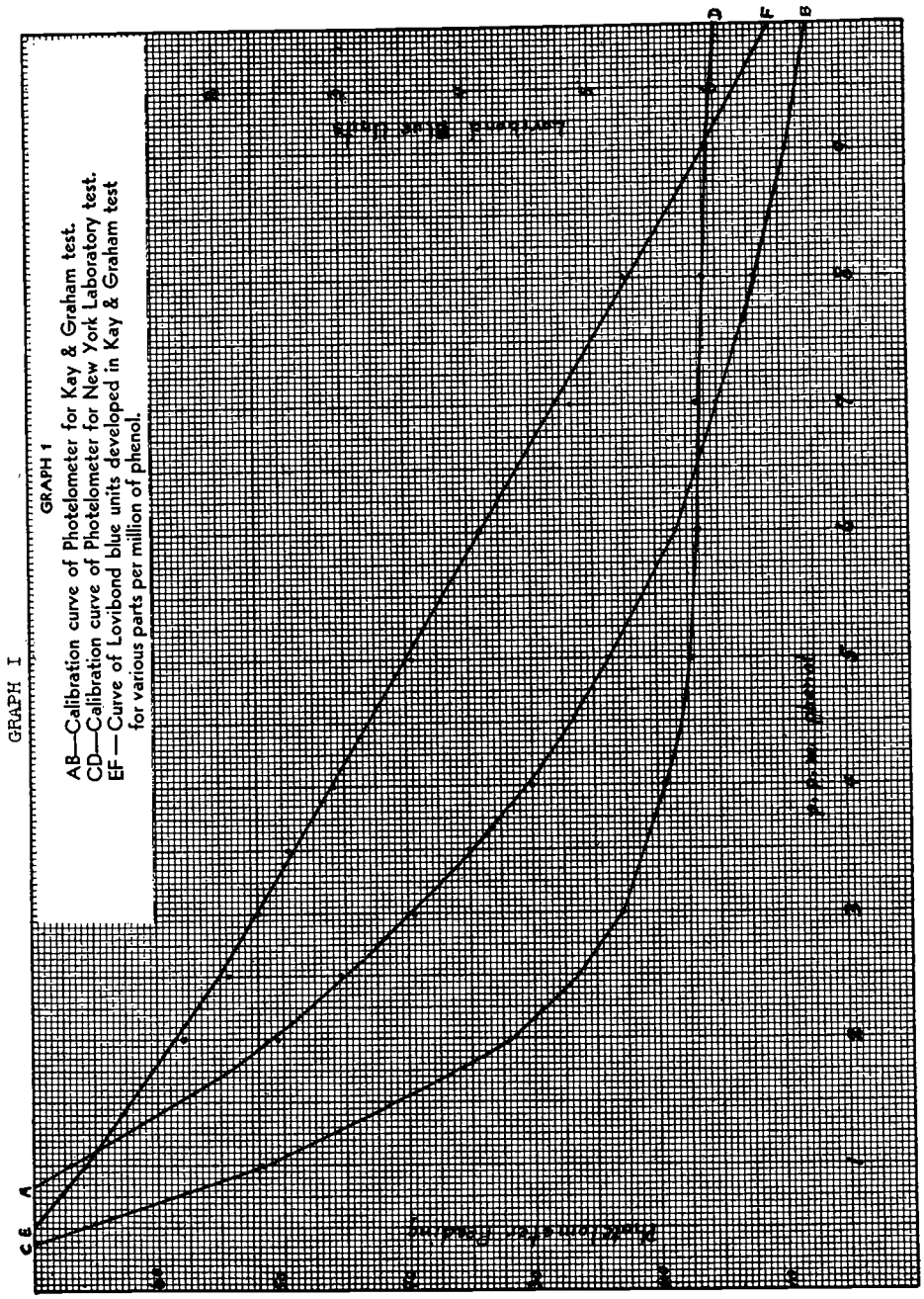
Solutions containing from one-half part to 10 parts of phenol per million were prepared from a phenol solution standardized against bromine according to the method outlined in the U. S. Pharmacopoeia XI edition. The calibrations for both the Kay and Graham test and the New York Laboratory test were made from the same standard phenol solution that contained 0.1 mg. of phenol per ml.

The phenol solutions were prepared twice for the Kay and Graham test, and three times for the N. Y. Laboratory test, and standardized against bromine as mentioned above.

The standards were made according to directions given by Scharer (3) and were allowed to stand in refrigerator for one hour before using.

Two sets of standards were prepared from each solution in the Kay and Graham test, making four sets, the average reading of the four sets being used to plot the curve AB in Graph I. The standards were prepared as follows:

In calibrating the photelometer for the Kay and Graham test, 0.1 mg. per ml. (1/10,000) phenol solution was diluted in buffer substrate and Folin's reagent as follows: To 90 ml. of 10 parts buffer substrate and 4.5 parts Folin's reagent (dilute), 10 ml. of the 1/10,000 phenol solution were added giving a strength of 1/100,000. This was then diluted in



more buffer substrate and Folin's reagent to give the p.p.m. desired.

To 10 ml. of each of the phenol solutions, 2 ml. of 14 percent Na_2CO_3 were added. Then the tubes were mixed and placed in a boiling water bath for five minutes and filtered. A control tube of 10 parts buffer substrate plus 4.5 parts

TABLE 5

Calibration of the Photelometer for the Kay and Graham Phosphatase Test

	Cenco Photelometer					Lovibond Tintometer				
	Group I		Group II		Av. of	Group I		Group II		Av. of
P.P.M. phenol	Phot. Reading Set A	Set B	Phot. Reading Set C	Set D	All sets ABCD	Lov. blue units Set A	Set B	Lov. blue units Set C	Set D	All sets ABCD
BS F*	90.0	91.0	90.0	91.0	90.5	.175	.10	.10	.10	.12
.5	77.0	77.5	76.0	78.0	77.1	.55	.55	.55	.55	.55
1.0	68.0	67.3	66.8	66.7	67.2	.875	.8	1.0	1.0	.92
2.0	51.0	51.0	49.0	51.6	50.6	1.6	1.6	1.8	1.8	1.70
2.5	46.0	—	45.0	46.0	45.7	2.0	—	2.1	2.1	2.07
3.0	39.0	37.5	40.0	41.0	39.4	2.20	2.3	2.35	2.35	2.3
3.2	—	38.5	36.5	38.0	37.7	—	2.3	2.45	2.45	2.38
3.5	—	35.0	34.0	36.0	35.0	—	2.5	2.6	2.6	2.55
4.0	30.0	30.0	30.0	30.0	30.0	2.85	2.85	3.0	3.0	2.92
5.0	23.5	23.0	24.0	24.5	23.8	3.4	3.6	3.6	3.6	3.55
6.0	18.0	18.0	19.0	19.0	18.5	4.0	4.4	4.0	4.0	4.1
7.0	14.0	15.0	15.6	15.4	15.0	4.6	4.8	5.0	5.0	4.85
8.0	11.0	12.5	12.3	12.0	11.95	5.2	5.1	5.4	5.4	5.28
9.0	9.0	9.0	9.7	9.75	9.4	5.8	6.2	5.8	5.8	5.9
10.0	7.0	7.5	7.9	8.0	7.6	6.5	6.5	6.4	6.4	6.45

* BS F = 10 parts Buffer Substrate 4.5 parts dilute Folin's Reagent.

Folin's reagent containing no added phenol was also made. The readings obtained on these tubes are shown in Table 5. Each set was read on a Lovibond tintometer and then readings were recorded from the photelometer.

The Line AB on Graph I shows the calibration curve of the Kay and Graham test on ordinary graph paper. The average values of the photelometer readings shown in Tables 5 and 6 were placed in the ordinate and the values of the phenol standards were placed in the abscissa. The average readings in Lovibond blue units on the tintometer obtained on the same solutions are shown in this graph as line EF. An analysis of the chart shows that the solution that contains 3 p.p.m. had an average reading on the tintometer of 2.3 Lovibond blue units. Table 5 shows that readings of 2.3 blue units were obtained on solutions containing 3.0 and 3.2 p.p.m. phenol.

Using Scharer's (3) method, five sets of standard phenol solutions were made, triplicate samples being prepared from one of the standard stock solutions. These readings are shown in Table 6, and the average of these readings were used to plot the curve for calibrating the photelometer for the New York Laboratory test. This curve is shown as line CD in Graph I.

TABLE 6

Calibration of the Photelometer for the N. Y. Lab. Test

P.P.M. Phenol	Set A	Set B	Set C	Ave. of all Sets
.25			73.7	73.7
.50	65.0	67.0	66.0	66.0
1.00	51.5	53.5	52.0	52.3
1.50	41.5			41.5
2.00	32.0	32.5	31.9	32.1
2.50	26.5			26.5
3.00	22.0	23.0	24.0	23.0
4.00	17.0	19.25	22.4	19.6
5.00	16.0	17.4	18.9	17.4
6.00		16.5	16.8	16.7
7.00		15.7	17.9	16.8
8.00		15.0	17.1	16.0
9.00		14.5	17.25	15.8
10.00	14.5	14.2	15.3	14.7

Sets A and B are of single samples, Set C is the average reading of three samples prepared from the same standard stock solution.

These results show that the photelometer used, when calibrated for the Kay and Graham test, gave an average reading of 39.4 for 3.0 p.p.m. of phenol. This was equivalent to 2.3 Lovibond blue units and would be interpreted as the lowest reading, indicating milk properly pasteurized at 143.0° F. for 30 minutes.

TABLE 7

A Comparison Between Readings With a Photelometer and Lovibond Tintometer Using the Kay and Graham Test on Milk Pasteurized at 143.5° F. for 30 Minutes.

Sample No.	Kay and Graham Test: Lovibond Blue Units	Photelometer Reading	Photelometer P.P.M.
1	1.8	48.0	2.2
2	1.3	56.0	1.7
3	1.6	48.5	2.17
4	1.4	53.0	1.83
5	1.8	49.5	2.1
6	1.65	49.0	2.13
7	1.55	50.5	2.0
8	1.8	46.5	2.35
9	1.6	49.5	2.1
10	1.5	51.0	1.97
11	1.55	50.5	2.0
12	1.55	50.7	2.0
13	1.7	45.5	2.41
		Range	Average
Lovibond blue units		1.3 - 1.8	1.6
Photelometer Reading		55 - 45.5	49.78
Parts per million		1.7 - 2.41	2.074

When calibrated for the Scharer (N. Y.) Laboratory test, 0.5 p.p.m. of phenol, the standard set by Scharer as indicating proper pasteurization of 143.0° F. for 30 minutes, gave an average reading of 66.0. So a reading of 66.0 or over on this test should indicate proper pasteurization. However, results given in Table 2 indicate that less than 1.00 p.p.m. of phenol would be a better standard to use. In such a case, a reading of 54.5 or over would indicate proper pasteurization. (About 0.9 p.p.m. of phenol or less.)

Using 66.0 as a standard, we should find all milks, even those heated to 144° F. for 30 minutes or more being interpreted as underpasteurized.

