EIGHTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN NEW YORK CITY
DECEMBER 4-5-6, 1919

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
1120 CONNECTICUT AVENUE
WASHINGTON, D. C.

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"A good cause makes a stout heart and a strong arm."

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
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WASHINGTON, D. C.

Price Two Dollars

International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911

NAME

This Association shall be known as the International Association of Dairy and Milk Inspectors.

OBJECT

The object of this Association shall be to develop uniform and efficient inspection of dairy farms, milk establishments, milk and milk products, and to place the inspection of the same in the hands of men who have a thorough knowledge of dairy work.

MEMBERSHIP

The membership of this Association shall be composed of men who now are or who have been actively engaged in dairy or milk inspection. Any person who now is or who has been so engaged may make application to the Secretary-Treasurer, and if application is accepted by the Membership Committee, said applicant may become a member of the Association upon payment of the annual dues of five dollars ($5.00).

OFFICERS

The officers of this Association shall be a President, three Vice-Presidents, a Secretary-Treasurer, and two Auditors, who shall be elected by a majority ballot at the Annual Meeting of the Association, and shall hold office for one year or until their successors are elected. An Executive Board, who shall direct the affairs of the Association when not in Annual Session, shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

AMENDMENTS

This Constitution may be amended at any Annual Meeting by a two-thirds vote of the entire membership of the Association. Any member proposing amendments must submit the same in writing to the Secretary-Treasurer at least sixty days before the date of the Annual Meeting, and the Secretary-Treasurer shall at once notify all members of such proposed amendments. All members voting on such proposed amendments shall register their vote with the Secretary-Treasurer on blanks provided by the Association before the date of the Annual Meeting.

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

The Constitution shall be the basis of government of this Association.

ARTICLE 1

MEMBERSHIP

SECTION 1. Any person eligible for membership under the Constitution who shall file an official application, accompanied by the first annual membership dues of five dollars, and whose application for membership shall have the approval of the Membership Committee, may become a member of the Association for one year.

SECTION 2. Any person having once become a member may continue membership in the Association so long as the annual membership dues are paid. Any member who shall fail to pay annual dues within thirty days after having been notified by the Secretary that said dues are due and payable, shall be dropped from membership. Any member so dropped may, within ninety days, be reinstated by the Membership Committee, upon application filed in due form and accompanied by the annual membership dues for that year.

SECTION 3. A member of the Association may be expelled for due cause upon recommendation of the Membership Committee and a majority vote of the members at any annual meeting. Any member so expelled shall have refunded such *pro rata* part of his membership dues as may not be covered by his term of membership.

HONORARY MEMBERS*

SECTION 4. Members of the Association may elect as honorary members, at any stated meeting, on the recommendation of the Membership Committee, those whose labors have substantially added to the scientific knowledge of milk supply betterment, or those who have been of pronounced practical influence in the improvement of the milk industry. From such members no dues shall be required. They shall have the privilege of attending the meetings of the Association, but they shall not be entitled to vote.

ARTICLE 2

OFFICERS

SECTION 1. The officers of this Association shall be a President, a First, Second and Third Vice-President, a Secretary-Treasurer, and two Auditors, who shall be chosen by ballot at the annual meeting of the Association, and shall hold office for one year, or until their successors are duly elected.

SECTION 2. The Executive Board shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

SECTION 3. The Membership Committee shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

ARTICLE 3

DUTIES OF OFFICERS

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association. He shall examine and approve all bills previous to their payment, appoint

*Adopted October 29, 1915.

all committees unless otherwise directed by vote of the Association, and perform such other duties as usually devolve upon a presiding officer, or are required of him by the Association.

SECTION 2. The Vice-Presidents, in the order of their selection, shall perform the duties of the President in his absence.

SECTION 3. The Secretary-Treasurer shall record the proceedings of the Association. He shall keep a list of members, and collect all moneys due the Association, giving his receipt therefor. He shall record the amount of each payment, with the name and address of the person so paying. He shall faithfully care for all moneys entrusted to his keeping, paying out the same only with the approval of the President, and taking a receipt therefor. He shall, immediately after his election to office, file with the President of the Association a bond in the sum of five hundred dollars, the expense of which shall be borne by the Association. He shall, at the annual meeting, make a detailed statement of the financial condition of the Association.

It shall also be the duty of the Secretary-Treasurer to assist in making arrangements and preparing a program for the annual meeting, and to compile and prepare for publication all papers, addresses, discussions and other matter worthy of publication, as soon as possible after the annual meeting.

SECTION 4. The full management of the affairs of the Association when the Association is not in session shall be in the hands of the Executive Board, as provided in the Constitution.

SECTION 5. It shall be the duty of the Auditors to examine and audit the accounts of the Secretary-Treasurer, and all other financial accounts of the Association, and to make a full report of the condition of the same at the annual meeting.

ARTICLE 4

MEETINGS

SECTION 1. The annual meeting of the Association shall be held at such time and place during the month of October of each year or at such other time as shall be designated by the Executive Board.

SECTION 2. Special meetings of the Association may be called by the Executive Board, of which due notice shall be given to the members by the Secretary.

SECTION 3. Quorum.—Twenty-five per cent of the membership shall constitute a quorum for transaction of business at any annual meeting. Voting by proxy shall not be permitted.

ARTICLE 5

These By-Laws may be altered or amended at any annual meeting of the Association. Any member proposing amendments must seasonably submit the same in writing to the Secretary-Treasurer, who shall then give notice of the proposed amendments by mail to each member of the Association at least thirty days previous to the date of the annual meeting.

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Those who advertise with us are clearly in sympathy with the work of our Association. We are materially benefited by their patronage, and therefore our members and readers should correspond with them FIRST and mention this publication when in need of supplies.

International Association of Dairy and Milk Inspectors

OFFICERS, 1919-1920

President, ERNEST KELLY.....Washington, D. C.
First Vice-President, PROF. C. L. ROADHOUSE..Davis, Cal.
Second Vice-President, H. E. BOWMAN..Somerville, Mass.
Third Vice-President, DR. HARRY W. REDFIELD,
New York, N. Y.
Secretary-Treasurer, IVAN C. WELD....Washington, D. C.
Auditors—
THOMAS HOLT.....Hartford, Conn.
W. E. WARD.....Brookline, Mass.

COMMITTEES

Subjects which they will study and regarding which they will report at the ninth annual convention.

BOVINE DISEASES—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

Dr. Hulbert Young, *Chairman*
Dr. Frank P. Dorian
Dr. C. E. Eddy
Dr. G. H. Grapp
Dr. J. B. Hollingsworth
Dr. L. F. Koonce
Dr. Harry S. Lucas
Donald W. MacNair
Dr. John F. Miller
Prof. C. L. Roadhouse
Dr. Clarence E. Smith
Dr. F. P. Woolf

DISEASES OF MAN—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

A. F. Stevenson, *Chairman*
Dr. A. O. Diaz
Dr. E. Kanasugi
Horatio N. Parker
Dr. L. E. Pollock
Dr. Wm. H. Price
Prof. C. L. Roadhouse

NEW LEGISLATION AFFECTING MILK AND MILK PRODUCTS

Hermann C. Lythgoe, *Chairman*
Gustaf L. Berg
Dr. A. T. Charron
Prof. J. A. Gamble
John Gaub
Emmett R. Gauhn
Prof. T. J. McInerney
Benj. L. Purcell
M. J. Smisek
Dr. O. P. Thompson

TRANSPORTATION AND MARKETING OF MILK AND MILK PRODUCTS

Russell S. Smith, *Chairman*
Herbert E. Bowman
Dr. C. W. Eddy
Thomas Holt
Prof. C. B. Lane
Prof. W. P. B. Lockwood
James E. Thomson
F. D. Walmsley

METHODS OF BACTERIAL ANALYSES OF MILK AND MILK PRODUCTS

Dr. Geo. E. Bolling, *Chairman*
L. B. Cook
Dr. J. R. T. Gray
Dr. David Wilbur Horn
Horatio N. Parker
G. C. Supplee
Geo. B. Taylor
Dr. T. Watabiki

ORGANIZATION AND ADMINISTRATION OF MILK CONTROL

Dr. Wm. H. Price, *Chairman*
Prof. H. A. Harding
Thomas Holt
A. W. Lombard
Annetta Nicoll
Horatio N. Parker
Benj. L. Purcell
Ole Salthe
M. J. Smisek
Willard E. Ward

CONSTRUCTION OF DAIRY BUILDINGS AND ITS RELATION TO SANITATION

(a) Stables
(b) Farm Milk Houses
(c) Country Receiving Stations
(d) City Pasteurizing, Bottling and Distributing Plants

Ernest Kelly, *Chairman*
E. F. Burke
H. O. Daniels
A. N. Henderson
Ralph E. Irwin
E. C. Krehl
Prof. C. B. Lane
C. W. Simpson
Dr. O. P. Thompson

REMADE MILK

Leslie W. Ferris, *Chairman*
Prof. James O. Jordan
Prof. C. B. Lane
Dr. Wm. H. Price
Dr. Harry W. Redfield
A. F. Stevenson
Geo. B. Taylor

PASTEURIZATION OF MILK AND CREAM

Fred J. Moore, *Chairman*
C. E. Clement
L. B. Cook
Dr. R. E. Dyer
C. H. Kilbourne
E. C. Krehl
Prof. C. B. Lane
Prof. C. L. Roadhouse
Benjamin Vener

RESOLUTIONS

A. W. Lombard, *Chairman*
A. N. Henderson
Prof. James O. Jordan
Dr. Wm. H. Price

FOOD VALUE OF MILK AND MILK PRODUCTS

Geo. B. Taylor, *Chairman*
Brooks Brown
A. N. Henderson
Frank A. Jackson
Prof. W. P. B. Lockwood
Annetta Nicoll
Fred J. Widmayer

DAIRY METHODS

(a) Sterilization of Utensils
(b) Cooling of Milk
(c) Cleanliness of Buildings and Surroundings
(d) Care of Cattle

Prof. T. J. McInerney, *Chairman*
Thomas F. Flanagan
Prof. James A. Gamble
Clarence W. Horton
John F. Johnston
Thomas J. Strauch
Alexander R. Tolland

CO-OPERATIVE WORK IN RACTERIOLOGICAL ANALYSES WITH OTHER ASSOCIATIONS

Dr. Wm. H. Price, *Chairman*
Dr. Geo. E. Bolling
Annetta Nicoll
Dr. Harry W. Redfield
Prof. C. L. Roadhouse
Dr. T. Watabiki

MEMBERS

Armstrong, A. E.	Supervising Food Inspector, Dept. of Health	Chicago, Ill.
Ashworth, R. R.	Chief Food Inspector	Washington, D. C.
Banov, Leon	Asst. City Bacteriologist	Charleston, S. C.
Barrett, Lt. Stanton H		Base Hospital No. 80, A. E. F., France
Berg, Gustaf L.	Inspector of Milk	Worcester, Mass.
Billingsley, W. B.	Veterinarian, State Dept. of Health of Maryland	Baltimore, Md.
*Bissell, Wm. G.	Chief, Bureau of Laboratories, Dept. of Health	Buffalo, N. Y.
Bolling, Geo. E.	City Bacteriologist and Inspector of Milk	Brockton, Mass.
Bourbeau, E.	General Cheese Inspector	St. Hyacinthe, Quebec, Canada
Bowman, Herbert E.	Inspector of Milk	Somerville, Mass.
Brown, Brooks	Dairy Inspector, State Dept. of Agriculture	Augusta, Maine
Brown, Lucius P.	Director, Bureau of Food and Drugs, Dept. of Health	New York, N. Y.
Burke, E. F.	Chief, Bureau of Dairy Products, Dept. of Farms and Markets, Div. of Agriculture, State of New York	Albany, N. Y.
Chilson, C. H.	Director of Dairy and Food Inspection, Board of Health	Detroit, Mich.
Clement, C. E.	Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
Cook, L. B.	Dairy Div., U. S. Dept. of Agriculture	Grove City, Pa.
Coughlin, John J.	Food and Dairy Inspector, Board of Health	Elizabeth, N. J.
Daniels, H. O.	Deputy State Dairy and Food Commissioner	Middletown, Conn.
Dorian, Frank P.	Veterinary Inspector, Bureau of Health	Yonkers, N. Y.
Dyer, R. E.	Chief, Dairy Inspection Div., Health Dept.	Boston, Mass.
Eddy, C. W.	Telling-Belle Vernon Co.	Cleveland, Ohio
Flanagan, Thos. F.	Food and Milk Inspector	Hartford, Conn.
Forrest, Augustus	Chief, Bureau of Food and Dairy Inspection	Birmingham, Ala.
Gamble, James A.	Professor of Dairy Husbandry, Maryland State College of Agriculture	College Park Md.
Gaub, John	Health Officer	Montclair, N. J.
Gauhn, Emmett R.	Chief Milk Inspector	Rochester, N. Y.
Gault, Thomas C.	Chief, Dairy and Food Div., Ohio Board of Agriculture	Columbus, Ohio

*Deceased.

Gibbons, John F	Farm Inspector	New Haven, Ct.
Grapp, G. H	State Dairy Inspector, Maryland	Baltimore, Md.
Gray, J. R. T., Jr	City Bacteriologist	Chester, Pa.
Harding, H. A	Head, Dairy Dept., University of Illinois	Urbana, Ill.
Henderson, A. N	With Davis-Watkins Dairymen's Mfg. Co	S. Francisco, Cal.
Hollingsworth, J. B	Chief Food Inspector	Ottawa, Canada
Holt, Thomas	State Dairy and Food Commissioner	Hartford, Conn.
Horn, David Wilbur	Chemist and Bacteriologist in charge Milk Work	Bryn Mawr, Pa.
Horton, Clarence W	Milk Inspector	Swampscott, Mass.
Irwin, Ralph E	Asst. Engineer, State Dept. of Health	Harrisburg, Pa.
Jackson, Frank A	Chairman, Board of Food and Drug Commissioners of Rhode Island	Providence, R. I.
Johnston, John F	Inspector of Milk	Newport, R. I.
Jordan, James O	Inspector of Milk	Boston, Mass.
Kanasugi, E	President, Tokio Medical Association	Tokio, Japan
Kelly, Ernest	In charge Market Milk Investigations, U. S. Dept. of Agriculture	Washington, D. C.
Kilbourne, Chas. H	Food and Sanitary Specialist	New York, N. Y.
Koonce, L. F	Milk and Meat Inspector	Raleigh, N. C.
Krehl, E. C	Supt. Towar Wayne Co. Creamery	Detroit, Mich.
Lane, C. B	In charge Scientific Dept., Supplee-Wills-Jones Milk Co.	Philadelphia, Pa.
Lockwood, W. P. B	Head, Dairy Dept., Massachusetts Agricultural College	Amherst, Mass.
Lombard, Alfred W	Dairy Bureau Agent	Boston, Mass.
Lloyd, Hoyes	Department of the Interior	Ottawa, Canada
Lucas, Harry S	U. S. Public Health Service	Miami, Okla.
Lythgoe, Hermann C	Director of Div. of Food and Drugs, Mass. State Dept. of Health	Boston, Mass.
MacNair, Donald W	State Dairy Inspector	Saratoga, Cal.
Maloney, Thos. E	Veterinarian, Board of Health	Fall River, Mass.
Moore, Fred J	City Milk Inspector	Detroit, Mich.
McInerney, T. J	Milk Inspector	Ithaca, N. Y.
Miller, John F	Chief Milk Inspector	Albany, N. Y.
Newman, John B	Supt. Div. of Foods and Dairies, State Dept. of Agriculture	Chicago, Ill.
Nicoll, Annetta	City Food Inspector	Topeka, Kansas
Parker, Horatio N	City Bacteriologist	Jacksonville, Fla.
Phipps, W. H	Supervisor of Production, Missouri Dairy Co	Kansas City, Mo.
Pollock, L. E	In charge Milk Control	Toronto, Canada
Price, Wm. H	U. S. Public Health Service	Washington, D. C.
Punteney, Geo. Fred	Dairy and Milk Inspector, U. S. Public Health Service	Little Rock, Ark.

Purcell, Benj. L.	Dairy and Food Commissioner of Virginia	Richmond, Va.
Purrington, W. F.	Scientific Asst., U. S. Public Health Service	New London, Ct.
Redfield, Harry W.	Bacteriologist, U. S. Bureau of Chemistry	Washington, D. C.
Rive, Henry		In Canadian army
Roadhouse, C. L.	Professor of Dairy Industry, University of California	Davis, Cal.
Roshon, Harry B		U. S. Army
Salthe, Ole	Asst. Director of Bureau of Food and Drugs, Dept. of Health	New York, N. Y.
Seaman, Carl O	Health Officer	Manchester, N. H.
Shaw, A. G	Inspector, U. S. Public Health Service	Columbus, Ga.
Simpson, C. W		Delamere, Beltinge, Herne Bay, England
Smisek, M. J	Milk and Dairy Inspector	St. Paul, Minn.
Smith, Clarence E.	Health Officer	Columbia, S. C.
Smith, Russell S.	Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
*States, H. E	Director, Dairy and Food Dept., Dept. of Health	Detroit, Mich.
Stevenson, A. F.	Sanitary Engineer, U. S. Public Health Service	Washington, D. C.
Strauch, Thos. J.	Chief Dairy Inspector, Bureau of Health	Richmond, Va.
Taylor, Geo. B.	Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
Thomson, James E.	Chief of Div. of Milk Inspection, Dept. of Health	New York, N. Y.
Thompson, O. P.	State Dairy Inspector	Waterloo, Iowa
Tolland, Alexander R	Dairy Inspector, Health Dept.	Boston, Mass.
Vener, Benjamin	Asst. Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
Walmsley, F. D.	Inspector, Borden Company	New York, N. Y.
Ward, Willard E.	Agent, Board of Health, for Milk and Food Inspection	Brookline, Mass.
Watabiki, T	Professor of Bacteriology, Tokio Charity Hospital Medical College	Tokio, Japan
Weld, Ivan C	Investigator for Chestnut Farms Dairy	Washington, D. C.
Widmayer, Fred J.	Food and Milk Inspector	Scranton, Pa.
Woolf, F. P	Chief Meat and Milk Inspector	Mobile, Ala.
Young, Hulbert	Manger, Walker-Gordon Laboratory	Baltimore, Md.

*Deceased.

HONORARY MEMBERS

Evans, Wm. A.....Editor, Health Dept., Chicago *Tribune* .....Chicago, Ill.
Pearson, Raymond A.President, Iowa State College. Ames, Iowa
Woodward, Wm. C.. Commissioner of Health.....Boston, Mass.

EIGHTH ANNUAL CONVENTION

NEW YORK CITY, N. Y.

DECEMBER 4, 1919

FIRST SESSION

The Eighth Annual Convention of the International Association of Dairy and Milk Inspectors was called to order by President James O. Jordan at 11.30 A. M.

Dr. Royal S. Copeland, Commissioner of Health of New York City, welcomed the Association. President Jordan expressed the thanks of the Association and delivered the presidential address.

Dr. Wm. H. Price, Chairman, presented the report of the Committee on Organization and Administration of Milk Control.

Mr. Ole Salthe, Director of Food and Drug Laboratory, New York City Department of Health, outlined a plan by which a representative of his office would be in attendance at the sessions, prepared to conduct parties desiring to visit dairy or food establishments.

SECOND SESSION

The second session of the convention was called to order by President Jordan at 2.30 P. M. Mr. Geo. B. Taylor reported for the Committee on Food Value of Milk and Milk Products. Dr. Geo. E. Bolling reported for the Committee on Methods of Bacterial Analysis of Milk.

Prof. C. B. Lane presented a paper on "The Milk Situation in Philadelphia."

Invitations for the ninth annual convention were received from San Francisco, Chicago, Detroit, Buffalo and Springfield, Mass.

THIRD SESSION

The evening session was called to order by President Jordan at 8.30 o'clock.

The program consisted of a symposium on the subject of remade milk by the committee having had its study in charge. Dr. C. W. Eddy, Cleveland, Ohio, presented a paper on "Commercial Quality of Remade Milk." Mr. Geo. B. Taylor, Dairy Division, U. S. Department of Agriculture, presented a paper on "Effect of Remade Milk on Dairy Industry." Dr. Wm. H. Price, U. S. Public Health Service, presented a paper on "Result of Infant Feeding." Mr. A. F. Stevenson, New York City, presented a paper on "Legislative Restrictions Necessary." Dr. Harry W. Redfield, U. S. Bureau of Chemistry, Chairman of the Committee, gave a summary of the work of the committee.

FRIDAY, DECEMBER 5TH

FOURTH SESSION

The fourth session was called to order by President Jordan at 2.30 P. M.

Mr. Marsh, of the Massachusetts State Board of Health, read a paper on "The Milk Situation in Massachusetts."

Prof. James A. Gamble, Chairman, read a report of the Dairy Farm Inspection Committee.

A paper on the subject of "The Milk Inspector and Milk Plant Operation" by C. E. Clement, of the U. S. Department of Agriculture, was read by Mr. Geo. B. Taylor.

Mr. Russell S. Smith, Chairman, read a committee report on Transportation and Marketing of Milk and Milk Products.

FIFTH SESSION

The fifth session was called to order by President Jordan at 8.30 o'clock.

Dr. Kanasugi, Member of Parliament of Japan and President of the Tokio Medical Association, presented a brief paper.

Mr. Fred J. Moore presented a report of the Committee on Pasteurization of Milk and Cream.

Dr. Charles Krumwiede, Jr., of New York City Department of Health, read a paper on the subject of "Human and Bovine Tuberculosis."

Prof. C. L. Roadhouse presented a paper on "Dairy and Milk Inspection in California," which was read by Mr. James E. Thomson.

Mr. Ernest Kelly, Chairman of the Committee on Construction of Dairy Buildings and Its Relation to Sanitation, reported for the committee.

Mr. Alfred W. Lombard, of the Massachusetts State Dairy Bureau, addressed the Association briefly.

SATURDAY, DECEMBER 6TH

SIXTH SESSION

The sixth session was called to order by President Jordan at 10.30.

Mr. Frank A. Jackson read a paper prepared by Mr. John F. Johnston, Inspector of Milk, Newport, R. I., on the subject of "The Milk Supply of Newport, R. I."

Mr. Geo. B. Taylor read a paper on "The Use of Chlorinated Lime in the Sterilization of Milk Utensils."

Mr. H. W. Jeffers, President of the Walker-Gordon Company, Plainsboro, N. J., addressed the Association on "The Problems of Milk Production," which was followed by a paper prepared by Mr. Russell S. Smith, of the U. S.

Department of Agriculture, which in his absence was read by Dr. Hulbert Young of Baltimore.

SEVENTH SESSION

The seventh session was called to order by President Jordan at 2 o'clock.

Mr. Chas. H. Kilbourne, of New York City, read a paper on "The Pasteurization of Milk," and Ivan C. Weld, of Washington, D. C., read a brief paper regarding certain laboratory equipment and methods. The business session followed.

BUSINESS SESSION

Mr. Alfred W. Lombard and Dr. Hulbert Young, acting as auditors, reported an examination of the Treasurer's accounts had been made and that the same had been found correct.

The Secretary-Treasurer then presented the eighth annual report, showing the receipts and disbursements for the year.

The Committee on Resolutions reported the following resolutions, which were adopted:

1. WHEREAS, Milk furnished by producers in some localities has been decreasing in food value from year to year, and believing that the purchase and sale of milk with reference to its food value will have a tendency to improve the quality of milk; therefore be it

Resolved, That this Association urge that such methods of buying milk be followed as will take into consideration its value as a food.

2. *Resolved,* That the president of the International Association of Dairy and Milk Inspectors appoint a committee to cooperate with the Committee on Standard Methods of Milk Analysis of the Laboratory Section of the American

Public Health Association, the Public Health Service of the U. S. Treasury Department, the Dairy Division of the Bureau of Animal Industry of the U. S. Department of Agriculture, and the Microbiological Laboratory of the Bureau of Chemistry of the U. S. Department of Agriculture, for the purpose of developing a standard method for the bacteriological examination of milk which will give reliable and satisfactory results, and to formulate methods for eliminating the personal element leading to grave errors by a system of licensing or by some other means.

3. WHEREAS, The members of the International Association of Dairy and Milk Inspectors, and through them the communities which they represent in matters pertaining to control of food supplies, have profited by the report of an original study on the Effects of Use of Remade Milk in Infant Feeding; and

WHEREAS, It has been reported to the Association that the success of that study resulted in large measure from the training and experience and the conscientious, skillful and industrious work of the Director and the Staff Nurses of the Boston Baby Hygiene Association; therefore be it

Resolved, That the Secretary of this Association be, and hereby is, directed to express the appreciation of the Association to the Director and the Staff Nurses of the Boston Baby Hygiene Association for their valuable contribution to the cause of baby welfare and of public health.

4. *Resolved,* That the Bureau established during the past year for receiving complaints relative to lack of care of milk in transit and for referring such complaints to the U. S. Railroad Administration, the Interstate Commerce Commission, or other proper agency, for correction, be continued.

5. *Resolved,* That the importance of clean containers and adequate refrigeration for milk and milk products be referred to the Committee on Transportation and Marketing for its consideration when framing its next annual report.

6. *Resolved,* That the appreciation of the Association be extended to the U. S. Department of Agriculture, the U. S. Public Health Service, the Health Commissioner of New York City, Mr. Turner, Mr. C. E. Marsh, Mr. Hueling, Dr. Krumwiede, Mr. Jeffers, and Mr. Kilbourne, for their contributions to the success of this, the eighth annual convention of the International Association of Dairy and Milk Inspectors.

The Association then proceeded to elect the following officers:

President, Mr. Ernest Kelly, Washington, D. C.

First Vice-President, Prof. C. L. Roadhouse, Davis, Cal.

Second Vice-President, Mr. H. E. Bowman, Somerville, Mass.

Third Vice-President, Dr. Harry W. Redfield, New York, N. Y.

Secretary-Treasurer, Mr. Ivan C. Weld, Washington, D. C.

Auditors, Mr. Thomas Holt, Hartford, Conn.; Mr. Willard E. Ward, Brookline, Mass.

After brief remarks by former President A. W. Lombard, by the Secretary and by the retiring president, Prof. James O. Jordan, the convention finally adjourned.

"New occasions teach new duties."

ADDRESS OF WELCOME

DR. ROYAL S. COPELAND, COMMISSIONER OF HEALTH, NEW YORK CITY

Ladies and Gentlemen:

Purification of milk has saved more lives than have been saved by all the doctors, all the vaccine, and all the laboratories. That is my estimation of the importance of pasteurization of milk.

It is difficult for peace workers to get the Nobel prize, but the workers in this industry are doing a more important work than that done by others. We are proud of the work of the lawyer and the librarian, but the everyday work of controlling the purity of the milk supply is of greater importance.

Within the boundaries of my farm in the country is an old cemetery which I call my private cemetery. All who rest there were buried before they were fifty. The span of life is greater in the cities because of the insistence of purity of milk supplies. The life span has increased several years, principally because of the saving of lives of babies.

We are agitated regarding the price of milk. No one believes the farmer is getting too much. I have cows of my own. We cannot understand why, after the farmer has complied with restrictions and delivered his milk in the city for nine cents, it should cost nine cents more to bring it to my door. We do not say the dealer is making too much, but we must have cheaper milk. Thirty per cent of children are not properly nourished at the present time, and we feel that some steps should be taken that will result in their being better nourished.

Now if the Mayor has not removed me from office, I feel safe to say for the Mayor that you are most cordially welcome to our city. We hope you will enjoy its freedom, and we hope you will not be arrested, as there is no milk punch. Our Department will have one or more representatives here to help you to visit such points of interest in our city as you may desire to visit.

RESPONSE TO ADDRESS OF WELCOME

PRESIDENT JAMES O. JORDAN

We appreciate, Dr. Copeland, the cordial welcome which you as Commissioner of Health of this city have extended to our organization, and we thank you for the hand of good fellowship.

We very much appreciate the presence of Mr. Salthe and Mr. Turner, who as representatives of your Department will be in attendance at our convention and aid our members in visiting some of the dairy and food establishments in your city.

"Positive facts may be briefly stated."

PRESIDENTIAL ADDRESS

PROF. JAMES O. JORDAN, BOSTON

While milk sanitation is a paramount factor, the milk subject is not accorded adequate consideration unless due weight is given its economics. To dismiss this feature of the proposition would be like attempting to operate an automobile without an engine. As the source of motive power is vital to motor vehicles, so the money side of the milk problem is a necessary element in the procuring and use of this commodity by the public. Never in the history of the milk business has this question of price been so great an issue as in the last few years. In this respect the period beginning with 1916 to date has been epoch-making. The basis of this unusual condition, which brought a rapid increase in cost to the consumer, was an outcome of our recent military activities at home and abroad.

Such advances, while not so large as those of other necessities of life, have nevertheless been the subject of much investigation and attack. Outside of the necessary inquiries instituted by Federal Milk Commissions, and which were of the nature of a stabilizing influence to the industry, there has been a series of onsets and agitations, ill-conceived and unfair, by individuals, a few officials, and newspapers, upon this business, so extensive as seemingly to have become a habit. These movements have been without substantial foundations and were instigated from motives of harm, or lack of knowledge of even the elementary features of the trade. There is no doubt that some of these publicity campaigns were deliberately planned to injure the industry, and that they have been continued with this object in view. These activities of notoriety-seekers and vilifiers have not been without detriment to the business, as they have served as an evil influence upon the public mind. Repetition of a statement, if sufficiently intensive, even though illogical or false, acts as a convincing ferment with

the unthinking; thus in time unsound principles apparently become truths. Such a state exists now with many milk consumers, because of these thoughtless or planned agitations.

To date these assaults have been directed towards either the producer or dealer or both, with little or no attempt to locate contributing agencies. Most of these proceedings have been carried out on a bulldozing plan, the principal object being to break down prices, whether justly or otherwise, and both dealers and producers have been pictured not only as grasping robbers, but as a crushing force in the starvation of infants and invalids. While no brief is held for pleading the cause of producers or dealers, justice to communities demands advocacy of the facts, and a statement as to one of the important elements which has had much to do with milk prices in recent years. This is the cost of labor, which has been a large contributing factor in raising milk prices, a fact of which the public possesses no knowledge. So far as known there has been no attempt by these exploiting agencies to give consideration to this phase. Presumably the reasons for this failure were either lack of knowledge of the true conditions, or belief that from safe, sensational, or spectacular standpoints producers and dealers were more popular lines of aggression than that of labor. The purpose of this statement is not to decry labor or to deal with the subject unfairly, but to attempt to indicate something of the bearing of this feature upon milk prices.

It has not been possible to obtain information as to labor costs covering a wide area, but as the data cited applies to Boston, and to an extent to New England, it is fairly representative of the state of affairs which prevails elsewhere. Based on these facts, how many who revile dealers and producers over high milk prices stop to consider that the labor cost to the producer for each quart of milk is about two cents, and that this represents approximately 25 per

cent of what the farmer receives for his product? Who among these critics realizes that the sum which the dealer pays for labor for each quart of milk is about four cents, and represents over 60 per cent of the dealer's portion, *i. e.*, the difference between the amount paid to the producer and the sum which is charged to the consumer? What proportion of the public is aware that the item of labor cost to the railroads for transporting a quart of milk about 220 miles equals approximately $0.0033 cents? These prices paid for labor by the agencies mentioned aggregate a total of $0.0633 cents per quart, which naturally is passed on to the public. How many who charge milkmen and producers with profiteering stop to consider that of the amount paid the dealer for a quart of milk, over 38 per cent, or $0.0633 cents, is spent by various agencies for labor expenditures? Does the user of a glass of milk, based on the price paid the dealer, realize that the cost for labor for that quality of milk was about $0.015825 cents, or, on the same basis, the mother who gives a feeding of four ounces of milk to her baby, think that the tribute paid to labor for this amount of nourishment is equivalent to about $0.0079 cents? These labor costs are more than conservative, as they only represent direct payments; in addition to this, producers, dealers, and the railroads are taxed indirectly, as, for illustration, for the labor entailed in production and marketing of grain, hay, gasoline, steel rails, cross-ties, and like commodities. If these facts were given the consideration by the public to which they are entitled, there would be less fault-finding with dealers and producers exclusively. Probably there is no reason for criticism over recent milk prices, but objectors, if any, should consider that if ground for blame exists, it should include labor, and not be apportioned solely to producer and dealer.

There is no desire to disparage the legitimate efforts of labor to obtain adequate compensation for the service which it renders, but it should be pointed out that under condi-

tions now prevailing in the milk business, many unskilled workers are being more generously remunerated than those in the same employ, like chemists and bacteriologists, who have spent years of study in training themselves for the duties which they now perform. In this connection it may be noted that some of the attempts of employees of milk dealers to enforce their demands have bordered on the hold-up type of procedure, and that in some instances agreements have been made to violate rather than to respect. To the extent, however, that the demands for compensation of workers engaged in the milk industry are just or unjust, communities must expect to be proportionately taxed.

The importance of labor in the matter of milk costs is of such magnitude that it is felt that consumers need anticipate no substantial reduction in the price of this commodity until the claims of labor for wage increases undergo a reversal, and future advances in the cost of milk will be determined more by the attitude of labor than by any other contributing element.

What has been the effect of high prices of milk during recent years upon the consumption of this commodity?

Both the (a) Chicago and (b) New York Health Departments have ascertained as a result of recent investigations that at least in certain sections of those cities, less milk is being consumed than formerly, and the falling off in its use is attributed to increased cost. Harris (c) found that in 296 families "milk was eliminated from the children's dietary, and in 71 families the amount used for children was very considerably reduced." In Boston a fairly accurate and consistent record has been kept for a series of years of the amount of milk consumed daily. This data indicates that from 1916 to date there has been a decline in milk sales. Based on the amount of milk used in 1916, and the estimated population for that and subsequent years, it has been possible to determine roughly the quantity of milk which Bostonians should have used daily for the years 1917,

1918, and 1919. This, as may be noted from the following table, is much larger than the amounts actually consumed.

(a) Chicago Dept. of Health. Food Inspection in Relation to Public Health, by G. Koehler, M. D., in American Journal of Public Health, June, 1919, p. 423.

(b) New York Dept. of Health. Weekly Bulletins, Vol. 6, No. 44, Nov. 3, 1917, and "New Series," Vol. 8, No. 41, Oct. 11, 1919.

(c) Some Medical Aspects of the High Cost of Living, by Louis I. Harris, Dr. P. H., M. D., in Amer. Journal Public Health, July, 1919, p. 501.

Daily consumption of milk in Boston for the years 1916 to 1919 (both inclusive), and comparison with the amount of milk used in 1916 by the estimated population of that year, with the quantity which should have been consumed in 1917 to 1919 (both inclusive), on the basis of the 1916 usage, by the estimated population for the years 1917, 1918, and 1919.

Year.	Quarts of milk actually consumed daily.	Quarts of milk which should have been consumed daily, based on estimated yearly population and the quantity used in 1916 by the estimated population for that year.	Estimated population.
1916	347,735		760,400
1917	342,244	353,209	772,370
1918	342,451	358,617	784,340
1919	333,506	364,157	796,310

Thus from the information procurable from various sources it is apparent that under prevailing economic conditions and the attendant prices for milk, the consumption of this product in its fluid state is undergoing a steady decline. This presents a problem calling for the most serious consideration, as its varied aspects are so far reaching as to involve not only the future health of the community, but it may actually place an important business upon an un-

sound footing. On this latter basis the attendant ramifications would be widespread, but the subject naturally applies most directly to the producer, the dealer, and to labor, and is entitled to receive the earnest attention of all these forces, whose interests are closely allied.

It is not the province of this endeavor to include a discussion in its many angles of the great harm which would result to the public, and especially to the young, from a continuous lessened use of milk, excepting to indicate that ultimately it would bring disaster to the human economy. Increased usage of milk is so vital to humans that the downward trend of its employment must not only be checked, but the direction of the curve given an upward swing, until the public is utilizing a quantity of milk commensurate with its well-being.

In view of the falling-off in milk consumption, the influence of recent campaigns to promote more extended use of this substance may be questioned, as may also the success of long-continued efforts to educate the people by means of literature and argument, not only as to its value as a life-sustaining agent, but the economy of its use as compared with other commodities. Naturally this educational propadanda has not been without much benefit, but the present state of milk usage calls not only for a continuation of these publicity efforts on an extended plan, but also shows the need for devising and pushing new methods to acquaint consumers with the basic gain in general welfare from more extensive employment of this product. The fact should be thoroughly instilled into the public mind that although there have been advances in the price of milk, such increases have not kept pace with the raising of charges for other foods; that milk is still a cheap source of energy and protein, and that it fulfils a role so beneficial to good health that other commodities cannot be judiciously substituted for it.

In addition to other data previously cited indicating decreased employment of fluid milk, there is the further con-

firmation of a tremendous jump since 1916 in the sale of such milk products as evaporated, condensed milk, skimmed and whole milk powders. Many have known of this development in a general way, but probably only a few realize the exact situation, or the extent of this evolution.

It is felt that sufficient data has been procured, through the courtesy of Boston dealers, to demonstrate something of this development. To illustrate this feature, several tables are appended. The first shows the business of a concern which has operated the same set of stores for a number of years, and caters to what may be termed a high-class clientele, and is as follows:

	1916	1917	1918	1919*
	Cases	*Cases*	*Cases*	*Cases*
Evaporated Milk (Baby Size)....	333	332	616	640
Evaporated Milk (Family Size)..	1,499	2,257	3,179	2,847
Condensed Milk.....	574	998	2,208**	1,177
Confectioners' Milk (Evaporated)	288***	284***	470***	449***

*Figures are from Jan. 1 to Nov. 8, 1919.
**Abnormal by reason of supplying large quantities to government vessels.
***Cans hold one gallon.

Thus for the uncompleted year of 1919, the increase in sales of evaporated milk of both sizes over the transactions of 1916 was about ninety per cent; for the condensed variety the dealings increased over one hundred and five per cent; and for the confectioners' milk (evaporated), more than fifty-five per cent. Comparison of the sales of evaporated milk for 1916 with those for 1918 (full year), would naturally give a greater percentage of increase than was indicated by the part year business of 1919.

The next table is based on the business of a firm operating chain stores. The information furnished by this concern clearly shows that a large part of the community is depending, at least to some extent, on the milk products of

these types, and is employing them in increasing quantities. The details of this development follow:

	1916	1917	1918	1919*
	Cases	*Cases*	*Cases*	*Cases*
Evaporated Milk	12,000	26,600	40,500	48,500
Condensed Milk	18,500	26,100	36,000	28,500

*The figures are for the ten months from Jan. 1st to Nov. 1st.

On the basis of the 1916 and 1919 sales, these data point to an increase of transactions in evaporated milk sales of over 304 per cent, and with the condensed substance of over 54 per cent.

The receipts in Boston of evaporated and condensed milk, as shown by the records of the Chamber of Commerce of that city, are of interest in this connection. It was impossible, however, to obtain any facts as to the disposition or destination of these shipments, and is offered simply as additional evidence of the rapidly increasing traffic in these substances. The table of illustration follows:

	Cases
1916	762,446
1917	880,072
1918	1,237,647
1919 (for 10 months only)	1,647,264

This indicates an increase of sales of these products, as between the transactions of the year 1916 and of the year 1919, of over 116 per cent.

The employment of whole milk powder for household use, and a substitute for milk, only recently commenced on a fairly large scale, but as a result of aggressive commercial methods a stable business is being established in this commodity, which in the near future is likely to reduce the demand for milk in its fluid form.

Skimmed milk powder is more extensively used than that made from whole milk, and has been available in large quan-

tities for several years. There is an extensive market for this type of powder, which is developing constantly. It goes mainly to manufacturing establishments, and regardless of whether or not it is used in place of milk, the increase in sales of this commodity indicates its popularity with those who are able to utilize it to advantage.

The following table shows the business of three Boston concerns in this product for the periods indicated below:

	Pounds of skimmed milk powder
1916	735,809
1917	789,457
1918	913,575
1919 (for ten months only)	1,021,555

On this basis the traffic in skimmed milk powder has increased over thirty-eight per cent, if the sales for 1919 are compared with those of 1916. It is furthermore an index of the large amount of this substance which is consumed throughout this country.

This business in these concentrated forms of milk clearly shows the trend of opinion held by an increasing portion of the community, and points emphatically to their substitution for milk in its fluid form. The extent of this traffic is now a serious menace to the latter trade, and if continued will be a source of greater embarrassment. For some purposes these substitutes are without the special advantages as sources of food which are supplied by fluid milk; furthermore, many users of these concentrated products undoubtedly deprive themselves of substantial nourishment in their use, by the addition of more water than will yield a product equivalent to the milk prior to concentration. In other words, self-deception may result from an individual being his own milkman. But in any event the employment of these substances is of such gigantic proportions as to create a situation which all participants in supplying fluid milk should closely scrutinize. To ignore it would mean the

further abandonment of this traffic to inroads which bespeak disaster to both the industry and the public.

The aspects of this situation may be summarized as follows:

1. The cost of labor is a large item in the price of milk, a fact unknown to consumers.

2. There will be no substantial reduction in milk prices until labor accepts less remuneration for its services.

3. Fluid milk consumption appears to be lessening despite efforts to increase its use.

4. Products manufactured from milk are being substituted for fluid milk to a large extent, and the trade in these commodities has developed tremendously since 1916.

5. For the welfare of the public and the trade there should be an extension of the efforts for a greater use of fluid milk, and new methods should be devised and utilized to demonstrate its food value.

ESTABLISHMENT OF A COMPLAINT BUREAU

During the year the Executive Board of the Association arranged to present complaints to the United States Railroad Administration, received from members of the Association, and where practicable from others, regarding delays in transportation of milk by railways or other common carriers.

The object of this endeavor was to lessen the spoilage of milk by reason of insufficient refrigeration and inadequate transportation facilities. It was thought that through better protection of the milk supply by means of correction of faulty transportation, a real service could be rendered to consumers of milk as well as to the industry.

Notice was given of the establishment of this agency, and then some of the members of this Association, by means of of the press and letters, brought the project to the attention of milk dealers.

Following this several complaints were received concerning delinquencies on the part of railroads in connection with milk shipments. These related to such points as infrequent shipments, failure to ice milk, and delayed transportation of cans. When later these issues came to the attention of the Railroad Administration, they were accorded prompt consideration, and although the contentions of the complainants were not allowed in all cases, it is felt that as a whole good has resulted from the presentation of these matters to the authorities.

The Association was enabled to inaugurate and operate this bureau through the public-spiritedness, courtesy and tact of Secretary Weld, and its success is due to his valued efforts.

This problem of corrections of faults in milk transportation is of such importance that I suggest consideration of its continuance, and extension, if necessary. In this connection I also desire to recommend that a study be made of the types of railroad cars used in the United States and Canada in making milk shipments. These cars vary from the refrigerator type to baggage cars, or worse, as well as thin-walled affairs, with many doors, which fail to protect milk adequately either in summer or winter. Such inquiry, if made, should include influence upon milk resulting from other modes of transportation.

Unclean milk containers and inattention to the necessity of properly cooling milk and then maintaining it at a low temperature, on the part of farmers, carriers and dealers, causes a loss which runs into large figures. This spoilage increases the cost of conducting the milk business, results in a waste of food material, and is a condition which should not be allowed to exist. There have been attempts at correction, but without the momentum of concerted action. A knowledge of the monetary loss which follows from improper icing of milk, and from the employment of faulty milk cans ought to serve a useful purpose in focusing at-

tention on this proposition. Losses estimated in dollars might teach a lesson which would be ignored if stated in other terms.

As a starting point in eliminating this waste, and with a view of later outlining a corrective and cooperative program, it is proposed that an effort be made to determine the extent of the annual loss attendant upon the use of dirty milk vessels, and the lack of, or insufficient refrigeration of milk and milk products. If such data can be procured, and utilized advantageously, may we not hope, on the basis of Red Cross Day and days for other undertakings, for a Clean Can, Cold Milk Year in the near future. If this organization can aid in the creation of such a condition, it will serve the milk industry a most useful purpose and provide an object lesson which will be characteristic of dairy and milk handling methods in later years.

"A good dairy inspector is a builder of industry as well as a guardian of the public health."—Parker.

REPORT OF COMMITTEE ON ORGANIZATION AND ADMINISTRATION OF MILK CONTROL

DR. WM. H. PRICE, *Chairman*

Milk Control is attempted for the primary purposes of establishing and maintaining reasonable standards of food value, safety and cleanliness in milk and milk products, of developing an abundant supply of milk, of stimulating the demand for it, and of creating fair conditions of competition among dealers, to the end that adequate supplies of safe milk may be available to the public at prices as low as may be consonant with costs of production, handling and distribution. Organization of milk control should be based on those purposes.

Support of the purchasing community is the first essential in organization of milk control. Maintenance of that support, consistent progress toward accomplishment of the purposes, and avoidance of unnecessary friction with the milk industry are essentials in administration of milk control. These factors are of universal application; details of procedure may vary in different localities.

Enough support should originate within the community to undertake and sustain an official program including adequate personnel, appropriations, and equipment to demonstrate tangible progress toward solution of the milk problem of the particular community.

When such support for organization is available, choice of personnel and formulation of the program to be pursued are determining factors in the success or failure of the attempt at administration of milk control. Agricultural college graduates, chemists, bacteriologists, veterinarians, and others trained in sanitary science presumably take precedence in selection of personnel; but those qualifications by no means guarantee industry, integrity, good sense, and rational enthusiasm in the work, all of which qualities are of imperative importance, and which determine, to greater ex-

tent than other factors, the outcome of efforts for milk control, whether it shall be progressive and therefore inviting confidence and public support, whether drifting or functioning aimlessly without accomplishment, or whether it shall eventually disclose a blundering or scandalous administration resulting in discredit to itself, sustained opposition from the industry, withdrawal of public support, and condemnation of public activities generally. The committee invites, rather than suggests, procedures for securing public officials who can and will carry out, or whom the people will permit to carry out, the purposes for which public funds are appropriated.

Correct conception of prevailing conditions with respect to the local milk supply and knowledge of the accepted procedures available for attempts at milk control are indispensable factors in formulating a program capable of being sustained. Theoretical innovations, while interesting for discussion and experimental research, are not advocated to replace proved procedures in framing programs which involve considerable expenditures of public funds. Undue haste should not characterize the formulation of the program. Insight and reliability are of greater importance than speed. The dairy industry, in the experience of the committee, is commonly receptive when first approached with proposals for milk reform, and only becomes resentful in the presence of vacillating and extravagant policies, and enraged by sensational and discrediting publicity having, frequently, no foundation in fact. The interests of harmony and consistent progress when the program is undertaken warrant reasonable expenditure of time in its preparation. Knowledge of local conditions usually indicates the requirements for control and the relative value and proportions of the measures to be applied.

Fraud, unless controlled, almost invariably occurs in competitive milk markets. Control of fraud, by examination of collected samples, prosecutions, and withdrawal of license

following repeated violations, is of interest to the dairy industry as well as to milk consumers. The market milk business exists because of public confidence in the food values to be obtained in milk and obviously cannot progress, nor exist on its present basis, if public suspicion becomes directed against these values.

Held, or Positive, Pasteurization, with avoidance of subsequent contamination, is the greatest single safeguard for milk supplies. In this connection, it is interesting to recall that pasteurization, and later held pasteurization, were first introduced by milk dealers as adjuvants to their business and were only generally advocated for health purposes by health authorities at a later period after they had demonstrated their economic value to the dairy industry. Held, or positive, pasteurization is taken to be a process by which every portion of the milk so treated is heated to a temperature of 142-145 degrees F., held thereat for not less than thirty nor more than forty-five minutes, and then cooled to a temperature of 50 degrees F. or lower. The degree and time of heating, holding and cooling should be invariably recorded by a tested automatic device, the records of which, having been dated daily on removal from the device, should be checked at regular intervals by the health authorities.

Prevention of subsequent contamination is taken to mean, filling the milk immediately after pasteurization and at the place thereof, in reasonably sanitary surroundings (having special reference to pure water supply, complete and safe disposal of human excreta, control of fly prevalence, and adequately sterilized utensils), by healthy and non-pathogenic germ carrying handlers, into clean and sufficiently sterilized containers, which, having been machine-capped (in the case of bottles), are stored at a temperature lower than 50 degrees F. until delivered within twenty-four hours to consumers. Repasteurization is unnecessary, objectionable, and should be prohibited; clean production, adequate cooling, and speed in transportation and handling obviate neces-

sity for repasteurization and are practicable substitutes for it.

Deviation from the processes stated above should disqualify resulting products, so far as city milk supplies are concerned, from being termed Pasteurized.

Compilations of procedures taken in cities where milk control is attempted show Dairy Farm Inspection, with some form of score card in connection therewith, to be almost invariably a part of those procedures. It is permissible to assume that this preponderance of opinion favorable to dairy farm inspection proceeds from satisfactory results following its application. Absence of dairy farm inspection indicates abandonment of supervision over methods of production. Absence of use of score card in dairy farm inspection indicates lack of system and permanence in that procedure. Some differences of opinion exist among members of the committee regarding the importance of dairy farm inspection and the value of different types of score cards. It is the opinion of all that personal contact, through dairy farm inspection, between producers and competent inspectors has been good for both, and therefore of benefit to producers, distributers and consumers alike. It is the opinion of some that dairy farm inspection, with a uniform score card, is essential to satisfactory control of city milk supplies. Between these extremes various opinions are held regarding the limits of value of dairy farm inspection and of different types of score cards. It is impracticable to determine which of these differences are fundamental and which are academic or arise from observation of the results of incompetent inspection.

A majority of the committee favor dairy farm inspection, with a score card which is uniform in the case of several cities or other agents inspecting the same sources of supply, and with other procedures taken in connection therewith.

Systematic City Milk Plant Inspection is essential in the interests of decency, efficiency in pasteurization, and of presumptive safety in raw milk supplies.

Sediment Tests, adequately interpreted, furnish a valuable method of estimating cleanliness employed in production and handling. Being simple in application and readily understandable they afford practical demonstrations of a kind well calculated to promote active cooperation on the part of producers and dealers and to produce early results in cleaner production and handling. They are particularly useful in those communities that are just beginning the regulation of their milk supplies and to those officials whose funds for milk inspection are severely limited.

Bacterial counts, conscientiously made by skilled and experienced workers, and intelligently interpreted in the light of all factors concerned, are valuable indexes regarding cleanliness of production and handling, age and cooling of milk, and efficiency of pasteurizing equipments and methods. On account of unsatisfactory standard methods, prevalence of multiplicity of methods, common and individual sources of error, and wide variations when counts are made by careless, unskilled or inexperienced workers and laboratory assistants with a modicum of knowledge of the dairy industry, the usefulness of the bacterial count as a measure of milk quality would be greatly extended by thorough and concerted study by disinterested and competent authorities to the end that satisfactory standard methods might be arrived at and that acceptable limits in variation might be better defined.

Some differences in opinion exist among members of the committee regarding the relative importance of Milk Grading in promoting accomplishment of the purposes for which milk control is attempted. It is the opinion of some that grading is a primary factor to those ends, and that food value contained as indicated by butter-fat content, cleanliness of production and handling, bacterial counts, and other

factors should be considered in measuring grades. Others believe that grading is secondary in importance to other procedures. All agree that provision of grades permits choice on the part of the consumer and that such discrimination in purchasing assists in raising the average of all milk supplies, provided a readily understood system which involves no more than three grades is operated by the public authorities. All likewise agree that the requirements for the lowest grade should be adequate to insure standard food value and to protect the public health. It is the opinion of the committee that milk grading as operated by some private and commercial agencies borders closely on if it does not intermingle with fraud. Successful grading depends on correct conception of what producers are willing to produce for an advance in price and of what consumers are willing to pay an advance in price for, as well as on a statement of what health authorities declare to be a superior or an ideal product. Laws providing for grades which fail to materialize on the market bear testimony to the fact that such grades were not conceived with understanding and that legal enactment alone is not sufficient to accomplish reform.

Revocable License System. No system of milk control can observe every day every act concerned with the milk supply of a large city. Neither does an occasional fine for violation of laws or rules accomplish the public requirement of uniformly safe, clean methods of dealing with that supply. It is apparent that milk production and handling are occupations of trust and should be controlled and protected as such. The annual, revocable license system lends itself to such a purpose, when issuance, refusal, and recall of licenses is based on the record each dairyman makes for himself; that is, his record regarding standard food content, pasteurization, scores, bacterial counts, and reports of communicable diseases, if any, occurring among his employees or producers. Needless to say, such data should be

recorded in a complete and economical way. In such records dairymen usually range themselves in three classes:

First. Those who know how to produce and handle clean safe milk, will produce and handle such a commodity, and will not produce and handle any other kind. There is danger of such dairymen being driven out of the milk business by unfair competition from the dishonest, the careless, and the ignorant whose methods the first class dairymen refuse to engage in.

Secondly. Those who do not know how to produce and handle clean, safe milk but are willing to learn to do so, and, having learned, make excellent dairymen. It is largely the development of good dairymen out of this class that makes successful milk control an evolutionary process.

Thirdly. Those who do not know how to produce and handle clean safe milk, are unable or unwilling to learn to do so, or, having learned, refuse to practice their new-found knowledge. Such dairymen, if allowed to continue in business, establish the milk supply on a low plane by unfair competition with the first two classes. Successful milk control requires the elimination of this class for the health administrator can never be certain of cooperation from them. Elimination may be best based on the records they establish for themselves. They often decline to be convinced by such records and may resort to an unscrupulous fight to retain their connection with the milk business which they regard as their vested property. Much forbearance is due dairymen during the transition period from an uncontrolled to a controlled milk supply, especially at times when they are in misery regarding high costs of feed and labor and difficulty in securing good labor at all, but the milk inspector who temporizes with the dairyman who has clearly demonstrated his unfitness for the business is merely deferring the day of reckoning and piling up the evils thereof. Such dairymen, if tolerated, infect others with their standards, establish communication with politicians, and may be successful in defeating or indefinitely postponing

adequate control of the milk supply. With a record of unfitness clearly established, the undesirable dairyman should be smitten, so far as his connection with the milk business is concerned, hip and thigh, with a full realization that a collision is inevitable and that when it comes it will be to a finish between those favoring safe milk and the class three dairymen.

The measure of control that is obtained over this third class marks the difference between actual milk control and merely paper milk control.

Enactment of law and accomplishment of the purposes for which attempts at milk control are undertaken should not be confused. Enactment of law, including adoption of rules and regulations, is only one part of the procedure for arriving at satisfactory control of milk supplies. Many laws have been barren of tangible results; fortunately so in the case of ill-conceived laws. On the other hand, through the genius of competent inspectors, much progress has been accomplished in the absence of elaborate laws, and in spite of poor ones. A well conceived and reasonably executed plan for maintenance of sufficient milk supplies, adequately safeguarded, at the lowest price consistent therewith, does not depart in great measure from the interests of all parties concerned, the producer, the dealer, and the consumer, and no great difficulty should be encountered in enlisting the support of a majority of all those parties in its favor, either in the absence of law or to secure enactment of adequate law.

Legislative enactment may be restricted to three provisions and a controlled milk supply result. The provisions referred to are the following:

First. Delegation of authority to the health administration, usually a board of health or health commission, to adopt such regulations, including definitions and standards, as it may deem necessary for preservation of food values and of the public health.

Secondly. Provision for operation, under the health administration, of the annual, revocable license system.

Thirdly. Penalty for violation of the rules and regulations and for sale of milk without a license.

The rules and regulations adopted in pursuance of the authority delegated should be composed of a rational combination of the measures previously suggested, the relative proportion of each being determined by clear insight of the requirements, possibilities, and limitations of the particular community.

Reliable Publicity which really informs is a valuable adjuvant in attempts at milk control. The value of publicity may be estimated directly by the measure of constructive activity which it stimulates, and inversely by its destructive or discrediting reaction.

Milk Economics, like all food economics, have occasioned much discussion throughout the country. Controversy has produced milk strikes and boycotts with loss of food values but without satisfactory solution of the issues in dispute. Just what, if any, attitude should be taken by the public authorities, and particularly by the health authorities, regarding milk prices has elicited much discussion during the last two years. It is contended by some that milk handling and distribution (but not production) should be taken over and operated by the government; by others that price-fixing commissions should be established and retained; while many believe that municipal ownership and operation of milk plants and delivery systems would result in waste instead of saving, and that price-fixing in any form, except in extreme emergency, is a dangerous interference with the natural laws of commerce and of supply and demand.

Whatever the final conclusion may be regarding those contentions, it is certain that, in the final analysis, economics govern all phases of the milk problem, absolutely. It is equally certain that prevention of fraud and sanitary control are logical responsibilities of health authorities. It fol-

lows that, in attempting such control, health authorities should employ such methods as will prevent fraud, insure safety, and promote cleanliness in production and handling, and, at the same time, run parallel with and not interrupt normal practices of production, handling, and distribution, to the end that sufficient supplies, without unwarranted extravagance, may be maintained.

DISCUSSION

Dr. Redfield: I am surprised that the committee suggests the use of the sediment test, which shows principally whether or not the milk is carefully strained. The farmer may produce dirty milk but strain out the dirt.

Mr. Lombard: The sediment test, used in the laboratory, will do about what Dr. Redfield has claimed. If used on the farm it will accomplish what Dr. Price has claimed.

Prof. Gamble. Won't the strainer cloth, used on the farm, give the same result?

Mr. Lombard: Not unless the farmer uses a cotton strainer.

Prof. Stocking: The test is simple enough to be used at receiving stations, and is a good check on the farmer.

Mr. Koonce: The sediment test works wonders in getting out visible dirt.

Dr. Price: The sediment test is useful or not useful according to the forces back of it. We believe enough benefit will result from the use of the test to justify it. If better straining of milk alone is accomplished, it is worth while. It provides a basis for decision of cleanliness that will at least keep the visible dirt out of milk.

Mr. Jackson: Did the committee consider licensing systems?

Dr. Price: We did not clearly define the licensing of producers and dealers. Local conditions should decide regarding licensing or permits.

"Caution is the parent of safety."

REPORT OF COMMITTEE ON DAIRY FARM INSPECTION

PROF. JAMES A. GAMBLE, *Chairman*

Inventory or stock-taking is practised by successful enterprises, in order that those interested may know the true conditions of affairs. A brief survey of the developments in dairy farm inspection during the past decade should be equally valuable to those interested in still further improving the quality of milk and milk products.

Your dairy farm inspection committee have limited this report to those evolutions which have taken place in the handling of milk on the farm. The fact that milk quality is seldom determined at this point has left your committee without much real information upon which to determine the exact extent of farm improvement in milk which has taken place during the past twenty years. The general sampling practice has usually occurred in the city at railroad stations or from delivery wagons of dealers. When samples are taken on arrival in the city, time and temperature have often changed the quality during transit. For this reason, even when improved quality is shown by city records, such improvement cannot in fairness be entirely credited to better handling on the farm during production, for milk transportation during the last twenty years has likewise become more efficient.

Your committee is cognizant of the fact that milk is a very perishable food, produced in comparatively small quantities on millions of farms under very different economic and sanitary conditions. During the infancy of the market milk business dairymen, following lines of least resistance, elected to take the smallest part possible in the transportation and sale of this product.

The distribution of milk was taken over by a second party, the milk dealer. This agency furnished the cans and did the transporting and marketing. The dealer, guided by

complaints of consumers, soon discovered that he was receiving as many grades of milk as he had dairies supplying the same. Consumers who complained received the best he had and it became the custom to supply Mrs. Brown with milk from the best dairies, while Mrs. Blank could be depended upon to accept milk of almost any character delivered to her. This was the first milk grading. Discriminating consumers, however, increased rapidly in number and the dealer was forced to visit the country, in order that he might observe the methods which resulted in good milk. The dealer perhaps was the first to carry the methods practiced by best dairymen to those producing inferior milk.

While this was taking place, cities became interested in the improvement of their milk supply from a community rather than an individual standpoint. Men known as milk inspectors were appointed and movements for the betterment of the supply, often based upon little information and experience, were undertaken. In due time the milk inspector also arrived at the country and as best he could took up educational work among dairymen.

THE CITY AND DAIRY FARM INSPECTION

In dairy farm inspection each municipality has had its own problems and made its own progress, the advances in the different jurisdictions usually depending upon the ability of the local health officer and the funds he was able to command for dairy farm inspection work. As a result the milk situation in the different cities is so diverse that even when the main facts have been gathered, these permit but the use of generalities which are only reasonably true of the cities represented.

In this Association we have what might be termed the unusually active portion of the milk supervision field. The results secured in the municipalities listed in this Association are a source of pride to all of us. This cannot be said

of the country generally, yet when we consider the little preliminary training had by many dairy inspectors when first appointed, the results secured, while not so great as possible, have been truly commendable.

Looking at the question in a broad way, however, and taking the country as a whole, it appears that dairy farm inspection is in need of greater uniformity and standardization. In the absence of a master hand to steer and a guiding force to coordinate and make most effective the efforts of each worker, each little captain has steered his course as best he knew, usually without previous training and experience. This is evidenced by the multiplicity of somewhat contradictory milk and cream regulations and requirements which prevail in the different cities and towns.

It is still true that a great deal of earnest effort is being wasted and many visits which carry no message of improvement are still being made to dairy farms. Less than half of our cities and towns have facilities for determining the bacteria count and cleanliness of the milk they receive. How can a dairy farm inspector visit farms and secure greatest results in the improvement of the quality of the product on these farms without such information? We still have dairy inspectors who rush out into the country about one day a week and say "Hello" to thirty or more dairymen. If this committee understands the function of dairy farm inspection correctly, the dairy inspector, in order to safeguard public health and secure maximum results, should be the trouble man of the industry. In a sense his duties are similar to those of the trouble man employed by the telephone company. Being a trouble man, it is essential that he have complete information on the causes and prevention of milk troubles. Knowing how quality is controlled and being furnished with accurate information relative to the bacteria count, food value, cleanliness, or fault of the product supplied by each dairy in his jurisdiction, he is in a position to go to any dairy having trouble and not

only locate, but correct the cause of the same. For the sake of best results then, he should be able to approach trouble at any dairy with as full information as possible. By confining his energy to the correction of trouble where it exists, greater good to the supply should result than when the dairy inspector's energies are dissipated in attempting to make thirty or more superficial visits in a day. Inasmuch as a trouble visit usually entails going carefully over the equipment and methods practised during production, such visits take time—lots of it—but are likely to produce permanent results.

While recognizing the splendid results that have in some instances been achieved by dairy farm inspectors, this committee wishes to point out that full results have been curtailed because full information regarding the bacteria count, food value, cleanliness, or faults in the milk from the different dairies has not been supplied the inspectors. For this reason we recommend to health officers that such information be available and furnished such men.

THE DEALER AND DAIRY FARM INSPECTION

The milk dealer, more than any other agency, has dealt in realities from the first. He is the one who has faced the quality of milk as delivered each day, and has spent a great deal of time and money in attempting to induce dairymen to do for their milk supply what they, for business reasons, should have been interested at the start in doing themselves. Being a business man, he soon organized his business so that the price he paid the producer was sufficiently low to take care of all losses. Keen competition at times also forced him to sell for less than he should in order to hold trade, and these losses he also passed on to the producer. This is now changed and the price to the producer is based upon cost of production and supply and demand.

While grading is not universal as yet, the dealer undoubtedly has hastened the day when Farmer A, producing a

better grade of milk than Farmer B, will receive a better price. Instances too numerous to mention of premiums paid by dealers for milk of low temperature, low bacterial count, high food value and freedom from visible dirt when delivered might be cited in support of this statement. It is also true that much milk spoilage during the summer and fall has been prevented by the timely visits of the dealers' representatives to dairy farms. As an agency for passing on information of value to dairymen, he has done splendid service.

After summing up what has been attempted in bettering the present system of milk buying from the producer one dealer has said: "It is obviously unfair for the farmer who makes no attempt to produce clean milk to be paid the same price as one who is extremely careful in all his operations."

THE DAIRY PRESS AND MILK IMPROVEMENT

In discussing dairy farm inspection we should not lose sight of the part played during the past twenty years by that great educator, the dairy press. The service of some publications for the betterment of conditions can hardly be overestimated and certainly merits the highest commendation of this Association. The dairy press has many times stood between the dairy industry and impracticable schemes for dairy improvement. This agency has been of splendid service in passing on to dairymen the true factors controlling quality and quantity in milk as these were discovered by national and other authorities.

THE U. S. DAIRY DIVISION AND DAIRY FARM INSPECTION

The Market Milk Section of the United States Department of Agriculture was established about thirteen years ago to carry on investigations and educational work in dairy sanitation. This splendid work has gone forward con-

tinuously since that time, the major factors which control quality in milk have been ascertained, and methods worked out by which good milk of low bacterial content can be produced at our present dairies with minimum effort. As is well known to milk officials everywhere, the division maintains a force of men for the purpose of assisting milk officials to put into practice the truths discovered. This work is carried on in cooperation with State and city health departments. The Dairy Division teaches milk authorities how to safeguard milk supplies and to organize systems of local control which will be effective and continuous.

The efforts of this national body have always been a progressive and sustaining influence for the improvement of the milk supplies of the cities and towns of this country and until the organization of this Association was perhaps the only source to which dairy inspectors could turn for inspiration with confidence.

THE DAIRY INSPECTOR'S RELATION TO THE PROBLEM AND HIS QUALIFICATIONS

It has been said that the dairy inspector is a public servant paid out of public funds to perform certain duties. Among these is seeing to it that the milk product sold in his jurisdiction becomes increasingly more wholesome. He is, by law, invested with great power over the producers of milk. Much depends upon his training and experience. His major duty is the protection of the public health. In order to secure best results, however, he should be cognizant of dairy industry problems and be as helpful to producers, dealers and consumers as is possible. Only a man with such qualifications can bring about the best results quickly and with the minimum of effort.

This committee believes that a dairy farm inspector, in order to be most efficient, should have, among other qualifications, the following training and experience:

1. A thorough and practical knowledge of milk production and handling.

2. A thorough scientific and practical knowledge of dairy cattle, feeding, breeding and management.

3. Thorough training in dairy and pathogenic bacteriology.

4. A thorough knowledge of the factors which control quality, quantity and healthfulness of milk.

5. A knowledge of dairy chemistry.

6. An abundance of tact and courage.

While many capable men with but little previous experience are doing good work in many communities as dairy farm inspectors, it must be said that everything else being equal, trained men offer greater promise of service. In the opinion of this committee, graduates of State agricultural colleges should possess the training best calculated to produce the most efficient inspectors. As has been said, such a man is not a bacteriologist, chemist, veterinarian, medical man, dairyman or farmer, but one especially trained for a place which is responsible and essential in nearly every community. Clean milk may be produced with but little additional effort and this committee believes it to be the duty of the dairy inspector to show his producers how this can be done.

Permanent results is what we are after, and inasmuch as the production of clean milk is largely controlled by the attitude of the milker and other men handling the milk, successful milk inspection becomes largely a question of interesting the men to prevent inoculation with and multiplication of bacteria. Reforms should not be carried beyond the point where they will yield no adequate results. The economics of milk production and distribution must be considered if an adequate supply is to be forthcoming. Dairy farm inspection is no longer an experiment, it has demonstrated its ability to render service and will prevail, but according to latest figures, over one-half our dairy inspec-

tors have had no special training for dairy farm inspection. This committee believes that what the situation is calling for is not more systems of control, for we now have more than can be put into operation for many years to come; not more milk and cream regulations—we have more laws already on our statute books than are enforced; not new dairy farm score cards; but more work like that carried on by the Market Milk Section of the U. S. Dairy Division, the Public Health Service, this Association and other helpful agencies, and more and better trained dairy farm inspectors.

"Better a mistake avoided than two corrected."

REPORT OF COMMITTEE ON METHODS OF BACTERIAL ANALYSES OF MILK AND MILK PRODUCTS

DR. GEORGE E. BOLLING, *Chairman*

At the risk of being accused of continually "harping on one string" this committee still believes that the suggestions advanced the last few years are the most important to harp upon; therefore, with a few variations, the tune will be familiar to you.

As is well known, many laboratorians making official milk counts have refused to change from the older meat infusion to the now standard meat extract media. In effect, we were asked to change to a medium that would give approximately 50 per cent of the count obtainable with the previous medium, and use these counts as a basis for enforcing bacterial limit regulations of say 500,000 to the cubic centimeter.

The immediate result of this would be to admit to the market much milk previously excluded. Milk counting 800,000 on the older media now counts but 400,000 by the A. P. H. A. standard. If we are to accept this medium that we know gives but half the counts formerly obtained, why is it not equally fair to revise the bacterial limit regulation and set it at 250,000 in place of 500,000?

While admitting the greater convenience of using meat extract, the results or lack of results obtained from its use is causing it to be second choice in many quarters. In army laboratory work technicians will go to much trouble to secure fresh meat for making infusion media even though the canned extract is convenient to their elbows. About a month ago the U. S. Public Health Service requested that the use of meat extract for media be discontinued owing to such use having proved unsatisfactory and that meat infusion be substituted. Having previously advised that beef extract be employed "in exact accordance with the standard methods adopted by the A. P. H. A.," to quote their exact

wording, this change is significant. There is a strong feeling among milk bacteriologists that the older media came nearer to telling the truth about the milk under examination and until a medium was developed that came nearer to growing all bacteria in market milk—that is even nearer the truth—any change was inadvisable.

As was stated in the report of this committee last year, it is believed that the committee of the A. P. H. A. that formulated the present standard methods for bacterial milk analysis are not truly representative of the milk bacteriologists of the country. It has been suggested that our Association communicate with such bodies as the U. S. Dept. of Agriculture, the U. S. Public Health Service and the A. P. H. A. and endeavor to have representatives from each appointed to form a general committee to fix on methods of bacterial milk analysis that would be truly "standard."

It has been suggested also that such a committee might state requirements to be met by all making official milk counts. By eliminating careless, unskillful and inexperienced workers and establishing an accepted standard method, bacterial milk analysis would be placed upon a firmer foundation and protected against attacks to which it is now subjected.

DISCUSSION

Dr. Harry W. Redfield introduced the following resolution for the consideration of the members, and suggested that definite action be taken regarding the resolution at the business session:

"*Resolved,* That the president of the International Association of Dairy and Milk Inspectors appoint a committee to cooperate with the Committee on Standard Methods of Milk Analysis of the Laboratory Section of the American Public Health Association, the Public Health Service of the U. S. Treasury Department, the Dairy Division of the

Bureau of Animal Industry of the U. S. Department of Agriculture, and the Microbiological Laboratory of the Bureau of Chemistry of the U. S. Department of Agriculture, for the purpose of developing a standard method for the bacteriological examination of milk which will give reliable and satisfactory results, and to formulate methods for eliminating the personal element leading to grave errors by a system of licensing or by some other means."

Dr. Charles Thom: The standard method is an arbitrarily devised tool for enabling laboratorians to work with and get comparable results, rather than to determine the exact number of bacteria.

Dr. Price: I am familiar with the varied results given by laboratory workers with milk. I have been assisted by the counts reported by laboratory workers, and I have been able to do better work by disregarding the counts of other laboratory workers. Identical samples of milk were submitted by me to two laboratory workers, one of whom reported a count of 30,000 bacteria per c. c., the other a count of 1,800,000 bacteria per c. c. Identical samples of milk were submitted to two laboratory workers, one of whom reported 1 per cent fat, the other 3.8 per cent fat. Sixteen samples of milk submitted at another laboratory gave uniform results that could only result from careful work. Let us get some action, if possible, looking to uniform laboratory methods and greater accuracy in results. The reliability of laboratory workers is a matter that must not be overlooked.

Dr. Bolling: Possibly we should have a licensing system for workers in official bacteriology.

Mr. Kilbourne: Three samples of milk were submitted to three laboratories. The results varied from 250,000 bacteria per c. c. to 29,000,000 bacteria per c. c. Four laboratory workers in the same room, each using their own media but the same incubator, reported very uniform results.

Prof. Stocking: If we are to make use of bacterial

counts, those who do so must have confidence in their accuracy if others are to have similar confidence. Results of work at Geneva in cooperative work in milk bacteriology were sufficiently accurate for inspection purposes. Much depends on the care taken by the individual laboratory worker. If proper care is observed by the individual laboratory workers, the plate count will be found to be very nearly right.

"Leave what you've done for what you have to do."

THE MILK SITUATION IN PHILADELPHIA

PROF. CLARENCE B. LANE,

In Charge Scientific Department, Supplee-Wills-Jones Milk Company, Philadelphia, Pa.

The business of supplying clean, safe milk to a city like Philadelphia, whose population reaches close to the two million mark, is of some magnitude. With varied nationalities and a large percentage of the laboring class, the problem becomes more complex. The daily consumption of milk in this city amounts to 600,000 quarts, or about two-thirds of a pint per capita.