Using 54.5 as a standard we should find all milks but two heated to 143.0° F. for 30 minutes indicated as properly pasteurized. Four samples which should have shown underpasteurization according to treatment received were indicated as properly pasteurized by this standard of 54.5. One sample had been heated at 143.0° F. for 25 minutes, two to 143.5° F. for 25 minutes, and one had been

TABLE 8

A Comparison Between Readings with a Photelometer and the Lovibond Tintometer on the Kay and Graham Phosphatase Test

Temperature Initial	Temperature Final	Time Held Min.	Lovibond Blue Units A	Lovibond Blue Units B	Photelometer Reading A	Photelometer Reading B	P.P.M. Average
143.5	142.5	37	1.8	1.7	52.5	59.0	1.65
143.5	142.0	33	1.6	1.5	55.5	59.5	1.65
143.5	142.5	31	2.3	2.1	46.0	53.0	1.83
143.5	142.0	33	2.3	2.2	46.0	48.0	2.2
144.0	142.0	30	2.0	2.0	50.5	53.0	1.95
143.5	142.5	38	2.3	2.3	47.0	48.0	2.25
143.5	142.0	40	2.0	2.0	51.5	51.0	1.97
143.5	142.5	31	2.0	2.1	50.0	49.0	2.13
144.0	143.0	34	2.1	2.0	48.0	55.5	1.9
144.0	143.0	34	1.8	1.8	55.0	56.0	1.65
143.5	142.5	35	1.8	1.8	53.0	56.0	1.75
143.5	143.5	35	1.4	1.4	54.0	58.0	1.65
143.5	143.5	42	1.5	—	53.0	—	1.83
143.0	143.5	31	2.3	2.3	39.0	41.5	2.87
143.5	143.5	32	1.6	1.5	49.0	56.0	1.9
143.5	143.5	32	1.3	1.3	56.0	58.5	1.56
143.5	143.5	37	1.2	1.2	58.0	58.0	1.5
143.5	143.5	31	1.5	1.5	52.0	55.0	1.8
143.5	143.5	32	1.6	1.6	47.0	52.0	2.1
143.5	143.5	32	1.4	1.4	54.0	52.5	1.8
Range:							
144.0	142.0	30-42	1.2-2.3		39.0-59.0		1.5-2.87
Average:							
143.55	142.90	34	1.79	1.77	50.85	53.66	1.90
143.22		34	1.78		52.26		1.90

TABLE 9

Milk Pasteurized in Boiling Water for 20 Minutes. Incubated 16 Hours at 37° C. After Inoculation.

Sample No.	Inoculated Milk .1 cc. in 140 cc.	Phenol Controls		Count	Incubated Milk % Acid	Bacteria Count	Lovibond Blue Units Phenol Cont.		Final	Test
6	Milk control	.5	.5	0	.22	11,700,000	.8	.8	1.6	1.8
1	Psd. aeruginosa	.5	.5	385,000	.19	333,000,000	1.3	1.3	2.1	2.1
2	A. aerogenes	.5	.5	277,000	.42	355,000,000	.6	.6	1.3	1.3
3	B. subtilis	.5	.5	7,000	.18	21,000,000	.7	.9	1.6	1.8
4	Esch. coli	.5	.5	324,000	.37	470,000,000	.5	.6	1.4	1.2
5	S. liquefaciens	.5	.5	400,000	.83	1,820,000,000	5.4	5.2	6.6	6.6

heated to 143.5° F. for 30 minutes, but contained 0.1 percent added raw milk. The photelometer in these tests did not prove any more effective than did the use of color standards.

The results shown in Table 3 showed the photelometer more effective than the use of color standards.

With the Kay and Graham test, comparative results of the use of the photelometer are reported in Tables 2, 3, 4, 7, and 8. In Table 2, no pasteurized sample was indicated as improperly pasteurized, and only four samples were indicated as pasteurized which were improperly pasteurized according to treatment. One had been heated to 143° F. for 30 minutes, and then 0.1 percent raw milk had been added, two had been heated to 143.5° F. for 25 minutes, and one had been heated to 144° F. for 25 minutes.

In Table 3 all samples showed proper pasteurization.

In Table 4 one sample was misinterpreted by the use of the photelometer. It was a sample which had been heated to 143.5° F. for 30 minutes, and to which 0.1 percent raw milk had been added.

In Tables 7 and 8 all samples showed proper pasteurization.

Although the results as a whole did not seem to show that the use of the photelometer was more effective than comparing the test with color standards, it did eliminate the human element of trying to match color. Its accuracy will, of course, depend upon the accuracy with which it is calibrated. Once calibrated it will not change in its accuracy; while color standards will fade or change in intensity.

With reference to the data in Table 9, the milk was boiled for 20 minutes and

TABLE 10

The Effect of the Addition of Cultures of Various Organisms on the Kay and Graham Phosphatase Test. Milks Subjected to Flowing Steam for 30 Min. on Two Successive Days Before Inoculation Incubated 18 Hours at 37° C.

Name of Organism	Inoculated Milk .1 cc. in 120 cc. Init. Acid %	Controls Lov. Blue Units	Controls photelometer. PPM	Milk Incubated After Inoculation Final Acid %	Bacteria Count	Lov. Blue Units Phenol controls	Lov. Blue Units final test	photelometer controls P.P.M.	photelometer final Phenol
B. subtilis	.175	1.3	1.45	.20	3,500,000	2.45	3.4	3.05	4.15
Psd. aeruginosa	.18	1.1	1.3	.21	485,000,000	2.05	3.1	2.2	3.5
B. mycoides	.18	1.15	1.2	.19	32,000,000	2.05	2.5	2.2	2.8
Esch. coli	.18	1.15	1.3	.47	880,000,000	1.5	2.4	1.6	2.5
A. aerogenes	.18	1.15	1.4	.50	580,000,000	1.45	2.55	1.5	2.65
S. lactis	.18	1.15	1.33	.72	——	1.6	1.8	1.8	1.95
S. liquefaciens	.18	1.15	7.4	.81	351,000,000	8.4	8.8	10.0	10.0
Control Refrigerator	.18	1.45	1.9	.18	——	1.3	1.6	1.25	1.8
Control 37° C. Incubator	.18	—	—	.18	30,000	1.0	1.6	1.05	1.8

cooled before the addition of 0.1 cc. of broth cultures of *A. aerogenes, Esch. coli, B. subtilis, Psd. aeruginosa,* and *S. liquefaciens* to 140 cc. of the milk. Estimates were made of the number of bacteria in the freshly inoculated milk and after it had been incubated 16 hours at 37° C. *S. liquefaciens* caused a marked increase in color value in the phenol controls and the completed test. None of the other organisms showed any significant increase even though the counts were in the millions.

In Table 10 the following organisms were inoculated into milk: *B. subtilis, Psd. aeruginosa, B. mycoides, Esch. coli, A. aerogenes, S. lactis,* and *S. liquefaciens.* These organisms were inoculated into milk that had been subjected to flowing steam for 30 minutes on two successive days. The parts per million of phenol were determined by the use of a photelometer as well as the Lovibond blue units. *B. subtilis* and *Psd. aeruginosa* showed slight increases, and again *S. liquefaciens* showed a very pronounced increase in color production. All the organisms were present in the millions, but only the *S. liquefaciens* caused any great increase in color development.

Streptococus liquefaciens was found to produce phenol in significant amounts in most instances when incubated for a sufficient length of time. The phenol production markedly increased the Lovibond blue units of color developed both in the phenol controls and the incubated test. There were large numbers of these bacteria present, and the developed acid was high. The other organisms, although also present in large numbers, did not generally show any great change in the Lovibond units of color developed. The proteolytic bacteria, *B. subtilis, Psd. aeruginosa* and *B. mycoides,* showed slight traces of end products affecting the test but these results were variable.

EFFECT OF THE ADDITION OF CULTURES OF VARIOUS ORGANISMS ON THE PHOSPHATASE TEST

In this study a number of organisms that are commonly found in milk were used to see what effect the bacterial flora might have on the accuracy of the test, either by the production of the enzyme or of phenol or phenol-like substances.

The milks before inoculating with the organisms were first pasteurized or sterilized. A control sample was used in each case, which was incubated in the same manner as the inoculated samples, except no culture had been added.

Some of the results obtained are shown in Tables 9 and 10.

That any of these bacteria produce bacterial phosphatase is doubtful; however, some of them do produce varying amounts of phenol.

The practical significance of these data to the application of the phosphatase test is rather uncertain. The presence of exceedingly large numbers of bacteria after pasteurization or allowing milk to remain at warm temperatures for a long period of time is not likely to occur under practical conditions.

A number of authors have noted increases in the amount of color developed either in the controls or in the completed test following storage after pasteurization. It would seem from the above data that these increases would not be due to the presence of large numbers of bacteria alone, but to certain groups or species of bacteria. A control test should always be made on all samples showing underpasteurization. The use of control tests would detect the production of phenol, or phenol-like substances.

All samples of dairy products intended for the phosphatase test should be kept at low temperature to prevent bacterial development.

Tracy and Hahn (4) found that samples could be preserved with bichloride of mercury without affecting the phosphatase test.

EFFECT OF AGE OF SAMPLE ON THE PHOSPHATASE TEST

Twelve samples placed in a refrigerator for four days after the initial test gave nearly identical results when tested by the Kay and Graham test. There was an average difference of only 0.07 L.B.U. per sample.

TABLE 11

Results Obtained at Various Intervals on Samples Held Under Refrigeration by the Kay and Graham Test (expressed in Lovibond Blue Units)

Initial Test		Number of Days Under Storage 1	5	11	15			
						Acidity*		
Blue Units	Acidity	B. Units	B. Units	B. Units	B. Units	Acid	Reduced to	Blue Units
15.0	.165	13.2	14.4	8.8	5.0	.65	.10	11.6
4.0	.16	4.4	4.3	3.85	2.25	.71	.12	3.9
18.0	.17	18.0	18.0	12.6	8.4	.67	.14	16.0
2.65	.15	2.6	2.45	2.9	2.2	.68	.12	2.85
4.2	.155	4.6	4.1	4.8	2.7	.66	.12	4.05
7.5	.14	—	6.15	4.2	2.6	.63	.13	3.65
3.1	.145	—	3.05	3.1	2.05	.73	.11	2.85
21.6	.15	—	21.6	19.9	17.3	.70	.11	18.0
1.95	.15	—	1.8	2.6	1.3	.71	.12	1.9
18.6	.16	—	18.6	16.8	15.2	.66	.13	15.0
6.6	.15	—	6.2	5.2	2.8	.65	.10	5.0
6.0	.15	—	6.35	4.6	2.3	.69	.11	3.8
Maximum increase:		.40	.35	.65	0			.20
Maximum decrease:		1.8	1.35	6.20	10.0			3.40
Minimum difference:		0	.05	0	.65			.10

*14% Na_2CO_3 used

In another series of tests made on 12 samples kept in a refrigerator for fifteen days and tested at intervals showed varying results. These samples ranged from properly pasteurized to grossly underpasteurized milk when first tested. No great changes were noted in the results at end of five days' storage. At the end of eleven days, however, three samples showed an average increase of 0.5 blue units, eight samples showed an average decrease of 2.7 units, and one sample showed no change.

At the end of fifteen days all samples showed a decrease. As the acidity of all the samples had increased materially during that time, it was thought that perhaps this may have had some effect. So the acidity was reduced to near the original acidity with 14 percent Na_2CO_3, and the samples again tested. Correction for the dilution due to neutralizing was made in sampling. A correspondingly larger sample was taken so that the proper amount of undiluted milk was present. When this was done, the test again approached very closely to the original.

These results are shown in Table 11. From this study it would be assumed that storage under refrigeration for four or five days would have little effect on the results of the test, and no preservative would be needed.

If samples are to be kept for longer periods or no refrigeration is available, then the use of preservatives is recommended.

SUMMARY AND CONCLUSIONS

The Kay and Graham, Gilcreas and Davis, and Scharer's New York Laboratory tests are all nearly equal in effectiveness when the standard for Scharer's Laboratory test is taken as 0.9 p.p.m. of phenol instead of 0.5 p.p.m. We are unable to account for the difference in our findings as compared to Scharer's.

Scharer's Laboratory test has the distinct advantage in time of operation. Only 1 hour incubation period is required compared to 24 hours for the other two tests. Cost of making the Scharer Laboratory test is much less also; for in the Kay and Graham and Gilcreas and Davis tests, acid washed filter papers are required which are quite expensive. In Scharer's test, any filter paper will do.

Scharer's Improved Field test is nearly as effective as any of the laboratory tests, and has the distinct advantage of time and cost in its favor. It is a great improvement over the original field test.

The sensitivity of B.Q.C. is a factor that should be taken into consideration.

All reagents and glassware used in the test should be treated as described under the directions for the Improved Field test. Also instruction given by Scharer (3) and Kay and Neave (5) should be followed.

The application of the photelometer to the phosphatase test as carried out in the laboratory is apparent. Its use would eliminate the human element in trying to match colors.

Bacteria as a factor in affecting the phosphatase test are remote. Although some bacteria when present in large numbers may produce phenol or phenol-like compounds, the use of a control test would discover it.

Age of sample may be a factor. Samples may be kept four or five days in a refrigerator without any noticeable effect.