BOARD OF HEALTH INSPECTION

The Board of Health in Philadelphia is not very well eqipped to do effective inspection work. The annual budget for milk inspection this year was $21,000, or about one cent per capita for the city's population. No attempt is made to do any inspection work in the country. There are 15 milk inspectors in the city and one chief. They have the use of one automobile and employ one stenographer. There is one chemist and one bacteriologist for the entire Board of Health and Charities, including the milk work. About 3,000 chemical and bacteriological examinations are made annually. Samples are collected at receiving platforms, groceries, restaurants, pasteurizing plants and retail wagons. Tests for gravity, temperatures and preservatives are made on the street. We have a few good regulations, which are enforced. It is required that milk be received in the city at a temperature not above 60 degrees, that all milk be pasteurized except certified milk, and that all milk be retailed in bottles. I might add that the certified milk delivered in Philadelphia is of very high quality. The chief milk inspector advised me that the average bacteria count in this milk is below 5,000 to the cubic centimeter.

Philadelphia has the distinction of selling milk to the public at a lower price (14 cents per quart) than any of the ten largest cities in the United States. Further, the milk dealers in Philadelphia sell milk on a smaller spread than dealers of the ten largest cities. This is made possible for several reasons, one of the principal ones being that 95 per cent of the milk is delivered from retail wagons, bottled, direct to the consumer, which makes the milk cost less to distribute than in other cities. For example, in New York City only 35 per cent of the milk goes out on retail wagons and 65 per cent goes through grocery stores, restaurants and other channels. This matter of delivering a large percentage of the milk from retail wagons is a very important one. In Pittsburg they have reduced the distributing cost one-half cent per quart, despite the fact that the distributer has had very rapidly rising material and labor costs. The reason is clear. In past years when dealers had a wider spread, half their milk went through grocery stores and they often lost money or at least made little profit on the milk that went through that particular channel. By putting all the milk on the retail wagon it was distributed economically as the consumer wanted it, and the unit cost of delivering milk was therefore lowered. I could name several cities where the actual cost of delivering milk is lower in spite of increased labor and material costs, just because of increased volume through the retail channel.

Again, the low cost of handling milk in Philadelphia is due in part to the large loads handled on the delivery wagons, which at the present time average about 425 quarts. Shortening the haul and increasing the load very materially decreases the cost of distribution. It has been suggested that we should do away with all duplication of service on the streets and have but one wagon on each street delivering milk. In one city in Pennsylvania Dr. Clyde L. King, the milk arbitrator for the State, got the dealers to agree to have no duplication of routes. All the ills that the con-

sumer feared did not materialize. The dealers took off one cent a quart from their spread (difference between the price paid the producer and price charged the consumer). They made more money on a 4-cent spread without duplicating routes and service than they had made on a 5-cent spread when duplicating routes and service. Now it does not follow that in every city a cent a quart can be saved by doing away with useless duplications. This depends upon the extent of the duplications, the length of the haul the driver has to make, the wages paid, whether the retail loads are heavy and other factors of that kind. Usually the saving will run from one-half cent to one cent per quart.

Another reason for the low cost of delivery in Philadelphia is the combinations which several of the milk dealers have entered into, making several large companies. There are about 235 milk distributers in the city, but 90 per cent of the milk is distributed by five firms.

Among the other factors that have tended to reduce the cost of milk in Philadelphia may be mentioned the small number of apartment houses as compared with private houses, and cooperation between the board of health, producers and consumers.

CASH AND CARRY PLAN

During the war, when the prices of all foods were increasing, there was a demand in several cities for what is known as the cash-and-carry plan for distributing milk. The idea of this plan was that the consumer could carry his milk and save a cent or two a quart and in that way avoid paying a higher price for milk. This plan, however, rarely proved successful. The consumer did not go regularly for the milk; either the maid was out, if there was a maid, or the children were not home from school, or the housewife did not want to make a special trip to the grocer's, and the result was irregularity in the consumption.

In the cash-and-carry plan the grocer also had to count upon a certain loss because the consumption one day was not exactly the same as another. Thus some of the milk turned sour or could not be sold at all, and altogether the actual cost of handling the milk was greater and few if any people profited.

HOW DOES A LOW PRICE TO THE CONSUMER AFFECT THE FARMER?

Milk on the basis of its food value is worth more than the price commonly paid for it by the consumer, which ranges from 13 to 18 cents. Many farmers feel that if milk is worth, say, 20 cents per quart, the consumer should pay 20 cents. The fact, is however, that the sale of milk is going to depend on keeping the margin as wide as possible between the food value of solid foods and the food value of milk, and the wider the margin the greater will be the sale of milk. The margin can be widened by lowering the distribution costs and distribution costs can be lowered in no other way so much as by increasing volume on the retail wagon. The share that the farmer gets for his milk out of the price to the consumer will to that extent be larger. To illustrate: In the good old days of 8-cent milk to the consumer in Philadelphia, the farmer the year round got about 4 cents a quart, the distributer's costs, including profits, were 4 cents a quart, and the consumer paid 8. In the present month the spread in the city of Philadelphia is 5 cents per quart. The price to the farmer is 9 cents. In other words the farmer is getting 125 per cent more than he had been getting formerly. The distributer is getting a spread of 5 cents instead of 4, or 25 per cent more than he was receiving before. Now it would be hard to find any large business of any kind anywhere that is doing business today at an increase of 25 per cent over the pre-war period. Increasing the volume on the retail wagon and in the plant has brought economies and these economies have been suf-

ficient to offset the rising labor and material costs. Due to this fact the farmer is able to get prices for his milk that are entirely satisfactory to the consumer and at the same time is making a wider and better market for his milk. This is bound to give the producer relatively higher prices in the future.

UNTRUTHFUL CRITICISM DAMAGING TO THE MILK BUSINESS

There is nothing so harmful to both the farmer's and distributer's interest as unfair and untruthful criticism. If the farmer has the feeling that the distributer is getting too much money or vice versa, and these matters are discussed in public without having the actual facts, the consumer thinks there is something wrong and he begins to boycott the very food they both have to sell. The result is lower sales and less profit for both. In Philadelphia, I think we have had only two or three open letters in the papers during the past twelve months, complaining about the price of milk. The reason lies not wholly in the price of milk, but also in the way the matter has been presented to the consumer and the consumer's understanding of the problem. To illustrate how some of this education has been accomplished, let me quote the following from the Annual Report of F. P. Willets, President of the Interstate Milk Producers' Association. Mr. Willets said: "They had looked into the costs of distributing milk in Philadelphia and other Pennsylvania cities, had found them fair, and as a matter of fact had found the distributing cost in the city of Philadelphia to be lower than in any other large city in the United States." Instead of adding to a baseless discontent among producers and consumers, Mr. Willets took the position that facts were facts and that they should be stated as such by him as well as by everybody else.

All fair statements of this kind aid in the sale of milk and benefit both producer and distributer. In those cities where there has been little criticism, as in Philadelphia and

Pittsburgh, there is more milk being produced by far this autumn than in previous years. It is also true that the per capita consumption is greater now than before the war. That is, Philadelphia is consuming more milk per capita at 14 cents a quart than it did when the price was 8 cents per quart. Now that means the farmers' organizations selling in Philadelphia have an expanding market in which to sell their product for years to come. They do not have to wait for a rapid fall in price to the consumer to get the assurance that their market will be stabilized and increased.

STABLE PRICE TO THE CONSUMER THE YEAR ROUND BENEFICIAL

A reasonable price stabilization to the consumer means larger sales and a larger net profit to producer and distributer and greater satisfaction to the consumer. I am not saying that it is possible at the present time to sell milk to the consumer for the same price in winter as in summer, although this is a future possibility owing to the new plan for paying for surplus milk in the summer season. The retail price of milk to the consumers in Philadelphia has only changed twice this year. The price for five months was 13 cents per quart and for seven months 14 cents. The consumer can understand a two or three cent increase from summer to winter in the price of milk, but when the increase amounts to four cents or more they think there is something wrong. It is not a question of fact as to the food value of milk; it is just a question of belief on the part of the consumer. In New York City the price of bulk milk to the consumer in the summer of 1917 was seven cents a quart. That winter it increased to 14 cents, an advance of seven cents per quart.

Now regardless of how well a consumer can afford to buy milk she is going to kick when she has to pay a seven-cent increase in a commodity like milk, where the welfare of the babies may depend upon the price. By keeping the in-

crease from summer to winter down to two or three cents, the children are protected, the consumer is satisfied, and the per capita consumption remains high, to the interest of the producer.

COOPERATION MEANS GOOD BUSINESS FOR THE FARMER AND CHEAPER MILK FOR THE CONSUMER

The time has come when boards of health should not look upon farmers and milk distributers as evaders of the law. The presumption should be in favor of their honesty and good faith. Much better and more efficient control could be gained by the boards in adopting this attitude and working with them and extending every aid in their power in a cooperative way, to the end that the public in general shall have a safer and better quality of milk.

Producers and dealers should get together and discuss the milk problem from the viewpoint of justice to both factors and at the same time give a high quality product and good service to the public. The consumer should not lose sight of the fact that milk has been shown to be one of the most perfect, most economical and most healthful foods, and for this reason it should be used liberally in every household.

DISCUSSION

Dr. Thom: What is the average distance from the city that milk is hauled?

Prof. Lane: About 50 miles.

Mr. Freeman: How is the milk graded?

Prof. Lane: We have three grades: A, B, and certified. "A" is selected milk containing about 4½ per cent fat. Grade B contains about 3.8 per cent fat. Grade A Pasteurized sells for 16 cents per quart. Grade B Pasteurized sells for 14 cents per quart. The bacterial count is not used in the grading of milk. There is no ordinance providing

for grading, and all grading is done by the dealers. Grade A milk represents about 15 per cent of the entire volume, Grade B about 85 per cent. The amount of certified milk used is of course very limited. One company furnishes about 50 per cent of the milk used in the city. During the war a voluntary movement on the part of the dealers resulted in greater consolidation of the milk business in the city.

Mr. Purcell: Has your spread of 20 cents per gallon been constant, or has there been an increase?

Prof. Lane: Previous to the war the spread was 16 cents per gallon. Later it was 18 cents per gallon. It is now 20 cents per gallon. Our delivery wagons average 425 quarts to the wagon.

"He will always be a slave
Who knows not how to earn and save."

MILK INSPECTION ASSOCIATION OF THE ORANGES, N. J.

WM. B. PALMER, *Milk Inspector of the Oranges,*
Orange, N. J.

In 1914 a survey of the milk supplies of the Oranges (Orange, East Orange, West Orange, South Orange Village and South Orange Township, total population about 130,000) was made by the Civic Committee of the Women's Club of the Oranges.

A joint meeting of the Boards of Health of the five Oranges was then held and a report of the work submitted. The result was the organization of the Milk Inspection Association of the Oranges. Since July 1, 1914, the entire supervision of the milk supplies has been under the control of this association, which is composed of two members and the Health Officer of each of the Boards of Health acting as a single body, instead of each of the five cities duplicating the work done by the others. Something of the extent of the problem, with its wasteful overlapping and duplication of municipal control under the old system, can easily be realized, when practically all of the dealers sold in two or more of the cities. Dairy inspection offered a large and complicated problem as the large dealers—consequently those having the largest number of dairies—delivered in the smaller as well as the larger of the Oranges. At the time joint control was put in effect about 750 dairies supplied the Oranges, 700 of which produced for three and 350 of them produced for all the Oranges. If the work was carried out this meant that 700 dairies were inspected by three different inspectors giving presumably three different sets of instructions and 350 were thus harangued by five different men.

The cost of the work is apportioned among the five cities on a per capita basis. The present budget of the association is about one-tenth of the total public health appropriations for all the Oranges. An inspector and analyst is em-

ployed, who is the executive officer of the association, and a central office and laboratory is maintained at Orange. By this method full time supervision is given the milk supplies. The plan has resulted in approximately the following savings: Salaries, 66 2/3 per cent; milk samples, 50 per cent; field inspections, 66 2/3 per cent; equipment, etc., 66 2/3 per cent.

Immediately after its organization the association drafted a uniform ordinance which was adopted by the Boards of Health, and which permitted only certified milk, milk from tuberculin tested cattle and pasteurized milk, and also graded the product based on bacterial content and dairy score. Until recently this regulation had been in effect. The association recently recommended to the Boards of Health the adoption of an ordinance permitting only certified and pasteurized milk. To date three of the municipalities have passed this regulation and it has been in force in East Orange since May 1, 1918, in West Orange since June, 1919, and becomes operative in South Orange Township on January 1, 1920. South Orange Village has passed the ordinance on first and second reading and it will be adopted and in operation at an early date. Orange is about to follow the same procedure. At present about 80 per cent of the milk sold in the Oranges is pasteurized.

Based on this same principle of cooperation and consolidation, a plan was perfected by the inspector of the association which resulted in the incorporation of seven of the local dealers, who erected and put in operation a central pasteurizing plant. In addition five other dealers are supplied by this plant, making a total of twelve receiving milk from the one station. This has facilitated more efficient supervision because of the common source of supply and the elimination of small milk plants. Formerly these men purchased and bottled their own supplies. In 1914 fifty-five dealers were licensed, while at present there are

but twenty-two, many having been forced out of business because of poor supplies and failure to improve.

In addition to its regular work the association has contracted with two other municipalities for the supervision of their milk supplies.

A monthly report is submitted by the inspector to each of the Boards of Health and an annual report is printed for general distribution.

In conclusion it can be said that the advantages of consolidation and centralization are of great value and an attempt to apply to public health the principle of concentrated efficiency.

"Go deep enough and you will find in every one some spring of knowledge."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

GEORGE B. TAYLOR, *Chairman*

It would be a waste of time simply to discuss the above subject as the members of this Association realize already the food value of milk and its products. It was decided, therefore, to consider this subject along the following lines:

1. What is being done to bring before the consumer the importance of milk as a food?
2. How can we best accomplish our purpose in regard to this?

To obtain opinions and find out the work being done along the above lines, letters were written to the heads of dairy departments in the various State agricultural colleges. Replies were received from 26 States. For convenience these States replying were divided into ten sectional groups, as follows:

1. New England—
   Connecticut, Massachusetts, New Hampshire.
2. Middle Atlantic—
   Maryland, New York, Pennsylvania, West Virginia.
3. South Atlantic—
   Georgia.
4. Gulf—
   Florida.
5. North Central, East—
   Illinois, Michigan, Ohio.
6. South Central, East—
   Kentucky, Tennessee.
7. North Central, West—
   Iowa, Kansas, Minnesota, Nebraska.
8. South Central, West—
   Arkansas.

9. Rocky Mountain—
   Idaho, Montana, Nevada, Utah.
10. Pacific—
   California, Oregon, Washington.

A glance at this grouping shows that every section of the country was included in the replies. It is believed, therefore, that the endeavors and plans given herein represent what has been and is being done to bring before the consumer the value of milk and its products as food.

SUMMARY

1. What is being done to bring before the consumer the importance of milk as a food?

Not many States seem to be doing intensive or independent work. A few, however, are carrying on this work with good effect. For example, Massachusetts has planned and is carrying out a continuous campaign. The expenses incident to this are raised among producers and dealers by taxing each three-fourths of a cent per hundred pounds of milk. The majority of States are using the extension and home economics service for this campaign. In some States milk shows, lectures and demonstrations have been put on. In others, they have seemed content to distribute leaflets, cards, posters, and to carry publicity matter in newspapers. In several States there have been organized State dairy councils and information has been distributed through them.

Georgia gave 70 home economics students a nine weeks' course to fit them to demonstrate the value of milk and its products. Pennsylvania and Michigan have also made good use of extension workers.

2. Suggestions for continuance of campaigns made by heads of dairy departments.

McCollum's work seems to be the foundation upon which much publicity is based. The agencies recommended to

handle the publicity are various. Three are especially considered—the State dairy councils, the State dairy departments through their extension and home economics workers, and cooperative organizations of producers and dealers. These agencies are to conduct advertising and demonstration campaigns. Advertising should be done systematically by means of leaflets, posters, billboards and through newspapers and magazines. Demonstrations should be given in different communities by extension and home demonstration workers. Exhibits are also recommended. One special point brought out is the necessity of putting out milk and its products in such a way as to appeal to the taste. Another feature recommended to increase consumption of milk is compulsory pasteurization and the printing of the percentage of fat on the bottle cap.

3. Financing campaigns.

Although this feature is of the greatest importance very little consideration has been given to it in the letters from the heads of dairy departments. As stated above, Massachusetts collects three-fourths of a cent per hundred pounds of milk from both producers and dealers. It has been suggested that one dollar per cow per year be assessed upon producers. This, however, would put most of the burden on the producers.

The above summary is gathered from replies received from heads of dairy departments during June and July, 1919. Since that time several campaigns, especially in some of the larger cities, have been held by State or local agencies in connection with extension workers of the Dairy Division, U. S. Department of Agriculture. The objects of these campaigns as given in the report of the extension section of the Dairy Division were as follows:

"To stimulate through educational work with women the production and consumption of milk and milk products for human food, in order to

1. Eliminate waste in the dairy industry by more complete and varied utilization of dairy products.
2. Improve the family health.
3. Encourage the dairy industry."

City campaigns have been conducted in the following States: New Jersey, Connecticut, Rhode Island, Massachusetts, Michigan, Iowa, Kansas and Utah. In each case preliminary conferences were held with extension directors, local authorities, representatives of producers and dealers and farm bureaus. Although milk dealers and producers furnished the bulk of the funds, the work was purely impersonal. Usually a publicity agent was appointed to prepare newspaper and other articles during the campaign. Lectures were given by health officials, physicians, home demonstration agents and dairy specialists to women's clubs, factory and store workers, school children and the public generally. Moving picture houses threw upon the screens facts relating to milk and its products. Show windows in stores were used to show interesting features relating to milk, and in many places milk feeding experiments with children were started.

In every instance milk dealers in the cities where campaigns were conducted reported increased sales of milk ranging from 6 to 15 per cent. These are only the beginning of a series of campaigns conducted by National and State agencies working in cooperation to teach the lessons of the importance of milk and its products as food.

RECOMMENDATIONS

The attitude of the whole people toward milk must be changed. The prominence given its worst features so long emphasized by health officials, sanitarians and even dairymen themselves must give way to the highly important fact that as a food milk is absolutely in a class by itself. The work of McCollum and others must be told in a popular interesting way. Articles telling of the value of milk and

its products as food must be run continually in newspapers and magazines so that these facts can be gradually impressed on the public. Such articles should be accompanied by cuts likely to appeal to consumers. These features are quiet, unobtrusive, continuous and impressive, and results will be lasting.

These facts must also be brought to children in the public schools not only in lessons but by school lunches featuring milk products.

Milk shows and exhibits have an important place in this program. These can be featured especially in cities by local organizations assisted by State and National dairy extension and home economics workers. These drives should be short, intensive and impersonal. They should cost little to put on and funds necessary should, if possible, not be furnished by interested business. The drive must, therefore, not feature producers or dealers of milk.

At the same time, there must be no let-down to campaigns for safe, clean, pure milk and it is suggested that milk campaigns should not be put on in cities which can not furnish a wholesome milk supply.

The program outlined above, if properly carried out, should result in an increased milk supply, increased consumption, and finally in the improvement in the physical condition and health of the whole nation.

ABSTRACTS OF REPLIES RECEIVED FROM HEADS OF DAIRY DEPARTMENTS IN STATE COLLEGES

Connecticut—White.

Extensive campaign on food value of milk to bring this to attention of consumers through extension service and county farm bureaus, assisted by U. S. Department of Agriculture.

Massachusetts—James.

With the realization that consumers did not know as much about the food value of milk as was generally supposed and

its relatively low cost, those interested in the dairy industry felt the necessity of fuller cooperation, which hitherto had been a great handicap, and a well organized campaign to correctly inform consumers as to the value of milk was launched.

Formerly publicity in relation to milk dwelt chiefly with its bacterial and dirt content and its disease potentialities, and the fact was neglected that there is more starvation, suffering and disease due to insufficient use of milk than is caused by germs or dirt which it may carry. This caused a negative result. Financial difficulties were also encountered.

The greatest impetus to the extensive campaign to show the food value of milk was given by the discoveries by Doctor McCollum. These, together with other facts, not the least of which was the cheapness of milk as compared to other animal foods, were made the basis of appeal to the people. The patriotic appeals to save meat were generally considered and this was also a factor. Massachusetts is probably the first State to organize an intensive milk campaign on a long-time basis. Producers and dealers each give three-fourths cents per hundred pounds of milk sold and this gives necessary funds. The State college, the State and United States Departments of Agriculture, dairy interests, and civil organizations all cooperate in this work. Five or six well-trained lecturers are employed for the year. Advertisements are carried in daily newspapers and street cars.

In every case where milk campaigns have been put on for a week or longer, results have been greater than were anticipated and fairly permanent.

New Hampshire—Fuller.

State dairymen's association provided series of six circulars distributed by milkmen to nearly 22,000 homes, but lack of funds made the effect more or less temporary. It is difficult to get producers to see the value of contributing money to advertise dairy products. A contribution of one

dollar per cow per year is recommended. This would give $90,000 for this work.

Maryland—Gamble.

Consumers purchase primarily not so much for food value as for satisfaction of appetites. More can be done by popularizing more palatable milk drinks than by advertising food value. Teaching the value of milk as a food could be done in our schools.

New York—Stocking.

Milk show in New York City was held for special purpose of encouraging consumption of dairy products. Department of Home Economics is doing considerable work along this line.

Pennsylvania—Borland.

There has been a continuous campaign to thoroughly impress the consumer with the importance of milk as a food as well as its economy when compared with other animal products. Demonstrations have been held by home economics extension workers, of whom there are about 30, setting forth facts as shown by Dr. McCollum's investigation that milk is essential to growth and well being of the young.

West Virginia—Anthony.

A large number of people fail to realize the comparative value of milk. Much good may be accomplished by the adoption of a broad practice of constant advertising for the wider use of milk as a food.

Georgia—Jarnagin.

Seventy home economics students have been trained especially to familarize the public with the care, use and value of dairy products. Posters showing importance of these products were placed in school houses, banks, and other public places.

Florida—Willoughby.

Efforts are being made to stimulate both the idea of more milk and better milk by bringing attention to the value of dairy products through local boards of health; city milk control officials are asked to attend the university for special courses of training along dairy and milk inspection lines. Later practical inspection and laboratory control work will be given by State Board of Health.

Illinois—Harding.

The food value of milk and its products can be impressed upon the consumer partly through education. As a help in this direction this department has published a circular along these lines. Something can be done toward bringing home the variations in food value of different samples by stimulating the presence on the cap of each bottle of a statement regarding its fat content. An inhibiting influence which largely nullifies information regarding food values is the feeling of the people that milk is not safe with regard to disease organisms. It is believed that if a condition could be brought about where all milk would be properly pasteurized and made safe, the consumption of milk would be doubled.

Michigan—Anderson.

The food value of milk and milk products has been brought to the attention of the consuming public more during the past two years than at any equal period in the history of the dairy industry. It is quite probable that the food value of dairy products will be advertised more widely in the next few years than it has been at any time in the past. The distributers of milk in the cities are emphasizing the importance of the food value of milk in all their advertisements. In some sections cooperative campaigns between producers' and distributers' associations are being carried on with the associations sharing the expense of advertising campaigns jointly. In most of these advertisements the edu-

cational side has been featured. Very liberal use has been made of the epoch-making contributions of Doctor McCollum, his fellow-workers, and his contemporaries. The extension representatives of the Department of Agriculture and the agricultural colleges have sent their aid. Especially noteworthy work has been performed by home economics demonstrators and visiting nurses.

Ohio—Erf.

There are several ways in which the food value of milk and milk products can be brought before the public. It is believed that the most effective method is a paid advertisement in good newspapers and magazines. Billboard advertising is effective in some places. Advertising should be done through State departments or organizations rather than by individuals. It may also be done through the picture shows; and literature sent out by the United States Department of Agriculture and State agricultural departments plays a large part in advertising dairy products.

Kentucky—Hooper.

The best work done to educate the consumer in regard to the food value of milk has been carried on by the dairy councils in various parts of America. Out in Iowa they took whole pages of the local newspapers. The work of the National Dairy Council in placing advertisements in the Saturday Evening Post was splendid and did a lot of good. In Kentucky articles have been run in the various papers throughout the State and instruction has been given to our agricultural students in regard to the value of milk as a food.

Tennessee—Wylie.

One local exhibit to show comparative food value of milk.

Iowa—McCandlish.

Various agricultural institutions are doing a great deal in educating the public as to the true value of dairy products.

However, this work could very well be extended and activities should be conducted not only by the extension departments of agricultural institutions but also by cooperative work among the breed associations and various dairy organizations and journals. In extension work much good can be done through the medium of home demonstration agents in the various counties because they really have the opportunity for demonstrating the value of milk and its products and their activities along this line should be encouraged.

Kansas—Fitch.

The work of scientists in discovering the importance of vitamines in the diet has led to a greater appreciation of the value of milk and its products for adults and their absolute necessity for growing children. A dairy demonstration agent of the U. S. Department of Agriculture in cooperation with the Kansas Agricultural College has been doing considerable "dairy products consumption" promoting. Kansas has recently organized a State dairy council. Perhaps the best way to bring a greater knowledge of the value of milk before the consumer would be to gain the sympathy and cooperation of the newspapers. At the present time most of them are more willing to knock the dairy industry than to boost it—probably because the substitute manufacturers are such extensive advertisers. It would seem that constant but judicious advertising would sell a food like milk which has innumerable talking points in its favor. When the dairy industry convinces the newspaper men, it will have gone a long way towards convincing the general public.

Minnesota—Washburn.

The food value of milk and milk products constitutes one of the most fascinating fields for investigation and study of the present period, because of the far-reaching effect on human beings other than mere quantitative nourishment.

The present knowledge is sufficient to warrant thorough, systematic education of the people regarding the peculiar nutritive properties and general inexpensiveness of dairy foods. Instruction should proceed first to and through domestic science teachers, settlement workers, nurses, hospitals and homes for children and medical fraternity in general—pediatrists in particular; thence to mothers' clubs, and through the mothers' magazines in general to the public most vitally interested.

Nebraska—Frandsen.

This State has recognized the necessity of doing something to call attention to the food value of dairy products and as a result has distributed two different cards showing the comparative value of a quart of milk with eleven other foodstuffs, each one represented in its natural color.

Arkansas—Dvorachek.

People have not in the past given much thought to the food value of dairy products, but now that the discovery has been made that milk or butterfat contains the protective properties that it does, every one should be interested and dairy products should come into more general use. Prohibition is going to bring about a demand for some form of beverage and there is no reason why milk and milk products should not come in for their share of patronage.

Idaho—Davis.

A concentrated campaign of advertising placed before the consuming public will do much to increase the consumption of milk and dairy products. The increase in domestic consumption is a situation much to be desired, because the permanence of much of our present export trade is rather doubtful. As soon as conditions become at all normal, much of our export condensed milk trade is likely to be lost, due to competition from Switzerland and other European countries. We will have great difficulty in competing with such

countries as Australia, New Zealand, Siberia, Denmark and Holland for any export butter trade. Therefore, unless we can stimulate domestic consumption, we are likely to be confronted with a surplus.

Much of the advertising and publicity given to dairy products has been rather too technical. Emphasis has been laid upon the great food value of milk, and comparisons have been made of its protein, carbohydrates, fat, etc., with other well-known foods. Campaigns of this sort have undoubtedly done much good, but it is believed that the time is ripe for a campaign in which the attractiveness of milk and its products is portrayed. If it were possible through such an organization as the National Dairy Council to arrange for a campaign of national advertising, using some of the better-known periodicals, newspapers, etc., and obtaining the cooperation of all the dairy interests, a great deal could be accomplished.

Let us urge people to use dairy products because they are attractive and because they are good foods, emphasizing the necessity of vitamines in the human diet.

Montana—Martin.

The work of Doctor McCollum is the foundation for publicity regarding the food value of milk and that can best be brought to the attention of the public through the work of the dairy councils.

Utah—Caine.

The average people of the country have not yet come to the realization of the value of milk and its products. Anything that can be done to impress the mind of the average man or woman that they should consume a certain amount of milk every day is important. About the only way to get this information before the public is with organized efforts along lines of publicity to come as a State and National movement.

Nevada—Scott.

Literature is sent from the college of agriculture to dairymen in the State who distribute it to their customers in order to encourage the use of more milk. Each year a series of articles is printed in the local papers, dwelling on the benefits of milk as a food and the importance of using it in large amounts.

Oregon—Brandt.

Most of the States now have dairy councils, modeled after the National Dairy Council. In their work they endeavor to bring before the public the importance of milk as a food. In addition to the general educational program that the various dairy councils are carrying on, the milk dealers and producers should be encouraged to cooperate in advertising milk as a food. A general educational program, which is purely educational, is excellent for a groundwork upon which specialized advertising to increase sales can be based. However, it is doubtful whether the various State dairy councils can be made permanent enough and can be financed sufficiently to enable them to carry on a constructive advertising campaign of sufficient duration to get the right kind of results. It is believed that with proper cooperation between producers and distributers the under consumption of milk during periods of high prices can be to a great extent obviated.

State of Washington—Woodward.

Bringing the value of milk as a food before the public in general can best be accomplished by systematic advertising in the form not only of newspaper and billboard ads, but by educational exhibits and meetings staged by women's clubs in the cities. This work can well be promoted by State dairy councils such as have already been organized here in the West by California and Oregon.

DISCUSSION

Dr. Redfield: What conditions will warrant a campaign on the part of a city looking toward increased consumption of milk?

Mr. Taylor: The milk supply of a city should be safe, reasonably clean and pure before a campaign is started. In one case we refused to start a campaign because the milk of that city was too bad to warrant it.

Mr. Lombard: If the milk supply is safe, it seems that such a campaign should increase the demand for it.

Mr. Earl: Should we not pay more for a better milk? There is more argument in price than in arbitrary regulations.

Mr. Holt: There must be a difference of more than 15 cents per cwt. in price before the farmer who is making Grade B milk can make Grade A profitably.

Mr. Jackson: An intelligent man with clean methods can get good results and produce clean milk.

Mr. Holt: There should be greater difference in price between *clean* and other milk.

Mr. Taylor: The food value of milk is of great importance. Where clean milk is available, boost milk and show its food value.

"Per capita consumption of milk may be taken as an index of the intelligence of a community with respect to nutritional values."

POINTS FROM *THE DELINEATOR* "SAVE THE SEVENTH BABY" CAMPAIGN

HORATIO NEWTON PARKER, *City Bacteriologist,* Health Department, Jacksonville, Fla.

At the time of the epidemic of infantile paralysis in the United States in 1917, Mrs. Honore Willsie, editor of *The Delineator,* became deeply interested in this serious menace to childhood and felt that a national woman's magazine ought somehow to be of service in helping to better the situation. She discussed this matter with Dr. C. E. Terry, who convinced her that the problem of reducing infant deaths from about one in every seven babies born in our country to a materially lower ratio was even more important and offered greater promise of yielding to a campaign of education and publicity than the more specific one of poliomyelitis.

Accordingly the "Save the Seventh Baby Campaign" was launched, with Dr. Terry in charge and Franz Schneider, Jr., as his associate. A staff of graduate nurses, all of whom had large experience in important public health work, was organized, as was a laboratory division in charge of Dr. Walter Dodd and the writer. *The Delineator* offered to make a sanitary survey, with particular reference to those conditions that affect the infant death rate and child life, of such cities having populations of between 10,000 and 40,000 as should apply for it through responsible public officials and should comply with certain other conditions such as housing the nurses, etc. The central idea was to make the surveys with the assistance of the women's clubs, other civic bodies and the local officials, so that there should be left behind citizens who would be thoroughly informed as to sanitary and other conditions in their cities and whose interest in the problems of motherhood and childhood would be stimulated and educated by the help they had given. Communities were studied that represented conditions from southern New England to central Texas and from eastern

New York to the Rocky Mountains. The campaign lasted a year, from May 1, 1917, to May 1, 1918, when because of the war with Germany it had to be closed, with enough applications for surveys in hand to have kept all of the staff busy for another year and with new applications still coming in.

During the campaign much useful information accumulated. Of particular interest to this association is that gathered in investigating the market milk, for it gives a good picture of the milk supplies of small cities in the United States. It is the object of this paper to briefly present this data and that secured by the writer after the close of the campaign in two other cities, Jacksonville, Florida and Wilmington, Delaware.

It was customary to begin the investigations of the milk supply of a city by going over local conditions with the health officer and the milk inspector, if there was one. Then such records as were on file were studied, after which the principal producing dairies were scored and the milk plants visited. Always the endeavor was made to get at the viewpoint of those in the dairy business and of the consumers. Finally, samples of milk from wagons, plants and stores were collected and tested for butterfat and bacterial content. The data thus secured was forwarded to the New York office, where it was incorporated in the report that was rendered the several organizations that cooperated in making the survey.

It is now some time since the field work was finished and some of the cities, at least, have improved their supplies.

In proceeding to consider the milk supplies of the cities that were visited it seems best to begin with a few words about their codes, inspection, publicity, and the sorts of milk they consumed.

MILK CODES

The cities of Framingham, Mass.; Westfield, Mass.; Amsterdam, N. Y.; Long Branch, N. J.; Raleigh, N. C.;

Austin, Texas, and Boulder, Colo., had good codes. The other cities had codes that were old-fashioned, incomplete, or bad. There was a tendency to rely on State laws instead of enacting ordinances adapted to the peculiar needs of the city. Some ordinances established standards there was no machinery to uphold. It was common to adopt the State or Federal standard for butterfat, and standards ran from 3.00 to 3.50 per cent. Except in one or two cities they were adopted without any reference to the prevailing type of dairy cow of the region. Of course, to adopt a low butterfat standard in dairy districts where breeds other than the Holstein and other low-testing cows do not dominate is an invitation to sophisticate and juggle milk to the limit.

One city set a specific gravity minimum, viz.: 1.032.

There appeared to be some doubt as to what the bacterial limit for raw milk should be. A good many of the cities had none. Most of those that set a limit seemed to think one of from 300,000 to 500,000 per c. c. to be about right, but two cities set it at 1,000,000 per c. c. The cities of Amsterdam, N. Y., and Long Branch, N. J., both of which graded their milk, had reasonable standards for both raw and pasteurized milk.

PUBLICITY

There was little attempt to foster the dairy industry by well considered publicity. Framingham, Mass.; Winston-Salem, N. C., and Rome, Ga., published tests or dairy scores. Jacksonville, Fla., had done so but temporarily discontinued the practice.

Amsterdam, N. Y., and Long Branch, N. J., issued interesting annual reports.

In Long Branch, N. J.; Hot Springs, Ark., and Atchison, Kans., the chemistry of milk and testing were taken up in the high schools.

In Oskaloosa, Iowa; Huntsville, Ala.; Raleigh, N. C., and Gulfport, Miss., occasional articles on dairy subjects were contributed to the newspapers, usually by the health depart-

ments. This was the practice also in Winston-Salem, N. C., which besides issued a monthly letter to the dairymen. In Wyoming the results of the sediment tests made by the State Board of Health were given to the daily press, to teachers and libraries. In Boulder, Colo., the character of the milk supply was interestingly discussed in two papers published in "University Studies."

In Amsterdam, N. Y., a milk exhibit was held that had a stimulating influence on producers and public alike. Jacksonville at one time staged a clean vs. dirty milking demonstration. However, by and large, publicity was neglected in most of the cities where *The Delineator* surveys were made.

INSPECTION

Eleven of the cities, Putnam, Conn.; Middletown, Conn.; Amsterdam, N. Y.; Wilmington, Del.; Winston-Salem, N. C.; Raleigh, N. C.; Rome, Ga.; Jacksonville, Fla.; Austin, Texas; Fort Smith, Ark., and Boulder, Colo., each employed a man to inspect dairies, collect milk samples, etc. The vocations of the incumbents were various, among them being a butcher, part time veterinarians, a painter, a practical farmer, veterinarians, and agricultural college graduates. The achievements of the men naturally varied, but the work in Amsterdam, Winston-Salem, Raleigh, Rome, Jacksonville, Austin and Boulder was worthy of hearty commendation.