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LEGAL QUALIFICATIONS FOR MILK SANITARIANS AND SOURCES OF TRAINING*

Summary of Report of the Joint Committee on Milk Supply of the Public Health Engineering Section of the A. P. H. A. and of the Conference of State Sanitary Engineers for 1938.

The need for better trained men is recognized in the field of milk sanitation as in many other fields. Answers to an inquiry to state officials and college officials are summarized. Six of the forty-eight states prescribe qualifications for local milk inspectors by statute or official regulation. Eleven colleges in eight states are offering fundamental courses in regular undergraduate work that are of special value in training milk sanitarians from the standpoint of public health. Two colleges in different states are offering special 15 day courses of instruction for milk sanitarians. The United States Public Health Service offers one week seminars. State Departments of Health, colleges, conferences of mayors and milk inspectors' associations in ten states and the International Association of Milk Sanitarians have technical meetings or conferences annually which are usually of three days' duration. Increasing opportunities for both undergraduate and *in* service training in milk sanitation should make it possible for milk sanitarians to meet higher educational requirements.

Although it is too early for the committee to recommend definite qualifications, the goal is suggested that all new appointees should at least be graduates in sanitary engineering, dairying, veterinary medicine or some other field allied to milk sanitation, and that either as graduates or undergraduates they should have attended the equivalent of one short course or seminar in the more specialized public health aspects of milk control.

Joint Committee on Milk Supply.
W. D. TIEDEMAN, *Chairman*
L. C. FRANK
R. E. IRWIN
E. S. TISDALE
H. A. WHITTAKER

* Presented before Public Health Engineering Section of the American Public Health Association at Kansas City, Mo., on October 26, 1938.

The Metals Used in a Modern Dairy

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There is little that is really new in this subject, but sometimes it is advantageous to assemble facts and consider them in their relation to each other.

PRESENT PRACTICE

Low Carbon Rolled Steel. This metal is the most used, and the most important in the industry. It is used for bodies of tanks, vats, bottle washers, conveyers, and frames of all kinds.

There has been no great change in the composition of this material, although some plates contain a small amount of copper, molybdenum, and other metals. The principal endeavor, in connection with the use of this material, is to find a surface coating that will endure and prevent rusting.

To coat the inside of spray pasteurizer bodies, we have lately been using an asphalt base with lacquer thinner as a vehicle, and the results have been fairly satisfactory.

When the surface is visible, aluminum lacquer is generally used.

Stainless Steel. Chrome-nickel steel 18/8 percent is in general the most satisfactory metal to use in contact with milk. The sheets are easily fabricated, the metal draws well, makes good welds, is nearly insoluble in milk, cleans easily, and is attractive in appearance.

Its chief fault is that it does not cast well. For the linings of tanks and vats, it is without doubt the best metal we know.

Chrome Iron, which is also called stainless steel, is sometimes used for outside coverings or veneers for vats or tanks, but is not entirely rustless.

Use With Brines. Stainless steel 18/8 percent cannot be guaranteed when used in connection with brine. It is apt to stand up for months, and then all of a sudden several small holes will appear that pierce the sheet or tube.

Molybdenum Stainless. This steel, containing 2 to 4 percent molybdenum, which is termed 18/8 S.M., is supposed to resist the action of brine better than the plain 18/8 percent, although the manufacturers will not guarantee this material.

Another material of similar appearance is *Inconel* which is about 80 percent nickel, with around 13 percent chromium, and the balance mostly iron. This is an excellent metal to resist action of milk, both hot and cold, but is not immune to corrosion due to brines, and is not guaranteed by the manufacturers to resist brine. The most satisfactory metal to use in contact with brine is copper.

Resistance to Corrosion by Milk. Whereas 18/8 percent stainless steel is usually very satisfactory in resisting corrosion by milk, actually corrosion is apt to occur where two pieces of this metal are close together and partially in contact (contact corrosion) and the milk is hot. Both stainless steel containing molybdenum, and Inconel are more satisfactory under these conditions than the regular 18/8 percent chrome-nickel steel.

Sanitary Pipe and Fittings. For sanitary pipe lines, the 18/8 percent stainless has been very satisfactory. Users have hesitated to buy stainless steel fittings because of the high cost. A considerable number of copper nickel alloy fittings, in combination with stainless steel pipe, have proven satisfactory.

Statements have been made that no copper alloy should be used in contact with milk, but results seem to prove this too broad a statement. It depends upon how the copper is alloyed and how the metal is used.

With regard to the question as to what is the best copper-nickel alloy, it seems that there is no such single alloy. The problem depends upon what use is to be made of it.

Read before the Metropolitan Dairy Technology Society, New York, N. Y., June 21, 1938.

For appearances, the trade desires a white alloy that will not easily tarnish; one that is fairly hard so as to resist bruises, that will cast free from blow holes, and that is practical to machine, but, unfortunately, the metal that seems to best answer these specifications, and which would be best for dressing up apparatus, is not the most insoluble in hot milk. Therefore the alloys that come in contact with hot milk have to sacrifice some of the whiteness.

We have, however, succeeded in obtaining an alloy that stands up well in contact with hot milk. Fittings made from this alloy do not easily give up copper to milk thus producing oxidized flavor. It should be remembered that milk normally contains a small amount of copper, about one-half part in a million, but we do not want to greatly increase this.

In passing through a pipe line, any particle of milk is in contact with the sanitary fittings only a very short time.

Tinned Copper. Copper, tinned by the hot process, was in very common use in milk plants only a few years ago. It is now used much less. However, tubular coolers and certain other copper equipment, tinned by the electrolytic process, is finding a very satisfactory and increasing use. There is no better metal for contact with milk than tin. The trouble with it is that it is too soft to use by itself, and in the past it has too quickly worn off surfaces that have been coated with it. When a piece of copper is tinned by the hot process, the coating of tin is extremely thin, less than one thousandth of an inch. It is common with the electrolytic process to have the coating four or five thousandths of an inch thick. This equipment cannot ordinarily be soldered satisfactorily, because, in heating the copper, the tin runs off; therefore to make equipment coated with tin four thousandths of an inch thick, it is necessary first to completely fabricate the cooler, or other piece of equipment.

In making cooler sections, the tubes and headers are brazed together, and completely finished, then this is electro-tinned, covering the sections with pure tin four thousandths of an inch thick. This gives a beautiful looking surface, and one that stands up in use for a considerable time. When the tin finally does wear off, it can be retinned.

Galvanizing. This means coating with zinc. It is common practice to use hot galvanized iron sheets and steel rolled pieces. Also zinc can be placed on other metals electrolytically, and this process is in common use. A third way is the *Metallizing Process* where the zinc is shot onto the surface as a molten spray. This was formerly known as the *Schoop Process.* With this process, the thickness of the layer can be controlled, and much more zinc put on than is possible with the *Hot Process.* It is possible, also, to spray other metals or alloys. Defective or injured shafts can be brought up to size by spraying steel to the damaged part, and then grinding to size.

Abroad, copper vats and coils are coated with an alloy of tin, copper, and antimony. This made a surface which was not as bright and shiny as a pure tin surface. Users claimed that it would never develop black spots which so often appear on tinned copper surfaces. It is, also, considerably harder than pure tin. It is to be supposed that antimony is unobjectionable if it does not go into solution in the milk. However, in this country there would be some prejudice against the use of a coating of that kind.

Chromium Plating. Another coating that has been used in connection with milk equipment, but to rather a small extent, is pure chromium. In the past, a number of pieces of equipment have been electro-plated with chromium. Where the chromium has been put on thick enough, satisfactory results have been obtained, but it is rather expensive.

Aluminum. Aluminum has been used some in this country for tanks, particularly truck tanks, where its light weight is of decided advantage; also it is used for vat covers and cooler covers. It is easy to fabricate. Another very good quality of aluminum is that it does not

produce off-flavors when milk stands in contact with it.

The declining use of aluminum for vats abroad is probably on account of the increasing popularity of stainless steel. The latter is a much harder and more enduring metal, and is easier to clean.

One difficulty of aluminum in this country has been that dairy plant operators will not take the pains necessary in cleaning. Also, care must be exercised as to how it is connected with other metals because of electrolytic action.

There is an important and increasing use of aluminum in milk bottle caps.

Nickel. Nickel is used in almost every piece of equipment that is found in the dairy plant. Probably the greatest use of nickel is in stainless steel, and then in copper-nickel alloys, sanitary fittings, vat and tank outlets, manhole casings, pumps, and other equipment.

Pure nickel is an excellent metal for ice cream freezer cylinders. In the Vogt Freezer, it has proven the most satisfactory material.

At one time, pure nickel had a wider use. It was found unsatisfactory, however, for coolers, or for contact with milk when the metal is cooler than the milk, unless both are cold. Some Spray Pasteurizers, the linings of which are Pure Nickel, have been in regular use for many years, and are still in good condition. In that case, the milk was heated and held in the pure nickel, and cooled over a surface cooler.

One of the most surprising things is the way a pure nickel cooler tube is dissolved by the hot milk running over it. For heater tubes, nickel is excellent. Also it is excellent for handling cold milk. Nickel is another metal that does not give milk bad flavors.

Solder. The ordinary solder that has been used for many years is half tin and half lead. That was generally used for soldering together the tinned iron sheets that went into cheese vats many years ago, and was later used to hold together tinned copper equipment. Under ordinary circumstances, it is quite insoluble in milk. Many old vats have been used for a great many years where the solder has stood years of use. However, some health officers refuse to permit its use on account of the lead content, and have suggested the use of pure tin as solder. This is not a satisfactory substitute. It is very apt to crack, does not stand nearly as well as the half tin and half lead solder, and is not as strong. This objection to the use of solder arose from some popsickle molds that were tinned largely with lead. In that case, with the lead alloy covering the entire surface of the mold, the action is quite different, because the material to be frozen, containing fruit juices and sugar, is kept in contact with the metal for some time.

For many years certain people, where they wanted to reduce the cost of tinning, have used a mixture of tin and lead, with an increasing percentage of lead where price required it. Half and half tin-lead solder, where properly used, is a good solder from a health standpoint. It is not recommended that containers be tinned with a mixture of this kind. When it comes to coating a surface, the metal should be pure tin.

FUTURE EQUIPMENT AND PROCESSES

Pasteurization. Continuing changes in pasteurization may be expected. Cities will probably require that *all* milk be pasteurized, and there will be a decided trend towards shorter time holding than thirty minutes, and with temperature higher than 144° F.

Last summer in Berlin it was interesting to notice the absence of holders, except single pasteurizing vats. When it comes to large capacities, they were using short time, high temperature pasteurization.

Recently Cherry-Burrell has been introducing a process which we term Duo-Shortime Pasteurizing Process. This was worked out by Mr. Rolan J. Wightman. The milk is heated quickly to about 158° F., cooled to about 145°, then heated to 160° or 161° F., held for 15 seconds, and then cooled.

In tests made of that process, the cream line was as good and usually better than when the milk was heated directly to 160°

or 161° F., held for 15 seconds, and then cooled. There was considerable improvement in the destruction of bacteria.

At one well-known plant in an important city, the average bacteria plate count for 84 samples, using the single short time system, was 12,600 organisms per milliliter with cream layer varying from 15¾ to 16 percent. After this same unit was changed over to the Duo-Shortime System, the results showed, in 84 samples, an average bacteria count of 6,830, with the raw milk having a higher initial bacteria content than when the single shortime system was used. The cream layer, after the change was made to the Duo-Shortime System, averaged between 17 and 19 percent.

At another well known plant, the bacteria counts were reduced approximately 40 percent, with maintenance of slightly better cream layer after the Duo-Shortime Pasteurizing System was started.

On the Continent of Europe where they are not so particular about the cream line as we are in this country, they were pasteurizing at a higher temperature, namely, about 162° F., and holding for about 40 seconds.

If we could adopt a required temperature of 150° F., and hold for 5 minutes, it would be very practical. In Dr. Dahlberg's New York State Agricultural Experiment Station Bulletin, No. 203, it shows that the tubercle bacillus is destroyed at 150° F. after holding for 3½ minutes.

Homogenizer. The talk about the cream line brings up another subject. There will be an increase in the use of homogenized milk where the cream line is entirely done away with. The reasons for this are the improved flavor, and uniform distribution of cream. Many people believe it is more easily digested.

Discoveries by Professor Sharp, Guthrie and others. Some experiments conducted by Professors Sharp, Guthrie and others at Cornell University have shown that if the oxygen or air is removed from the milk at the time it is pasteurized, and if it is bottled without exposure to air, the oxidized flavor will not develop.

Packaging and Distribution. Changes will also occur in the packaging and distribution of milk. For some years, there has been the hope among health officers that the top of the bottle of milk will be covered at the dairy to prevent contamination of the pouring lip. There has been hesitancy about requiring this because of cost.

In England, there has been a very surprising swing to the use of *Small Mouth Bottles* with aluminum caps.

Two years ago, the Borden Farm Products Co. started an experiment along this line at their Utica, N. Y., plant, where bottles having an outside diameter of 38 mm. were used. In the meantime, other plants have been started. For instance, at South Norwalk, a bottle that they call 41 mm. diameter is used. This diameter is measured at the very top of the bottle. Lower down, where the skirt of the cap touches the bottle, it measures about 43 mm. in diameter. Caps of this size, out of plain aluminum foil, cost about 76 cents per thousand, and make a tight seal for the bottle without using a cardboard disc.

There has also been recently a considerable swing towards paper bottles for milk that is sold wholesale to retail stores.

Packaging of Ice Cream. There is a rapidly increasing custom of putting ice cream in paper cartons, or cups, as it comes from continuous freezers. Two or three different flavors are run in at the same time in layers, and fancy shaped centers can be made.

General Improvements in Design of Equipment for Sanitary Reasons. There has been given increased thought to sanitation. The desire to get away from stuffing boxes has brought forth the rotary seal, as for instance, around the shaft of the centrifugal pump and freezer, and also the improved packings in the viscolizer. The propeller shaft for the agitator in storage tanks is now arranged to come down through the top of the tank, and can be readily disconnected and taken out for cleaning. Also, the corners of equipment in general are made more rounding, and the surfaces smoother.

The Introduction Into Chicago of the High-Temperature Short- Time Method of Milk Pasteurization*

Paul F. Krueger,
Chief Sanitary Officer, Board of Health, Chicago, Illinois.

The destruction of bacteria by heat involves a time and temperature relationship,—the higher the temperature, the shorter the required period of exposure to that temperature.

The first attempts in the United States to pasteurize milk commercially were largely what was then termed, "flash" pasteurization. In general, it consisted of heating milk to temperatures of 155° F. to 160° F. for a period of about one minute. The principal advantage of this method was the fact that the equipment was inexpensive and required a small amount of floor space. However, the fact that the proper heating and holding of all particles of the milk could not be insured forced its abandonment in favor of a lower temperature and a correspondingly longer holding period.

The heating of milk to temperatures of 142° to 145° F., at which it is held for 30 minutes, has been the almost universal practice in the United States in the last decade, and was used primarily because available milk pasteurization and control equipment for this time and temperature made for the greatest safety. From a commercial standpoint, however, this method has a number of disadvantages, particularly in that the equipment used is bulky, consumes considerable floor space, and is relatively expensive in first cost because it must be well built to prevent any cooling of the milk as it is held for relatively long periods. In addition, when used continuously for five or six hours or more, thermophilic bacteria are given an opportunity to grow and multiply in the milk when some types of commercial equipment are used.

Ever since the abandonment of "flash" pasteurization, many manufacturers of dairy equipment have attempted to provide proper heating and holding equipment designed to heat the milk to relatively high temperatures and then to hold it for a relatively short time. That their early efforts were not successful was due mainly to the fact that sufficiently sensitive and accurate temperature-control devices were not available to insure proper operation at all times.

In Chicago there are a large number of milk pasteurizing installations which are operated continuously for from 6 to 12 hours daily and, in some instances, for considerably longer periods. It is but natural that trouble should develop in the form of excessive bacterial counts and off-flavor conditions caused by the growth of thermophilic organisms in the milk passing through some of the holder systems used. Where these conditions were found by the Chicago Board of Health in milk plants under its jurisdiction, the plant operators were requested to provide a remedy.

Early in 1937, the matter was brought to a definite issue, and the milk dealers agreed to cooperate in the program of eliminating the unsatisfactory conditions. However, in order to reduce the extra expense occasioned by shut-downs for clean-up purposes or by providing duplicate pasteurization equipment, it was requested of the Board of Health that permission be granted to use high-temperature short-time pasteurizing equipment.

The Board of Health expressed the belief that installations of this type of equipment should satisfy the following requirements:

1. It would need to be demonstrated that the equipment was so constructed

* Delivered before the International Association of Milk Sanitarians, at its Annual Meeting in Cleveland, Ohio, October 19, 1938.

and would permit of such operation that the proper pasteurizing time and temperature would be maintained at all times.

2. It would need to be demonstrated that milk pasteurized by the short-time high-temperature method was as assuredly safe as that pasteurized by the existing accepted method.

In order to determine answers to these questions, the manufacturers of some of the equipment and the dealers interested in using it agreed to make trial installations so that suitable tests could be made of the operation of the equipment and the pasteurization of the milk, it being understood that the milk so treated was not to be used for general market purposes.

EQUIPMENT DESIGN

The first requirement for the equipment to be installed for test was that it comply with the latest provisions of the United States Public Health Service. The necessity of this demand is obvious in view of the fact that Chicago's milk control work is done in accordance with the standards of the United States Public Health Service Milk Ordinance and Code.

Late in 1937, the first installation was made, followed by a number of others. A brief description of all equipment that was installed and operated follows. (See Table 1).

Some preliminary tests were made of a surface-heater installation, but since its construction did not meet with the requirements of the United States Public Health Service, it is not included in this description. We have been informed recently, however, that the original objections have now been overcome, though we have not tested the new design.

A plate-type unit of a new design has recently been accepted for trial installation in Chicago.

Complete engineering specifications of each type of equipment will not be included in this paper for they may be secured from the manufacturers. For the sake of brevity, the individual results of the thousands of individual tests of the equipment, as well as the milk processed, made both by the Board of Health and the dairy concerns, are omitted from this report. The conclusions reached after a thorough study of the problem are herewith presented.

Inasmuch as the proper functioning of high-temperature short-time milk pasteurizing equipment depends very largely upon its temperature-control equipment, that phase was given intensive study. It was early established that the temperature-control mechanism used in connection with the flow-diversion valve functioned exceptionally well, being quickly respon-

TABLE I.

Plant	A	B	C	D
Make of equipment	AA	AA	AA	BB
Make of controls	AAA	AAA	AAA	AAA
Rated capacity pounds per hr.	12,000	18,000	6,000	12,000
Hours operation per day	7	9	2	7
Total Plates	63	100	62	151
Heater	22	39	25	42
Regenerator	41	61	37	73
Cooler	Surface	Surface	Surface	36
Location of surge tank	Floor	Floor	none	above unit
Diversion	To surge tank	To surge tank	Suction side of pump	Suction side of pump
Holder	20½ ft. of 3" pipe	16 1/6 ft. of 4" pipe	15½ ft. of 2½" pipe	6 ft. of 2" pipe 19 ft. of 3" pipe
Clarifier	Yes	None	None	Yes
Filter	None	Cloth	Cloth	None

All installations were of the plate-type and used hot water for heating and brine for cooling, in addition to milk-to-milk regeneration.
In each instance a flow diversion valve located at the outlet of the holder was employed.

sive to small temperature differences. However, a number of changes were found necessary in the design of the valve itself, particularly in eliminating the metal-to-metal contact with the valve seats, eliminating corrodible metal parts, enlarging the leak grooves, and constructing the valve in such manner that it could not easily be improperly assembled and thus prevent its proper functioning at all times when in position.

The milk heating, holding, regenerating, and cooling equipment were found to function properly. The rubber gaskets on the plate-type equipment are not all that may be desired from a milk sanitarian's viewpoint, but are an improvement over those used a number of years ago. In some makes of this equipment, closing of the plates after washing for disinfection purposes permits water or disinfecting solution to remain. For that reason it is necessary to open such machines after disinfection so that all of the water may drain out, or to discard the first milk pasteurized.

Without detailing the changes in design found necessary, it may be stated in conclusion that it was found that proper pasteurizing temperatures could be maintained and proper holding times assured by the use of the high-temperature short-time equipment tested, with the same degree of accuracy and safety as is possible with existing long-time low-temperature equipment.

SAFETY OF TREATMENT

In answer to the second requirement as to whether or not milk treated by the high-temperature short-time method was assuredly safe, a review of the important experimental work done in this connection during the past years was examined, which indicated that under proper conditions pathogens which may normally be found in milk were destroyed, including those organisms recently isolated which have an even higher thermal death rate than tuberculosis. These conclusions had been reached by workers using pathogenic and certain heat-resistant bacteria as their test organisms.

In order to eliminate the lengthy, time-consuming, and expensive testing by the use of these test organisms, it was decided to use the phosphatase test as an index of proper pasteurizing. This decision was based upon our experience with the efficiency of this test for the long-time low-temperature method. After successfully using it for some time in our studies, we were gratified in the statement by Hoy and Neave[1] that the phosphatase test could be applied equally well for all temperatures and all exposure periods.

It was our original belief that the length of time used in heating the milk to the required temperature before holding was a definite factor to be considered, and that the heating time would need to be included along with the holding time before we could be sure the milk was properly treated. It was thought that some of the excellent results obtained by early experimenters were due to the long priods of heating and cooling which were employed. All of the experiments we conducted, however, definitely proved that 160° Fahrenheit for 15 seconds was sufficient treatment. Various lengths of time for heating the milk before holding were tried, but it was found that the phosphatase test showed up as well for milk heated from 40° to 160° in 2 to 3 seconds, held for 15 seconds and then immediately cooled, as it did for milk heated during an 80-second interval, or by long-time low-temperature methods.

In order to make for uniform operating conditions in the Chicago area with existing requirements for long-time low-temperature methods, and to provide as much of a safety factor as provided by that method, it was decided to boost the temperature requirement from 160° to 161° to correspond to the 144° F. requirement on the long-time low-temperature method, and to increase the holding time from 15 seconds to 16 seconds to

1 "Further results of the Application of Kay and Graham's phosphatase test for efficiency of pasteurization", W. A. Hoy and F. K. Neave, B.S.A., The Lancet, Sept. 4, 1937, p. 595.

allow for the one-second interval in which the flow diversion valve may act.

It is significant to note that this time and temperature relation has approximately the same effect on the cream line as does 144° for 30 minutes. It is realized that other factors besides temperature affect the cream line, but all factors being considered, the same result obtains by both methods.

Similarly, claims have been advanced that high-temperature short-time pasteurization makes for a milk having a flavor more nearly that of raw. The determination of flavor is such a complex subject that it is difficult to evaluate such claims. However, it may be properly observed that no detrimental flavors were found to be developed. It is perhaps significant that this method of milk treatment has its strongest champions in those sections of the country where raw milk offers serious competition, the plant operators claiming that flavor distinction between grade A raw milk and grade A pasteurized milk is impossible for any one to make. In this connection the elimination of certain forms of heat-resisting organisms also may be an important factor.

BACTERIOLOGICAL STUDIES

This brings us to the third and most interesting part of our study, which was to determine whether or not thermophilic forms of bacteria multiplied in this equipment as they had done in some of the long-time low-temperature equipment. That may be answered simply by stating that all of the experiments conducted showed no increase in the thermophilic flora in milk pasteurized by the short-time high-temperature method over that in the raw milk. The apparent reason for this result is the fact that the milk passes through the equipment with such high velocity that no opportunity is afforded the thermophiles to develop.

It was soon observed, however, that in most instances, bacterial counts of the milk were almost the same at the start and end of the run but that high counts might occur at any time without notice and disappear as rapidly. This presented a very baffling situation at first, for no matter how high a temperature was used or how long a time the milk was held, high counts were found either existing momentarily or persisting for longer periods of time. After finding no improvement possible in the equipment, we resorted to laboratory pasteurization of the milk and found, at times, that with both low-temperature long-time and high-temperature short-time methods, high counts resulted in the test-tube in the same way they had been found in the milk under plant conditions. The next step was to pasteurize each producer's milk in the laboratory and then plate both the raw and pasteurized. This was done for several days, and it was found that in almost every instance the same producers showed up each day. Field investigations were immediately made at these offending farms, and to our surprise it was found that between 90 percent and 95 percent of the offenders used milking machines.