Eighteen other of the cities, Pittsfield, Mass.; Westfield, Mass.; Framingham, Mass.; Long Branch, N. J.; Huntsville, Ala.; Meridian, Miss.; Laurel, Miss.; Gulfport, Miss.; Monroe, La.; Helena, Ark.; Hot Springs, Ark.; Steubenville, Ohio; Oskaloosa, Iowa; Atchison, Kans.; Cheyenne, Wyo.; Casper, Wyo.; Laramie, Wyo., and Sheridan, Wyo., all intrusted dairy inspection to local or county health officers, or to the inspectors of State health or live stock boards. Effective work was done in the Massachusetts cities, though in that State more frequent inspections were

desirable. It seems apparent that though good results may be obtained with this type of inspection, in general it does not produce them, for the work falls on men who have their hands full of other matters and who have neither proper interest in or training for the work.

The cities of Staunton, Va.; Jackson, Miss., and Pine Bluff, Ark., maintained no dairy inspection service.

The matter of dairy inspection in these 32 cities may be summed up by saying that while a few of them are supplying funds to carry it on properly, are employing well trained men for the work, and are getting excellent results, the rest do not appreciate its importance and, not providing it, get as a result poor and inadequate milk supplies in consequence.

CHARACTER OF MILK CONSUMED

Raw milk was used exclusively in 17 cities, and in each of the 15 others made up 50 per cent or more of the total supply.

In all of the cities a good many family cows were kept within city limits. Seldom seen by veterinarians, they are usually poorly stabled, in places where they cause more or less annoyance to the neighbors, and the milk is often carelessly handled. The total amount of milk produced by these animals is not inconsiderable; thus in Jacksonville a very moderate estimate of the amount would be 125,000 pounds a year. The owners compete in a small way with licensed dairymen, and generally on unfair terms, for customarily these dairies are expressly taken out of the jurisdiction of the health department by law. In Jacksonville, a byre is not a dairy until four cows are stabled. To continue this policy seems most unwise, for this uninspected milk may do considerable harm. The writer was told of one city where all the sick babies, by special request, were reported to the health department, which investigated their milk supplies and found every one of them using milk from family cows; not a single one used the milk of a licensed

dairyman. The city council lost no time in placing the family cows in control of the board of health.

Certified milk was not produced or sold in any of the cities, except Long Branch, which received a little that was shipped in by rail. However, there were dairies in several of the cities that might have produced milk of this sort had there been demand enough for it to promise financial success to a dairy that might undertake to market it.

Pasteurized milk was used in 16 of the 32 cities, which had among them 27 pasteurizing plants, 17 of the held and 10 of the flash types. Table I shows the kind of plants and the percentage of pasteurized milk compared with the whole amount of market milk. It should be noted that Cheyenne and Casper, Wyo., both receive pasteurized milk from Brighton, Colo. In Cheyenne the milk is repasteurized before it is sold but in Casper it is not. Of course the Cheyenne practice is indefensible.

But three of the cities—Amsterdam, Long Branch and Raleigh—had successfully established systems of grading milk, and in the opinion of the writer it would have been unwise for others to attempt it.

Though raw milk made up at least 50 per cent of the total milk supply of each of the cities, tuberculin testing of the herds was not general. In this matter it seems likely a change is rapidly coming; thus, both Florida and Wyoming now have State laws requiring the tuberculin testing of dairy cattle, and sentiment in its favor is rapidly growing among dairymen, especially in the South where owners desire to be protected from importing disease in pure-bred and other cattle that they may purchase from northern and western dealers to improve their herds, when once their districts have been freed of the cattle tick.

TABLE I

TYPE OF PASTEURIZATION AND PERCENTAGE OF PASTEURIZED MILK USED IN SIXTEEN CITIES

City.	*Flash type.*	*Held type.*	*Per cent of market milk consumption.*
Framingham, Mass.	1	..	33⅓
Middletown, Conn.	..	1	33⅓
Amsterdam, N. Y.	..	3	33⅓
Long Branch, N. J.	..	1	60
Wilmington, Del.	1	2	50
Winston-Salem, N. C.	1	..	..
Hot Springs, Ark.	..	2	20
Steubenville, Ohio	4	2	50
Oskaloosa, Iowa	..	1	..
Atchison, Kans.	..	1	60
Boulder, Colo.	1	1	..
Cheyenne, Wyo.	..	1	50
Casper, Wyo.	..	..	50
Sheridan, Wyo.	1	..	0.5
Laramie, Wyo.	1	..	50
Jacksonville, Fla.	0	2	40
Totals	10	17	

The number of bacterial analyses made of the milk processed in these 32 cities was too few to judge the character of product on this basis, but although some of the plants were well equipped and operated, as a whole the impression produced by inspection was distinctly bad. Flash pasteurization is known to be uncertain in its action, so the protection that properly pasteurized milk gives was discounted in those towns where the process was used. Even in those cities that had the held process, automatic temperature recorders as a rule were not used, particular care was not by any means always taken to maintain temperatures within limits during the run, and the period of heating often fluctuated. In some instances the general sanitation of the plants was poor. Too often the prime object was to restrain the growth of lactic germs to delay souring, rather than to turn out a uniform product deserving of unqualified commendation. The experience of this campaign convinced the writer that commercial pasteurization may be a very good thing or quite the reverse, according as the char-

acter of the owner and the official inspection are of the highest grade, or not.

PRODUCING DAIRIES AND MILK QUALITY.

The small dairyman was an important factor in producing the milk supply of the cities surveyed. Dairies of over 20 cows were unusual, and those of 10 cows or less were common. As one studied the different districts, he could not help but wonder how many cows ought to be kept in order to make dairy farming profitable, and one felt that considerable cooperation among the farmers was necessary in order for the business to be operated with efficiency and economy. To get this is difficult, because the dairyman instinctively feels safest with his business entirely in his own keeping and because, among other reasons, though most of the dairymen are industrious there are some who are willing to idle about the city while their families eke out a living by working hard to produce the milk for them to deliver daily.

The most obvious suggestion is to organize the country into districts from which the milk shall be hauled by motor trucks operated by the farmers or by a large retailer, but such a plan requires capital, farms within easy distance of each other, good roads, general support from the dairymen, and the best of judgment on the part of the owners of the truck lines, a combination of desiderata that, under favorable circumstances, can be only partially attained.

That the retailing of milk by the small producer is likely to be unprofitable is evidenced by the noticeable tendency of the business, as for instance in Casper and Cheyenne, to concentrate in the hands of a single dealer to whom the dairy farmers sell their milk wholesale. The danger of this situation is that the producer loses control of the market and must accept what is offered for his milk. The wise contractor does not squeeze his producers; in fact, he accepts the responsibility of developing his producing dis-

DELINEATOR DAIRY SCORE CARD

Name..... No.....

Street..... City..... State.....

Date..... Inspector.....

Is milk delivered by producer?..... Is it cooled in transit?.....

Is milk sold wholesale?..... Or retail?.....

For milk supply of.....

Pasteurization .....

No. of cows kept..... No. cows milking..... Gal. milk produced daily.....

Qts. bought..... Of whom ?..... Price paid .....

Qts. sold..... To whom?..... Price received.....

Total score.....

DELINEATOR DAIRY SCORE-CARD

Primary Equipment	Perfect	Allowed
MILKING:		
Milking-pail opening not over 6 inches	5	
Metal utensils smooth and soldered flush	3	
Proper strainer of gauze and cotton	2	
Total	10	
COOLING:		
Ice available for the entire season	5	
Water supply adequate and cold	2	
Cooling system adequate	2	
Total	9	
STERILIZING:		
Boiling water or steam adequate (or allow 2 points for adequate chemical disinfection)	6	
Alkali washing powder	2	
Scrub-brushes	2	
Total	10	
Total for Primary Equipment	29	

Primary Methods	Perfect	Allowed
MILKING:		
Clean udders and surrounding parts	5	
Clean, dry hands	6	
Small-top pails (not over 6-inch opening)	8	
Total	19	
COOLING:		
Milk is cooled to below 50 degrees F. within 3 hours (or to below 60 degrees F. within 3 hours, allow 5)	15	
Total	15	
STERILIZING:		
Utensils scrubbed and sterilized	15	
Strainers washed and sterilized	5	
Total	20	
Total for Primary Methods	54	

Secondary Equipment		
Stable location and construction	0.8	
Stable, air, light, ventilation	0.5	
Milk-house, location and fly-proof	1.0	
Privy, location and fly proof	2.0	
Total for Secondary Equipment	4.3	

Secondary Methods		
Cleanliness of stable	1.0	
Barnyard well drained	.25	
Milk house free from flies, domestic animals, and well drained	2.0	
Cows tuberculin tested within 1 year	5.0	
Medical inspection of employees	2.95	
Proper disposal of slops and privy contents	1.50	
Total for Secondary Methods	12.7	

Equipment ..... + Methods ..... = ... Final Score

Note 1—Any dairy feeding distillery slop shall not score more than 49

Note 2—If water supply shows pollution, score shall not be more than 49

tricts by the payment of fair prices and in other ways encouraging his patrons, but whether this system can maintain itself or not remains to be seen. For the business of city milk supply to succeed, it must be profitable to producers and distributers, and the milk must be supplied to the consumer at an attractive price. To protect the interests of all three it may eventually be necessary to have prices determined by a board on which all parties shall be represented.

In all but four of the cities of the campaign, 50 to 100 per cent of the dairies were located within five miles or less of the city. Pittsfield, Long Branch, Steubenville and Cheyenne were the only ones having more than a third to a half of their dairies 10 to 50 miles distant from the city.

The dairies were scored on a modified North Score Card, which is reproduced in order to give an idea of the mode of scoring. Though certain criticisms of the card obviously might be made, it served the purpose of the campaign well.

In Table II the salient facts that appeared in the inspection of the dairies of the several cities are tabulated. At the head of the list is a group of four cities comprising Raleigh, N. C.; Amsterdam, N. Y.; Rome, Ga., and Long Branch, N. J., whose dairies have median scores between 80 and 84, the lower quartiles being between 76 and 77 and the minimum scores between 56 and 73 Table III shows that in three of the cities the average butterfat content was between 3.9 per cent and 4.3 per cent, and that in the other, Amsterdam, N. Y., it was 3.5 per cent, which is natural since the city is in a Holstein district. The bacterial counts in all of the cities are reasonably low. In fact all of these milk supplies are excellent. To secure them persistent and determined effort has been made under highly competent inspectors who have helped to build up the dairy business and have secured milk of good quality. All four of the cities maintain laboratories;

TABLE II

DAIRIES IN 32 CITIES

CITY	Total No. of Dairies	Est. No. of Family Cows	Herds Tuberculin Tested within 1 year.	Number of Dairies Scored	Dairy Scores					Character of Privies	Small-top Pails Used	Steam for Sterilizing	Milk cooled before delivery	Deliveries Daily
					Median	Upper Quartile	Lower Quartile	Maximum	Minimum					
Raleigh, N. Y.	27	192	25	22	84.2	90.6	77.2	94.0	58.5	bad	100%	good	90%	Summer 60%=1 Winter 75%=1
Amsterdam, N. Y.	165	15	4 all phys. exam.	25	80.8	85.1	75.5	92.0	56.4	poor	100%	good	100% 90% with ice	1 1 50%=1
Rome, Ga.	25	200	many cows	6	80.4	92.5	76.5	93.6	73.6	?	Many in use	fair	100%	50%=2
Long Branch, N. J.	40	50	40	12	80.1	84.6	76.4	93.1	71.8	fair	0		100% of the retail	1
Laramie, Wyo.	15	9		9	76.8	80.1	55.7	81.4	45.4	bad	good	fair	good	1
Cheyenne, Wyo.	30	3		3	71.0			77.5	62.8	bad	66%	fair	good	1
Jacksonville, Fla.	90	440	9	42	69.5a	75.2	61.5	91.4	41.0	poor	80%	poor	Evening milk	1 and 2 75%=1
Winston-Salem, N. C.	35	82	35	14	68.4	90.4	61.0	94.6	58.2	poor	100%	good	40%	25%=2
Framingham, Mass.				10	68.3a						0	poor	poor	
Middletown, Conn.		7	2	21	66.3	71.7	58.9	86.4	46.9	good	few	good	water	1
Austin, Tex.	25	92	0	24	66.2	71.1	59.7	89.4	37.3	poor	Not in mon use	com-	100%	88%=1 12%=2
Pittsfield, Mass.	215	400	0	22	65.1	74.2	61.0	86.6	45.0	good	50%	poor	75% ice 25% wat.	1 60%=2
Laurel, Miss.	5	60	0	5	64.2			66.4	40.8	poor	40%	poor	20%	40%=1
Staunton, Va.	17	60	17	14	63.7	82.1	54.3	92.5	48.7	poor	35%	fair	poor	1

TABLE II—Continued

DAIRIES IN 32 CITIES

CITY	Total No. of Dairies	Est. No. of Family Cows	Herds Tuberculin Tested within 1 year	Number of Dairies Scored	Dairy Scores					Character of Privies	Small-top Pails Used	Steam for Sterilizing	Milk cooled before delivery	Deliveries Daily
					Median	Upper Quartile	Lower Quartile	Maximum	Minimum					
Fort Smith, Ark.	41	61	0	10	63.3	73.2	49.7	80.0	41.4	bad	50%	none	65%	1 and 2
Hot Springs, Ark.	28	50	3	22	58.9	65.3	47.4	70.8	40.6	poor	0	poor		95% = 1 5% = 2
Oskaloosa, Iowa	14	100	0	12	57.1	66.6	49.2	79.8	45.7	bad	9%	poor	poor	80% = 1 20% = 2
Putnam, Conn.	34	10	0	8	57.0	60.6	54.4	69.5	41.6	fair	0	good	25% ice 75% wat.	1
Pine Bluff, Ark.		44	0	3	56.7			70.2	43.3	poor	0	poor	2 dairies	1 and 2
Jackson, Miss.	9	100	2	9	55.1	71.7	42.0	87.0	34.4	bad	66%	fair	bad	1 and 2
Monroe, La.	9	32	1	9	54.6a			63.0	38.8	bad	100%	none	18%	78% = 1 22% = 2
Sheridan, Wyo.	5	10	1	5	54.4			90.0	46.7	bad	0	poor	good	1
Casper, Wyo.	8		0	6	54.0			83.3	47.9	bad	0	bad	100%	1
Meridian, Miss.	16	150	16	14	52.9	64.0	44.7	73.8	30.4	poor	35%	35%	75%	68% = 1 32% = 2
Wilmington, Del.	300		0	54	52.6	57.8	49.8	92.7	35.4	poor	very few	poor		1
Westfield, Mass.	98	50	2	28	52.5	60.7	43.8	88.8	42.3	poor	0	poor	poor	1
Atchison, Kansas	50	103	0	5	52.1			57.1	42.1	bad	0	poor	poor	1
Steubenville, O.	75	few?	0	29	51.2	52.8	49.2	75.7	43.2		0		good	1
Gulfport, Miss.	11	30	11	11	50.4	61.2	48.3	87.2	45.6	bad	37%	fair	22%	70% = 1 30% = 2
Huntsville, Ala.	9	250	1	7	48.6			77.0	35.6	bad	15%	fair	15%	45% = 1 55% = 2
Boulder, Colo.	25	102	3	22	45.3	56.6	35.8	86.3	19.5	bad	0	poor	bad	1
Helena, Ark.	7	62	7	7	39.3			50.5	20.9	bad	15%	none	28%	10% = 1 90% = 2

a. = average

in three of them small-top pails and steam for sterilizing are in general use, and in all of them the milk is pre-cooled. In one respect the sanitation of the dairies supplying these cities is bad, as it is in all of the 32 cities except Middletown: the privies on the dairy farms are insanitary. However, the cities of the group are getting excellent milk and are proving that other small cities may do so if they will make proper effort.

Following this first group is a second composed of 11 cities, Laramie, Wyo.; Cheyenne, Wyo.; Jacksonville, Fla.; Winston-Salem, N. C.; Framingham, Mass.; Staunton, Va.; Middletown, Conn.; Austin, Texas; Pittsfield, Mass.; Laurel, Miss., and Fort Smith, Ark., the median scores of whose dairies lie between 63 and 77, whose lower quartiles run from 50 to 61, and whose lowest scores vary from 37 to 62.

All of the dairies of the second group were inspected, some of them thoroughly by competent men and others irregularly by men too busy, or not well enough trained in dairying, to get the best results. The privies at the dairy farms are in poor condition. Small-top pails are coming into use, except in the New England cities and Cheyenne, but perhaps not more than half of the dairies have them. Steam for sterilizing is not utilized to the extent it should be and the pre-cooling of the milk was only moderately well done. Jacksonville, Winston-Salem, Framingham, Middletown and Fort Smith have milk samples analyzed regularly in municipal or private laboratories. Laramie and Cheyenne rely on sediment tests by an inspector of the State Board of Health to keep the milk clean; he also takes samples for chemical examination at the State laboratory at Laramie. The other cities of the group rely on more or less frequent tests in State laboratories to maintain the purity of the supplies. Table III shows the nutritive value of the milk sold in this second group of cities to be good. In the 10 cities where tests were made the but-

TABLE III

Quality of Milk Sold in 32 American Cities.

CITY	Temp. of milk on Delivery Wagons				Butterfat				Samples probably watered	Samples probably skimmed	Bacterial Content of Raw Milk			
	Number of Samples	Maximum	Minumum	Average	Number of Samples	Maximum	Minumum	Average			Under 60,000 per c.c.	60,000 to 200,000 per c.c.	200,000 to 1,000,000 per c.c.	Over 1,000,000 per c c.
Raleigh, N. C.	37	69	35	52	41w	7.7	3.3	4.3	2	0	35w	4w	2w	
											3s	4s	1s	
Amsterdam, N. Y.		74	51	63.7	30	4.2	2.3	3.5	few	4	3w	9w	6w	3w
Rome, Ga.	5			70 - 80	9w	5.4	2.5	4.1	1	0	4	3	2	
Long Branch, N. J.		55	33	38	23	5.2	2.5	3.9	0	0	11	4	4	1
Laramie, Wyo.	13	73	33	53	5	5.1	3.4	4.2	2	0	3	5	3	
											1d	1d	1d	1d
Cheyenne, Wyo.	4	51	47		12	4.6	2.8	5.6	3	3	3w	1w	1w	
					25c	6.2c	3.4c	4.3c	16c		5		13c	8c
Jacksonville, Fla.	87	94	40	79	16b	7.8b	3.0b	4.0b	1b	1	6b	2b	5b	2b
Winston-Salem, N. C		64	43	55	22	6.2	2.9	4.3	3	2	17	3	1	
Framingham, Mass.											5	12		
					15b	4.8b	3.0b	3.8b	0	0	3b	9b		1b
Middletown, Conn.				64	13c	4.6b	3.1c	4.0c	0	0	5c	3c	2	3c
Austin, Tex.	13	68	45	56.5	24	6.3	4.0	5.1	4	1	2w	9w	9w	3w
Pittfield, Mass	24	66	39	55.9	27	5.3	3.0	3.9	0	0	10	13	3	1
Laurel, Miss.	10	73	48	65.0	15	5.5	3.2	4.5	0	0	2s	6w	1w	
											4w			
											2s	2s		
Staunton, Va.	27	67	45	59	31	6.2	3.6	4.9	0	0	26w	1w		
Fort Smith, Ark.	15	76	35	55	22w	5.6	2.6	4.3	10	2	6w	1w	5w	12w
					10s	5.2s	1.7s	3.1s			9s	1s		
Hot Springs, Ark	33	65	33	47	10w	5.8w	3.4w	4.4w	9	0	10w			
												9s		
Oskaloosa, Iowa.	16	71	42	68	15	6.1	3.7	4.0	4	0	3w	6w	6w	1w
Putnam, Conn.					16	5.0	3.3	3.8	1		8	6	2	

TABLE III—Continued

Quality of Milk Sold in 32 American Cities.

CITY	Temp. of milk on Delivery Wagons				Butterfat				Samples probably watered	Samples probably skimmed	Bacterial Content of Raw Milk			
	Number of Samples	Maximum	Minimum	Average	Number of Samples	Maximum	Minimum	Average			Under 60,000 per c.c.	60,000 to 200,000 per c.c.	200,000 to 1,000,000 per c.c.	Over 1,000,000 per c.c.
Pine Bluff, Ark.	16	55	33	44	12s 9w	9.0s 5.2w	1.6s 3.4	3.5s 2.5	4	8	5s 10w		7s	
Jackson, Miss.					19	6.2	1.4	4.3	5	3	17s 5w	5s 1w	11s 3w	10s 1w
Monroe, La.	9	90	72.5	81.4							7	2		
Sheridan, Wyo.	5	74	39	50.1	8	4.1	2.5	3.5	0	4	1 1s	3 1s	2	1
Casper, Wyo.					13	5.5	2.5	3.6	2	3	4w	5w		
Meridian, Miss.		77	50	69.7	26w	5.7	2.1	4.1			21	2	1	
Wilmington, Del.					47w 23d	5.4w 7.5d	1.2w 2.7d	3.7w 3.5d	1w 1d	11w 5d	2w 1d	7w 0d	14w 4d	22w 7d
Westfield, Mass.	11	64	48.5	55	12b	4.2	5.2	3.5			2	6	4	1
Atchison, Kan.					6	4.3	3.1	3.7	0	1		3w	1w	
Steubenville, O.	3w	57	54		42	4.5	2.4	3.4			32 20s	6 1s	3 1s	1
Gulfport, Miss.	24	65	38	49	29	6.6	1.0	4.2	7	0	5w	1w		
Huntsville, Ala.	10	80	52	72	12	4.7	3.0	4.1	12	0	6	6	1	2
Boulder, Col.	10	64	49.5	58.4	19	6.3	3.1	4.4	4	0	4w	9w	3w	1w
Helena, Ark.					6	6.3	2.1	4.8		1	3w	3w	1w	

b. Bottled Milk
c. Milk in Cans
d. Depot
s. Stores and Cafes
w. Wagon Samples

terfat averaged 4.3 per cent, there being but the two New England cities of Pittsfield and Middletown, and Cheyenne, Wyo., in which the butterfat averaged less than 4 per cent. There was more tendency to sophisticate milk in this group of cities than in the first; this is especially noticeable in Cheyenne, Jacksonville, Austin and Fort Smith. The bacterial counts were moderately low in all of the cities except Jacksonville, Austin and Fort Smith, all of which had too many counts above 200,000 per c.c.

Next is a third group, consisting of the cities of Hot Springs, Ark.; Oskaloosa, Iowa; Putnam, Conn.; Pine Bluff, Ark.; Jackson, Miss.; Monroe, La.; Sheridan, Wyo.; Casper, Wyo.; Meridian, Miss.; Wilmington, Del.; Westfield, Mass.; Atchison, Kansas; Steubenville, Ohio; and Gulfport, Miss., whose dairies have median scores of from 50 to 59, whose lower quartiles are from 42 to 54 and whose lowest scores range from 30 to 48. The dairy privies are in poor condition, small-top pails and steam for sterilizing are but little used, and the cooling of the milk is not properly attended to. The dairies are a little less than half way good.

Table III shows that the average butterfat content of the milk of the 14 cities of this group ran from 3.5 to 4.4 per cent, and that in six of them the average was less than 4 per cent. The cities that had good butterfat were all in the South, save Oskaloosa, Iowa, where grades of the Channel Islands breeds are the mainstay of the herds. The bacterial counts of the milk sold in these cities, except Jackson, Wilmington and Westfield, were reasonably low, because most of the sampling was done in the cooler months of the year and because the milk is produced in the environs of the city and is quickly put on the market. A cursory examination of Table III shows the milk of these cities of Group 3 is often tampered with. In fact the milk sold is distinctly inferior in this respect to that of the cities of the two preceding groups.

Finally there comes a fourth group, composed of the cities of Huntsville, Boulder and Helena, the median scores of whose dairies varies from 39 to 49, and the low scores from 19 to 36. Boulder is proud of one or two excellent dairies, but in general its dairies and those of this last group leave much to be desired. The average milk sold in these cities runs over 4 per cent butterfat and the bacteria counts were fairly satisfactory; nevertheless the dairymen of these cities have far to go before they find themselves well advanced on the paths of good dairying.

This statement of the conditions that were observed gives, it is believed, a correct idea of the character of the milk supplies of the several cities that were surveyed. It is the writer's belief the pictures presented are representative of the different types of milk supplies that are usual in cities of their size in the United States.

One must be cautious in generalizing from data as limited as this, but from the distribution of the cities, the fact that they represent manufacturing and rural communities, and old and pioneer dairy districts, the writer is led to believe:

1. That the food value of the milk that is served in the small cities of the greater part of our country is high, and that it is the duty of health officers to maintain it.

2. That there is little need at present for "adjusted" or "standardized" milk in these communities; if it is sold, it is because it is to the financial advantage of the dealer to do so.

3. To protect the public, and to enable dealers to compete with one another fairly, milk should be graded on the butterfat basis, making 4 per cent and above Grade A milk.

4. Bacterial standards should be set for "baby" milk, raw milk for adult consumption, raw milk before pasteurization, and for pasteurized milk.

5. Bacterial standards for small cities, those using milk produced nearby, may be low; one of 200,000 to 250,000

per c. c. can usually be met without undue difficulty by producers and dealers, if utensils are kept sterile, and milk that is held on the farms and in milk plants is cooled promptly and held at low temperature.

Standards of 1,000,000 bacteria per c. c. for milk before pasteurization and 50,000 per c. c. as delivered can be met by pasteurizing plants.

6. Only milk pasteurized by the "held" or "positive" process should be allowed to be sold as pasteurized milk, and then only if automatic temperature recorders are regularly used and the records preserved for official inspection. The reprocessing of milk should be prohibited.

7. To thrive, the dairy industry needs competent milk inspection to help producers to adopt the most improved methods, to keep milk plants sanitary and pasteurization up to the mark, to enforce milk standards, thereby securing fair competition to the dealers, and pure, clean milk in quantity for the public.

8. The milk problems of the small city are less acute and somewhat different from those of large ones, therefore standards of quality and methods of handling the production and sale of milk in the smaller cities should be worked out by local health officers with some degree of independence and with the peculiar needs and possibilities of their communities constantly in mind.

9. Necessary to efficient control of the city milk supply are a laboratory, regular competent inspection, and a good milk code.

"Milk inspection is not solely a matter of policing, nor of production, nor consumption, nor laboratory technique, nor medical dictation, nor score card marks, but the essence of all these reduced to good practices."—Marshall.

REPORT OF COMMITTEE ON REMADE MILK—PART I

Commercial and Economical Aspects of Remade Milk

Dr. C. W. Eddy, Cleveland, Ohio

The commercial use of remade milk as a fluid market milk is somewhat of a problem, as no great use has been made, as yet, of this product.

The writer's observations of remade milk have been confined solely to its use in the manufacture of ice cream and buttermilk.

Its use as a substitute for fluid milk would be problematical, and we believe that the public should be educated to its value, much in the same way as has been done with evaporated and condensed milk.

As we have had no experience in offering this milk for public consumption, we do not know what combination would be most acceptable, but believe from such experiments as we have made that skim milk powder, sweet butter, sweet or frozen cream and water mixed in a pasteurizing vat, and blended with an emulsor or homogenized, would make the most acceptable mixture, and at the same time provide the cheapest combination of materials.

The quality of the separate ingredients entering into this mixture would, of course, in a great measure determine its appearance and palatability, and consequently its commercial value. Great care would have to be exercised in this connection, or severe losses would ensue. It is true that in some communities the average market milk is of such poor quality that good remade milk would be preferable, but this condition does not prevail where the best markets would be afforded, namely, in the big cities equipped with modern milk plants, and where the milk is produced under more or less efficient inspection.

To succeed commercially, the product should sell for less than raw milk, unless it could be proven to have superior

nutritive value. As a substitute in time of serious shortage, it would undoubtedly have a great value in supplying milk to children who would otherwise suffer. Its use in breaking a milk strike would be problematical, depending, of course, upon the length of time the strike lasted, the number of shippers involved, and the consequent shortage of milk.

The cost of remade milk would be a most vital factor in its commercial success, as before indicated, and from any data or figures that we have available we are unable to see how it can be put out as cheaply as raw milk, at least under present conditions.

For comparison, we submit the following figures of the cost of a quart of raw milk at our plant in comparison with a quart of remade milk, made with sweet butter and skim milk powder, and a quart made with frozen cream and the same powdered milk. In determining the cost of this remade milk we have taken the market price of the ingredients as they would cost us today, September 9th. To argue, for instance, that a pound of sweet butter did not cost us 56 cents, and therefore should not be used at this figure, does not appear fair to us, because the real value of an article is the price that can be obtained for it.

It is to be distinctly understood that the cost figures here presented are based upon meager data, but they are offered for what they are worth.

NATURAL MILK, 3.5%

Price to shipper per quart	$ .085
Shrinkage in plant	.0015
Pasteurization cost	.00888
Cost per quart before bottling	$ .09538

QUART COST OF REMADE MILK WITH SKIM MILK POWDER AND SWEET BUTTER (10 gal. mixture)

8 pounds skim milk powder @ 28c pound	$2.24
3.75 pounds sweet butter @ 56c pound	2.10
Cost of 10 gallons 3.5 % remade milk	$4.34
Cost of 1 quart 3.5% remade milk	.1085

QUART COST OF REMADE MILK WITH SKIM MILK POWDER AND STORAGE CREAM

8 pounds skim milk powder @ 28c pound.....	$2.24
3.15 pounds butter fat @ 70c pound.....	2.205
Cost of 10 gallons 3.5% remade milk.....	$4.445
Cost of 1 quart 3.5% remade milk.....	.111125

COMPARISON

Natural fluid milk	$ .095	quart
Remade milk, skim powder and sweet butter..	.108	"
Remade milk, skim powder and storage cream.	.111	"

In the figures given, no shrinkage is charged, nor is handling, in the case of the remade milks. We have not given these figures, as we have not done enough of this blending to determine accurately their cost, but from the nature of the ingredients, we are positive that the cost would be materially greater. We believe that there would be approximately the same relation of prices between fluid milk and remade milks at all seasons, and we further do not see how this product can ever be made and sold in price competition with fluid natural milk.

It goes without saying that the more milk is handled, and the more processes that it goes through, the more expense is attached thereto, and any remade milk would of necessity cost more on that basis than market milk.

That there is a field for this product cannot be denied, and more commercial experiments should be undertaken to establish it on a firm basis, as this would undoubtedly tend to stabilize all milk markets, which would work to the advantage of every producer, distributer and consumer.

"The intelligent, progressive dairyman is the last man in the world whose business should be allowed to suffer."

REPORT OF COMMITTEE ON REMADE MILK—PART II

Effect of Remade Milk on the Dairy Industry

George B. Taylor, *Market Milk Specialist,* Dairy Division, U. S. Department of Agriculture, Washington, D. C.

As the subject outlined above is at this time really a matter of opinion only, it was thought best to take it up with persons who should be most familiar with the subject. Accordingly, letters were written to all the heads of dairy departments in the State agricultural colleges, asking them to express their opinions.

Replies were received from twenty States. For convenience the States are usually divided into sectional groups as follows: New England; Middle Atlantic; South Atlantic; Gulf; North Central, East; South Central, East; North Central, West; South Central, West; Rocky Mountain; and Pacific. Reports were received from every sectional group except one. Since powdered milk factories are found in only four of the sectional groups, it is a matter of gratification that most of the others responded. It is not surprising that many of the heads of dairy departments admitted ignorance on the subject and that a few frankly declined to express an opinion.

There are dried milk factories in ten States at least. All of these manufacture powdered skim milk, though some of them manufacture whole milk powder, and there is put out a little powdered cream. The manufacture of skim milk powder is well established because the material will keep well. On account of the poor keeping qualities of whole milk and cream powder, this phase of the powdered milk industry cannot be considered as well enough established at this time to consider seriously.

The use of remade milk in competition with whole milk is made possible by combining milk powder with unsalted butter and water, and remade milk of varying composition

can be produced. It is presumed that the heads of departments in answering the inquiries had the above facts in mind.

SUMMARY.

1. The great majority of heads of dairy departments report their belief that the powdered milk industry will be a benefit to the dairy industry and to agriculture in general as stated in the following reasons:

a. It will help stabilize the market for dairy products.
b. It will help solve the problem of surplus milk.
c. It will increase the use of milk generally, especially in countries where on account of climatic conditions the use of milk has been restricted.
d. It will not compete directly with the market milk industry, but will be used principally for cooking, for bakeries and confectioneries.
e. The manufacture of skim milk powder would be an advantage to dairymen since the prices realized by them in supplying milk for this product are very satisfactory.
f. The more uses milk is put to, the better it is for the dairy farmers.

2. A few heads of dairy departments take a somewhat pessimistic view of the effect of this industry for the following reasons:

a. It will have a tendency to take the place of fresh milk in the newer dairy districts and in districts where as yet dairying has not entered into the scheme of agriculture.

b. It might be a cheaper source of milk than fresh milk, thus putting a price on fresh milk which would discourage production.
c. On account of lack of local laws or of laxity in enforcing them, it is often mixed with fresh milk and sold as such.
d. It is still doubtful whether remade milk contains all the important growth principles of fresh milk.

ABSTRACTS OF REPLIES RECEIVED

Connecticut—White.

More extensive use of powdered milk in the home for cooking purposes, but it is doubtful whether in liquid form it will supplant whole milk, especially with children. Wide publicity given to powdered milk will have a tendency to increase use of milk generally. An increase of condensed and powdered machinery in milk plants will help solve the the problem of surplus milk and will have a tendency to stabilize the market for dairy products in the same way as cold storage has stabilized the butter and egg market.

Massachusetts—Lockwood.

It is doubted whether milk powder will ever replace whole milk for drinking purposes. Two advantages are seen in that the powder is made close to where the milk is produced and it takes a good quality milk to make the powder. Use of milk powder by consumers might enable a large number of districts to do away with forced winter feeding and go back to the more natural way of making milk as a seasonal proposition. It might help control markets so we would not have so much trouble with surplus milk as we have at the present time.

New Hampshire—Fuller.

If powdered milk is used in place of whole milk, origin of product is merely shifted. This would not be injurious unless in the manufacture a substitute for butterfat is used.

If use of powdered milk proves more economical than use of whole milk, dairymen in regions where cost of production is high may have to make provision to meet the competition.

Maryland—Gamble.

On account of high milk prices and increased production, a surplus of milk is bound to exist. The manufacture of powdered milk will help take care of this surplus. Milk powder has come to stay and its consumption should be recommended whole-heartedly by the dairy industry.

New York—Stocking.

Powdered milk industry is bound to prove of great importance as an outlet for a large amount of milk in dairy sections and as a means of furnishing people in non-dairy sections, especially in hot climates, with a constant supply of good dairy products.

Pennsylvania—Borland.

Powdered milk will facilitate the volume of business in the milk industry and will enable the sending of milk into territory where it is now difficult to do so. The powdered milk industry ought not to lower the price of milk since the taking of milk for the manufacture of milk powder will simply relieve the market of the equivalent amount of fluid milk and this ought to be helpful in stabilizing the price of milk.

West Virginia—Anthony.

There is no other recent development along the lines of dairy manufacture that shows such an opportunity for use-

ful development as that of the powdered milk industry. Present practices of handling and distribution of milk may be materially changed by development of the powdered milk industry, yet there would be a wider use of milk and milk products and this greater use would mean a more prosperous and stabilized dairy industry.

Georgia—Jarnagin.

In general it is believed that the powdered milk industry will have a detrimental rather than a beneficial effect. In certain channels such as the manufacture of ice cream, powdered milk might be used advantageously as there is not a sufficient amount of raw products at this time to supply the demand. On the other hand, we would be very much opposed to the use of powdered milk as a substitute for fresh milk, as the manufacturing process undoubtedly has a detrimental effect on the nutritive value of the milk. A better policy is to encourage the keeping of dairy cows rather than the building up of such industries in this territory.

Florida—Willoughby.

Powdered milk used very little in this section, though the use of condensed milk is general. It is believed that the powdered milk industry should be a helpful development in dairy work as it will enable dairymen to utilize their surplus milk at a uniform price.

Illinois—Harding.

Powdered milk is destined to play a large part in the city milk industry, and if properly handled will be a great help to that industry. Powdered milk furnishes an opportunity to utilize the surplus of summer in supplying the shortage of winter and thus to stabilize the price of milk. The only valid objection to the present plan of reconstituted milk is the fact that the latter is uniformly sold as milk. Inasmuch

as such reconstituted milk is commonly sold blended with whole milk, the problem of labeling presents many difficulties.

Michigan—Anderson.

The powdered milk industry had its inception in an attempt to take care of quantities of skim milk which were left after the cream had been removed either for city cream trade, for ice cream making or for butter making. This industry has had a steady and wholesome growth. Its products have been used by bread makers, confectioners, and, to some extent, by ice cream makers. It has also been an article of export. One advantage of skim milk powder is that it keeps with reasonable satisfaction in almost any climate and for an indefinite period of time.

While whole milk has been powdered, we do not anticipate that it will come into a high degree of favor and replace other milks because of its liability to become rancid and the necessity of keeping it in cold storage.

So far as the city supply of market milk is concerned, while it may be used in a supplemental way, the amount of service performed in producing, drying, jobbing, shipping, storing, recombining and marketing the remade milk is so great that very small economies would be made in vending milk of this sort. Therefore when the handicap of quality is considered, milk of this sort could not be an extensive competitor with standard grades of fresh milk used in northern cities.

As a household supplement to milk used for culinary purposes, skim milk powder has a number of advantages if it could be purchased at grocery stores in ordinary quantities. It would keep easily along with the other food supplies of the kitchen. It would always be available and the absence of water would, in the preparation of many foods, be very desirable. It is believed that the use of powdered milk for infant feeding in our northern homes would be the most doubtful field into which it could be introduced.

It does not seem that the powdered milk industry introduces any discordant agricultural factor or presents any menace to the other branches of the dairy industry.

Ohio—Erf.

The effect of the powered milk industry upon dairying in particular should be very beneficial, provided the powder is kept pure. Milk powder should be used not as a substitute but as an additional material for culinary purposes. Condensed milk is rapidly creating a great demand, but it is believed that milk powder will be better suited for the average cooking.

Minnesota—Washburn.

The effect of the powdered milk industry upon agriculture will be gradual and generally wholesome and helpful, relieving the tension near our big cities and giving milk producers located at greater distance from market opportunity to market their product at higher rates. Viewed from another standpoint, it will enable much of the milk food consumed in cities to be derived from the more remote and cheaper pastures rather than tapping the nearby cultivated fields for the whole amount. The effect will be helpful as a whole, provided final analysis proves that the milk is not injured in any way for feeding purposes by the process involved.

Kansas—Fitch.

Powdered milk is of undoubted value as a stabilizer for the dairy industry to furnish milk in time of shortage. Properly made from a high-grade powder, remade milk is of equal value to fresh milk for most purposes.

The danger to the general dairy industry from this product lies in the fact that it may take the place of fresh milk in the newer dairy districts and in districts where as yet dairying has not entered into the scheme of agriculture.

Since powdered milk is made principally from surplus milk in the well developed dairy districts, there is a danger that it might be a cheaper source of milk than the fresh article, thus putting a price on fresh milk which would discourage production. Since dairying is an important soil-building industry, it follows that agriculture in general in the newer districts at least would be harmed. This is a pessimistic outlook and may be far from what will actually happen.

Arkansas—Dvorachek.

From the standpoint of powdered whole milk, it is doubted if the powdered milk industry is going to make any large progress in this country, as people are not likely to take kindly to manufactured milk in place of the raw product, except in large cities where the raw product can not be adequately supplied. The manufacture of milk powder in dairy territory where milk is produced would do away with a great deal of waste and expense. Milk powder plants as a general thing pay more for the product even on the butterfat basis than farmers can realize from the butterfat and skim milk, especially in view of the fact that a large share of skim milk is fed to hogs which might very well be converted into human food directly.

Taking it all in all, it is believed that the advantages of the milk powder industry will be greater than the disadvantages to the dairy industry.

There is one question which perhaps has not been solved—that is, whether drying the milk will destroy the protective properties. The influence of the condensed milk industry on the dairy industry has been beneficial and the milk powder industry should have the same effect, especially if it is used as a means of saving skim milk.

Idaho—Davis.

It seems now to be possible to dry milk and powder it, put it up in cans and ship it considerable distances, and

there reconstitute it with the addition of unsalted butter in the case of powdered skim milk, and produce a product which is cheaper than the average milk upon the market. If this can be done it would seem as if it would seriously affect the market milk industry.

Undoubtedly there is a certain difference of taste between reconstituted milk and fresh milk, but it is not likely that this difference in taste will affect people seriously if they can purchase it much cheaper. As to the sanitary features, if it can be reconstituted and have a low bacterial count, it will have its appeal to sanitarians from that standpoint.

Montana—Martin.

Some people have the idea that the milk powder industry will do away with the condensed milk industry and harm to some extent the market milk industry. I do not anticipate anything of the kind. It is believed that the uses for milk powder will multiply in such a way that it will have very little effect upon the consumption of raw or condensed milk. The milk powder industry should increase the use of dairy products because milk powder will be used in those parts of the world where at the present time raw milk is not available and where people are not in the habit of using dairy and milk products.

Nevada—Scott.

It is believed that the powdered milk industry is of benefit to the dairy farmers and to agriculture in general. Of course it must be sold for what it is. The more uses milk is put to, the better it is for dairy farmers. If powdered milk does take the place of some fresh milk, its uses in other lines make up for this many times.

California—Roadhouse.

It is believed that the powdered milk industry, particularly the manufacture of skim milk powder, is here to stay. The use of skim milk powder in ice cream making is of

such convenience to the manufacturer that it should be encouraged. There should also be a place in the home for the use of skim milk powder.

Just how successful will be the manufacture and holding of whole milk powder, only the future will determine. If it can be marketed and used in a short period of time, undoubtedly the demand for it will increase. In California the manufacture of powdered whole milk has been discontinued. We believe the manufacture of skim milk powder is a stable business and that the demand for it will increase.

The manufacture of skim milk powder should be an advantage to dairymen since the prices realized by them in supplying milk for this product are very satisfactory. If the manufacture of powdered whole milk proves to be a success, it may become injurious to agriculture, particularly if it comes into regular use in cities as a substitute for fresh milk, thus eliminating dairymen from direct contact with the more profitable market of city milk supply.

Oregon—Brandt.

One phase of the powdered milk industry which can easily be seen to be decidedly detrimental to dairy interests in a particular locality would be the abuse of the use of powdered milk, provided local laws and inspection are not sufficient.

"Our minds possess by nature an insatiable desire to know the truth."

REPORT OF COMMITTEE ON REMADE MILK—PART III

Results of Feeding Infants on Remade Milk

Dr. Wm. H. Price, U. S. Public Health Service

Appearance of dry milk powder in the retail shops, and its possession by some city milk dealers, suggest inquiry regarding the safety and usefulness of remade milk from the human nutritive point of view. Normal growth and the development of vitality in children depend in large measure on the presence of milk in their diet. Fresh cows' milk is believed to be the best available substitute for mothers' milk. The convenience, in some respects, of whole milk powder invites some mothers to substitute it for natural milk. During periods of shortage certain milk dealers increase their stock by adding remade to natural milk. What influence these substitutions will have on the growth and vitality of children is a matter of considerable public health importance. The United States Public Health Service, the Boston Baby Hygiene Association, the Boston Health Department, and several other agencies are cooperating to determine something of the nature of that influence.

The fat, sugar, protein and salts contained in the various brands of dry milk powder can be easily determined in any laboratory equipped to make similar tests of natural milk. Determination of digestibility and the presence of vitamines is a different matter, and these are indispensable requisites in the diet of infants. Regarding the food value of dry milk powder, as indicated by its effect on animals, I am permitted to quote Prof. E. V. McCollum as follows:

"So far as I have been able to determine by experiments on animals the milk powders which I have employed have essentially the same dietary properties as fresh milk.

"I hold the view that one cannot draw conclusions from experiments on animals as to the value of milk products in infant feeding. The span of life of the rat is rarely longer

than thirty-six months, and any animals with which we deal in the laboratory in our experiments correspond to children of eight to ten years or older. We cannot possibly experiment with a rat before it is thirty-five or forty days old. Furthermore, the bacteriological factor is an important one in nutrition, and it is not safe to conclude that different species will react in quite the same way. The third factor of great importance in this connection is the now well established principle that the human species requires an anti-scorbutic substance, whereas the rat so far as we can determine, and we have studied it very thoroughly, can not be made to develop scurvy, and apparently does not need this substance in its food supply."

The following brief review of the literature relating to certain phases of the dietary properties of dry milk powder is furnished by Dr. Milton V. Veldee, Acting Assistant Surgeon, U. S. Public Health Service.

Infant feeding involves more than the simple introduction of measured amounts of carbohydrate, fat, and protein into the baby's alimentary tract. Mother's milk has been provided with certain accessory factors, generally termed "vitamines," which are absolutely essential to proper growth and development. When it becomes necessary to resort to artificial feeding, the normal vitamine balance is thrown out. This phase of artificial feeding has been extensively investigated with regard to cow's milk, also with pasteurized milk, and must now be considered from a new angle. With the introduction of dried milk powder into the field of complete foods for infant feeding, the question of anti-scorbutic and anti-neuritic vitamines is again revived. The value of whole fresh milk as an anti-scorbutic is now well recognized as being very low. Pasteurization further decreases the anti-scorbutic value. Hess (1) concluded that "the anti-scorbutic value of pasteurized milk is inversely proportional to the time elapsed between pasteurization and consumption." The time element applies

also to raw milk, but to a much greater degree to dried milk powder. The same author concluded that "babies fed on pasteurized milk should receive an anti-scorbutic from the time they are a few weeks old, as there is no reason for allowing the negative balance of 'vitamine' to continue for a longer period." Hess and Unger (2) contend that the anti-scorbutic value of dried milk depends largely upon the method of manufacture. They are not in agreement with Chick and Hume who, working at the Lyster Institute, found that dried milk is devoid of all anti-scorbutic value. To substantiate their contention they selected a brand which in the process of making is heated to 116 degrees C., for only a few seconds. Such a powder fed in ten-gram quantities (equivalent to 80 c.c. of whole milk) caused guinea pigs which had previously developed scurvy to become well and gain weight. In another experiment (3) they were able to cause distinct improvement in two babies, who had developed scurvy on a malt soup diet, by substituting a diet of dried milk. Chick, Hume, and Skelton (4) present data, as the result of guinea pig experimentation, and conclude that raw milk contains the accessory food factor which protects from scurvy but that this is present in small amounts and that it is further decreased by heating or drying. From this they conclude, as did Hess, that artificially fed babies should receive some additional anti-scorbutic ration. In another article (5) they find that dried milk is largely, if not entirely, lacking in anti-scorbutic vitamine. This loss they think occurs either during the process of drying or during the storage period which necessarily follows before consumption. Hart, Steenbock, and Smith (6) working with powder found that guinea pigs could not eat enough of this powder in addition to hay and rolled oats to prevent scurvy. Barnes and Hume (7) ran parallel series of guinea pigs and monkeys on fresh raw milk and fresh dried milk. The results were the same in both sets of animals. Dried milk powder could not protect the ani-

mals from contracting scurvy, even in quantities much greater than that required of fresh raw milk.

This variation in the anti-scorbutic value of dried milk powders, as found by the various investigators, is apparently dependent on two factors: 1. The freshness of the milk before drying and the method of drying. 2. The element of time between drying and consumption. We therefore must conclude from the evidence at hand that, as the result of drying and storing, milk loses some, if not all, of its already poor anti-scorbutic property; and further, that babies fed on this food should receive from the beginning additional anti-scorbutic substance, preferably orange juice.

From the work thus far reported it would seem that the anti-neuritic vitamines, fat soluble A and water soluble B, are comparatively thermostable. E. V. McCollum (8), (9), (10) and his associates have conducted a great deal of such research on rats. They find that dried milk has lost none of its anti-neuritic vitamine. But they found that heating dried milk powder in a double boiler for four hours did cause a considerable decrease in its anti-neuritic value. Osborne and Mendel (11) summarize their work on rats by saying: "Indeed we have no reason to believe that the nutrition-promoting properties of milk are lost by brief periods of heating. Comparative trials made with approximately equivalent amounts of protein-free milk (a mixture of dried milk, starch, and lard) and fresh milk not incorporated with the food mixture, have shown substantially the same results." Hopkins and Neville (12) at an earlier date found similar results. It has been shown by several workers that the vitamine content of milk from various animals varies directly with the vitamine content of the food eaten. Consequently cows' milk will show variations from season to season. Gibson and Concepcion (13) found no anti-neuritic deterioration in cows' milk through autoclaving for two hours at 125 degrees C. They were working

with fowl, dogs, and pigs. They believe that young are born with an excess supply of anti-neuritic vitamines, and that it is this surplus that carries the baby over until foods other than milk are given.

Data pertaining to the nutrition-promoting property of dried milk on infants are still lacking. Accurate conclusions cannot be drawn from rat, dog, fowl, or pig experimentation because of the differences in the duration of the nursing life of these animals as compared with babies.

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Difficulties beset attempts to demonstrate usefulness and comparative value of different foods with human subjects, and these difficulties are multiplied when infants are involved. Individual tolerance for different foods varies among infants, and their home surroundings, including economic status, medical and nursing supervision, and the intelligence of their mothers are also variable factors. To offset these variations, the average of a large number of infants must be secured. To eliminate the influence of other foods in their diet, babies less than six months old and who are entirely artificially fed are required. To observe the development, if any, of scurvy, rickets, malnutrition, and predisposition to other diseases, tests extending over several years are desirable. In the case of remade milk, quality of natural milk used in manufacture, different processes of drying and remaking, and length of time of storage before remaking result in varying qualities in the remade product. To determine the safety and usefulness of all varieties of dry milk powder now on the market would require an exceedingly large number of infants.

The Boston Baby Hygiene Association encourages maternal nursing, with such success that, although 6,000 infants less than one year old were under its supervision when this study was undertaken, only 196 babies were found to be less than six months old and entirely artificially fed. For various reasons, including infrequent attendance of babies at conference, feeble-minded mothers, non-cooperative mothers, and refusal by mothers to permit their babies to participate in the study, the number of babies available for the study was further reduced at its beginning. Division of the small number finally available among several brands of dry milk powder would probably have so reduced the number included in each group as to preclude collection of valuable data; therefore, only one brand was used in this study, but both whole milk powder and skimmed milk powder were employed. The study has continued only three months; therefore, only general conclusions can be drawn. Only the desire to contribute such first hand information as is available to the members of the International Association of Dairy and Milk Inspectors for their consideration when attempting regulation of the manufacture and sale of dry milk powder and remade milk actuates the reporting of these meager data at this time.

The following is abstracted from a statement by its manufacturers regarding the dry milk powder that was used in this study:

"Natural milk used in the manufacture of this dry milk powder conforms to the requirements for Grade B milk, New York City inspection. Last night's and this morning's milk is received at the factories and processed this morning. It is, therefore, much fresher than would be the same Grade B milk if delivered as natural milk in New York City. Its acidity is low and no neutralization is needed or practiced. Whole milk powder is prepared from natural milk which contains 3.5 per cent butterfat. Natural milk, whether whole or skimmed, is first pasteurized by the

holding process, 145 degrees for 30 minutes; then condensed by the vacuum pan process, the whole milk to a ratio of about three and one-half to one, the skimmed milk to about four and one-quarter to one; then dried by the spray process whereby the condensed milk is injected in a fine spray into a chamber having a hot-air blast of about 240 degrees F.

"The process of evaporation not only reduces the temperature of the air current to 170 or 180 degrees F., but, by the rapidity and intensity of its action, keeps the individual particles of milk in a cool condition until they are dried; and this assertion is borne out by the fact that the lactalbumen is not coagulated and the enzymes are not destroyed."

The milk powder employed in this study was received direct from the factory at monthly intervals and was therefore comparatively fresh when used.

The chemical and bacteriological laboratories of the Boston Health Department made numerous examinations of these dry milk powders and their remade products both before the study began and during its progress. These examinations disclosed the following:

One hundred and sixty-four grams (one and one-half cupfuls of an ordinary eight-ounce tin measuring cup) of the whole milk powder combined with one quart of water produces a reconstituted milk which contains the following constituents: Fat, 4.00 per cent; Sugar, 5.70 per cent; Protein, 3.70 per cent. Four per cent fat was desired and these proportions were employed with one group in the study.

Made in the above proportions with tap water and clean but not sterilized utensils, this mixture contains between 2,000 and 12,000 bacteria per cubic centimeter.

Unsalted butter and skimmed milk powder were emulsed by means of a well known centrifugal apparatus and the resulting product fed to another group of infants. This

reconstructed milk contained the following constituents: Fat 4.00 per cent; Sugar, 5.10 per cent; Protein, 3.1 per cent.

The bacterial count of this product ranged between 35,000 and 45,000 bacteria per cubic centimeter.

The Boston Baby Hygiene Association gives special attention to the quality of the milk that is fed to babies under its supervision. Nearly all are fed what is known locally as "Grade A" milk. This is an unofficial grade, but special precautions are taken during its production, handling, and distribution. It is pasteurized by the holding process, 145 degrees F. for 30 minutes, at the plant of a city milk dealer. This milk contains the following constituents: Fat 4.00 per cent; Sugar, 4.80 per cent; Protein, 3.18 per cent. The bacterial count of this milk ranges between 6,000 and 90,000, averaging 32,000 per cubic centimeter. Orange juice is usually advised in connection with this diet, but, on account of varying home conditions, but little uniformity prevails regarding its introduction.

The following instructions were issued to the nurses of the Baby Hygiene Association at the beginning of the study:

"Regarding the Feeding Study.

"To ascertain the human nutritive value of powdered milk is of considerable practical importance. Powdered milk is increasing as an article of commerce, it may become a common household commodity, and certain economic phases are connected with it. There are indications that in nutritive value and digestibility powdered milk compares favorably with natural milk, but that point has not been proved scientifically by feeding powdered milk and natural milk to different groups of individuals who are under observation of the same clinicians and comparing the results.

"The United States Public Health Service, the Boston Baby Hygiene Association, the Boston Health Department,

and several other agencies are cooperating to ascertain the value of powered milk from the human nutritive point of view. The data resulting from this cooperation will assist Federal, State and city food officials in framing and enforcing health regulations regarding manufacture and sale of powdered milk. The information obtained will also assist in controlling morbidity in infants.

"Only infants less than six months old and who are entirely artificially fed will be included in the study. Babies on diet will not be included. Orange juice may be given, however, as it is given to babies on Grade A milk. The babies in the study will be divided in three groups, the divisions being made according to the kind of food used.

"Group 1 will consist of babies whose modifications are prepared from Grade A milk. The constituents of this natural milk are: Fat 4.00 per cent; Sugar 4.80 per cent; Protein 3.18 per cent.

"Group 2 will consist of babies whose modifications are prepared from whole milk powder which will be reconstituted in the homes. This powder will be kept on hand in the stations and dispensed by the nurses. The powder comes in five-pound tins, and the nurse should know how long a tin should last. The paper wrapper must be removed and a label marked "Baby Milk Powder" pasted on the tin.

"Group 3 will consist of babies whose modifications are prepared from milk which has been reconstructed from unsalted butter and skimmed milk powder. This preparation will be delivered as is Grade A milk.

"The conference physician will order all modifications, as usual.

"Method of preparing milk.

"For Group 1: Same as usual.

"For Group 2: Add 164 grams (equivalent to one and one-half cupfuls) of the whole milk powder to one quart of cooled boiled water. When measuring the powder dip

it from the tin with a large spoon. The powder is light and should not be packed down. Beat with a Dover egg-beater until it is thoroughly mixed. The constituents of this mixture will be approximately as follows: Fat, 4.00 per cent; Sugar, 5.70 per cent; Protein, 3.71 per cent. The per cent of sugar will be about 1 per cent higher than in Grade A milk. The conference physician, when ordering modifications that use this mixture as a basis, will take this fact into consideration when ordering the sugar.

"For Group 3: The constituents of this reconstructed milk will be approximately as follows: Fat 4.00 per cent; Sugar, 5.10 per cent; Protein 3.10 per cent. The method of modification will be the same as if Grade A were used.

"The following data should be recorded on history cards:

1. Weight of baby at beginning and at least every two weeks thereafter.

2. Strength and amount of feeding, hours of feeding, amount taken in twenty-four hours, and changes made.

The conference physician may change the food, either to a different modification of the same food or to a different food, but the reason for such change should be recorded. It is hoped that a fair trial will be given each food before changes are made, but the welfare of the children comes first and changes should be made in their interest.

3. Nature and extent of any illness and treatment.

4. General condition of the baby with special reference to character and changes in stools, general development, activity, teething and disposition.

5. Environment of the baby, with special reference to the mother's intelligence and cooperation.

"The babies included in this study should be watched closely and careful notes must be made after each visit.

"This is an unusual opportunity for the Baby Hygiene Association to contribute to the cause of baby welfare and of public health. The success of the study depends large-

ly on the excellent work which the staff nurses can do. Accurate observations and recording are essential to success.

"The results of the study will be compiled at the central office at the end of three months, and in due time be made available to officials charged with regulation of milk supplies and to the medical profession."

Progress of the Study.

The nurses at the various conference stations submitted the names of all artificially fed babies who were less than six months old to the central office of the Association. The Director of the Association assigned the babies to the various groups, thus eliminating any partiality in the selections. Some delay occured in beginning the study, with the result that a few of the babies were slightly more than six months old when the feeding was actually begun.

Babies were first fed remade milk on August 18th, and the study was extended as rapidly as the nurses could visit the homes and demonstrate the preparation of the new foods. Other babies than those assigned at the beginning have been added to the groups but the tabulations presented here include none who were added subsequent to September 24th.

It was thought desirable at the beginning, but after the groups were formed, to classify all babies in subgroups such as "Well," "Slightly sick," "Sick," and "Very sick," according to their physical condition, and a fairly definite system for so doing was improvised. In the cases of individual babies some very interesting data developed from this subgrouping, but the numbers included in these subdivisions are so small that it is impractical to draw conclusions from them as subgroups. The subdivisions remain, but are not utilized in this report.

Some difficulty was experienced in obtaining a perfect emulsion of the unsalted butter and powdered skimmed. A thin float of fat appeared on the surface of the milk in

the necks of the bottles and this difficulty was never entirely overcome. This loss of fat was compensated for, however, so that the remaining emulsion contained the required 4.00 per cent, and the float was removed and discarded. It is believed that the ingredients and the machine used in this study are capable of producing better results than we obtained, but it is doubtful if better results are likely to be obtained in commercial practice at the present time.

This study was conducted under such practical conditions as are likely to prevail if remade milk should be used for infant feeding in the home; it did not, therefore, afford opportunity for so close observations and control as would have been possible with hospitalized babies.

A considerable number of mothers refused the invitation to transfer their babies from natural milk to either form of remade milk. The psychology which prompted this refusal prevailed to some, though to a less extent among the mothers who accepted the invitation; without material reason for so doing a number of mothers removed their babies from the remade milk within a few days after beginning its use. The appearance of the floating fat perviously referred to was also a disturbing influence to some. A number of the mothers consulted private physicians, who advised discontinuance of the remade milk (on general principles), as was to be expected because use of remade milk in infant feeding is comparatively new and not universally understood.

Such data as were obtained are contained in the following tables:

GROUP 2

TAKEN OFF: WHOLE MILK POWDER.

	AT BEGINNING			On powder mos. days	Weight lbs. oz.	Condition	Change made by	Approval of Conference Physician or Nurse?	
	Age mos. days	Weighed lbs. oz.	Condition						
B–36	1–5	7–8	very sick	–9	7– 5	Better	Private physician	No	
B–38	4–13	9–14	slightly sick	– 1	Not weighed	No change	Mother	No	
B–39	1–21	7– 9	slightly sick	– 2			Mother	No	
B–40	Died for	following	g operation	Few days	Not weighed	No change			
		congeni	tal defect						
B–32	5– 6	14–14	Well	–21	14–10	No change	Nurse	Yes	Nurse did not believe baby was getting powder.
B–41	5–15	Not weighed		– 9	Not weighed	No change	Mother	No	
B–42	2–19	9– 2	Well	–26	Not weighed	No change	Mother	No	Back on powder again
B–43	3–26	13– 8	Well	Few days	Not weighed	No change	Mother	No	
B–44	2–	12– 4	Well	Few days	Not weighed	No change	Mother	No	
B–45	1– 4	9– 8	Well (on sugar - reported on full milk formula)	– 5	Not weighed	Sick (overfeeding)	Private physician		Error due to mother's misstatement.
B–46	4–15	10– 1	Sick	– 5	Not weighed	No change	Private physician	No	Related to B–45, same physician.
B–47	4–15	14– 2	Well	– 5	Not weighed	No change	Private physician	No	Friend of B–45, same physician
B–34	2–21	8– 1	Slightly sick	1– 4	9– 1	No change	Mother	No	
B–48	1–	8– 6	Sick	Few days	Not weighed	No change	Private physician	No	
B–35	5–26	15–	Slightly sick	–20	16–	No change	Conference physician	Yes	To a fat free formula
B–37	2–15	12– 2	Very sick	–21	13– 2	Better	Mother	No	
B–49	2–11	12–10	Seemed well	Few days	Not weighed	No change	Mother	No	
B–50	2–20	10–10	Well	– 1	Not weighed	No change	Mother	No	
B–33	5– 2	13– 2	Well	– 3	13– 7	No change	Private physician	No	

GROUP 3

TAKEN OFF: EMULSED

	AT BEGINNING			On emulsed	Weight				
	Age mo days	Weighed lbs. oz.	Condition	mos. days	lbs. oz.	Condition	Change made by	Approval of Conference Physician or Nurse?	
C–19	6–21	16– 4	Sick	–15	16– 9	Loose movements	Mother	No	
C–24	5–25	13– 9	Slightly sick	Few days	Not weighed	No change	Mother	No	
C–20	2–10	11– 1	Very sick	– 3	10–10	No change	Conference physician	Yes	
C–15	2–20	12– 2	Well	1–15	13– 3	Not so well	Conference physician	Yes	
C–17	5– 9	12–	Sick	1–15	13– 2	Not so well	Conference physician	Yes	
C–16	1–14	7–10	Slightly sick	–19	8– 6	No change	Mother		
C–18	6– 3	11–14	Sick	2–	13– 5	Not doing well	Conference physician	Yes	
C–21	2–	7– 2	Very sick	–13	7– 5	Better	Conference physician	Yes	
C–25	1–21	8–10	Slightly sick	1–	9– 6	No change	Conference physician	Yes	Baby lost track of
C–26	3–25	12–12	Well				Family moved		Baby lost track of
C–27	1–15	7–10			8– 8		Family moved		
C–22	2–17	10–12	Very sick	–14	10– 8	No change	Mother	No	
C–23	6– 2	10–8	Very sick	1–21	11– 8	No change	Conference physician	Yes	
C–28				– 2			Mother	No	

The columns "Change made by" and "Approval of conference physician or nurse" are taken to be the significant ones of these tables. It is permissible to assume that the conference physicians and nurses would have removed the babies from the remade milk groups on the development of any untoward symptoms that might reasonably be attributed to the remade milk; in fact, removal of babies by the conference physicians does not necessarily justify condemnation of remade milk for infant feeding, for the conference physicians took no chances but removed babies on the development of symptoms or for lack of progress which was only remotely attributable to the remade milk. Mothers and private physicians, on the other hand, actuated by the psychology previously referred to, i. e. prejudice against any new form of infant feeding, are likely to remove babies from studies of this kind without any material reason for so doing.

No attempt was made to transfer babies from Group 1 (natural milk) to either of the other groups; therefore no table "Taken Off" is presented for Group 1. In the Weight Table for Group 1, however, it will be noticed that nine babies did not return to the conference stations to be weighed during the second period of the study. It is reasonable to conclude that had these babies been on a new and not universally understood diet, a considerable proportion of them would have been removed from it.

GROUP 1

NATURAL MILK

	AT BEGINNING		FIRST PERIOD			SECOND PERIOD			ENTIRE PERIOD		
	Age mo. da.	Weight lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs oz.	Time on mo da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo da.	Gain lbs. oz.	Loss lbs. oz.
Well											
A- 1	4 - 21	11 - 6	- 7	- 3		2 - 23	3 - 4		3 -	3 - 7	
A- 2	4 - 7	12 - 12							3 -	3 - 9	
A- 3	3 - 26	13 - 3	2 - 3	3 - 7		- 27	- 2		3 -	3 - 9	
A- 4	3 - 25	11 - 13	1 - 25	3 - 5		- 27	1 - 7		2 - 22	4 - 12	
A- 5	3 - 9	11 - 6	1 - 18	2 - 14		1 - 4	1 - 5		2 - 22	4 - 3	
A- 6	3 - 14	11 - 4									
A- 7	5 - 2	11 - 13	2 - 16	2 - 5					2 - 16	2 - 5	
A- 8	3 - 16	10 - 6	1 - 29	2 - 8					1 - 29	2 - 8	
A- 9	3 - 13	13 - 8	1 - 5	1 - 7					1 - 5	1 - 7	
A-10	3 - 25	13 - 2	1 - 4	1 - 6					1 - 4	1 - 6	
A-11	4 - 6	14 - 10	1 - 25	2 - 10					1 - 25	2 - 10	
A-12	3 - 27	12 - 8	1 - 5	1 - 3		1 - 3	1 - 14		2 - 8	3 - 1	
A-13	4 - 2	11 - 11	2 - 5	1 - 13		- 20	- 11		2 - 25	2 - 8	
A-14	5 -	12 - 13	- 20		1 -				- 20		1 - *
A-15	5 -	12 - 15	2 - 2	2 - 13					2 - 2	2 - 13	
A-16	3 - 26	11 - 5	1 - 11	2 - 3		1 - 11	- 10		2 - 22	2 - 13	
A-17	4 - 29	10 -	2 - 5	2 - 9		- 27	- 3		3 - 2	2 - 12	
Slightly sick											
A-18	2 - 6	8 - 10	1 - 26	2 - 10		1 - 4	1 - 15		3 -	4 - 9	
A-19	1 - 26	8 - 6	2 - 12	4 - 7		- 20	1 - 5		3 - 2	5 - 12	
A-25	1 -	10 - 1	1 - 4	1 - 15		2 - 2	2 - 14		3 - 6	4 - 13	
Sick											
A-20	3 -	5 - 12	2 - 2	- 12		- 20	- 10		2 - 22	1 - 6	
A-21	3 - 17	10 -	1 - 19	2 - 2		1 - 4	- 12		2 - 23	2 - 14	
A-22	5 - 1	11 - 1	2 -	1 - 11		- 22	- 5		2 - 22	2 -	
A-23	1 - 7	6 - 6	- 28	1 - 5					- 28	1 - 5	
A-24	1 - 7	6 -	- 28	1 - 1		Died at Infants Hospital			- 28	1 - 1	‡
A-26	5 - 16	10 - 15	1 - 19	1 - 1		- 27	2 - 5		2 - 16	3 - 6	
Very sick											
A-27	3 -	7 - 15	- 10		- 2				- 10		- 2
A-28	5 - 6	13 - 4	1 - 4	1 - 4					1 - 4	1 - 4	
TOTAL - in all 28 babies	103 - 4	304 - 13	40 - 2	47 - 12		17 - 1	19 - 10		60 - 3	70 - 15	
Average	3-20.5	10-14.2	Average gain per day of 26 babies - - - - . 635 oz.			Average gain per day of 15 babies - - - . 614 oz.			Average gain per day of 27 babies - - - - . 629 oz		

*Now in Hospital. ‡Indigestion.

GROUP 2

STAYED ON WHOLE MILK POWDER

	AT BEGINNING		FIRST PERIOD			SECOND PERIOD			ENTIRE PERIOD		
	Age mo. da.	Weight lbs. oz.	Time on mo. da.	Gain lbs. oz	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.
Well											
B- 1	6 - 10	13 - 14	2 - 4	4 - 7		- 21	1 - 6		2 - 25	5 - 13	
B- 2	1 - 27	8 - 8	2 - 2	5 -		- 22	- 12		2 - 24	5 - 12	
B- 3	4 - 1	14 - 11	1 - 28	3 - 6		- 28	1 - 3		2 - 26	4 - 9	
B- 4	3 - 20	12 - 1	2 - 4	3 - 5		- 21	- 7		2 - 25	3 - 12	
B- 5	5 - 10	12 - 12	1 - 4	1 - 7		1 - 18	2 - 2		2 -22	3 - 9	
B- 6	4 - 4	11 - 4	1 - 4	2 - 10		1 - 18	2 - 9		2 - 22	5 - 3	
B- 7	4 - 21	15 - 5	1 - 12	1 - 4		- 21	- 6		2 - 3	1 - 10	
B- 8	2 - 22	8 - 14	2 - 2	3 - 10		- 21	1 - 1		2 - 23	4 - 11	
B- 9	4 - 27	12 -	1 - 3	2 - 6		1 - 4	1 - 5		2 - 7	3 - 11	
B-10	3 - 6	11 - 14	1 - 18	2 - 9		1 - 4	2 - 4		2 - 22	4 - 13	
B-11	5 - 3	14 - 14	1 - 19	2 - 4		- 21	1 - 9		2 - 10	3 - 13	
B-12	4 - 17	12 - 10	1 - 11	2 - 12		- 29	- 10		2 - 10	3 - 6	
Slightly sick											
B-13	4 - 6	10 - 8	- 20	1 - 7		1 - 4	2 - 6		1 - 24	3 - 13	
B-14	- 28	8 - 2	1 - 14	1 - 5		1 - 3	1 - 9		2 - 17	2 - 14	
B-15	3 - 11	12 - 4	1 - 14	2 - 12		- 18	1 - 4		2 - 2	4 -	
B-16	2 - 29	10 -	1 - 11	1 - 5					1 - 11	1 - 5	
B-17	4 - 27	10 -	1 - 11	2 - 7		- 26	1 - 8		2 - 7	3 - 15	
B-18	3 - 7	11 - 1	1 - 1	2 - 11		1 -	1 - 15		2 - 1	4 - 10	
B-19	5 - 13	13 - 9	1 - 11	2 - 9		- 26	1 - 4		2 - 7	3 - 13	
B-20	5 - 14	11 - 1	1 - 15	4 - 2		- 24	- 11		2 - 9	4 - 13	
B-21	2 - 15	5 - 15	2 - 4	3 - 8		- 20	1 - 2		2 - 24	4 - 10	

GROUP 2—Continued

Sick										
B–22	3 – 16	6 – 7	2 – 2	4 – 5		– 13	1 – 3		2 – 15	5 – 8
B–23	4 – 20	8 – 8	2 – 2	3 – 8		– 20	1 – 2		2 – 22	4 – 10
B–25	1 – 28	6 – 1	1 – 12	1 – 2		– 28	1 –		2 – 10	2 – 2
B–26	3 –	7 – 13	– 19	– 9		1 –	– 15		1 – 19	1 – 8
B–27	4 – 1	9 –	– 20	1 – 1		– 21	1 – 9		1 – 11	2 – 10
B–28	3 – 5	8 – 14	1 – 5	– 12		1 – 1	1 – 6		2 – 6	2 – 2
Very sick										
B–29	3 – 3	7 – 13	1 – 26	2 – 3		– 27	1 –		2 – 23	3 – 3
B–30	1 –	7 –	2 –	7 – 2		– 13		– 3	2 – 13	6 – 15
B–31	2 – 1	10 – 1	1 – 13	1 – 15		1 – 1	5 – 7		2 – 14	7 – 6
TOTAL - in all 30 babies	110 – 2	312 – 12	45 – 11	79 – 11		25 – 23	40 – 12		71 – 4	120 – 7
Average	3 – 20	10–6.8	Average gain per day of 30 babies - - - . 937 oz.			Average gain per day of 29 babies - - - . 844 oz.			Average gain per day of 30 babies - - - . 903 oz.	

GROUP 2

TAKEN OFF WHOLE MILK POWDER: WHILE ON

	AT BEGINNING		FIRST PERIOD			SECOND PERIOD			ENTIRE PERIOD		
	Age mo. da.	Weight lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.
Well											
B–32	5 – 6	14 – 14	– 21		– 4						
B–33	5 – 2	13 – 2	– 3	– 5							
Slightly sick											
B–34	2 – 21	8 – 1	1 – 4	1 –							
B–35	5 – 26	15 –	– 20	1 –							
Sick											
Very sick											
B–36	1 – 5	7 – 8	– 9		– 3						
B–37	2 – 15	12 – 2	– 21	1 –							
TOTAL - in all 6 babies	22 – 15	70 – 11	3 – 18	2 – 14							
Average	3 –22. 5	11 –12. 5	Average gain per day of 6 babies - - - . 426 oz.								