With this information, we called upon Dr. M. J. Prucha, Head of the Department of Dairy Bacteriology, University of Illinois, and Dr. E. H. Parfitt, Head of the Department of Dairy Bacteriology, Purdue University, to aid us in our study and to suggest means of formulating methods to overcome the difficulty found. As is typical of these men, they willingly cooperated and, of greatest importance, suggested means of washing and treating milking machines, which, when followed, entirely eliminated the trouble. The biggest improvement was brought about by the treatment of the rubber parts of the machine with a lye solution. In those instances where milking machines were not used, removal of milkstone deposits and proper utensil disinfection corrected the trouble.

Briefly stated, milking machines should be properly constructed so as to be easily cleaned, rubber parts should be short so as to permit of easy cleaning, should be taken apart, washed and disinfected after each usage, the rubber parts then being placed on a rack or otherwise handled so

that a lye solution will be in contact with all of the surfaces with which milk comes in contact until the next use. A ½ percent solution is sufficient for storage, and an occasional boiling in a 1 percent solution is essential. In fairness it should be stated that the problem of thermoduric organisms does not apply alone to high-temperature short-time pasteurization but applies to other methods of pasteurization as well.

Plants using the high-temperature short-time equipment immediately made arrangements for doing the necessary field work on producing dairy farms and laboratory control work in addition, to continue to insure the elimination of thermoduric organisms from the raw milk. Upon satisfactorily doing this work, illegal high counts of milk were eliminated and the bacterial counts were found to be satisfactory. Permission was then granted to use the high-temperature short-time process for the pasteurization of market milk so that observations could be made under commercial conditions. Approximately 300,000 pounds of milk have been pasteurized by this method daily during the past few months.

No extensive experimental work has been done to indicate the time and temperatures necessary for the high-temperature short-time holding of products other than milk. We do know from preliminary studies that considerably higher temperatures are necessary for ice cream mix than that employed for milk.

SUMMARY AND CONCLUSIONS

There is no single time and temperature combination that may be declared as the only one to be used for milk pasteurization. As efficient equipment is developed, the milk sanitarian may well expect a variety of such combinations to be employed for the proper pasteurization of milk and milk products.

Pasteurizing milk at a temperature of 161° F. for 16 seconds in suitable apparatus equipped with proper temperature controls may be considered as equally efficient as 144° F. for 30 minutes under similar conditions.

SUMMARY OF 1938 TRANSACTIONS OF U. S. PUBLIC HEALTH SANITATION ADVISORY BOARD SERVICE

FROZEN DESSERTS ORDINANCE

At its annual meeting September 26-30, 1938, the U. S. Public Health Service Sanitation Advisory Board approved the early publication of a Frozen Desserts Ordinance and Code to be recommended by the Public Health Service for adoption by states and communities. This ordinance will recognize two grades of frozen desserts manufacturers. Grade A manufacturers will be those whose plants comply with all of the specified plant requirements and whose frozen desserts ingredients comply with the production requirements for grade A pasteurized milk as defined in the Milk Ordinance recommended by the Public Health Service. All non-grade A manufacturers will have to comply with the same plant requirements but not with any production requirements for ingredients. No grade A rating will be awarded until a certain number of years after adoption of the ordinance, the number of years to be inserted by each community at the time of adoption to allow the industry a reasonable time to develop its ingredients shed.

REVISION OF MILK ORDINANCE AND CODE

The following are the more important amendments to be incorporated in the forthcoming edition of the Milk Ordinance and Code recommended by the Public Health Service:

1. Degrading is to be based on violation of the *same* item on two consecutive inspections, instead of on violation of *any* item.

2. Herds free from Bang's disease will be required for grade A raw milk within a period of years (not exceeding 5 years) after the adoption of the ordinance.

3. Exposure in an oven or hot-air cabinet to hot air at a temperature of at least 180° F. for at least 20 minutes will be recognized as a satisfactory method of bactericidal treatment for containers and utensils. This recognition is based on studies conducted by the Public Health Service (Reprint No. 912).

4. Chlorine rinse of cows' udders and teats before milking is again to be made mandatory.

5. The construction requirements for milk stools will be deleted, and stools will simply be required to be kept clean.

6. Certified pasteurized milk must be pasteurized in a plant complying with the grade A pasteurized milk requirements.

7. The various grade definitions will be reworded so as to overcome the erroneous impression created in some quarters by the present definitions, namely, that grade A pasteurized milk is a low grade of milk rescued by pasteurization.

8. A statement will be included in the Code outlining the value of the phosphatase test for pasteurization as a supplement to plant inspection, but warning that the test must be performed by competent personnel and in a controlled manner.

9. A recommendation will be included in the Code urging state milk control officials to develop a training program for pasteurization plant operators with a view to future licensing of operators.

10. Public health reasons will be given for items 16p - 16p(f).

11. Item 16p(a) will be limited to thermometer specifications, and all other requirements will be transferred to item 16p(b).

12. Item 16p(b) on control of pasteurization temperature and time has been revised to clarify and improve the present requirements. The provisions governing manual type vats have been segregated and placed first. The provisions governing automatic pasteurization systems have, after careful study, been revised with a view to making such systems more truly automatic under all conditions.

13. The specifications for regenerators will be strengthened so as automatically to insure the proper relative pressures at all times.

14. The cap or cover of all containers of grade A pasteurized milk and milk products will be required to cover the pouring lip at least to its largest diameter.

15. All material in the Code which is explanatory rather than mandatory, including public health reasons for each item, will be printed in smaller type.

A. W. F.

OFFICIAL STANDARDS FOR BUTTER

The Department of Agriculture has just announced that official United States standards for quality creamery butter will become effective April 1, 1939. These standards were discussed in detail in the May issue, page 19, of THE JOURNAL OF MILK TECHNOLOGY.

These official standards will replace the former score card method of grading, and provide what is considered to be a more exact (Editor—less inexact) and simplified system of determining the official United States score of creamery butter. Flavor will constitute the most important factor of quality; workmanship will be secondary. Full instructions accompany the new grading procedure.

Use of the official grades in merchandizing butter is voluntary, with the exception that deliveries in settlement of futures contracts on and after April 1, 1939, must conform to the official grades, as provided under The Commodity Exchange Act. This law provides "that all contracts of sale of any commodity for future delivery on such contract market shall provide for the delivery thereunder of commodities of grades conforming to United States standards, if such standards shall have been officially promulgated."

Copies of the new official standards and method of rating can be secured without cost by writing to the Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

J. H. SHRADER.

The New Developments at the Dairy Industries Exposition*

Eclipsing all of its previous programs, the eleventh Dairy Industries Exposition was conducted in the mammoth Cleveland Public Auditorium during the week of October 17. There were 330 exhibitors displaying some 800 pieces of machinery. The attendance exceeded 19,000, roughly 3,000 above the largest previous attendance at Atlantic City in 1936. They came from forty-four states and nine foreign countries. Some 900 visitors were milk sanitarians engaged in public health or commercial work, or in educational work in various institutions. Twenty-three colleges sent teams to the Students' National Contest in Judging Dairy Products—won by the Cornell team. An innovation was an invitation to a highly representative number of leading professional men and women—physicians, dentists, educators, dietitians, and social workers—to view the exhibit and gain information regarding the importance of the industry, its technological development, and the use of milk foods in the diet. It is planned to hold unlimited Dairy Industries Expositions in even years, and semi-regionalized expositions in odd years.

The exposition was so immense that no one person could completely cover it and discover all that was new and worthy of detailed examination. To meet this situation, the JOURNAL OF MILK TECHNOLOGY arranged for a group of expert milk products technologists and sanitarians to examine carefully the exhibits in accordance with a prearranged plan, and to note only new developments in the industry. Space limitations do not allow more than brief reference to any one item. Readers who are particularly interested in following up some particular item will be furnished the name and address of the exhibitor upon request made to the Editor of this Journal.

* Those participating in this survey were as follows: **A. G. Fay, G. W. Grim, J. G. Hardenbergh, R. E. Irwin, C. K. Johns, J. A. Keenan, H. N. Parker, R. R. Palmer, A. J. Powers, F. L. Scales, and W. D. Tiedeman.**

EXHIBITS

BOTTLES

The new light weight bottle is economical in freight, conveyance load, cap costs, and cheaper purchase price because of its lighter weight.

New novelty designs of cream top bottles have been produced, one of which features a policeman's face in the bottle. New finishes accommodate the development in bottle caps. The Arnold bottle has a square edged pouring lip and is intended to eliminate the dripping down the edge and side of the bottle which would contaminate subsequent pourings.

BOTTLE CAPS AND COVERS

A new type of aluminum bottle cap uses the screw cap principle. The bottle is threaded and the aluminum cap is passed around the threaded-mold of the bottle lip. The advantage of the greater frictional surface for the closure eliminates the necessity for an inner cap.

Hoods of 51 and 45 mm. cover the pouring lips of the smaller mouth bottles, with attendant accommodation of the machine operations.

A well known firm showed an improvement by a built-in arrangement on the capper for air and water wash of bottle caps. It does not require electric leads in the plant as it is operated by water power. Wire spools for the capper are now in a vertical position rather than horizontal, eliminating wear and friction on the spindle.

A hooding device has been made available for large mouth (2 11/16") sour cream jars. This machine will fasten the Standard Hood by an electrically welded wire.

A new cellulose acetate material tough-

er than cellophane has been prepared for cover caps for milk bottles. This material is pressed into shape and is sealed by heat (steam) at 240° F. The material is tough, waterproof, and resistant to pressure, but is susceptible to shearing over the inner pouring edge of the bottle just above the cap seat.

BOTTLE COLLAR

A new milk bottle advertising collar, fabricated by stitching and waterproof gumming, was exhibited.

BOTTLE FILLERS

A much simplified type of vacuum filler was exhibited for use with various types of bottle caps. A vacuum type filler demands for its operation air tight closure which favors protection of the milk from contamination. Another make of vacuum filler has eliminated the long tubes of earlier models, thereby facilitating cleaning.

A new filler was shown to be apparently simpler in construction than anything on the market. It runs on a vacuum gravity principle with the vacuum removing the air from the bottles as the milk runs in. The valve is very simple and has a single spring lifter. It consists of a hollow tube which gives a swirling motion to the product as it enters the bottle, although solder is used inside the tube. This pipe fits against rubber so that there is no metal to metal. The ball-bearing roller on the lifter is open and can be washed. A hydraulic cam on the capper takes care of different height bottles. It is claimed that this filler will not fill cracked or nicked bottles. There is some question about it delivering a filled bottle with no milk on the outside of the cap. It was thought that if a broken bottle came along and raised the valve but did not fill, there might be some air introduced into the bowl.

BOTTLE VENDING MACHINE

An insulated and electrically refrigerated cabinet with capacity of 224 standard half pints was developed for dispensing milk and dairy drinks in bottles or cylindrical containers. Another company exhibited a coin-operated, insulated, refrigerated milk and dairy products service machine for half pints. The size is reduced from former models and the mechanism and coin selection is improved.

BOTTLE WASHER

A bantam washer was developed for very small plants. Another new small bottle washer, synchronized with the milk filler, enables one operator to feed bottles into the machine and take them off an accumulator table at his side, filled and capped and ready to go into the case. This machine has a pre-rinse, a soak tank, a clear spray rinse, and a cooling and a chlorine spray.

In one of the well known makes, the main improvements consist of general simplification of parts to facilitate maintenance. Some parts formerly welded or riveted in place are now designed to bolt or screw in place so as to facilitate removal and replacement. Simplification of loading and unloading tables has resulted in the elimination of about twenty wearing parts. The prerinse (sweet water) has been extended about 35 seconds but no change has been made in the regular 10 minute soak.

Another concern furnishes optionally visible jets, and a glass front.

BUTTER CHURNS

Churns are now being produced without workers. The butter is worked by falling from ledges that are built so that they are parts of the shells of the churns. This greatly facilitates cleaning. All harmful metal surfaces have been removed from contact with the butter. The kneading action is believed to give more uniform composition and better incorporation of salt and moisture.