GROUP 3

STAYED ON RECONSTRUCTED: SWEET BUTTER AND POWDERED SKIMMED

	AT BEGINNING		FIRST PERIOD			SECOND PERIOD			ENTIRE PERIOD		
	Age mo. da.	Weight lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.
Well											
C- 1	5 - 22	13 - 11	1 - 27	3 - 11		- 21	1 - 4		2 - 18	4 - 15	
C- 2	3 - 5	10 - 4	1 - 23	1 - 11		- 21	1 - 11		2 - 14	3 - 6	
C- 3	3 - 4	11 - 8	1 - 26	3 -		- 14	- 3		2 - 10	3 - 3	
C- 4	2 - 18	12 - 11	1 - 23	2 - 9		- 28	1 - 13		2 - 21	4 - 6	
C- 5	5 - 1	14 - 2	1 - 10	3 - 2		1 - 8	3 - 5		2 - 18	6 - 7	
C- 6	4 - 3	14 - 8	1 - 13	2 -		- 14	1 - 4		1 - 27	3 - 4	
C- 7	4 - 25	16 - 12	- 11	- 7					- 11	- 7	
Slightly sick											
C- 8	3 - 26	12 - 7	1 - 25	2 - 4		- 21	1 - 1		2 - 16	3 - 5	
C- 9	4 - 10	12 - 3	1 - 14	1 - 10		1 - 4	1 - 6		2 - 18	3 -	
Sick											
C-10	3 - 18	8 - 14	1 - 27	2 -		- 21	- 13		2 - 18	2 - 13	
C-11	6 - 3	15 - 7	1 - 12	1 - 1		1 - 3	- 15		2 - 15	2 -	
C-12	1 - 15	9 - 6	1 - 23	3 - 2		- 28	2 - 3		2 - 21	5 - 5	
Very sick											
C- 13	3 - 12	10 - 14	1 - 3	1 - 11		- 26	- 10		1 - 29	2 - 5	
C-14	4 - 16	9 -	1 - 28	4 - 6		- 14	- 9		2 - 11	4 - 15	
TOTAL - in all 14 babies	55 - 28	171 - 11	21 - 24	32 - 10		10 - 13	17 - 1		32 - 7	49 - 11	
Average	4 -	12 -4.2	Average gain per day of 14 babies - - - . 798 oz.			Average gain per day of 13 babies - - - - . 872 oz.			Average gain per day of 14 babies - - - - . 822 oz.		

GROUP 3

TAKEN OFF RECONSTRUCTED: SWEET BUTTER AND POWDERED SKIMMED : WHILE ON:

	AT BEGINNING		FIRST PERIOD			SECOND PERIOD			ENTIRE PERIOD		
	Age mo. da.	Weight lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.	Time on mo. da.	Gain lbs. oz.	Loss lbs. oz.
Well											
C–15	2 – 20	12 – 2	1 – 15	1 – 1					1 – 15	1 – 1	
Slightly sick											
C–16	1 – 14	7 – 10	– 19	– 12					– 19	– 12	
Sick											
C–17	5 – 9	12 –	1 – 15	1 – 2					1 – 15	1 – 2	
C–18	6 – 3	11 – 14	2 –	1 – 7					2 –	1 – 7	
C–19	6 – 21	16 – 4	– 15	– 5					– 15	– 5	
Very sick											
C–20	2 – 10	11 – 1	– 3		– 7				– 3		– 7
C–21	2 –	7 – 2	– 13	– 3					– 13	– 3	
C–22	2 – 17	10 – 12	– 14		– 4				– 14		– 4
C–23	6 – 2	10 – 8	1 – 21	1 –					1 – 21	1 –	
TOTAL - in all 9 babies	35 – 6	99 – 5	8 – 25	5 – 3					8 – 25	5 – 3	
Average	3 – 27	11 – 5	Average gain per day of 9 babies - - - . 313 oz.						Average gain per day of 9 babies - - - . 313 oz.		

SUMMARY

	GROUP I	GROUP 2			GROUP 3		
		Stayed on	Taken off	Total, Group 2	Stayed on	Taken off	Total, Group 3
At beginning	28 babies	30 babies	6 babies	36 babies	14 babies	9 babies	23 babies
Total age	103 mo. 4 da.	110 mo. 2 da.	22 mos 15 da.	132 mo 17 da	55 mo. 28 da.	35 mo. 6 da.	91 mo. 4 da
Average age	3 mo 20.5 da.	3 mo 20 da.	3 mo 22.5 da	3 mo. 20.5da.	4 mos.	3 mo. 27 da.	3 mo. 29 da.
Total weight	304 lbs. 13 oz.	312 lbs. 12 oz.	70 lbs. 11 oz.	383 lbs. 7 oz.	171 lbs. 11oz.	99 lbs. 5 oz	271 lbs.
Average weight	10 lbs.14.2 oz.	10 lbs. 6.8 oz.	11 lbs.12.5 oz.	10 lbs.10.5 oz.	12 lbs. 4.2 oz.	11 lbs. . 5 oz.	11 lbs. 12 oz.
First period	26 babies	30 babies	6 babies	36 babies	14 babies	9 babies	23 babies
Time of feeding	40 mo. 2 da.	45 mo.11 da.	3 mo. 18 da.	48 mo. 29 da.	21 mo. 24 da.	8 mo. 25 da.	30 mo. 19 da.
Total gain	47 lbs. 12 oz.	79 lbs. 11 oz.	2 lbs. 14 oz.	82 lbs. 9 oz.	32 lbs. 10 oz.	5 lbs. 3 oz.	37 lbs. 13 oz.
Average gain per capita per day	.635 oz.	.937 oz.	.426 oz.	.899 oz.	.798 oz.	.313 oz.	.658 oz.
Second period	15 babies	29 babies		29 babies	13 babies		13 babies
Time of feeding	17 mo. 1 da.	25 mo. 23 da.		25 mo. 23 da.	10 mo. 13 da.		10 mo. 13 da.
Total gain	19 lbs. 10 oz.	40 lbs. 12 oz.		40 lb. 12 oz.	17 lb. 1 oz.		17 lbs. 1 oz.
Average gain per capita per day	.614 oz.	.844 oz		.844 oz	.872 oz.		.872 oz.
Entire period	27 babies	30 babies		36 babies	14 babies		23 babies
Time of feeding	60 mo. 3 da.	71 mo. 4 da.		74 mo. 22 da.	32 mo. 7 da.		41 mo. 2 da.
Total gain	70 lbs. 15 oz.	120 lbs. 7 oz.		123 lbs. 5 oz.	49 lbs. 11 oz.		54 lbs. 14 oz.
Average gain per capita per day	.629 oz.	.903 oz.		.880 oz.	.822 oz.		.713 oz.

The Weight Tables give individual and average ages and weights at the beginning of the study; individual and total time, in months and days, of feeding; individual gain or loss, in pounds and ounces; total gain, and average gain per baby per day. In the cases of Groups 2 and 3, separate tables are presented of such comparative weights as were obtained of the babies who were subsequently "Taken Off." All comparative weights taken previous to October 22 were compiled and are here presented as "Time on" and "Gain" or "Loss" for the "First period." Comparative times of feeding and comparative weights that were taken after October 22 and before November 13 are here presented as for the "Second period." Comparative times of feeding and comparative weights taken between the beginning of the study and November 13 are presented as for the "Entire period."

The averages of all groups, including age and weight at beginning, "Stayed on" and "Taken off," time on, total gain, and average gain per baby per day for all periods, are carried forward into a Summary.

Satisfactory laboratory analyses and experiments with animals, freedom from immediate dangers and increase in weight following their use are not sufficient criteria to warrant final conclusions relative to the comparative values of different foods in infant feeding; nor, as has been said, are final conclusions warranted until the effects of use of different foods have been studied for a prolonged period. However, the opinions of trained and experienced workers, in this case the nurses of the Boston Baby Hygiene Association, who have had intimate contact with the units which go to make up a study of this kind, are of some value when considering the relative values of different foods as used.

Each nurse who had supervised one or more babies in Groups 2 or 3 (there were about twenty such nurses) was asked to express a conservative opinion on November

12th regarding the progress, with special reference to general development, activity, teething, and disposition, of such babies as she had supervised. In asking these opinions the point was emphasized, as it had been at all times during the study, that those who were cooperating in the study were not interested to determine superiority for any kind of food, but were only interested to secure facts as they exist. In order that these opinions might be reduced to a comparable basis the nurses were asked to state whether each baby had progressed "Better," "No change," or "Not so well" on remade milk as used, in comparison with the progress the same baby had made on its former diet or with the progress similar babies are likely to accomplish on natural milk.

In this preliminary report the foregoing data, viz.: laboratory analyses; removals from the powder, with special reference to the attitude thereto of the physicians and nurses of the Boston Baby Hygiene Association; gain in weight per baby per day; and the judgment of the nurses as to the general development, activity, teething, and disposition of the babies in Groups 2 and 3, are used in drawing preliminary conclusions relative to the Safety, Usefulness, and Comparative Value of remade milk, of the brand employed, as used, in infant feeding.

SAFETY

Such laboratory analyses as were made indicate that the dry milk powders and their remade products used in this study are safe for infant feeding.

Two babies died during the period of the study. Of these, one baby, a member of Group 2 (whole milk powder) died following an operation for a congenital defect. The other, a twin, and a member of Group 1, was badly nourished at the time she was placed on natural milk; she died of indigestion.

Only one other baby, a member of Group 2. developed serious illness. This illness resulted from misinformation furnished by the mother who informed the conference physician that her baby was being fed on a milk mixture when, as a matter of fact, she had been feeding him on a proprietary food which consists almost entirely of sugar. The conference physician prescribed whole milk powder in a strength corresponding with natural milk as stated by the mother. A serious case of overfeeding resulted, but was followed by recovery.

These deaths and the serious illness are not considered to be significant so far as the foods used are concerned. Such other illnesses as occurred were slight and transitory.

Group 2. In all, forty-nine babies were fed milk that had been reconstituted from whole milk powder. Nineteen babies were removed from this group. Two removals have already been accounted for. For various reasons, or for no material reason, twelve babies were removed within a few days and three more after longer periods by their mothers or by private physicians. Development of illness attributable to the milk powder was not a significant reason for these removals. Only two babies were removed from the powder by conference physicians or nurses. The conference physician removed one baby for the purpose of putting it on a fat-free formula. A conference nurse removed the other because other members of the family were using the milk powder.

The circumstances attending the removal of babies from the whole milk powder employed as used in this study furnish no indication that it is unsafe for infant feeding.

Group 3. In all, twenty-eight babies were fed on remade milk which had been reconstructed from unsalted butter and skimmed milk powder. Difficulties experienced in making daily deliveries of this mixture account in large measure for lesser number of babies included in this group than in Group 2.

Fourteen babies were removed from Group 3. No baby in this group died, nor did any become seriously ill. The families of two moved and the babies were lost sight of; five were removed by their mothers for reasons that can not be considered adverse to the feeding mixture; conference physicians removed seven for the purpose of putting them on other feeding mixtures.

The circumstances attending the removal of babies from the remade milk obtained by reconstructing unsalted butter and the skimmed milk powder employed in this study furnish no indication that it is unsafe for infant feeding; the circumstance that fifty per cent of the removals from reconstructed milk were approved by the conference physicians, as compared with ten per cent in the case of milk that had been reconstituted from whole milk powder, justifies the conclusion that these forms of remade milk differ in their effects when fed to infants.

USEFULNESS.

Group 1. Twenty-seven babies were fed on modifications of natural milk for a combined period of sixty months and three days; their combined gain in weight was seventy pounds and fifteen ounces; the average gain per baby per day was .629 ounces.

Group 2. Thirty-six babies were fed on modifications of whole milk powder for a combined period of seventy-four months and twenty-two days; their combined gain in weight was one hundred and twenty-three pounds and five ounces; the average gain per baby per day was .880 ounces.

Group 3. Twenty-three babies were fed on modifications of milk that had been reconstructed from unsalted butter and skimmed milk powder for a combined period of forty-one months and two days; their combined gain in weight was fifty-four pounds and fourteen ounces; the average gain per baby per day was .713 ounces.

While gain in weight alone is not sufficient evidence on which to base final conclusions relative to the adequacy

of a food for infant feeding, and while it may prove that excess gain over that which has been considered normal may not be desirable, the foregoing figures seem to warrant the conclusion the whole milk powder and the skimmed milk powder and unsalted butter employed in this study are useful in infant feeding, and further, and especially in the case of the whole milk powder, and in the case of babies who are undernourished and who digest natural milk badly, these remade milks may have points of distinct advantage in infant feeding. The figures also warrant the conclusion that reconstituted, reconstructed, and natural milks differ in their effects when fed to infants; and that reconstituted and reconstructed milk should be labeled and sold for what they are and that they should not be substituted and sold for natural milk without knowledge of the fact by the purchaser.

COMPARATIVE VALUE

The opinions expressed by the nurses with respect to the comparative value of reconstituted, reconstructed, and natural milk in infant feeding, and with special reference to their influence on the babies' general development, activity, teething, and disposition, strengthen the conclusions already drawn, viz., that reconstituted and reconstructed milks, of the brand employed and as used in this study, are safe and useful for infant feeding and that in certain respects, particularly in the case of reconstituted milk, and in the cases of babies who digest natural milk badly, they may have points of distinct advantage in infant feeding. The opinions of the nurses further strengthen the conclusion previously arrived at that reconstituted, reconstructed, and natural milks differ in their effects when fed to infants.

The facilities available for this study were only sufficient to enable use of one brand of dry milk powder. Therefore, no conclusions are drawn relative to the effects of use in infant feeding of other brands of dry milk powder which were not employed in this study.

REPORT OF COMMITTEE ON REMADE MILK—PART IV

Legislative Restrictions Necessary for Remade Milk

Albert F. Stevenson, New York City

In order to control the manufacture and sale of remade milk products, such products must be clearly defined. As the art of making remade milk is so young and immature, your committee suggests that any definition accepted must be sufficiently comprehensive to include possible combinations which are not yet in use. The following definition is suggested for your consideration:

Remade milk products are products made by the reassembling of the various component parts of milk in proportions similar to those occurring in the natural milk products.

This definition will include milk or cream made from butterfat and either of the following combinations: Unsweetened condensed skimmed milk and water, skimmed milk powder and water, or normal skimmed milk. It will also include products made from dried whole milk and water, dried cream and water, condensed milk and water, and frozen cream.

To properly control the quality of remade milk it will be necessary to formulate and enforce regulations governing the production, manufacture and handling of the various substances which enter into the manufacture of remade milk. It is not thought that this first report should contain details of such regulations, but rather that the main principles involved should be established. In general it may be said that any product used in the manufacture of remade milk should be produced and handled with the same degree of cleanliness and care that we demand in the production and handling of our fluid market milk, and that during manufacture no treatment should be employed which in any way deleteriously alters the nutritive value of the product.

At the present time it is impossible to tell just what processes of manufacture do damage the nutritive value of the product, for only actual feeding experiments can settle this question; but it may be said that any ingredient which will not blend with the other ingredients to make a product resembling milk or cream in appearance and flavor should be looked on with suspicion.

In the control of products entering into the manufacture of remade milk it is of extreme importance that the various States and provinces adopt uniform regulations. This point may be easily understood when we consider that the point of production of the various ingredients and the point of consumption of the remade milk are likely to be so widely separated that the production end of the chain can never be seen by the food officials representing the consumer. Let us, then, at the outset of our attempt to regulate this industry agree on necessary regulations and see to it that these regulations are adopted throughout the United States and Canada. With such uniformity established, any food official should be able to determine the grade of product under discussion by simply referring to the most recent plant inspection report of the official in charge of the district where the product in question was produced.

The need of official control of dried milk, condensed milk and butter factories is great and these industries should be required to conform to all the regulations prescribed for the production of fluid market milk before their products are accepted as fit for use in the manufacture of remade milk.

"The supervision of the milk supply presents greater difficulties than does the supervision of any other food."

REPORT OF COMMITTEE ON REMADE MILK—PART V

General Conclusions of the Committee

Dr. Harry W. Redfield, *Chairman*

1. COMMERCIAL AND ECONOMIC ASPECTS.

Your committee believes that whole milk powder, skim milk powder, unsalted butter, sweet or frozen cream and potable water are the best raw materials to use for preparing remade milk. We believe that for the good of producer and consumer alike, only high-grade constituents should be used in preparing remade milk. We believe that as a substitute in time of serious shortage, remade milk would have a really great value in supplying milk to children who would otherwise suffer. We believe that the cost of remade milk is a vital factor in its commercial success, and on the basis of available data it appears doubtful whether it can be sold as cheaply as natural milk.

2. EFFECT ON DAIRY INDUSTRY.

Your committee believes that the use of remade milk will help to stabilize the market for dairy products; will help to solve the problem of surplus milk; and will help to increase the use of milk generally.

3. RESULT OF INFANT FEEDING.

Your committee believes that such data as are available indicate that:

a. Different qualities in raw milk used, different processes of drying and remaking, and different periods of storage result in different qualities in the remade product.

b. The anti-neuritic element is retained in dried milk powder; the anti-scorbutic element contained in raw milk is reduced, or lost, during the process of drying and during prolonged storage.

c. The results of an original investigation conducted by the committee indicate that the brand of milk powder employed, and as used, is safe and useful for infant feeding; that in certain cases it may possess points of distinct advantage in infant feeding; and that the indications are that natural, reconstituted, and reconstructed milks differ in their effects when fed to infants.

4. LEGISLATIVE RESTRICTIONS NECESSARY.

As a direct corollary of the last observation, your committee believes that remade milk should not be sold in mixture with natural milk, but should be sold only unmixed as remade milk; and that it should be labelled so as to show clearly of what constituents it was prepared and by what method of manufacture these constituents were combined. It further believes that:

A revocable license should be issued by State authorities to each plant within its borders making and selling any product which might enter into remade milk or cream, such as milk powder, frozen cream and unsalted butter. The plant should be subject to inspection and the license should be contingent upon the maintenance of good sanitary conditions which should be specified.

Bacterial limits should be set for milk (or any of its products) which is to be manufactured into milk powder, frozen cream or unsalted butter from which in turn remade milk or cream might subsequently be prepared.

If sugar is used in making milk powder, frozen cream or unsalted butter, from which remade milk or cream might subsequently be prepared, the per cent present in the product as ready for marketing should be required on the label.

The addition of any alkaline substance, any preservatives or any other substances except sugar and small amounts of calcium hydrate should be prohibited in the

manufacture of milk powder, frozen cream or unsalted butter from which remade milk or cream might subsequently be prepared.

Skim milk powder should be clearly labelled.

The word "milk" either singly or in combination should not be allowed upon the label of any product in which butterfat has been wholly or in part substituted by any other fat and from which remade milk or cream might subsequently be prepared.

A revocable license should be issued by the authorities of each city to each plant within its jurisdiction making and selling remade milk and cream. The plant should be subject to inspection and the license should be contingent upon the maintenance of good sanitary conditions which should be specified.

Bacterial limits should be set for remade milk and cream at the time of delivery to consumers. All remade milk and cream should be pasteurized efficiently.

If added sugar is present from whatever source, the amount present should be stated on the label.

The presence of added alkaline substances, preservatives of any kind, or other added chemical substance (except sugar and small amounts of calcium hydrate) from whatever source, should be prohibited.

If butterfat has been substituted by any other fat, the use of the word "milk" on the label in any connection whatever should be denied.

The requirements concerning the amounts of fat and solids not fat may be made whatever seems desirable, but these requirements for fat and solids not fat in remade milk should conform to similar local requirements in natural milk.

The same temperature requirements as for natural milk and cream should be applied.

DISCUSSION

Mr. Kelly: This is a wonderful report, and we are fortunate to have it. I am in doubt, however, regarding the economic phase of the report. If the powdered milk business stabilizes the industry it will be a wonderful thing. I know of one city now planning to put remade milk on the market for at least five cents per quart less than fresh milk is now sold for. If powdered milk can be made where milk is plentiful and relatively cheap and sold in sections where there is little or no milk produced, it may delay the production of a greater supply of fresh milk in such places. Milk powder may be made in seasons of low prices for use in seasons of high prices.

Mr. Taylor: I was surprised that people in non-dairy States seemed to favor powdered milk.

Dr. Redfield: I believe that only in exceptional cases can remade milk be made and sold for less than the fresh product.

"He that will not be ruled by the rudder must be ruled by the rock."

STUDIES ON THE COMPOSITION OF MARKET MILK IN MASSACHUSETTS

C. E. MARSH, Massachusetts State Board of Health

In 1917, Mr. Hermann C. Lythgoe stated before the Convention at Washington that "the composition of the milk in Massachusetts indicates a marked deterioration in quality, a considerable decrease in the sale of high-grade milk, and a marked increase in the sale of low-grade milk." If that statement were true in 1917, it is still more true now, as the deterioration in quality has been steadily going on as will be seen from the following tables.

TABLE I

AVERAGE OF MILK NOT DECLARED ADULTERATED

Year.	*Number of samples.*	*Solids, per cent.*	*Fat, per cent.*	*Solids not fat, per cent.*
1909	4,242	12.78	4.10	8.68
1910	5,032	12.85	4.02	8.83
1911	4,341	12.83	4.00	8.83
1912	4,516	12.66	3.89	8.77
1913	6,154	12.69	3.84	8.85
1914	5,502	12.70	3.82	8.88
1915	6,765	12.68	3.82	8.86
1916	7,458	12.66	3.72	8.94
1917	6,317	12.53	3.73	8.80
1918	6,995	12.47	3.76	8.71
1919	8,890	12.40	3.72	8.68

This table shows an almost steady decline in the quality of milk, and if the present rate of deterioration keeps up, it will not be long before our State standard of 12 per cent solids and 3.35 per cent of fat will be too high for many of the farmers to live up to; especially as the Holstein type is more and more replacing the Jersey and Guernsey types of cows.

The next table shows the same thing in a little different way.

TABLE II

	1899.	*1909–10–11.*	*1916.*	*1916–17–18.*
Number of samples.....	6,088	14,697	7,796	22,287
Above 13%	47.9%	35.7%	24.0%	18.8%
Between 12 and 13%.....	40.1%	43.6%	53.5%	56.5%
Below 12%	12.0%	20.7%	22.5%	24.7%

Note here the decrease in the number of samples containing over 13 per cent solids, and the increase in those below 12 per cent. The percentage of samples running between 12 and 13 per cent solids is also steadily increasing. The plot of samples for the three years 1909-10-11 compared with those of the years 1916-17-18 shows this same general tendency.

The next table of the milk statistics by months for the last two years shows the kind of milk which is being sold

MILK STATISTICS BY MONTHS

	Av. of all Samples				Av. of all Samples not declared Skimmed or Watered.			
Month	No.	Solids	Fat	S.N.F.	No.	Solids	Fat	S.N.F
1917								
Dec.	263	12.62	3.73	8.89	256	12.69	3.73	8.86
1918								
Jan.	408	12.05	3.46	8.59	345	12.38	3.62	8.76
Feb.	250	12.57	3.73	8.84	238	12.71	3.81	8.90
Mar.	696	12.44	3.64	8.80	625	12.56	3.71	8.85
Apr.	837	12.31	3.62	8.59	769	12.51	3.70	8.81
May	1,073	12.12	3.55	8.57	998	12.27	3.66	8.61
June	974	12.29	3.64	8.65	905	12.45	3.75	8.70
July	950	12.13	3.65	8.48	862	12.31	3.76	8.55
Aug.	832	12.27	3.88	8.39	729.	12.48	3.95	8.53
Sept.	430	12.39	3.81	8.78	427	12.61	3.82	8.79
Oct.	602	12.42	3.76	8.66	578	12.58	3.81	8.77
Nov.	302	12.25	3.70	8.55	263	12.63	3.82	8.81
Total	7.617	12.31	3.68	8.63	6,995	12.47	3.76	8.71
1918								
Dec.	774	12.48	3.72	8.76	714	12.63	3.79	8.84
1919								
Jan.	700	12.22	3.63	8.59	619	12.44	3.70	8.74
Feb.	936	12.37	3.65	8.72	891	12.49	3.72	8.77
Mar.	895	12.18	3.56	8.62	823	12.36	3.65	8.71
Apr.	850	12.20	3.60	8.60	786	12.40	3.70	8.70
May	864	12.30	3.66	8.64	812	12.37	3.72	8.65
June	776	12.20	3.59	8.61	685	12.39	3.73	8.66
July	886	12.04	3.60	8.44	829	12.20	3.69	8.51
Aug.	1,191	11.97	3.54	8.43	1,130	12.08	3.63	8.45
Sept.	596	12.30	3.68	8.62	559	12.40	3.73	8.67
Oct.	570	12.46	3.72	8.74	530	12.62	3.77	8.85
Nov.	526	12.58	3.78	8.80	512	12.65	3.82	8.84
Total	9,686	12.10	3.59	8.51	8,890	12.40	3.72	8.68

in the State. In past years, the figures for February have been higher than for other months, due to the fact that inspectors have taken samples from partly frozen milk, and could not obtain fair samples. Samples taken this way usually are too rich in fat, as the cream comes in a lump into the inspector's bottle, and he usually leaves some of the frozen portion in the dealer's bottle.* In July and August, 1919, we had more than the usual number of low samples, as at that time we were testing out an unusual number of suspected producers, and probably some adulterated milk was classed merely as low grade. On the whole, however, the milk is fairly uniform during the year.

The chart of market milk not declared adulterated since 1909 shows that milk, like most commodities, has steadily decreased in value, and increased in price. The decrease in solids and fat has, of course, lowered the food value; while the price per quart has as steadily increased. While the price per quart increased from 8 cents to 17 cents or 112 per cent, the price based on food value has increased from 1.25 cents to 2.80 cents per 100 calories, or an increase of 124 per cent, which is 10.7 per cent more than the increased price per quart.

The monthly fluctuations in the quality of milk are now much less marked than they were several years ago.

The method used to stamp out the watering of milk in one of our large cities may be of interest. While this method is like that used all over the State, the degree of cooperation was larger than usual, in this case, and the results were unusually good. This particular city had for some time held the reputation of having more watered milk than any city or town in the State. One winter we had from one to four cases in court almost every week, and whenever an inspector brought back milk to the laboratory

*This contradicts the statements of some milk men that if the inspector takes samples from partly frozen milk the results of the analyses will be too low. Our experience over several years shows the contrary to be true.

he was almost sure to bring some watered samples. If the bad milk came from a dealer, the inspector went back the next day to investigate the farmers. In case the farmers were found to be furnishing good milk, the dealer was put into court, but if watered milk was found in the farmers' possession, the dealer was not prosecuted. The dealers finally began to rely on us to watch their farmers for them, and made no attempt to learn what kind of milk they were buying. In fact, some of them bought milk from farmers who had already been in court for selling bad milk. We felt that they did this to shield themselves behind the farmer, while they themselves were stretching their supply. At last we caused a notice to be published in the paper that unless a dealer took enough interest in his supply to have samples tested either by the local inspector or by our department we would hold him personally liable if watered milk was found in his possession. Five of the largest dealers then appeared at the office and agreed to bring about 60 samples each week from their producers. After our analyses of these samples our inspectors knew just where to look for bad milk, and did not waste time collecting from the honest farmers. This method gave the farmer no idea that he was being watched until he had been caught, and our inspection force was saved many unnecessary trips. Under this scheme an inspector often visited several suspected producers on each trip, and brought to the laboratory a collection of from 15 to 20 watered samples. One dealer found that almost half his producers had been selling him water, and all of them soon learned that many farmers were selling them milk from the pump. They then hired a chemist to test samples at their milk rooms, and reported to us all cases of suspicious samples. After three or four months, the milk supply of these dealers was practically straightened out, and the only trouble we had was with some of the smaller dealers who had not cooperated either with us or the local inspec-

The Interstate Commerce Commission has stated that milk should be in cars "iced in summer" and "heated in winter." This seems inadequate for the industry, and it is the opinion of the committee that railroads should be required to maintain a definite degree of air temperature in cars used for transporting milk.

It should also be determined under what conditions of distance and time, refrigerator-car service becomes essential. Unless some such provisions are made, it does not seem reasonable for the responsibility for spoilage during transit to revert back to the shipper.

The problem of cooling and transporting milk at low temperatures in communities, especially south of the natural ice area, grows in importance as our knowledge of the value of fluid milk, and especially its value in pellagra-infested communities, increases.

Train service from distant milk producing districts to southern cities has not been adapted to the development of the dairy industry. This results in small shipments from many stations on slow local trains, arriving during the day, and a delay at the milk plants before the entire supply has been received for pasteurization.

In some districts, special types of refrigerator cans have been brought into use in an effort to prevent spoilage during transit, and as a temporary solution this practice seems to be effective. More milk must be used throughout the South, if for no other reason than its value in the prevention of pellagra. Larger shipments from milk producers should be encouraged by the installation of country-cooling stations by city milk companies, and by providing facilities for maintaining a low temperature during transportation by railroads.

MOTOR TRANSPORTATION

In the dairy industry, in which transportation is so important, the motor truck finds a proper field for efficient

service. Its immunity from fatigue and disease, its availability, adaptability, economy, efficiency and defiance of weather, all contribute to its adoption and ever-increasing use.

In suburban districts, large companies use motor trucks to good advantage in the retail delivery of milk because of the distance of travel from the milk plant, the heavy loads, and the distance between customers.

The use of the rural motor truck express in transporting milk from producing territories adjacent to large cities has been reported to be successful because of its rapidity, the territory covered away from railroad or trolley lines, and the time it saves the shipper. Wherever such shipments occur in large quantities, it would seem economical for the producers or the milk companies to maintain their own truck service.

The motor truck exhibit at the National Dairy Show gave proof of the adaptability of different types of motor trucks to the dairy industry.

MARKETING PRACTICES

The problems of city milk distribution are many, and it is interesting to note some innovations from the old method of deliveries at adjacent houses by different milk companies. The cost of delivery is an important item, governing the price of milk to the consumer, and any system that will secure lower costs should receive consideration.

In Ottawa, Canada, the Food Controller was able to set a lower margin for the handling of milk than was set in any other city because of the efficient management of the Ottawa Dairy Company which handled about 80 per cent of the city supply.

In Vancouver the farmers of the Fraser Valley Milk Producers' Association largely control both the milk supply and its distribution. By good management the farmers were able to effect certain economies in the handling of

milk and in this way they gained the confidence and support of the consumers.

In Calgary three companies are reported to have divided the field, each concentrating mainly on the handling of one particular dairy product such as milk, cream, and ice cream. In this way economies of various kinds have been made possible.

In Regina the milk, cream and ice cream supply is largely in the hands of the milk producers who are shareholders in a cooperative creamery owning the main distributing plant in that city.

In Toronto and Hamilton, private and producers' companies divide the business between them.

The outcome of these different systems will be of interest in pointing to methods of reducing costs of handling milk from the producer to the consumer.

The milk man must cease to be the peddler that he has been, and change to a merchant who has something to sell, which has been undervalued, which is economical, which is highly perishable and which is essential.

In order to promote sales and to reduce the cost of delivery the "cash and carry" slogan has helped in the distribution of milk, but as milk plants are not always conveniently located, grocery stores equipped with proper storage for milk have been used to good advantage as distributing centers. Milk companies have used established chain grocery stores to increase sales, the store advertising the reduced price for milk due to the elimination of the cost of delivery.

Small "jitney" ice houses have been established by ice companies in suburban residence districts for the sale of ice. Milk companies may take advantage of the presence of the "jitney" ice stations to promote sales of milk, cream and ice cream as residents come for ice.

The important subject concerning the entire field of refrigeration rates and practices has been presented to the

Interstate Commerce Commission by the National Association of Ice Industries and a report is now pending. When the report is available, it may be of interest to the dairy industry.

The Committee has submitted this report with the feeling that it is perhaps inadequate for a committee assigned to such a broad subject. The procuring of definite and extensive data on the subject of transportation and marketing of milk and milk products seems advisable, such data to be concerned with practices in different sections and with different conditions.

DISCUSSION

Mr. Kelly: The more we study the problem of sanitation the more we see the need of refrigeration. High bacterial counts more frequently result from increase in numbers than from initial contamination. We must get back and see that the milk is properly prepared for transportation. We cannot expect to reduce the temperature of milk while in transit. One plant alone returned 50,000 gallons of sour milk to the producers, at a loss of $20,000.00. It is an economic as well as a sanitary question. Milk must be properly prepared for transportation. In some sections it is possible to build and equip cooling stations and to properly cool the milk for shipment.

Mr. Flanagan: Milk should be produced right and cooled right, and then we can demand proper service from the railroad companies.

Prof. Lane: I believe the railroads will pay for milk which sours as a result of delayed transportation. We are now refrigerating our milk while in transit and at our own expense.

Prof. Jordan: Boston dealers are having good results when they ice their own cars. Shipments picked up at various stations by the railroads are not so well iced.

"There is not a moment without some duty."

REPORT OF COMMITTEE ON PASTEURIZATION OF MILK AND CREAM

FRED J. MOORE, *Chairman*

Everyone who is connected in any way with sanitary inspection of milk plants should be familiar with the objects to be obtained by pasteurization. Therefore, we do not feel it necessary to discuss in great detail why milk or cream should be pasteurized, or to explain the relative merits of the pasteurizing apparatus on the market today.

Methods of pasteurizing have narrowed down to three general systems: first, the vat system, which is probably the most positive, if properly operated; second, a combination of continuous heating and vat holding; and third, a continuous flow heating and holding type. The two latter types, to be operated properly, must be equipped with automatic temperature regulators. All types should be equipped with recording thermometers of an approved type. A complete record of each day's run of milk and cream should be filed with the milk inspection division either daily or weekly.

The committee feels there is still great opportunity to improve pasteurizing apparatus. All movable parts coming in contact with milk, and the amount of pipes and fittings, should be reduced to a minimum. At present a great many milk plants have altogether too much piping for their milk to flow through, making it more difficult and expensive to keep their apparatus clean.

There is no doubt that the objects to be attained by pasteurization may be counteracted by careless operation or by carelessness in the proper cleaning and sterilizing of the pasteurizing apparatus. The committee feels that it is almost useless for a municipality to adopt pasteurizing regulations unless it has a proper inspection force to see that the work is properly performed. It may be that it will become necessary to license the operators, as well as to

license the distributers. It should be necessary for the operator to be familiar with the objects to be attained by pasteurization, as well as to know how to operate a machine, and it should be the duty of the milk inspector to instruct, not only the management of a milk plant, but also the operators of the apparatus.

Pasteurizing apparatus should be frequently checked by the milk inspector, to see that the milk is being properly heated and held and cooled, and also frequently inspected at cleaning time.

The glass-lined tank with the propeller agitator is being used to some extent for pasteurizing. From a standpoint of positiveness of heating and holding, this type approaches the ideal. It is also very simple to keep clean and has a minimum of moving parts, and if properly installed, a minimum of piping can be used. However, there is a question of the practicability of this type, as the heating medium used is live steam under pressure, and there is danger of the milk cooking to the sides of the vat if not properly handled. One member of this committee has observed milk pasteurized with this type vat in which the milk was heated to 145° F. and positively held at 145° for thirty minutes without imparting a cooked flavor or diminishing the cream line, and getting a bacteria reduction of 99.2 per cent.

It has also come to the committee's attention that an electrical apparatus has been developed for heating milk and at present is being used in a city in the Middle West.

The committee makes the following recommendations:

1. Milk or cream to be pasteurized should be fresh and of a low bacteria count. The object of pasteurization is to make the milk or cream safe by destroying possible pathogenic organisms, and also to destroy as many other bacteria as possible.

2. All pasteurizing apparatus should be of an approved type and be equipped with automatic temperature controls or their equivalent, and recording thermometers.

3. Milk or cream should be heated to 145° F., held at that temperature for thirty minutes, and cooled quickly to 40° F.

4. *Inspectors.* There should be two methods of inspection: sanitary and laboratory. Sanitary inspection should be frequent and should be backed up by frequent laboratory tests. Laboratory tests should include milk or cream before being pasteurized, as well as after, and frequent samples should be taken from the delivery wagons.

5. *Health of Employees.* All persons handling milk or cream should be clean in their person and habits and should wear clean clothing, preferably white, while at work in the milk plant. It is also recommended that milk plant employees engaged in handling the milk be given frequent medical examinations to insure their freedom from infectious diseases.

6. All pasteurizing plants should be so constructed and arranged that they may be kept clean with a minimum of labor and all apparatus used should be of the most approved sanitary type, so that it may be easily cleaned and sterilized.

The committee recommends that a committee be appointed to check each of the various types of pasteurization apparatus and furnish result of bacteria count of the milk during each step of the process.

"One moment may throw down the credit years have built."

THE ROLE OF THE BOVINE TYPE OF TUBERCLE BACILLUS IN HUMAN TUBERCULOSIS

CHARLES KRUMWIEDE, M. D., *Assistant Director*, Bureau of Laboratories, Department of Health, New York City.

In spite of the fact that tuberculosis is one of the leading causes of death, it is hard to keep attention focused on it. To a great extent this is due to the fact that we become inured to its presence and also to the absence in this disease of the more spectacular epidemic character possessed by other less important diseases. Contrast for example the wide spread interest, if not panic, and the offer of almost unlimited financial appropriations when there is an outbreak of a disease such as epidemic influenza.

This disease in New York City caused nearly 40,000 deaths in 1918-19, the deaths occurring within a period of about eight months. The prior visit of this disease, however, was nearly thirty years ago. Although this disease may have caused some deaths in the interim it is doubtful if it was any considerable factor in the general death rate. From the time of the cessation of the previous influenza epidemic, however, there have accumulated, in round numbers, 250,000 deaths from tuberculosis. The comparatively large death rate from tuberculosis is again shown by the fact that in New York City the deaths last year from tuberculosis were three times the combined deaths from typhoid fever, measles, scarlet fever, diphtheria, whooping cough and meningitis.

Because of these facts it seemed of value to again call attention to one of the sources of human tuberculosis, viz.: the milk of tuberculous cattle.

The idea that part of the tuberculous disease in man was of bovine origin had its beginning in the early part of the nineteenth century. In 1896-98 Theobald Smith showed that the tubercle bacilli from cattle differed from those he

had isolated from man. In other words he showed that there existed a bovine and a human type of tubercle bacillus.

Robert Koch in 1901 focused attention on the subject by the following statement. "I should be inclined to consider the number of cases of tuberculosis caused by milk, butter or meat of tuberculous cattle not much greater than that of hereditary cases, and I believe, therefore, that no special protective measures are indicated."

These views met with violent opposition in many quarters. Numerous investigations followed as to the type of bacillus found in bovine and in human disease. It was found that the bacilli from bovine disease always showed the same characteristics or in other words they agreed with Theobald Smith's description of the bovine type. The bacilli from man were of two types. Most commonly they differed definitely from the bovine type and were designated as the human type. Less frequently the cultures from human disease showed all the characteristics of the bovine type. This variety was most commonly encountered in children and especially in disease of alimentary origin. These findings, as well as the fact that the bacilli were able to cause progressive tuberculosis in cattle, whereas the human type did not, left no doubt that the bacilli were of the bovine type, or that the bovine type of tubercle bacillus could cause disease in man.

The next point was to determine the relative incidence of infection in man by the two types. With the knowledge obtained as to the essential differences between these two types such determination was relatively easy, although time-consuming.

The steps in the process are as follows: The tuberculous sputum or ground-up tuberculous lesion is injected into guinea pigs. Such material is usually contaminated with other bacteria and commonly contains only a moderate number of tubercle bacilli. The guinea pig serves as a dif-

ferential enrichment medium. The contaminating bacteria are usually destroyed by his cells, whereas because of his susceptibility to tuberculous infection, the tubercle bacillus multiplies and invades the neighboring and distant lymph-nodes, spleen and other organs. After four to six weeks the pig is killed and these tissues, rich in tubercle bacilli but free from other bacteria, are used for cultures.

These tissues are removed aseptically, minced with scissors and pieces rubbed over the surface of a culture medium of coagulated egg. Some of this egg medium contains glycerin, the other does not. These cultures are incubated at body temperature. After 10 to 14 days' growth becomes evident and reaches its maximum in from 4 to 5 weeks.

If one is sufficiently skilled one can tell with great surety from the character of the growth whether one is dealing with a bovine or a human type. The human type grows vigorously, especially upon the glycerin egg medium. The bovine type grows feebly and glycerin commonly interferes with its growth, or at most does not materially increase it. These differences tend to disappear when the two types are cultivated for successive generations on artificial culture media.

The cultural findings can be checked by determination of the virulence (disease producing property) for rabbits. A weighed amount of the culture, 0.01 milligram, is injected into the ear vein of a rabbit. If the culture is of the human type, the rabbit will remain well, usually gaining weight, and if killed after six to eight weeks, will show tuberculous lesions in the lungs or kidneys or both. These lesions as a rule are not extensive and show a marked tendency to retrogression. If the culture is of the bovine type the rabbit will develop a progressive generalized tuberculosis, involving not only the lungs and kidneys but the spleen, liver and lymphnodes as well. The rabbit loses weight and usually dies after three to four weeks.

In earlier investigations these findings were checked by calf inoculation. The human type is unable to cause progressive tuberculosis in this animal whereas the bovine type has this ability.

All the evidence we possess indicates that these two types are stable; that is, the bovine type does not change into the human type as a result of residence in the human body.

Over 1,500 cases of human tuberculosis have been studied as to the type of infecting organism. To a large extent the figures are not directly applicable as an index to the frequency of bovine infection. In the effort to show that man was susceptible to bovine infection cases were selected which would most likely show this, viz.: cases of alimentary tuberculosis. For this reason our own unselected series of cases only is given. On the whole we believe that they serve as a general index of the incidence of bovine infection to be expected with an unpasteurized milk supply, from average non-tuberculin tested herd.

The following table gives the relative incidence of bovine and human infections encountered in a series of 478 cases.

TABLE I

Diagnosis of Cases Examined	Adults 16 Years and Over		Children 5 to 16 Years		Children Under 5 Years	
	H	B	H	B	H	B
Pulmonary tuberculosis	281	—	8	—	7	—
Tuberculous adenitis, inguinal and axillary	1	—	4	—	—	—
Tuberculous adenitis, cervical	9	—	19	8	6	13
Abdominal tuberculosis	1	—	1	1	1	3
Generalized tuberculosis, alimentary origin	—	—	—	—	1	2
Generalized tuberculosis	2	—	1	—	18	4
Generalized tuberculosis, including meninges	1	—	—	—	25	1
Tubercular meningitis	1	—	2	—	26	2
Tuberculosis of bones and joints	1	—	10	—	7	—
Genito-urinary tuberculosis	6	1	1	—	—	—
Tuberculosis of skin	1	—	—	—	—	—
Tuberculous abscess	1	—	—	—	—	—
Totals.....	305	1	46	9	91	25

Double infection, one case. Both types isolated. Generalized including meninges, thirteen months. Mesenteric nodes gave human type. Meningeal fluid gave bovine type.

TOTAL CASES—478.

A study of this table shows that bovine infection is a nearly negligible factor in the tuberculosis of adult life. Nor is it a factor in the causation of pulmonary tuberculosis or "consumption" which causes the vast majority of deaths from tuberculosis in man and which because of the infectious sputum is responsible for the transfer of the disease from man to man.

In children, however, bovine infection is a decided factor, especially under five years of age. As was to be expected, the incidence of bovine infection is highest in lesions where infection resulted from ingestion of the bacilli.

This is shown in the table under the diagnosis of cervical adenitis (tuberculous lymphnodes of the neck), abdominal tuberculosis and generalized tuberculosis of alimentary origin as determined by autopsy findings. Under generalized tuberculosis the four bovine infections were of alimentary origin but are not given under this heading, because the post-mortem findings did not in themselves indicate the site of primary infection.

Although the preceding table gives the incidence of bovine infection it does not indicate what bearing this has on mortality. The following tabular summary gives the relative importance of bovine infection as a cause of death.

TABLE II

TOTAL FATAL CASES IN CHILDREN

Diagnosis	Children 5 to 16 Years of Age		Children under 5 Years		Notes
	H	B	H	B	
Pulmonary tuberculosis	—	—	7	—	One case included, probably fatal, data incomplete.
Tuberculous adenitis	1	—	—	—	Other cases recovered as far as is known.
Abdominal tuberculosis	—	—	—	3	Three other cases, one bovine and two human, were operative cases with recovery as far as known.
Generalized tuberculosis	1	—	91	4	Two other bovine cases died directly of exanthemata with complications.
Generalized tuberculosis including meninges	—	—	25	2	One case gave both type of bacilli, included under bovine, as this type caused the meningitis.
Tubercular meningitis	2	—	26	2	
Totals	4	—	77	11	or 12½% due to bovine type under 5 years.

The percentage given is somewhat too high, due to the inclusion of a few cases from a foundling hospital. As they were exclusively fed on cows' milk, they are not representative of the general population. If these cases are excluded the percentage of deaths due to bovine infection falls to about 10 per cent.

If we consider the total deaths from tuberculosis of children under five years of age, the total fatalities due to bovine infection are not high as compared with the total fatalities for all ages from tuberculosis. The total

annual fatalities in New York City average somewhat below 10,000. The average annual deaths under five years of age are between eight and nine hundred. The total annual fatalities, therefore, from bovine infection would only be eighty to ninety.

The deaths from bovine infections, although the most serious, are not the only reasons for prevention of such infection.

Not all cases of tuberculous infection of alimentary origin die. For this reason, we must consider the disease and suffering of the non-fatal cases. In some types of abdominal tuberculosis operation may be needed to save life. In tuberculous adenitis bovine infection is as important as infection by the human type of tubercle bacillus (see Table I). Such infections are only infrequently fatal but they do lead to discomfort or temporary disablement and may require operation and lead to more or less disfigurement.

(A full discussion of the subject with a summary of the work of other investigators and bibliography up to 1912 is given in the three reports by Park and Krumwiede in the Journal of Medical Research, Vol. 23, page 205, Vol. 25, page 313, Vol. 27, page 109).

DISCUSSION

Mr. Kelly: Are not cases of tuberculosis showing the bovine type of organism found in the tropics, where cows' milk is not used?

Dr. Young: Has any recent work been done to determine whether bovine tubercle bacilli long present in humans will lose characteristics of bovine tubercle bacilli?

Dr. Krumwiede: Milk is not the only source of bovine tuberculosis. I am inclined to question the finding of the bovine type of tuberculosis in humans in the tropics. Regarding the tubercle bacilli of the bovine type changing to the human type, I do not believe the types change. We

must differentiate between tuberculosis infection and the disease. Many people doubtless become infected with the germ. The disease develops only to a slight extent, and it is thought that a certain immunity is thereby provided. As has been said before, it is probable that "it is better to have had a little tuberculosis than never to have been tubercular at all." In one known instance, twenty years after infection of a human by the bovine type of organism, the germ was still of the bovine type.

"The object of our Association is to advance the public welfare through the protection of public health."—Henderson.

DAIRY AND MILK INSPECTION IN CALIFORNIA

PROF. C. L. ROADHOUSE, *Dairy Industry Division,* University of California, Davis, Cal.

Dairy and milk inspection in California has kept pace in recent years with inspection in other sections of this country.

The supervision of milk plants and the delivery of milk within the large cities has been followed for many years but the supervision of all dairies supplying the cities did not become general until about 1909. It was at this time that San Francisco inaugurated a system of general dairy inspection which provided for a permit being secured by all dairies supplying milk to that city. During the first year of general milk supervision in San Francisco eighty per cent of the samples of milk secured within the city from all sources showed bacterial counts below 100,000 per c. c. This was principally raw milk and the counts showed a marked improvement over previous results.

Dairy inspection in the cities of California continued without marked change except improvement of equipment and buildings until 1915, when an addition to the State Dairy Law was passed by the legislature. The people of California were interested in securing dairy products that were free from tubercle bacilli and in 1915 the new State law provided the machinery for making this possible.

During the five years preceding the passage of this law, dairy inspectors, health officers, members of city milk improvement associations and members of the Veterinary Division of the State Agricultural College had been appearing on programs where subjects pertaining to clean milk and safe milk had been discussed. A slaughter demonstration of an animal reacting to the tuberculin test had been given each year at the Farmers' Short Courses in Agriculture and at a few other meetings of farmers and members of medical milk commissions. Several cities had

passed ordinances requiring animals supplying milk to these cities to pass the tuberculin test; but many of these ordinances failed in their enforcement and it was seen that a different procedure was necessary if any rapid progress was to be made toward securing dairy products that were reasonably free from bovine tuberculosis.

Persons well informed on this subject realized the danger to infants and children from consuming raw milk and it was realized also that sunshine and outdoor life in a mild climate did not prevent animals from becoming infected if they were allowed to come into direct contact with animals discharging tubercle bacilli. Few of those interested in this question, however, realized that there could be an early remedy.

When California voted in favor of women's suffrage in 1913 those casting their ballots did not have the milk question in mind; they believed that women's suffrage should be given a trial; but it is only fair to say that the women of California deserve the credit for the final passage of a law, the enforcement of which gives to the people of the State dairy products which are free from tubercle bacilli and reasonably free from all other objectionable conditions. When an interested women's club member, a resident of the State Capital, went before the members of the State legislature with the statement that she represented 30,000 organized women voters of the state, she was given a hearing and was able to secure the support of the majority of the law makers.

PROVISIONS OF THE CALIFORNIA STATE DAIRY LAW

The California State Dairy Law dealing with this question gives this alternative: either to pasteurize the milk and cream sold at retail or to submit the cattle to an official tuberculin test. Dairymen who sell in bulk to the wholesale trade need not have their cows tested or install a pasteurizer. The responsibility of pasteurization rests on the

creamery and it must check the pasteurizing process by the use of an automatic recording thermometer and the temperature record must be kept on file for a period of 60 days for the information of the inspection officials.

Every cow owner who intends to retail any unpasteurized milk or other dairy product, except cheese, may write to the State Veterinarian, requesting that his cows be tuberculin tested. Those intending to retail in any city or county having a dairy inspection service are to file a duplicate request with the local health officer. After filing these requests the dairyman is not liable under the provisions of the law until the State Veterinarian or his representative shall be able to make the required tests.

THE GRADING OF MILK

When milk is produced under the supervision of an approved city inspection department it may be graded as follows: Certified milk, guaranteed milk, Grade A milk, Grade B milk and milk not suitable for human consumption.

Guaranteed Milk. Milk of this grade may be raw or pasteurized, the quality of which is guaranteed by the dealer, who must have the written approval of the inspecting department, and the milk must be of a higher standard than that required for Grade A raw milk.

Grade A Milk. Delivered in sterile containers.

If raw it must be produced from healthy cows as determined by physical examination and by the tuberculin test administered by a qualified veterinarian under the supervision of the inspecting department, the test repeated every six months if reacting animals are found. The dairies must score not less than seventy per cent on the score card adopted by the U. S. Bureau of Animal Industry. Grade A raw milk must contain less than 100,000 bacteria per c.c. when it reaches the consumer.

Grade A pasteurized milk must contain less than 200,000 bacteria per c.c. before pasteurization and less than 15,000

bacteria per c.c. at the time of delivery. The dairies must score at least sixty on the score card.

Grade B Milk. Milk for pasteurization.

Grade B milk must be produced from cows in no way unfit for the production of milk as determined by a physical examination at least once in six months by a qualified veterinarian of an inspecting department. It shall contain less than one million bacteria per c.c. before pasteurization and less than fifty thousand bacteria per c.c. after pasteurization.

Milk for pasteurization must be heated to a temperature between 140° and 145° F., held for 25 minutes, cooled rapidly to 50° F. or below, and delivered within 48 hours thereafter. Repasteurization is not permitted for milk to be used for human consumption.

Milk not suitable for human consumption may be sold for industrial purposes provided it is heated to a temperature higher than necessary for pasteurization.

Pasteurization of Cream for Buttermaking. Cream for buttermaking may be heated to a temperature higher than 145° F. and for each degree heated above 151° F., the time of heating may be reduced one minute.

Practically all butter manufactured and used commercially in the State is made from pasteurized cream since the official tuberculin test has not been adopted widely enough to make it possible for a creamery to secure all the cream from cows which have passed the test.

The State Dairy Law briefly described above is having the effect of standardizing dairy inspection in the larger cities of the State where approved inspection departments are maintained. The city of Los Angeles is strictly enforcing the grading of milk as provided by law and this, with the city milk contests held in that city at intervals throughout the year, has given remarkable results. The educational value of this form of city milk supervision is evidenced by the fact that the Los Angeles Health Depart-

ment received the banner from the last National Dairy Show for the highest scoring entries of milk. At this show dairymen of Los Angeles received four first places in the milk and cream classes.

The State law provides that dairymen may have their cows tested without charge upon application to the State Veterinarian. As a result of voluntary requests made by cow owners the State Veterinarian tested 92,112 cattle on 9,501 dairy farms between October 1, 1916, and June 30, 1918. The average cost to the state for testing was 35 cents per head.

Recent legislation has combined the State Dairy Bureau and State Veterinarian's office so that the inspection of dairies and testing of animals is carried on from one office which has simplified the work and increased efficiency. This State Department has a force of 27 veterinarians and dairy inspectors supervising the testing of animals and inspection of dairies supplying creameries and smaller towns not having inspecting departments. The principal advantages of the law are that it makes it possible to secure safe dairy products; it tends to standardize dairy inspection and it makes the tuberculin testing of animals voluntary on the part of owners, which should accomplish more permanent results in reducing tuberculosis among dairy animals.

"A very large part of the sanitation that is necessary for clean milk is also necessary for the most economic production."—Rawl.

REPORT OF COMMITTEE ON CONSTRUCTION OF DAIRY BUILDINGS AND ITS RELATION TO SANITATION

ERNEST KELLY, *Chairman*

Recent investigations in dairy sanitation have drawn especial attention to certain essential factors in the production of milk of low bacterial count. By putting greater stress and more effort on these factors it is possible for us to accomplish the greatest reduction of the bacterial count of milk with the least effort. Many things, however, are concerned in the production and handling of a desirable quality of foodstuff other than the mere bacterial count. It is well recognized by those who are in touch with the situation that desirable features of sanitation should be carefully studied and put into practice as fast as their successful accomplishment is practicable. Therefore, even though we may expend our greatest efforts toward the adoption of the essential factors in lowering the bacterial count it is also desirable for us to study, perhaps more closely, those other corollary factors which have less to do with the bacterial count but which are intimately interwoven with the successful production of the better grades of milk. The time for filthy establishments for food handling has passed and this is as true of the dairy industry as of any other branch of food production. While the sensible dairy inspector will hesitate to suggest radical changes in places already constructed, a full knowledge of desirable construction is essential in order that he may advise those dairymen who contemplate extensive changes or the erection of new buildings.

Aside from any question of sanitary significance, proper construction of dairy buildings makes for greater returns in comfort and profits. Properly constructed buildings are more durable, make work easier, add to the comfort of men and animals (and thereby increase production) and

conserve the health of the cattle housed within them.

Your committee at this time does not feel that it has expended sufficient study on this question to justify a detailed report. The observations that follow are general and are presented principally for the purpose of creating discussion and leading inspectors into more constructive thought along these lines.

STABLES

Stables for dairy cows should be substantial. They should be constructed of material which is capable of withstanding extremes of temperature and moisture with the smallest possible deterioration. Such materials will, perhaps, require a greater initial outlay but will prove a good investment in the long run and will aid in sanitation. Stables should be built which are adequate to the needs of the farm; that is, they should not be so crowded as to hamper work or throw together two dissimilar parts of the farm enterprise. Crowded stables are not usually sanitary nor is it easy to perform the work in them. Stables should be so arranged as to make work easy. In planning stables the care of the cattle, including feeding, milking, watering and manure disposal, should be thoroughly considered in order that the work may be performed in a logical manner with the least possible effort. The construction, especially the floors, should be, so far as possible, wear-proof and water-proof. Such floors are durable, aid in conserving the liquid elements and are more easily kept in a sanitary condition. Walls, ceilings and other parts of the dairy stable should be of smooth construction so that they can be easily cleaned. Light and ventilation are important. In almost any climate it is necessary to supply glass for admitting light. Even in the far South it is necessary at some times during the year to keep the cattle within on frosty nights or out of the cold winds, with some means provided for closing the ordinary openings.

It is recommended by this committee that at least four square feet of window glass be allowed for each animal housed within the building. Ventilation is also necessary to preserve the health and comfort of the cattle, and to increase the desirability of the milk. No less than 500 cubic feet of air space for each cow should be allowed. Under some climatic conditions considerably more than 500 feet is allowable, the maximum space being limited chiefly by the cost of construction of the building and the lowest outside temperatures which may be met with during the year. Obviously, stables containing large amounts of air space are harder to keep warm in the North, and the comfort of the cattle should be considered. It is advisable to provide at a convenient point an abundant supply of pure water. The stable should be kept reasonably warm in winter and cool in summer, which could be accomplished to a great extent through proper ventilation and air space. Floors under the cows should be warm or adequately protected by an abundance of bedding and the cows should be confined in suitable stanchions, which allow free movement. Box stalls should be provided for sick animals and for cows at calving time, but separate from the stable in which the milking is done.

FARM MILK HOUSES

Farm milk houses should be located so that they are convenient to the stable, but should not be subjected to contamination from the stable odor. If milk houses are too far removed from the barn there is less likelihood that the milk of each cow will be carried to the milk house immediately after milking. The milk house should be located so that the drainage will be from the milk house toward the barn, rather than vice versa. It should be constructed of smooth, durable, non-absorbent materials. The floors especially should be of concrete or similar material which can be thoroughly washed and which do not absorb spilled

milk. The construction should be plain and simple and the inside surfaces should be smooth and easily cleanable. The milk house should be provided with ample light, having window glass equivalent to at least ten per cent of the floor area. Ventilation should be through screened openings, and all openings should be thoroughly screened to prevent the entrance of flies and other insects. The dairy house should be provided with cold, running water and with steam.

Particular care should be taken to see to the proper waste disposal from the dairy house. If spilled milk and other material is simply swept out of the door, or drains around the house, it will attract flies and create odors which are not desirable. Waste should be carried well away from the milk house, preferably through a closed drain laid under ground.

COUNTRY RECEIVING STATIONS

Country receiving stations should be so located as to be convenient to the wagon roads from which deliveries are made and to the railroad track on which the milk is to be shipped. They should be built of durable material and should have concrete floors reinforced with iron plates where the greatest wear comes. Their inside construction should be smooth and cleanable; and they should be so arranged that no undue handling of the milk or any long series of pipes is necessitated. Country stations should be lighted with at least sufficient glass to equal ten per cent of the floor space, equally distributed to light all parts of the building, especially the milk handling room. Proper ventilation is also essential and all openings should be thoroughly screened. In the screening of country stations one obstacle met with is the receiving room where the milk is taken in. During a great part of the time the door of this room must be kept open to receive the milk from the wagons of the farmers. This milk is then weighed and poured into the

receiving can from which it goes into the plant proper. Considerable milk is usually spilled on the floors of the receiving room and many flies are usually present. Wherever possible a fan, giving a strong current of air, should be placed directly over the receiving tank in order to keep the flies out of the milk or off the strainer. Of course an abundant supply of running water must be available for the country receiving stations and all sewage should be carried to some distance through trapped drains that will not allow the return of any foul odors to the plant. The floors should be so pitched as to drain thoroughly and be kept in such condition that they are free from holes or depressions where dirty water may gather.

CITY MILK PLANTS

City milk plants should be located in a section where they are convenient for both receiving and distributing milk, and where they are free from contact with insanitary surroundings. They should be built of an adequate size for the necessary operations. Overcrowding of milk plants is a frequent cause of insanitary conditions. The arrangement of the plant should be carefully planned to facilitate the quick movement of milk with a minimum of piping and to conserve labor. The floors should be tight and non-absorbent and the walls and ceiling should be of smooth construction. There should be separate rooms for the various operations and these rooms should be thoroughly lighted, ventilated and screened.

Adequate toilet facilities should be provided for workers in the plant and there should be a special effort to have a wash bowl in a convenient location for the workers in the milk room.

It will be seen from this report that buildings which answer the requirements of good sanitation also answer the requirements of good business. In fact, the cost of a sanitary building, all things considered, is little if any greater

than the cost of a building which will prove unsatisfactory from a sanitary standpoint. This being the case it is incumbent upon dairy inspectors to see that all buildings erected within their territory are carefully planned, durably constructed and kept in a sanitary condition at all times. Such procedure will not only serve best the production of milk of a high quality but it will conserve labor, increase economy and stand as an invaluable advertisement to those who are interested in increasing the use of dairy products as a human food.

"In every community there is one man a little more progressive than the others, who naturally becomes a leader. Upon this man we build our hopes and turn heaven and earth to make him our friend. He is our example to set before other dairymen."—Henderson.

THE MILK SUPPLY OF NEWPORT, R. I.

JOHN F. JOHNSTON, *Inspector of Milk,* Health Department, Newport, R. I.

The character of its milk supply plays an important part in the health of any community. When produced amid unsanitary surroundings or handled in a careless manner, milk used by infants and children is certain to cause intestinal troubles and frequent deaths. Milk produced by unhealthy cows or handled where infection may reach it may carry poisons to persons of all ages and destroy where it should nourish and build.

During the summer of 1917, Newport was marked by an epidemic of diphtheria at a time when the city appeared to be unusually free from this disease. The chief facts of interest were the "explosive" character of the outbreak in midsummer, the high proportion of adults affected and the apparent implication of dairy products, especially ice cream. The source of the infection was quickly traced to several dairy farms where members of the family were found to be suffering from mild cases of the disease. The milk from these farms was being sold in the city in a raw state and the large number of adults affected was accounted for by the fact that most of the infected milk had been used in the manufacture of ice cream.

Realizing that no system of inspection could guarantee that milk might not be infected at the farm by unrecognized or unreported cases of contagion, the Newport Board of Health took its greatest step forward in the prevention of disease by adopting the following regulations: "That on and after January 1st, 1918, or as soon thereafter as practicable, this Board of Health prescribes two classes of milk to be sold in the City of Newport. Class A shall be certified by a Medical Milk Commission and the product and premises shall conform with the rules and regulations as established by the American Association of Medical Milk

Commissions. Class B shall include all other milk, all of which shall be pasteurized in the final container or other approved means before it is allowed to be distributed and that no other milk except the two grades designated shall be offered for sale in the City of Newport."

Newport's milk was being produced within a radius of nine miles of the city and the delivery system was in the hands of milk producing farmers. Ninety-six wagons were supplying the city, involving the expense of drivers' salaries, care of equipment and a duplication of service. Many men dispensing but a few quarts of milk covered nearly every street in the city and this consumed time which could be spent to a better advantage in the fields, as war conditions made it impossible to secure sufficient labor to take care of crops.

Only raw milk was sold and this was measured from ten-quart cans and dumped into pitchers or pails found on door steps. These containers very often were not protected by covers and the dust from the street caused by passing vehicles added to the sediment already in the milk. Boys employed by the distributers as "runners," when out of sight of their employers often placed the measure to the lips and enjoyed a long drink of nature's food. Very often the milk was not agitated and the first customer served would receive more than a proper share of cream, while those coming after would have sufficient reason to complain of a thin product. Stores sold dipped milk as few farms were equipped with bottling machines, and the loss in measuring this milk did not assure a profit for the store keeper.

The writer assumed charge of the milk inspection bureau of the Newport Health Department in December, 1917, at a time when the distributers were preparing to comply with the new regulations. Formerly connected with a large New York milk company and having had experience in all phases of the milk industry, he saw that the action taken

by the health authorities involved a radical but much needed change in the methods of distributing milk in Newport. A knowledge gained by experience in the milk business was placed at the disposal of the milk men and with the wonderful assistance given by a local Farm Bureau agent in organizing the producers, a definite program was decided upon.

Countless meetings were held with the producing distributers, and an organization of farmers, known as the Aquidneck Dairymen's Association and at one time operated as a cow testing association, was revived. After much persuasion this organization assumed responsibility for the collection of money to build a central pasteurizing and distributing plant. Milk producers were interviewed and stock was sold for fifty dollars a share and the agreement called for the purchase of one share of stock for every twenty quarts of milk produced daily, based upon the dairyman's yearly production. Sufficient capital having been obtained to insure success, the company was organized, pasteurizing equipment ordered and alterations started on a large building which had been purchased in the city.

This concern, Newport's largest distributer, receives approximately 11,000 quarts of milk daily and is supplied by ninety-nine producers. Huge motor trucks are employed in collecting milk at the farms and in this way milk is hauled from the producer's cooling tubs directly to the city plant. On arriving at the plant, the milk is clarified, pasteurized by the holding method, cooled to a temperature of not higher than 46° F., and placed in a large cold room until delivery. During the summer months the delivery wagons are on the streets at 2:30 every morning but when the weather gets cooler daylight deliveries are found more satisfactory for men and horses.

The pasteurizing equipment consists of coil heaters, flow type holders and internal tube coolers. Girls are employed to operate the Milwaukee filler and from this machine the

filled bottles run on rollers into the cold room and the refrigerating system is automatically controlled so that this room is never above a temperature of 40° F.

Having had no experience in operating a plant of this kind the producers at first experienced much trouble, caused by insufficient boiler capacity and the lack of proper cooling facilities. Their main idea was to get the jump on the other dealers and the plant started operating before all the equipment had been placed in working order. Milk was reaching the consumers sour and in order to correct the situation the writer found it necessary to take charge for a time. A larger boiler was installed, another section of cooler provided and a very capable manager employed, resulting in a marked improvement in the situation. During the flush periods butter and cottage cheese are manufactured and the demand for these products is increasing daily. Owing to a mild autumn and plenty of pasturage Newport has not been troubled with a shortage of milk and shipments have been made to other sections of Rhode Island and Massachusetts.

The officers and directors of the Aquidneck Dairymen's Association are hard-working farmers and it is with pleasure that they point out the remarkable advantage derived from the establishment of a central plant. Twelve wagons or motors supply the trade and the city has been zoned so that scientific delivery and economy is now practiced in caring for the wholesale and retail trade formerly served by eighty-five wagons. The farmers do not find it necessary to spend from daybreak until noon making city deliveries and they now go into the fields early in the morning. Their entire attention can be given to farm work and time formerly required in the delivery of a few quarts of milk is now spent advantageously in the greater production of crops, and the care of more cows. The time saved to each producer is equivalent to twelve ten-hour working days each month and in addition there is saved the use of

horses, depreciation on equipment, duplication of service, the collection of bills and losses through bad accounts.

Newport's wholesale distributer, the Island Creamery Company, has successfully operated in this city for many years. When the farmers' organization was started the many producers delivering to the Island Company did not change as the proprietor had always been honest in his dealings and the market proved a good one. For some time the flash system of pasteurization had been used at this plant, but when the new regulations went into effect, the building was remodeled and vat pasteurizers installed. Due to an increased business the vats first installed were replaced by larger ones.

Milk is collected at the farms by large motor trucks, and arriving at the plant, the process of pasteurization is immediately started. After clarification, the milk flows into the vats in which the heating and holding is done. Properly covered surface coolers are used and a perfect refrigerating system maintains a low temperature in a storage room until the product is delivered the following morning. Motor trucks are used in serving the trade which is made up of stores, restaurants and ice cream parlors. The manufacturing end of the business has been practically discontinued, but a fine grade of butter is made during flush periods.

Another firm, the Thos. J. Murphy Company, runs its milk business in connection with a large market. Although small, the plant is excellently equipped with a pasteurizing outfit and the trade is very well satisfied with the milk and cream delivered. This Company serves the U. S. Naval Training Station and Naval Hospitals located in Newport.

Newport's fourth and latest distributer, the Newport Dairy Company, has been in business but a few months and observations prove the old saying: "There is always room for one more." The equipment of the plant is of the best and every indication points to a bright future.

The city's raw milk supply comes from the only two dairies producing certified milk in the State of Rhode Island. These farms are under the supervision of a recently organized Medical Milk Commission appointed by the Newport County Medical Society and the product is a credit to the producers. Samples for bacteriological analysis are taken twice each week and the count rarely exceeds 700 bacteria per c.c., while the butterfat content will average nearly five per cent. One of the certified farms received a bronze medal at the recent Dairy Show in Chicago with a score of 97.8.

Seventeen months of hard work and a spirit of cooperation displayed by all concerned has accomplished much. Four pasteurizing plants have been remodeled or erected and apparatus installed. Two dairies were instructed in the production of certified milk. Instead of receiving a raw product delivered in unsterilized cans, the consumer now purchases only certified or pasteurized milk put up in clean, sterile, mechanically sealed bottles and twenty-two wagons or motors serve the trade formerly employing ninety-six. All of this could not have been realized if it were not for the fact that the Milk Inspection Bureau of the Newport Health Department, appreciating the gigantic task in hand, acted in an advisory capacity and assisted the producers and dealers in their administrative and executive problems.

Although in its infancy, Newport's present system of milk control and distribution of approximately 25,000 quarts is a remarkable success. The producers enjoy more comfort, the distributers have more confidence and the milk-consuming public is receiving a safe, pure food at a very reasonable price.

"The first step in educating the farmer is to make him think. If this can be accomplished without developing hostility, progress in better methods of milk production is insured and intelligent instruction is all that needs to follow."
—Henderson.

THE USE OF CHLORINATED LIME IN THE STERILIZATION OF MILK UTENSILS

GEORGE BARKLEY TAYLOR, *Market Milk Specialist,* Dairy Division, U. S. Department of Agriculture, Washington, D. C.

Solutions of chlorinated lime, when properly made up and when properly used will, for all practical purposes, render milk utensils sterile.

The above statement and the report of the work which follows does not indicate that we believe in the unrestricted use of such disinfecting agents. On the contrary, the use of such agents should be restricted. They may be used in milk plants or creameries where the use of steam might injuriously affect piping by causing too sudden expansion or in places where the full effect of live steam cannot be reached. They may be used in dairies only where the person in charge knows how to make up and to use these solutions and realizes their limitations. We believe that for general purposes of sterilization, no disinfecting solutions can take the place of live steam.

Although chlorinated lime, or bleaching powder, is one of the most generally used disinfectants and is recognized as having great germicidal properties, yet its use along dairy lines has been limited. On the other hand, its use in the purification of water supplies has been very extensive as it is known that "bleaching powder will in two to four hours destroy coli, typhosis, and cholera bacteria in 2,000 parts of ordinary sewage" (Lunge).

Bleaching powder or, chemically speaking, calcium hypochlorite, is made by treating slaked lime with gaseous chlorine. Lunge gives the following analysis of bleaching powder "made from perfectly pure lime with greater care:"

Available chlorine	43.13 per cent
Chlorine as chloride	.29 per cent
Lime	39.89 per cent
Carbon dioxide	.42 per cent
Water	17.00 per cent
Calculated as	
Calcium hypochlorite and combined water	88.08 per cent
Calcium carbonate	.96 per cent
Calcium chloride	.45 per cent
Calcium hydroxide	6.74 per cent
Water (not combined)	3.77 per cent

Commercial chloride of lime as put on the market in this country very rarely contains over 32 per cent of available chlorine; in fact, the labels guarantee only 30 per cent. This would indicate that the commercial powder contains approximately 70 per cent of inert material most of which is insoluble in water.

When bleaching powder is treated with dilute acids, the "available chlorine" is set free:

$$CaO\ Cl_2 + 2\ HCl = CaCl_2 + H_2O + 2Cl$$

SOLUBILITY

As the active disinfecting agent is the available chlorine, it is desirable to extract it from the insoluble inert material if possible in a clear solution. At the same time it is necessary for practical purposes that this solution be fairly stable. A powder showing on analysis to contain 32.74 per cent of available chlorine was thoroughly mixed with a definite amount of distilled water. The mixture was filtered to a clear solution which on analysis and calculated to a dry basis, the weight of the original powder, was found to contain 32.4 per cent available chlorine. *This would indicate that the available chlorine present in bleaching powder is soluble in water.*

The reaction of this solution was alkaline due to the presence of calcium hydroxide. The presence of an excess of calcium hydroxide assists in keeping the solution stable.

STABILITY OF SOLUTION

A solution of this material containing 0.32 gram available chlorine in 100 cubic centimeters, showed no change when kept in a glass-stoppered clear-glass flask, away from light for twenty days. The bleaching powder itself, transferred to a wide-mouth, glass-stoppered bottle, did not change its physical condition and showed no loss of available chlorine in twenty days.

Experiments were made to determine the maximum strength of available chlorine in solution which could be obtained by treating bleaching powder with water. The bleaching powder used in these experiments contained on analysis 27.80 per cent of available chlorine. One hundred grams of material and 100 cubic centimeters of water were mixed together in a mortar. This made a white pasty mass from which no liquid drained off. Another hundred cubic centimeters were added to the mixture and on filtering over night 70 cubic centimeters of a clear light yellow liquid were obtained. This liquid contained 4.28 grams available chlorine per hundred cubic centimeters; the theoretical yield being about 9 per cent. One hundred grams of bleaching powder were then triturated with 500 cubic centimeters of water. Three hundred cubic centimeters of solution were recovered. Analysis showed this to contain 4.39 grams of available chlorine per 100 cubic centimeters, the theoretical yield being 4.63 grams per 100 cubic centimeters. Therefore, the highest percentage maximum yield closely approaching the theoretical yield could be obtained by triturating bleaching powder and water in the proportion one to five or above. Tests were made to determine the stability of this solution. This solution di-

vided into two parts was held at room temperature, about 75 degrees Fahrenheit, in brown bottles placed in the light, one tightly stoppered, the other left open.