One model had a shelf just below the door at the side of the churn so that the butter operator does not have to reach into the churn to remove the butter—a decided advance in butter sanitation. One

type was completely suspended so that there was no strain on the heads.

BUTTER PRINT SCALE

A new offering is a butter print scale, made of porcelain and stainless steel, with maximum weighing capacity of 5 pounds and with graduations in 4 ounces.

BUTTERMILK VAT

A spray vat was displayed for culturing, holding, setting, breaking, and cooling buttermilk to the churning temperature. When the product is ready for churning, it is pumped into a small concussion chamber where it falls into a pan, thereby producing conditions comparable to those in a churn. It takes from 35 to 40 minutes to form butter granules. This machine is made in capacities of 300 to 500 gallons.

CAN FILLER

An automatic can filling and measuring device has been designed to assure accuracy of filling and to obviate the necessity of the use of dippers or measuring sticks. The design is simple in operation, and is useful and sanitary in filling containers of milk or cream for wholesale distribution.

CANS AND UTENSILS

Welding, grinding, and polishing in the production of seamless milk plant equipment is now applied to milk cans, covers, and utensils, as demonstrated by the display of one concern.

CAN WASHER

A new design in a well known line of can washers insured the proper replacement of the lids on cans of variable sizes. Another firm supplied a combination milk and ice cream can washer with rising wash jets. There was also displayed a hot water mixing valve with by-pass circulating line to insure continuously high temperatures.

A small straightaway super-duty can washer, occupying little space, has been designed to treat the covers along with the cans. The mouth of the can was closed by a flat plate so that a small amount of steam and no air was used. This was claimed to keep the workrooms dry and comfortable. The cans were dried with a blast of cool filtered air.

CAPPING MACHINE

A new capping machine for aluminum caps was displayed. When the paper cap is not used, the machine can be sped up to 90 per minute.

Several firms exhibited equipment to put aluminum closures on milk bottles. In the simplest machine, the foil is pushed through the capper. The reason is that if the foil is pushed through the machine, it does not have to be as wide as the foil that is pulled through. The latter has to be wide enough so that arms can be placed on it to pull it forward.

In another type of machine, the cap is brought by a vacuum to the capping head. The used foil in this case is rewound. The capping head forms the foil down on the screw top bottle. In this case, the cap can be removed and applied again.

In all cases, the used foil and the aluminum core on which the foil is wound can be salvaged as scrap. A plug cap seems to be needed on the common sense bottle, but not necessarily on the 45 mm. bottle. All the equipment seemed to operate simply and have relatively few working parts.

An innovation in paraffined paper hood caps was one which is applied to bottles without metal fasteners by a special machine synchronized with the filling machine. Controlled heat applied through a heating ring in the machine hood-capping head caused a special waterproof adhesive on the cap skirt to adhere the skirt folds. The cap was claimed to be tamper-proof because it must be torn for removal.

CASE WASHER

A new case washer handled 10 cases per minute. There were two compartments, a large one for the washing solution and a small one for the rinsing water. Another firm had developed an

automatic control of the temperature and alkalinity of water used in case washers.

COMPRESSORS

An engineering house showed that their rotary water seal compressor for delivering cool, clean air under pressure at 30 pounds can now deliver up to 75 pounds pressure.

CONCENTRATES, VITAMIN

Particular attention is now being paid to the vitamin A content of the concentrate from cod liver oil through refinements in the methods of extraction and concentration.

Another source of vitamin D concentrate, heretofore available only in an oil, is now furnished in evaporated milk to facilitate mixing with the bulk milk.

CONTROL, MERCOID FLOAT

A new mercoid float control has been developed to be used either on cooler troughs or on back pressure controls. In a cooler using a pump, the control will stop the pump when the trough gets too full. If gravity is used, the control will flash a light when the trough reaches the danger point. A number of lights or a bell can be used to show different levels in the trough, depending on the number of mercoids used. On the ammonia gravity back pressure control, the mercoid control will set the back pressure in accordance with the amount of milk running over the cooler.

CONTROL, TEMPERATURE

Improvements were noted in increasing sensitivity of temperature control devices, and production of stainless steel flexible tubing. A well known line of rotating pocket type pasteurizers has installed automatic temperature control of milk leaving the heater. A refinement in temperature control is the development of the diversion valve (q. v.).

COOLER, CABINET

A new fan type cooler uses the same dimpled surface on the sections as are used in the plate heater. The floor model showed an arrangement to pump the ammonia instead of using gravity controls. The upper trough is all welded. The lower trough is connected to the covers and is split in the center so that the milk will spill on the floor if the cooler is used while open. Brine, flooded ammonia, sweet water, and city water may be used as cooling mediums. These cabinets may also be used for heating and regenerating. This cooler is highly efficient. There are four passes of the refrigerant in each section, and three sections to the plate.

Another firm puts out an extruded aluminum cabinet cooler with the Alumilite finish.

CRATES

A new bottom runner on a so-called streamlined bottle case has eliminated blunt ends of metal at the corners, making a smoother and stronger bottom.

Wire milk crates have been strengthened by wrapping as well as welding partition wires, filling all the crevices with metal. A wire jug case, five unit capacity, for gallon glass milk containers, has been designed to stack with standard crates.

CREAM HEATER

In a plate heat exchanger for cream, the cream is passed through a series of plates in such a manner, according to the claim of the manufacturer, as to prevent the formation of cream plug in the bottle and to maintain a well flavored product. This equipment received very favorable comment.

CREAM TREATMENT

A continuous, heating, and vacuum steaming process was exhibited for use in reconditioning cream for butter manufacture. It is used principally to recondition inferior cream so that butter churned therefrom will compare favorably in texture and flavor with butter churned from fresh sweet cream. The result is accomplished through neutralization of the cream, then passing live steam directly into the cream under pressure, and evaporating out the added moisture in a specially designed pan. The

condensate carries off the greater portion of the volatile substances.

DRIERS, MILK

The end boards of a line of milk driers have been changed from wood (which used to disintegrate) to flexible stainless steel. The driers are equipped with stainless steel conveyer, elevator, flaker, and vapor hood. The design of the entrainment separator has been changed to reduce the milk solids loss, and give a cleaner cooling water that may be discharged into streams.

EXPANDED FITTINGS

A firm is producing fittings by expanding the pipe into the ferrule without the use of solder. The pipe comes through flush with the ferrule so that there are no cracks nor crevices. Only the pipe is expanded, so that the ferrule can be knocked off and used again.

FILTERS

A continuous milk filter used two sides, thus eliminating shut-downs. Several makes were made entirely of stainless steel. An arrangement of two horizontal filters, one mounted above the other, required no more floor space than one. A vertical type had an air bell to reduce pulsations. All joints were welded.

An improvement on the cartridge type of milk filter is provided by installing a series of twelve metal perforated discs for preliminary filtration. These discs have 900 perforations per square inch, and protect the filter cartridge from those substances that would plug the cotton filter pads.

HEATER

A new plate type heater has removable gaskets, thereby eliminating the objection to present models with embedded gaskets.

HOMOGENIZERS

Homogenizers have been remodeled and improved. Some are equipped with hydraulically balanced rotary pumps with self adjusting seal, eliminating all packing glands. They are built with stainless steel, and are designed to make cleaning easier. They may be used for market milk as well as for other products.

Another prominent line has removed all screw threads inside the cylinder block so that all the holes can be brushed through directly for cleaning. Homogenizer valves can be completely dismantled without tools. Sharp right angles are replaced by fillets. Packings are easily replaceable, and pistons are improved. A diaphragm actuated sanitary pressure gauge mechanism replaces the old leather cap washer and oil pressure arrangement. The intake strainer is constructed of perforated stainless steel instead of woven wire.

IRRADIATOR

One of the ultra-violet light irradiators is now equipped with a new type quartz lamp. This lamp may be used in other types of irradiating equipment, and will irradiate milk to higher unitages of vitamin D than regularly practiced now.

A new 3-phase carbon arc lamp has been installed in a high capacity, all stainless steel irradiator which utilizes only a small floor space, is easily cleaned, and is more economical in operation than current models.

LABORATORY BALANCE

A well known line of laboratory balances is now offered with a device for greatly increasing the speed of weighing. Weights are placed on the pan for weighing within 100 milligrams of the true weight. A magnetic damper brings the pans to rest. The position of the pointer off center is read on a scale by a lens. This reading indicates the number of milligrams to be added or subtracted. New stainless steel weights are non-corrosive, and replace the former lacquer-coated brass weights.

METALS

A rolling mill has developed a bright, cold rolled finish steel which has all the physical and chemical properties of polished steel at a cost about one-third less

than polished. The use of solder in the fabrication of equipment and in the joining of milk fittings has been practically eliminated—a decided improvement over the former methods.

MILK CANS

Milk cans made of aluminum were reported to have certain definite advantages over the steel cans in that the cover is made in two pieces, and joined at the outer edges. The collar effect of the ordinary milk can is eliminated thereby. These cans are approximately half the weight of an ordinary milk can. However, the cost is considerably more than that of the average can, namely, about eight dollars. For certain types of use, these cans are thought to have a future.

PASTEURIZERS

A new development was a spray pasteurizing vat which was heated by the spraying of hot water upon the outside of the milk container at two points. This permits a lower temperature of the hot water for heating, with claimed protection of the cream line and natural flavor of the milk. The same firm also exhibited a new circular vat pasteurizer which is constructed to cool the contents by means of a cooling coil that is closely wound around the outside surface of the milk container. The coil is continuously attached to establish a direct heat-transfer union between the refrigerant within the coil and the product in the vat, and is made in several separate convolutions fed from a common header.

PUMPS

A vacuum pump and a centrifugal pump for use with vacuum pans, condenser work, and deodorizing equipment now come mounted on one base.

A monel sleeve in the shaft of a deep well pump reduces the friction loss about 65 percent of the water passing the bearing chamber. A new stilling tube prevents sand from getting into the stuffing box packing. No oil is used in this pump; it is entirely water lubricated.

A well known pump now has no threads on the sanitary seal, has fillets (rounded corners) on all internal angles to promote ease of cleaning, has shoulders on all studs (bolt heads) on face plates, is "streamlined" to facilitate cleaning, and may be completely dismantled without use of tools.

Another new pump had an 18 — 8 stainless steel back cover for head. There were no threads, and every part was easily removable for cleaning. The stainless steel parts were held in place by a clamp to the frame. Since there were no threads, the discharge pipe could be turned in any direction.

Pumps are available with all parts made of stainless steel, thereby eliminating rough pitted surfaces of castings difficult to clean.

Another very simple pump has been developed with only two moving parts both of which can be readily removed for cleaning. The volume of the pump can be controlled by regulating the speed of the motor. Regardless of the speed, there is no churning effect. It is constructed of stainless steel and nickel silver. It operates on the rotary piston principle. It is reported to be an excellent pump for handling buttermilk as its action does not induce wheying off.

Refinements in manufacture and machining were noted in milk contact surfaces, particularly in milk pumps and pipe fittings. The resultant smoother surfaces will preclude accumulations of casein, milk stone, and other foreign matter, and will facilitate effective cleaning.

See also subject of Rotary Seals.

ROTARY SEAL

The rotary seal development on centrifugal pumps and shafts is new and marks a distinct sanitary advance because it enables ready disassembling of the parts and shafts for cleaning, thus eliminating the source of contamination from stuffing boxes of the older type. Pumps with rotary seals were exhibited by several concerns. They are not a brand new development for 1938, having previously been used on one of the continu-

ous freezer models and in a limited way on centrifugal pumps. However, the development did not reach wide proportions until the exhibits of 1938 when it was the general thing to expect rotary seals both on pumps and agitator shafts or wherever rotating parts immersed in milk were used. The use of rotary seals on storage tank agitators are a particularly recent development. Practically all tank manufacturers showed rotary seals on the agitators installed in horizontal storage tanks. An extremely simple seal, not requiring the use of packing, depended entirely upon two metal seats.

HIGH - SHORT PASTEURIZATION

Three units were shown of the plate type. Each employed a flow diversion valve and an insulated piece of piping through which the milk could flow during the holding period. One of the units used dimpled plates to give the milk a swirling motion as it travels between the plates. This unit gives the milk a double heat treatment. Five are reported to be in use. Another unit depends on ridges on its plates to give turbulance to the milk. This unit was the most compact. Twenty-two are reported to be in use. The third has plates with a washboard effect, and the milk runs diagonally across the plates from ports on either side instead of vertically as is the case in the other two units.

The first of the above units has attracted a great deal of attention because of the claim that the double heat treatment is particularly effective to reduce the bacteria count. In the regenerator the milk is heated from about 40° to 136° F. in approximately 40 seconds. It then passes into the primary heater section where the temperature is raised by hot water to 157° F. in approximately 12 seconds. Through another series of plates it is cooled by water from 157° to 145° F. in 8 seconds. Following this, it is heated from 145° to 161.5° F. in 10 seconds. The milk is then held for 16 seconds under continuous flow in a sanitary pipe. This pasteurized milk is then cooled through the regenerator section in about 40 seconds, and in the brine cooling section for 12 seconds. The total cycle requires 137 seconds. A flow diversion valve diverts any sub-temperature milk to the suction side of the feed pump so that it may be heated again through the primary heater stage. This valve is so sensitive that it reacts to ¼° F. below 160° F. in 0.27 - 0.39 second, and a response of 0.5 second for closing. The plates are thin stainless steel sheets with knob construction and rubber gaskets, with provisions for discharge of leaks. The floor space for a unit of 16,000 pounds capacity per hour is 8 x 9 or 72 sq. ft., and a similar unit for 28,000 pounds per hour requires 99 sq. ft. The equipment is easy to clean, and the plates may be thoroughly rinsed with a circulating solution before disassembling for cleaning. There is a relatively small number of short pipes and valves, and a pump to clean.

Another firm has a system using a plate regenerator and cooler, and two carbon electrodes to do the final heating. They claim to regenerate the milk up to 135° F., and then raise the temperature to 162° in 7 seconds with the electrodes. This system holds for 16 2/3 seconds. There is some criticism of its sanitary features. The original construction used a variable speed pump and a constant electric current, but the present design uses a constant speed milk pump and a variable current flow.

(A discussion of high temperature-short time—or high-short—pasteurization will be found on page 29 of this issue of the JOURNAL OF MILK TECHNOLOGY.)

SUPERHEATING

A new valve arrangement has been developed to permit easier operation of the superheating treatment of milk products.

TANK, STORAGE

A storage tank insulated with two inches of cork was cooled by sprays around the lining. Any anti-freeze could be used in the circulation unit. Another firm has equipped horizontal jacketed

tanks with a device for flowing refrigerated Prestone through the jacket, thereby eliminating the necessity for cooling coils inside the vat and removing the objection to brine circulation in the jackets of a vat.

THERMOMETER

The adjustable stem thermometer has a relatively long shank that makes possible the placing of the bulb of the thermometer at the proper place in the vat. It is held in proper position by a newly developed seal that is readily adjusted. It will fit all standard thermometer openings.

TRUCKS

A truck manufacturer has taken a Franklin air cooled motor of the flat four cylinder type and mounted it on the rear axle. The entire power unit, transmission, and rear axle can be removed as a unit for repair or replacement. This arrangement offers more usable space inside the body.

VALVES

Inasmuch as all stainless steel milk valves are inclined to gouge on account of the hardness of the metal, a stainless steel valve has been designed to provide a lift at the same time that the valve is turned, thereby also reducing wear.

To meet the demands of certain Boards of Health, a new removable outlet valve has been designed for pasteurizing vats. It is easily removable by two screws, and is resealed into place by a paper gasket.

VALVE, FLOW DIVERSION

The flow diversion valve is a quick-acting valve that has been developed for use on pasteurizing equipment of the continuous type. It diverts milk that is not up to the required temperature to either the surge tank or the heater. It is entirely automatic in action and exceptionally quick in its action. One type closes in 0.2 second with a temperature sensitivity of 0.1° F. Another type closes in 0.27 - 0.39 second and opens in 0.5 second. These valves can readily be taken apart for proper cleansing.

VAT, COIL

A vat has been produced with a coil made of tubing oval in cross section to give more heating area and tending to cut through the product. Another firm has placed counter current coils inside the jacket. Scrapers on the revolving agitators within the vat constantly remove the material from the sides of the vat, thereby increasing the efficiency of the heat transfer.

VATS, STEAM JACKETED

To eliminate the hazard of steam pressure from building up and warping the jacket of a vat, a new simple device which cannot become plugged serves as a pressure release.

WEIGH CANS

A single compartment weigh can with two twelve inch valves dumped 670 pounds of milk in three seconds. The manufacturers claim that this will do away with double compartment weigh cans. All that the operator has to do to dump his milk is to press a button. This weigh can will handle fourteen cans per minute, and only uses a forty inch elevation, thereby obviating the need of a pit for a receiving tank. All parts of this weigh can are easily disassembled, and no threads nor nuts are used.

Another manufacturer had an air operated double compartment weigh can. The spout of the weigh can is moved back and forth over the receiving vat by means of an air switch. Ten inch valves are used, and they are kept open until the milk is entirely drained by means of a kidney shaped attachment placed under the valve. The valve will not close as long as there is any milk in this mechanism. No nuts or threads are used, and it is a simple matter to disassemble, clean, and reassemble this equipment.

Lever systems on weigh scales have also been entirely enclosed for protection against moisture and steam. Stainless steel pivots and other parts are available at extra cost. An attachment will automatically print the weight of milk—the deck operator punches out the patron's name on the same slip.

A new design on the outlet valve of one make of weigh tanks provides a self-closing valve. The valve is closed by means of a lever which must be held back until all the milk is released. As soon as the lever is released, the valve automatically closes.

A single compartment, two valve weigh can is equipped with electrically operated valves with flash signal to indicate when valves are open by means of a robot control. It will empty in three seconds.

An elliptical pump vat or receiving vat prevents splashing in shallow installations and so precludes the need of pits.

FROZEN DESSERTS

CABINET

A cabinet was exhibited without seams or cracks, thereby easy to clean and keep clean. The same company exhibited equipment for using the Rentschler-James process for sterilizing glasses on soda fountains.

CONTAINERS

The stick in the push-up container for sherbets, ices, etc., is now separate. This saves storage space. The stick is marked for breaking, and the disc has an eyelet for making a spinning top and other novelties.

DIPPERS

A self-defrosting, non-mechanical ice cream dipper was made of a single aluminum unit casting with the self-contained defrosting unit, consisting of a liquid that is warmer than ice cream and placed in the handle.

FILLING MACHINE

An automatic filling machine has been designed to accommodate continuously frozen ice cream as well as the batch frozen product.

FREEZERS

Freezers are now constructed to permit revolving the inner and outer dashers independently for freezing or whipping, and simultaneously if desired. By use of a newly developed thermal expansion valve, the accumulators on direct expansion freezers are unnecessary.

PASTEURIZER

A 500-gallon pasteurizer for ice cream mix used steam as the heating medium in the cork insulated jacket. The temperature was followed by use of a thermometer in the condensation water. This unit will heat the mix from 45° F. to 155° F. in 21 minutes.

REFRIGERANT

A new form of refrigerant, reminiscent of the old cartridge days, has been introduced. A semi-jelly solution is made up of salt, Volclay KWK 33, and water. This is sealed in a rubber-processed, throw-away bag in the hardening room of the plant. This eutectic saline solution gives up its latent heat at zero to -6° F. Ice cream that is packed for 12 hours with this package may be removed at any time prior to this and found to be in edible condition without excessive hardening. The temperature can be varied by using a solution with correspondingly varied eutectic points. The 2 pound bag and its frozen contents is said to have the refrigerant properties of 1 pound of dry ice.

REFRIGERATION

An ammonia injector valve has been made for boosting the circulation of ammonia in systems where present installations do not remove as many heat units as may be required.

SALES PREMIUM

A special pattern, not available to others, in high grade Rogers plated silverware for the table has been developed for the use of dealers as premiums on milk sales.

SLAB TRAY

A wire slab tray with waxed paper liner was shown for the production of quarts, pints, and 5c specialties.

STICK HOLDER

A new design stick holder for novelties frozen to sticks and a new mold and mold rack were shown. Stick holders

and molds now in use are difficult to clean. The new stick holder is of stainless steel, designed for ready cleaning. A considerable improvement in the tinning of the molds was observed. The new mold is made separate from the mold frame, thus making it possible to clean both the exterior of the mold and the mold frame. The new stick holders and molds are now constructed so that the molds are cleaned and sterilized in mold washing equipment now being developed.

VANILLA POWDER

A well known flavor supply house exhibited a Mexican vanilla powder, a new product.

VENDING UNIT

A new ice cream vending unit, weighing 20—30 pounds lighter than formerly, was an important development in such leg-propelled vehicles.

WRAPPING MACHINE

A new automatic machine has been developed for cutting and wrapping ice cream bars. It fully wraps and seals brickettes ready for dispensing.

GENERAL REVIEW

The Dairy Industries Exposition has shown great growth. The recent exhibition has transcended all previous ones in number and volume of displays and of persons in attendance. There is no fundamental reason why it should not continue to grow, even if restricted to its present lines. However, there are indications that it has potentialities for still greater service to the industry. These seem to be along the lines of public relations and technological education.

There was a clearly defined tendency to use the stainless steels in more equipment. Even fittings, valves, and pumps are now made of it.

Throughout the exhibit, it was noted that equipment is being designed to facilitate its cleaning, operation, and maintenance in sanitary condition. Right angle joints have been practically replaced by ¾ to 1½" radius coving to obviate the necessity of flooding with solder. Welded and expanded fittings are replacing soldering. Equipment design has been further improved to reduce the tendency of dirt to accumulate. Precision instruments are being made more sensitive and dependable. New designs are making the working parts visible during operation, more accessible for disassembling, and easier to clean. A noteworthy feature in this field is the development of the rotary seal to eliminate stuffing boxes.

Further progress is noted in the speeding up of operations. This is particularly noted in the handling of the milk at the weigh can, the ease and rapidity of disassembling equipment for cleaning, the simplification of equipment by reduction in the number of parts, and the developments in high-short (high temperature-short hold) pasteurization.

More attention is being directed to the sanitation of the pouring lip of the milk bottle. This is manifested in the design of the pouring lip itself, the type of closure, and the extent and application of a cover-all protection. Emphasis was given to the comparative advantages of cover-all fiber-products caps, aluminum caps, and those made of the transparent cellophane-like substances.

Perfection of workmanship, durability of equipment, and attention to the proper finishing of milk-contact surfaces, as well as compactness and outer appearances were noted throughout the Exposition.

Great strides were noted in the improvement of milk sanitation and technology. Similar advances were noted in ice cream. In the butter industry, sanitary improvements were chiefly evident in improved churn design and operation. Improvement in the other parts of the dairy industry were not so conspicuous.

It is very clear that great advances have been made in the use of metals and metal alloys, and in the fabrication, design, and use of equipment. Continued collaboration between the machinery manufacturers, the milk and milk products industries, and milk sanitarians is desirable to maintain progress.

J. H. SHRADER.

INTERNATIONAL ASSOCIATION OF MILK SANITARIANS

Secretary's Office: State Department of Health, State Office Building, Albany, N. Y.

OFFICERS 1938-1939

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First Vice-President, Paul B. Brooks, M. D. ..... Albany, N. Y.
Second Vice-President, Leslie C. Frank ..... Washington, D. C.
Third Vice-President, Fred W. Fabian ..... East Lansing, Mich.
Secretary-Treasurer, C. Sidney Leete ..... Albany, N. Y.

NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS

Secretary's Office: New York State Department of Health, State Office Building, Albany, N. Y.

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Secretary's Office: P. O. Box 295, Elgin, Illinois

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METROPOLITAN DAIRY TECHNOLOGY SOCIETY

Secretary's Office: Rutgers University, New Brunswick, N. J.

President, J. H. Shrader ..... East Orange, N. J.
Secretary-Treasurer, O. F. Garrett ..... New Brunswick, N. J.

Report of the Secretary-Treasurer International Association of Milk Sanitarians

October 15, 1938

At the last annual meeting of this Association instructions were given to the Executive Board to

1. Discontinue the publication of the Annual Report and in lieu of that publication to publish a bi-monthly magazine to be known as "The Journal of Milk Technology."
2. Incorporate the International Association of Milk Sanitarians.
3. Register the name "The Journal of Milk Technology" in the Patent Office.

These three major instructions have been carried out so far as possible. "The Journal of Milk Technology" has been published bi-monthly.

The International Association of Milk Sanitarians is now incorporated under the laws of New Jersey as a "non-pecuniary corporation", which in effect means that the members are not financially responsible for any debts of the corporation. Only tangible assets of the corporation are subject to attachment.

The name "The Journal of Milk Technology" is in the process of registration. Before final rights are granted and registration completed, six months must elapse between publication of the application and final registration. This interim allows other organizations or persons to file protests. The date for final registration is some time later this year. To date we have not received notice that any protest has been filed.

At a meeting of the Executive Board held in New York City in November, the following staff of The Journal of Milk Technology was appointed, with instructions to publish the Journal bi-monthly:

Managing Editor, William B. Palmer
Editor, J. H. Shrader
Associate Editors:
C. A. Abele
Sarah Vance Dugan
J. G. Hardenbergh
M. A. Heinzman
J. A. Keenan
C. K. Johns
Ernest Kelly
P. F. Krueger
M. E. Parker
H. N. Parker
G. W. Putnam
H. R. Thornton

With your permission the Secretary wishes to have the report of the Journal to the Executive Board presented directly to the Association by the Managing Editor.

Facts which are known to only a few of us impel me, at this point, to digress. The detailed work necessary to successfully manage, publish, and edit a publication is probably beyond the knowledge of most of us, particularly when the project is new. Consider also the fact that those responsible for this work, unfortunately, were taken quite ill during the early part of the year. Only very exceptional optimism, ability, and a profound personal feeling of responsibility and the will to succeed, in addition to placing the Associaiton business above personal—and, at times, I dare say, official duties—could acocunt for the fact that The Journal of Milk Technology has found its rightful place in the dairy world, and that at present it is receiving recognition by the industry, as indicated by a mass of commendatory communications. To the efforts of the Managing Editor, Mr. Palmer, and the Editor, Dr. Shrader, the success achieved in this work is due. We are not unmindful, however, of the contributions of the other members nor of those who, in the past, laid the ground work upon which to build. The Executive Board and the Association, I am sure, are very appreciative of the work which has been and is being done.

In order to strengthen both the Association and its publication, some members have believed that the Association should be in a position to reach more persons interested in our work without

in any way lowering our standards, purpose, or ideals. With this in mind, several proposals to amend the Constitution have been submitted to the Secretary and have been brought to the attention of the members in accordance with the provisions of the Constitution. By action of the Executive Board, members of state or similar associations of milk inspectors or milk sanitarians may subscribe to the Journal of Milk Technology for the sum of $2 per year, provided

(1) That such Associations are approved by the Executive Board;
(2) That the members who apply are certified to the International Association by the local Association; and
(3) That the subscription fee is forwarded to the Journal Manager by the local secretary.

By further action of the Board, approved associations can designate The Journal of Milk Technology as the official publication of their respective associations, provided that the papers presented at the state or local meetings become the property of the state or local association and of the International Association of Milk Sanitarians.

Both of these actions were taken in order to strengthen the Journal and in order to bring members of state associations into closer contact and cooperation with the International. As a result, our subscription list is much greater than our membership list, which results in an expansion of our activities and our work, and also is a direct aid in financing the Journal.

At the annual meeting of the New York State Association of Dairy and Milk Inspectors, held in September this year, the Association adopted The Journal of Milk Technology as its official publication. The Massachusetts* and Connecticut associations are likewise considering this proposition.

It is hoped that the action taken by the Executive Board will be fully discussed from the floor.

Since our last meeting, 118 new members have been admitted to the Association. Thirty members have been dropped, either due to non-payment of dues (22 active; 6 associate) or by resignation. (1 active; 1 associate). A net increase of 88 members has resulted. The association is now composed of 196 active and 132 associate members located in the United States, Canada, Ireland, Cuba, India, Mexico and Venezuela.**

Your secretary wishes to express his appreciation to all those who have helped in preparing the program and in carrying out the other activities of his office. Also to express the appreciation of the Association to other organizations, notably the International Association of Milk Dealers, the International Association of Ice Cream Manufacturers, and the Dairy and Ice Cream Machinery and Supplies Association in opening their meetings to our membership, but more particularly for their cooperative efforts in furthering milk sanitation.

Respectfully submitted,

C. SIDNEY LEETE,
Secretary-Treasurer.

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* Since reporting the above, the Massachusetts Milk Inspectors' Association has taken this official action.—Editor.

** The membership now consists of 217 active and 144 associate members, a total of 325.—Editor.

Summary of Proceedings of the Annual Meeting of the International Association of Milk Sanitarians

Five proposed amendments to the Constitution of the Association were presented. All related to the objectives of the Association, membership requirements and dues. Two of them were voted by the Association to be placed before the entire membership for the required mail ballot. This will be mailed soon by the Secretary.

One of the proposed amendments aims to enlarge and make more specific the purpose of the Association. The other defines two classes of members, active and associate, and sets up specific qualifications and prerogatives. This proposed amendment also sets the annual membership dues, including subscription to the JOURNAL OF MILK TECHNOLOGY, at three and two dollars for active and associate members respectively.

The selection of the meeting place for the 1939 convention was left to the decision of the Executive Board.

The annual report of the management of the JOURNAL OF MILK TECHNOLOGY shows that the Journal is operating "in the black". This is a rather outstanding example of excellent management and Journal appeal, as most first year publications must be subsidized.

The officers were elected to the present positions from their former ones. Mr. Victor M. Ehlers, of Austin, Texas, is President; Dr. Paul B. Brooks, of Albany, N. Y., is First Vice-President; Mr. Leslie C. Frank, of Washington, D. C., is the Second Vice-President; Dr. F. W. Fabian, Michigan State College, was elected to be Third Vice-President. He has been active in the affairs of the Association for a long time, and is regarded as an outstanding authority in his field of work—sanitation as related to frozen desserts. The former Secretary-Treasurer, Mr. C. Sidney Leete was re-elected.

The New York State Association of Dairy and Milk Inspectors, the Massachusetts Milk Inspectors' Association, and the Central States Milk Sanitarians have designated the JOURNAL OF MILK TECHNOLOGY as their official organ.

The Executive Board approved the following rates for *group* subscriptions to the JOURNAL OF MILK TECHNOLOGY:

Not less than 10	$2.00
Not less than 100	1.50
Not less than 200	1.00
Students	1.00

However, these rates are applicable only to organizations or societies which have applied to the Executive Board of this Association for these rates and have been authorized to receive them.

Since the report of the Secretary-Treasurer was prepared, October 15, 1938, there have been 21 new active and 12 new associate members accepted by the Membership Committee. The registration at the Cleveland annual meeting was 184.

C. SIDNEY LEETE,
Secretary-Treasurer.

MASSACHUSETTS MILK INSPECTORS' ASSOCIATION

The nomination of officers was made at Holyoke, Mass., on October 26, and will be balloted upon in Worcester at the annual meeting on January 4 and 5, 1939.

Central States Milk Sanitarians

An Association of the leaders in the field of quality milk and milk products in the Central States

The Central States Milk Sanitarians is an Association of Milk Control Officials and Others who are sincerely interested in the betterment of our Milk Supply. This Association has been founded for the purpose of bringing together for their common interests milk control workers, also the dairy student, and the man of the milk industry so that each may share the ideas and ideals of the other.

The object of this Association, as outlined in its Constitution, is to develop uniform and efficient inspection of dairies and dairy products; to place the inspection of same in the hands of men who have a thorough knowledge of dairy work; to foster cooperation of inspectors in adjacent territories; to bring together persons who are interested in our milk supply; to collect, compile, and disseminate all kinds of information as may benefit our members.

The membership of the Association is divided into Active and Associate. The Active members are State and Municipal Milk Control Officials. These members are eligible to vote and to hold office in the Association. The Associate members are all others who are not State or Municipal milk control workers, but who are actively engaged in or are otherwise interested in the promotion of a wholesome supply of quality milk. Educators, Research Workers, Dairy Field Men and Owners or Employees of an individual dairy business, are eligible for Associate membership. These share in all the benefits of the Association; and they are able to improve their work or their businesses by keeping in close contact with the proceedings of the Association.

The Constitution provides that a meeting of the Association be held annually. This meeting is designed to be of special interest and instructive to the members, and is to be held at such time and place as is designated by the Executive Committee. There also is to be an Annual Dinner at the time of the Annual Meeting, to which due notice shall be given to all the members, for the purpose of making reservations.

The yearly dues in this Association are merely nominal. The enrollment fee of one dollar and a two dollar annual membership fee is very small in consideration for what the member receives. This fee is asked that the work of the Association may carry on, and that as soon as possible a publication may reach the members regularly.*

Application for membership in the Association, Central States Milk Sanitarians, should be made directly to

CENTRAL STATES MILK SANITARIANS,
Box 295, Elgin, Illinois.

Metropolitan (New York) Dairy Technology Society

At the regular meeting on Tuesday November 15, this organization voted unanimously to designate the JOURNAL OF MILK TECHNOLOGY as its official organ. Many members availed themselves of the opportunity to secure the Journal at the club rate of $2 each, available for groups from societies approved by the Executive Committee of the International Association of Milk Sanitarians.

Professor Paul F. Sharp of Cornell University addressed the society on the subject, "The physical state of the fat and its influence on the properties of milk," illustrated by charts and experimental data.

At the next meeting on December 20, the society will be addressed on the subject of high temperature-short hold pasteurization with special reference to previous difficulties and their correction in the newer developments.

* Editor—The association has designated the JOURNAL OF MILK TECHNOLOGY as its official publication.

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"DOCTOR JONES" SAYS —

"Maybe you remember: some little time back we were talking about health officers going to these public health meetings—what a good thing it was, not only for them but for the places they work for. Well, sir—I'm a great believer in practicing what you preach (even if I don't always do it), so here awhile ago I took a couple weeks off and made a wholesale job of it: took in two meetings, one right after the other.

"One of 'em was this International Association of Milk Sanitarians—met out there in Cleveland. There's an organization, if I'm any judge, we're going to hear more about as time goes on. Every year they get together: milk inspectors, college professors, men from the industry and what not, and for three days they just talk about milk—and, you know, a big part of it's new stuff. Now and then there's a health officer—but they seem to think—a lot of 'em, they don't need to know much about milk sanitation. In fact, that's one trouble with meetings like that: the ones go that know the most about the subject and the ones that need it most stay home. Well, anyway, the folks that go to this meeting, they're all interested in the subject and they don't want to miss anything. That's one reason it's a good meeting.

"They've got out a new magazine, this Association has, The Journal of Milk Technology; it's the best thing I've seen—that is, in that line. Anybody that wants to keep up on milk sanitation—they ought to be getting it.

"The other meeting was the American Public Health Association, out in Kansas City. They've got ten times as many members—in fact it's ten meetings in one, as you might say. They're good meetings, too—providing you can get around fast enough to find 'em before they're over.

"The one in Cleveland, and some of the sections there in Kansas City, I was glad to see they didn't have too many papers to a session. There was time for discussion in between—and that's what most folks like. If there's anything I hate it's a three hour session with seven or eight papers crowded into it—where the chairman's got to keep driving 'em to get 'em through in time to eat. They try to please everybody by covering the whole field and the result is they don't please anybody.

"One good thing: I see they're using amplifiers in most of the meetings now. Without 'em, in some of these big meeting rooms, the only ones that make any impression are the loud talkers. I've noticed it ain't always the ones that can holler the loudest that have the most to offer.

"That reminds me: one of 'em was telling about a meeting where the speaker was a world war veteran. He didn't have much of a voice and there was so many private conferences going on nobody could hear him. Finally some fellow got up. 'Boys,' he says, 'remember, our buddy went through hell for us. Shouldn't we be willing to do as much for him?'"

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* Article appearing in "New York State Health News," November 14, 1938. Dr. Mortimer Jones is well-known in New York State as "the health officer of the imaginary village of Utopia and for many years its only physician." Dr. Jones is in fact Dr. Paul B. Brooks, Deputy Commissioner of Health of New York State, and First Vice-President of the International Association of Milk Sanitarians.

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