	Available Chlorine Grams per 100 c.c.	
Time.	*Stoppered bottle.*	*Bottle not stoppered.*
0 days	4.39	4.39
7 days	4.25	4.29
22 days	4.08	4.15
52 days	3.80	4.01

The higher percentage shown in the unstoppered bottle can be accounted for only on the assumption that slight concentration took place on account of evaporation. This solution showed an alkalinity equivalent to thirty-fifth normal sodium hydroxide. In concentrated solution, therefore, chlorinated lime can be classed as stable. It might be added that *one tablespoonful of this concentrated solution added to one gallon of water will make a solution approximating 1 to 5,000 available chlorine.*

Experiments were also made to determine the length of time dilute water solutions could be kept in ordinary light in glass and galvanized iron containers before the strength of the solution would be weakened to such an extent as to be practically inert. Tests given further on in this paper showed that chlorinated lime solutions containing available chlorine, 1 – 10,000 will kill the bacteria in a milk can which has been properly washed.

The following results regarding the stability of the dilute solutions were obtained:

1. Exposed in open glass milk bottle in ordinarily lighted room.

Fresh – 1–4,850 available chlorine
1 day – 1–4,950 available chlorine
2 days – 1–5,140 available chlorine
3 days – 1–5,320 available chlorine

2. Exposed in open galvanized iron tank in ordinarily lighted room.

Fresh	– 1–5,376 available chlorine
1 day	– 1–6,135 available chlorine
2 days	– 1–7,246 available chlorine
3 days	– 1–8,064 available chlorine
4 days	– 1–9,090 available chlorine
5 days	– 1–9,434 available chlorine

During the last experiment, a washed five-gallon milk can was immersed in this solution for one minute once a day.

Corrosion of the tank was strong, a heavy precipitate of zinc being deposited on the bottom of the tank. *The last experiment indicates the practicability of using a solution originally made up to contain 1–5,000 available chlorine for an entire week's rinsing of milk utensils.* To obtain good results, a stoneware tank with cover to keep out light would be advisable. Utensils must be properly washed and rinsed before soaking. This is necessary to preserve the solution and to obtain proper sterilization.

Chlorine readily attacks organic matter. In the presence of much organic matter, such as may be found in milk utensils not properly washed, the amount of chlorine necessary to kill bacteria alone will be to a great extent neutralized. Consequently, to leave the available chlorine free to attack the bacteria left in the utensils, there should be removed by means of proper washing all this organic matter possible.

During the period of the last experiment, a five-gallon milk can with cover was soaked for about a minute in chlorinated lime solution, containing available chlorine 1–4,550, drained momentarily and allowed to stand covered for five days. At the end of the fifth day, slight corrosive action was noticed on the inside of the can cover; the odor in the can was fresh, not musty or disagreeable.

STERILIZING ACTION OF SOLUTIONS

The sterilizing action of solutions of chlorinated lime on both bottles and cans is shown in the tables given below. The dilution is indicated in terms of available chlorine:

BOTTLES (pint)

INOCULATED WITH SOUR MILK, 1 C.C. BACTERIA PER BOTTLE

(Plain agar—incubated 5 days at 30° C.)

Sour milk, 1 c.c.	*Washed, soaked one minute in sterile water.*	*Washed, soaked one minute in solution chlorinated lime.*	*Dilution available chlorine.*
800,000,000	11,000	0	1 – 5,000
		10	1 – 10,000
		150	1 – 20,000
		2,300	1 – 30,000
		110	1 – 40,000
		300	1 – 50,000
		heavy	1 – 75,000

The most satisfactory results were obtained from dilutions stronger than 1 to 10,000 available chlorine. This soaking rendered bottles sterile when they were well washed.

The table below shows the effect when the bottles were not washed.

Inoculated 1 c.c. sour milk.	*Not washed but soaked in sterile water one minute.*	*Not washed, soaked in chlorinated lime solution one minute.*	*Dilution available chlorine.*
670,000,000	8,200,000	0	1 – 500
		0	1 – 1,000
		0	1 – 5,000
		80,600	1 – 10,000

The best results are always obtained when the utensils are properly washed before sterilization. This is a very important point in sterilization by any method—to see that utensils are properly cleaned before sterilization.

MILK CANS (10 gallons)

BACTERIA PER CAN

(Plain agar—incubated 5 days at 30° C.)

Cans washed, one soaked one minute in chlorinated lime solution, 1-5,000 available chlorine, the other not treated. Counts made within one hour after washing.

Cans not soaked in chlorinated lime solution after washing.	*Cans soaked in chlorinated lime solution after washing.*
570,000	6,400
460,000	400
333,000	400
258,000	400
624,000	800
4,000,000	400
4,480,000	1,600
12,360,000	400
18,120,000	112,400
10,640,000	11,200
1,920,000	400
1,820,000	2,000
Average, 4,632,000	Average, 11,400

Cans treated as above were set aside twenty-four hours with covers on. Note the enormous growth, an increase 600 times that of the day before.

Cans not soaked in chlorinated lime solution.	*Cans soaked in chlorinated lime solution.*
3,192,000,000	400
4,480,000,000	22,400
384,000,000	400
2,664,000,000	000
Average, 2,680,000,000	Average, 800

SOLUTION OF CHLORINATED LIME NOT A PRESERVATIVE FOR MILK

Experiments were conducted to determine whether a solution of chlorinated lime can be used as a preservative for milk. Duplicate sets of milk samples were run. One sample was divided into seven parts, the other into six parts. To several of these samples solutions of chlorinated lime were added to make dilutions varying from 1 to 100 to 1 to 50,000 available chlorine. Aliquot parts of milk without preservatives were used as checks. One part was set aside for comparative purposes and not touched during the experiment. All samples were held at room temperature, about 75 degrees Fahrenheit (all bacteria counts show colonies made on plain agar, incubated 5 days at 30 degrees C.).

Dilution	Right after tre/ tment	24 hours after treatment	48 hours after treatment
Milk, not treated Sample I	Bacteria 2500 per c. c. Condition good	Bacteria 25,000,000 per c.c. Condition completely curdled	
Milk; not treated Sample II	Bacteria 10,000 per c.c. Condition good	Bacteria 5,000,000 per c.c. - slight curdling	Complete separation
Milk with available chlorine to make dilution 1-100. Sample I	Bacteria 000 per c.c. - coffee color, lumpy, aromatic odor	Bacteria 000 per c.c. - condition same as before	Condition, strong aromatic odor, lumpy
Milk with available chlorine to make dilution 1-1000 Sample I	Bacteria 500 per c.c. - condition, off color, aromatic odor	Bacteria 000 per c.c. - condition off color, aromatic odor	Condition, off color, lumpy
Milk with available chlorine to make dilution 1-1000 Sample II	Bacteria 4,000 per c.c. - condition good	Condition, reddish brown, astringent	Condition, reddish brown.
Milk with available chlorine to make dilution 1-5000 Sample I	Bacteria 1,000 per c.c. - condition slight chlorine odor	Bacteria 14,800 c.c. - condition astringent, slightly lumpy	Condition, sour, putrid.
Milk with available chlorine to make dilution 1-5000 Sample II	Bacteria 8,000 per c.c. - condition good	Bacteria 2,700,000 per c.c. - condition slight astringent, slight curdling	Condition: completely separated
Milk with available chlorine to make dilution 1-10,000 Sample I	Bacteria 1,000 per c.c. - condition good	Bacteria 60,100,000 per c.c. - condition sour	Condition: sour, putrid

Dilution	Right after treatment	24 hours after treatment	48 hours after treatment
Milk with available chlorine to make dilution 1-10,000 Sample II	Bacteria 8,500 per c.c. - condition good	Bacteria 1,900,000 per c.c. - condition slightly curdled	Condition: hard curd
Milk with available chlorine to make dilution 1-50,000 Sample I	Bacteria 900 per c.c.-condition good	Bacteria 23,100,000 per c.c. - condition sour	Condition: sour, putrid
Milk with available chlorine to make dilution 1-50,000 Sample II	Bacteria 6,000 per c.c.-condition good	Bacteria 27,000,000 per c.c. - condition slight curdling	Condition: complete separation
Milk not plated Sample I		Slight curdling	Complete separation

These results would seem to indicate that solutions of chlorinated lime can not be used to preserve milk except in amounts which rendered the milk objectionable in color, odor and taste.

DETERMINATION OF STRENGTH OF SOLUTION OF CHLORINATED LIME

Solutions: Sodium thiosulphate, tenth normal

1 c.c. = .00355 gram, chlorine.
Starch solution for indicator
Potassium iodine, 20 per cent solution
Acetic acid.

Fifty cubic centimeters of the dilute solution are transferred by means of a pipette to a beaker or Erlenmeyer flask. Ten cubic centimeters potassium iodine solution are added; the solution is then acidified with acetic acid.

The solution is now brown due to the liberation of iodine which has been set free by its equivalent in chlorine. Tenth normal sodium thiosulphate is added slowly in measured quantities from a burette until the brown color nearly disappears. Starch indicator is added and the titration continued until the blue color of the solution entirely disappears. The number of cubic centimeters of sodium thiosulphate is then read and the calculation is as follows:

c.c. $Na_2S_2O_3$n/10 x .00355 x 2 = ( ) gms available chlorine per 100 c.c.

DIRECTIONS FOR DILUTION

It has been found that one level tablespoon of commercial thirty per cent chlorinated lime when added to four and one-half gallons of water will make a solution closely approximating 1 to 5,000 available chlorine. The powder should not be added directly to the dilution water as the presence of inert material interferes with proper working.

To make a dilution of 1–5,000, the required amount of chlorinated lime (one level tablespoon to four and one-half gallons) should be put into a glass, enamel or stoneware container with about a half gallon of water. The material should be thoroughly mixed and allowed to stand for a few minutes.

After allowing the insoluble material to settle, the solution should be decanted through canton flannel into a stoneware tank with dilution water so that the milk utensils to be sterilized will be entirely submerged. Milk vessels should remain in contact with the solution for approximately one minute. The utensils should then be thoroughly drained and allowed to dry. A stoneware tank is advised as the solution will attack tin or galvanized iron, though slowly.

This dilution if made up to a strength of 1–5,000 may be used from five to six days as it loses strength slowly if protected from direct sunlight. Thorough washing of utensils before immersion is emphasized.

Directions given above refer to the use of chlorinated lime solution in sterilizing metal ware utensils which have been thoroughly washed and rinsed.

Thomas and Leete of the Market Milk Section of the Dairy Division, in their experiments on the sterilization of the rubber parts of milking machines, have found that for such purposes the directions given above in regard to the keeping qualities of the dilute solution do not apply. For rubber parts of milking machines they have modified directions as follows: Take a 12-ounce can of chlorinated lime, put this into 2 gallons of water in a stone or glass jar. Mix and filter through canton flannel or allow the inert matter to settle out. The clear solution will contain the active ingredient, available chlorine. This is the stock solution. It will retain its strength almost indefinitely if kept in a glass or stone jar away from direct sunlight.

To make a dilute solution, take a pint of the stock solution and mix it with 8 gallons of water, or one-half drinking glass to 2 gallons of water. This will make a solution containing available chlorine approximating 1–5,000. *This dilute solution should be made fresh every day as it loses its strength rapidly in contact with organic matter.*

COST OF SOLUTION

The cost of chlorinated lime in twelve-ounce cans varies from seven to fifteen cents a can retail. A twelve-ounce can will hold approximately thirty level tablespoonfuls of the powder. This would make up 135 gallons of solution approximately 1–5,000 strength, available chlorine. Therefore, the cost of the dilution would vary from one-twentieth to one-ninth of a cent a gallon. A tank holding forty-five gallons of solution, enough to last a week, will cost from two to five cents, depending upon the price of the twelve-ounce cans of chlorinated lime.

SUMMARY

Commercial chlorinated lime should contain on an average thirty per cent of available chlorine. Approximately all of this available chlorine is readily soluble in water. This water solution when protected from direct sunlight is stable.

The solution exerts only a slight corrosive action on milk utensils, if the vessels are properly drained soon after soaking. When left in tin, iron or zinc containers, the solution attacks them readily.

Solutions of chlorinated lime containing available chlorine of a strength greater than 1–10,000 will sterilize in a few moments milk utensils when these are submerged in the solution. To obtain this effect, however, it is necessary that all vessels be thoroughly washed and rinsed before soaking.

Solution of chlorinated lime will not act as a preservative for milk except when used in amounts which render the milk objectionable in color, odor, and taste.

Solutions of a strength that will sterilize milk utensils will vary in cost from one-twentieth to one-ninth of a cent a gallon, depending upon the retail price of the chlorinated lime.

DISCUSSION

Mr. Bright: The utensils must be clean. There is a tendency to think chemicals will do all the work. Water drawn through milking machines will not suffice. A little milk reduces the efficiency of the solution. The limitations of the solution must be understood. Milking machine connections should be rinsed with cold water first, second with a solution of soda water, then tubes and connections may be sterilized with a solution of chloride of lime.

Mr. Jackson: There is a danger in using chloride of lime solution. Salesmen urge that it will take the place of careful washing. In one case the solution caused the

loss of a day's milk to the farmer. It is essential that utensils be thoroughly cleaned before the solution is used.

Mr. Bright: We recommend only the dry chloride of lime. We recommend buying only in small quantities, fresh at least every two months.

Dr. Pease: In some cases these solutions seem to have a selective action on bacteria. Those not killed seem to produce odors. Any attempt to use chloride of lime as a preservative would be abortive.

"In the working of the system that produces the urban milk supply of today, the vendor, the inspector, the judge and the consumer play parts, and it is only as each understands the particular part he is to play, alone and in its relation to the part of all others, that smoothness of operation and sufficiency and good quality of output can be expected."—Woodward.

THE MILK INSPECTOR AND MILK PLANT OPERATION

C. E. CLEMENT, *Market Milk Specialist,* Dairy Division,
U. S. Department of Agriculture,
Washington, D. C.

While it is not expected that the dairy and milk inspector should be a practical milk plant man, it is important, however, that the man whose business it is to inspect the city milk plants should know something about the practical operation of a plant, just as the dairy inspector should know something about the practical side of dairying. He should be able to look at things from the standpoint of the plant operator. In order to give the milk plant foreman advice as to improving his methods the inspector should be able to see things from his point of view. If an inspector cannot talk intelligently on practical milk plant problems the foreman will not be likely to put so much confidence in what he has to say. It is very desirable that the inspector should be familiar with the common types of milk plant equipment. He should know something of the advantages and disadvantages of the various types of pasteurizers, holders, bottle fillers and washers, can washers, etc. When the inspector is familiar with such matters it is not uncommon for the milk plant operator to consult him when it is proposed to secure new equipment. By being able to give competent advice the inspector may often readily gain the confidence of the milk plant operator or owner and in so doing get much better results than would otherwise be possible.

A survey was made by the Dairy Division, U. S. Department of Agriculture, of 237 milk plants located in various cities of the country, to learn of the more common types of pasteurizers used. Of course quite a variety of types were found, and satisfactory results seemed to be obtained at plants using each type.

The most common types may be divided into five classes. (1) The vat system (vat pasteurizers are sold by all milk plant supply companies). (2) Tubular system, where the milk passes through tubes which are surrounded by the heating mediums (such types as the Davis, Simplex, Wisner and Progress machines). (3) "Film" or "Drum" pasteurizers, where the milk passes over or between upright heating surfaces in a thin film (such pasteurizers as the Willman, Commercial, Miller, etc.). (4) "Kettle" pasteurizers (including such types as the old Jensen and the Reid pasteurizers. (5) "In-the-bottle" pasteurizers, where the milk is pasteurized after it is put in the bottles.

The following table shows the various types found in the survey at various milk plants, and the amount of milk handled.

No. of gallons milk handled daily.	Vat.....	Tubular.....	"Film" or "Drum".....	"Kettle".....	In the bottle..	§In the can....	Total.....	Of these the "flash" system was used by.
Up to 100.....	4*	..	..	1	4	3	12	..
101 to 250.....	7†	..	1	2	5	..	15	1
251 to 500.....	26	1	2	6	2	1	38	4
501 to 1,000.....	24‡	9	8	10	1	..	52	4
1,000 to 2,000.....	14	12	12	7	3	..	48	3
2,001 to 4,000.....	8	12	9	10	1	..	40	2
4,001 to 6,000.....	2	4	12	..	..	..	18	1
6,001 to 10,000.....	2	3	..	..	..	..	5	..
Over 10,000	1	3	4	1	..	..	9	..
Totals	88	44	48	37	16	4	237	15

* Two of these were starter cans.
† One was the "spray" vat system.
‡ Two were the "spray" vat system.
§ Cans set in vat of water which is heated with live steam.

The vat and "in-the-bottle" systems are more common with the smaller plants while the "film" and tubular types are more common with the medium sized and large plants. Large dealers usually want a system that will handle a large quantity of milk quickly and continuously, so that

as fast as the milk is received and dumped it can be sent out immediately to the pasteurizer. In like manner at the large plants the bottle fillers must be operated continuously as the milk comes from the pasteurizing system. The small dealer can often economize by using a vat because of the various uses that may be made of it. By using a battery of three or more vats a practically continuous system can be obtained.

As is well known by milk inspectors generally, the "holding" system of pasteurizing is the only satisfactory method while the "flash" system is obsolete and not efficient. Of the 237 plants studied, 15 were using the "flash" system, 24 were using a "retarder" system, while all the others (198) were using positive holders. Where retarders are used tests should be made to determine the actual time the milk is being held. With the automatic positive or compartment holder great care should be taken to see that the valves open and close at the proper time and that none of them leak. With the hand-operated positive holders it is very important that a competent and reliable man be in charge, as it is very important that the valves be operated at the proper time and that all the milk be held at 145° F. for 30 minutes. Unscrupulous operators when they are rushed sometimes send the milk continuously through such a system without heating it high enough or holding it. While the last of the run may be heated to 145° for 80 minutes the rest of the milk may have been allowed to pass continuously through the vat with only a partial heating. Even if a recording thermometer is attached to the vat it may be impossible to detect this type of negligence.

Temperature recorders are essential for all pasteurizing plants and automatic temperature controls are essential for automatic or continuous systems of pasteurization. Where the vat system is used the operator can watch the temperatures and automatic temperature control is not essential, although it will, of course, do no harm. *If* the oper-

ator can be depended upon, he can control the temperature with this system by hand as accurately as when an automatic control is used, so that the extra investment might not be warranted in such a case.

It is very important that the recording thermometer record accurately and quickly. In many cases it has been noted that the temperature recorded by a recording thermometer was several degrees different from the actual temperature of the milk as shown by a hand thermometer or the bulb thermometer in the vat. This was due to the fact that the recording thermometer did not register quickly enough.

The recording thermometer as well as the bulb thermometer in the vat should be checked for accuracy often. At one plant where the operator was depending on the bulb thermometer it was found that it registered 10 degrees too high, so he was heating the milk only to 135° when he thought he was heating it to 145°.

The inspector should be familiar with the process of pasteurization and with some of the methods used by unscrupulous or misinformed operators. Among the causes of inefficient pasteurization that have been noticed are the following:

1. Pipes and pumps not cleaned and sterilized.
2. Filler and valves not cleaned and sterilized.
3. Milk rushed through the apparatus too fast.
4. Milk not heated high enough or held long enough.
5. Recording thermometer not accurate.
6. Bulb thermometer not accurate.
7. Raw milk added to pasteurized milk in vat (vat pasteurizer) before the latter is all drawn out.
8. Pumps and piping not of sanitary construction.
9. Leaky or inaccurate valves which allow some of the milk to get through the apparatus without being held the proper length of time.
10. Formation of foam in the holder.

Two main objects are desired in operating a pasteurizing plant:

1. The destruction of any disease-producing bacteria and at the same time reduction of the total bacteria in the milk, so as to prolong its keeping quality.

2. Economy in the use of heat, power and labor.

Unless the first is accomplished the second is, of course, of little account, for, if the milk is not *properly* pasteurized it would be useless to use the pasteurizer at all.

In general, two things are necessary in order to pasteurize milk properly:

1. Heating the milk to the proper temperature, holding it at that temperature for the proper time and an accurate control of the temperature.

2. Thorough cleansing and sterilization of all apparatus that comes in contact with the milk.

The cleansing and sterilizing of the apparatus is absolutely essential for good results. All milk pipes, pumps, and filler valves must be taken down after each run, thoroughly cleaned and rinsed and then sterilized by steam. At least 5 minutes of steaming is necessary. The pasteurizer also must be thoroughly washed, rinsed and steamed. Some plants get poor results after heating and holding the milk at proper temperature because the pipes and other apparatus are not properly cleansed and sterilized. All bottles and cans must be thoroughly cleansed and sterilized, or the value of the pasteurization will be greatly reduced.

Unless there is an automatic temperature control the steam and water valves must be carefully watched in order to maintain the proper temperatures. If the milk is not heated to, and held accurately at the proper temperatures, good results cannot be expected. All pipes or "pockets" in which milk is held during the holding process should be insulated, as otherwise the holding tempera-

ture cannot be maintained. Great care must be exercised also that the valves leading from the heater or holder do not leak.

The milk plant operator has many other problems to deal with besides the proper pasteurizing of the milk, and the inspector should be familiar with all his problems. The following are some of the points to be kept in mind:

1. Avoid milk piping as much as possible, by the proper arrangement of rooms and equipment. Not only is the piping difficult to keep clean, but extra labor is required. Besides, extra piping will increase the loss of milk.

2. Avoid use of milk pumps whenever possible, and use gravity system. Extra labor is required for cleaning pumps, and the gravity system is more desirable.

3. Keep a close watch for leaks, spillage, slop, etc., in milk handling, so as to keep the shrinkage as low as possible. A gallon of milk spilled now is twice the loss it was a few years ago.

4. Drain cans well after dumping the milk.

5. Have milk vats so set that they can be readily drained.

6. Keep all joints of milk pipes tight, and thus avoid leaks.

7. Utilize milk returned by drivers, and drain the containers well after dumping.

8. Shut down motors or other machinery as soon as through using, and thus avoid waste power.

9. Avoid extra shafting, pulleys, etc.

10. Avoid extra steam piping by proper arrangement of rooms, and thus avoid losses due to condensation of steam.

11. Keep steam valves and joints well packed to avoid leakage of steam.

12. Keep all machinery well oiled, but avoid waste of oil by careful use and by catching the drip.

13. Avoid water wastes. Save water from cooler coils and from condenser coils whenever practicable. Too much

water used in washing also requires extra washing powder. Water should not be left running when not needed.

14. Utilize exhaust to heat water for use in the plant, also to heat boiler feed water, and to heat the building.

15. Avoid waste of ice. Leaving ice on cement floors in work room, or exposed to drafts, causes unnecessary waste.

16. Keep doors of refrigerator room closed. Do not work in refrigerator longer than necessary, and do not leave the lights burning.

17. Eliminate breakage of glass as much as possible. Broken bottles at the fillers not only cause the loss of the bottle, but of milk, often considerably more than a bottleful. Save the broken glass.

18. Avoid extra labor by convenient arrangement of rooms and equipment. and by use of labor-saving devices when practicable.

19. In order to get a quick cream line the milk must be cooled quickly after pasteurizing and handled with as little agitation as possible.

It is the business of the milk plant operator to run the plant efficiently and to keep his expenses as low as possible. He must run the plant with as few men as possible and get results. There is a wide variation in the number of men used at various milk plants. The number of men required will depend not only on the care taken, but also on the efficiency of the management, arrangement of the plant, etc.

The following table shows the number of men employed at 154 plants of various sizes located throughout the country. The number used to actually operate the milk plant includes the men used in operating the boilers and engines. Men who put in their time in the butter or ice cream departments were not included, nor were the men used to operate trucks or those employed in stables.

TABLE SHOWING NUMBER OF MEN EMPLOYED IN CITY MILK PLANTS OF VARIOUS SIZES

Gallons handled daily.	Number of plants	Total gallons handled.....	Average gallons handled per plant.....	Total men in plants.....	Average men per plant.....	Variations.....	Average men in plant per 100 gallons handled	Variations.....
Up to 100 gallons.....	4	250	63	4.3	1.0	1.0 to 1.3	1.07	1.0 to 1.6
101 to 250.....	19	3,285	173	32.5	1.7	1.0 to 3	1.0	0.5 to 2.3
251 to 500.....	31	12,435	401	86.5	2.8	1.5 to 6	0.7	0.3 to 1.3
501 to 1,000.....	34	26,855	790	193.0	5.7	2.0 to 13	0.7	0.3 to 1.6
1,001 to 1,500.....	16	20,750	1,297	114.5	7.2	2.5 to 17	0.6	0.2 to 1.4
1,501 to 2,000.....	11	19,600	1,782	126.0	11.5	6.0 to 21	0.6	0.3 to 1.4
2,001 to 3,000.....	13	34,450	2,650	190.0	14.6	8.0 to 27	0.6	0.2 to 0.9
3,001 to 5,000.....	16	64,650	4,041	328.0	20.5	7.0 to 36	0.5	0.2 to 0.8
5,001 to 10,000.....	9	66,700	7,411	294.0	32.7	9.0 to 49	0.4	0.1 to 0.7
Over 10,000.....	4	69,000	17,250	343.0	85.8	49.0 to 100	0.5	0.3 to 0.6
Totals	157	317,975	2,025	1,711.8	10.9	1.0 to 100	0.5	0.1 to 2.3

There is a wide variation in the number of men employed at plants doing about the same amount of business, indicating that many of the plants are not run as efficiently as others in regard to labor. The layout and arrangement of the plant is often responsible for extra men being required. Too much division of rooms and too many floors will require more men to operate the plant, and it is well for the inspector to bear this in mind when he contemplates demanding radical changes in the arrangement of the plant. The milk plant operator is often opposed to making certain changes in the layout of the plant because he knows that when such changes are made he will require additional help. Of course many changes have to be made regardless of the extra expense and it is the business of the inspector to recommend such changes when necessary, but if he can look at the problem not only from his standpoint but also from the standpoint of the milk plant operator, he will get the desired cooperation.

While it is not necessary for the milk inspector to worry about the problems of the milk dealer, nevertheless a knowledge of some of his problems can do no harm, and maybe will result in increased efficiency.

DISCUSSION

Dr. Pease: The paper is both important and timely. We have too long neglected the pasteurizing plants, and many phases of milk plant supervision. Not enough emphasis has been placed on cleanliness of apparatus, and the apparatus must be clean if it is not to be a detriment to the keeping quality of milk. Bacteria grow wherever they have food and a favorable temperature, and the importance of cleanliness cannot be over-emphasized. As developments in the industry take place we find study more and more necessary by those who have to exercise supervision over the milk handling processes.

Prof. Lockwood: Cleanliness is relative. The carpet may be "clean," the table cloth "clean," but we do not use either for dressing a wound. We all have our ideas regarding cleanliness. We must secure real cleanliness in connection with the production and handling of milk.

Miss Nicoll: We had high counts in our pasteurized milk, and I insisted on the use of a recording thermometer, but I understand that thermometers are not all reliable recorders of time and temperature.

Prof. Lane: Recording thermometers should be checked to make sure they are working properly.

Prof. Lockwood: Use only laboratory tested thermometers of known accuracy. There should be definite control work.

Mr. Kilbourne: The recording thermometer is useful for comparative results. When properly adjusted they may become changed. The accuracy of record varies with temperature of the air. The stem is frequently very long and record varies somewhat with air temperature.

Miss Nicoll: What is the longest allowable length for connections?

Mr. Kilbourne: Not more than six or eight feet.

Mr. Irwin: Should we have a maximum number of bacteria that would be allowed and still regard containers as clean?

Dr. Pease: I do not think we now have sufficient information to express an opinion, but we should find an absence of undesirable kinds.

"Satisfactory dairy inspection cannot be performed as a mere routine matter, but calls for the exercise of intelligence and keen judgment which can come only as the result of thorough scientific training and experience."—Stocking.

THE PASTEURIZATION OF MILK

CHARLES H. KILBOURNE, New York City

The general principles which govern the treatment of milk by the heating process are fully known, at least to you inspectors. The various types of machines you are familiar with, as well as with the needs of the plants where they are installed. What you want to know particularly is how you can be sure that the plants and the apparatus are doing in actual practice the things which they are designed to do and which they are capable of doing.

I have recently had some evidence that the general public still entertains some hazy views as to the meaning of pasteurization. Not infrequently, some one in speaking to me asks what the process consists of. In a high school not more than 100 miles from New York a teacher told his pupils that pasteurization consisted of introducing into the milk a culture discovered by Louis Pasteur in some such way as in the treatment for rabies. The impression given was that the treatment of milk in this way was to prevent the consumers getting rabies.

Another instance of ignorance so ridiculous as almost to seem impossible is vouched for by a friend of whose honesty I have no doubt. A certain patient was told by her physician that she must use a quantity of milk in her diet, but that she must not use the milk supplied by, we will say, the A. B. C. Milk Company. The doctor said that this company put *corns* into the milk. Asked where they got enough corns to use, the doctor said that the Milk Company had an agreement with the chiropodists to save them for the use of the company.

From time to time methods have been devised for the treatment of milk. The electrical method was used in several plants in and about New York some years ago. Attempts have been made to use the ultra violet ray in destroying germs in milk. Not long ago an engineer told me he had experimented with that method and it was pos-

sible and probable that it would become a practical method in time. Some years ago a man came to my office and said he had a method for destroying the bacteria, that he did not use heat at all, nor any form of preservative. He said his process was entirely mechanical. He would not tell me what it was. He was a German scientist and it was before the war. I never learned his process.

Quite recently a man came into my office and said that he had learned of a new method of treating milk. I asked what it was. He replied: "Take a bottle of milk, shake it well, then pour it out into a glass, hold the glass above your head, and bring it slowly down past your eyes and—" Then he looked at me and I looked at him somewhat as you are looking at me now. I said, "Well?" He then repeated: "Pour the milk in a glass, hold it above your head, and bring it pasteurize." I see that you now see it as I did.

I know of very few new forms of pasteurizing apparatus recently placed on the market. One which has seemed to me to offer some promise for small plants is a rather new method of pasteurizing the milk in the bottle. Instead of surrounding the milk with hot water, or subjecting it to a spray of hot water, this method places the bottles in a well insulated box, and then introduces steam into the box at the bottom through pipes which are so perforated that the steam is projected against the bottom of the box. In this way the steam does not come in direct contact with the bottle but is diffused through the box, and the whole space is thus raised to a uniform temperature, which can be controlled either by hand or by an automatic controller. The steam which is condensed is carried off at the bottom of the tank. After the holding is completed cold water is introduced and the milk cooled. This seems to have some advantage over the usual process of bottle pasteurization in that all of the bottles get the same temperature, and water pumps are not necessary.

I do not know whether you are familiar with a certain modification of the flow type holder, in which the so-called Park holder has introduced into it another inverted cylinder in such a way that the milk flows into the top of the inner tank, down to the bottom, and then up through the space between the two cylinders and out through a pipe at the top of the outer cylinder. This arrangement has the effect of doubling the distance which the milk has to flow through the holder and so doubling the rate of flow. As we all know, there is less likelihood that the milk will become mixed and bypassed where the flow is rapid.

Our friend, Mr. Heuling, whom you have met, has a patent on a process by which he subjects the held milk to a superheating just before it is cooled in order to discourage those bacteria which have just escaped with their life during the holding process as it is usually employed. He is getting very low counts and still a good cream line.

In the construction of pasteurizing plants there is much which needs to be learned by the men who design them, and especially when an old creamery is remodeled into a pasteurizing plant, mistakes are made. One of the first errors to be made is in thinking that the old boiler used in the ordinary receiving plant can be made to do efficiently the work of a pasteurizing plant. Plants are frequently so arranged that the maximum amount of milk piping is required and it would sometimes seem as though it were the purpose to sell and use as much piping as possible. In one plant I remember I made an estimate of the length of piping and found that there was well over 2,500 feet of pipe through which the milk flowed. This is over half a mile. Some one wondered if the milk was all worn out in passing through.

Another plant was remodeled in such a way that the boiler was placed at one end of quite a long set of buildings, and the coal bin was at the other. The ice machine was at the opposite end from the boiler, and the pasteurizer

was also at a considerable distance from the source of heat. As a result the milk handling rooms were filled at the top with a maze of piping and shafting. The holding tanks were so placed that one had to go up stairs at one end of the building, pass through several rooms, and climb through a small door to get to them. After a time it was decided to rebuild and to construct a new plant. The architect saw me and wanted to know if I had any suggestions to make. I said, "Yes. Look this plant over very carefully and then make the new plant entirely different."

Now there is one point which I do not remember having heard either Mr. Clement or Mr. Moore mention in their excellent papers. That is the difficulty of being sure that a continuous process actually holds the milk for the full time required. We will assume that the holder has been tested and has been found capable of holding the milk for at least 30 minutes. How do you know that in actual operation the plant will not be speeded up so as to decrease the holding time? The milk is conveyed to the heater either by gravity flow from a tank into which it has been pumped or dumped, or else it is pumped directly to the heater. In the first case, the height of the milk in the feed tank will determine the speed of flow, since of course the higher the milk level, the greater will be the pressure. If there is a valve from the storage vat, this valve will be dependent on the carefulness of the man who operates it, and at times it may be opened so far as to increase the speed, and so decrease the holding time.

If the milk is pumped by means of a steam pump, then the speed of the pump will depend upon the amount of steam admitted to it, and this will depend not only upon the hand manipulation of the steam valve but also on the steam pressure in the pipe supplying the steam. Very few plants with which I am familiar are so arranged that these possible difficulties are overcome. One or two plants where the milk flows to the heater are provided with a small feed-

ing trough into which the milk flows from the storage tank. The height of the milk in this feed trough is maintained by means of a float valve, and the speed of flow is determined by the size of the opening of the pipe which feeds the heater. The milk cannot flow any faster than this pipe will admit it, and if the feed trough gets too full the float valve shuts off the milk from the trough.

In the case of the pump, there should be a steam pressure reducer in the pipe supplying the pump with steam, so that no matter what the boiler pressure, the pressure at the pump will not vary. Then the pump should be so adjusted that when the valve to the steam box is wide open, the speed of the pump cannot be more than a predetermined rate. This will also aid in the even heating of the milk, and if the steam to the heater is also from the line where the pressure reducer is placed, the heater always gets the same pressure and the controlling of the milk temperature can almost be done by hand without an automatic control.

There is one other point in the pasteurization of milk which I have not heard mentioned at these meetings. We all know that the bacterial content of the pasteurized milk is taken to be an index of the efficiency of the process. Now it has happened that the pasteurized milk was found to contain as great and sometimes greater numbers of bacteria than the raw milk. Of course we at once think that the process is not being well done, or that the apparatus is dirty at some point. This is sometimes true, but at other times no apparent cause is discoverable. I have known at least five or six instances where these high counts persisted where the process was carried on in a proper manner and where the apparatus was known to be clean and sterilized by processes which could be properly applied. In two or three instances under my observation, the apparatus has been steamed for half an hour before the milk was admitted, and also a disinfectant has been pumped through the pipes, and so forth, and still high counts persisted.

Now I can only think of three possible causes for these results.

1. There may be some strain of bacteria which either resists the heat of pasteurization or even grows at high temperatures.

2. There may be some hidden sources of infection in the apparatus which under the influence of a continuing pasteurization become effective in seeding the milk; or

3. In the laboratory where the counts are made there may be some bacterial dust or other infection which gets to the plates and so deceives the worker as to the source of the trouble.

In these instances which I have cited, no satisfactory cause has ever been discovered. After doing all sorts of things to discover the source of infection, the difficulty has gradually or suddenly disappeared and left us no wiser than before.

Some western inspector wrote at one time of such a trouble which he traced to its lair. I hope he is here and can give us his experience. As a result of the hint which he gave, I tried in some cases to segregate milk from different sources before pasteurization, place each batch of milk in a separate bottle, and then pasteurize it *in the bottle,* to see if in milk which I knew was well pasteurized there were still persistent bacteria. In all cases where this was tried, the trouble disappeared before the test was made, and I learned nothing.

I have one such case at the present time and I am watching it with considerable interest.

"The milk inspector is a servant of the people."—Kelly.

A FEW WORDS TO THE CONFERENCE

DR. E. KANASUGI, *President of the Tokio Medical Association,* Tokio, Japan

Mr. Chairman, Ladies and Gentlemen:

I am happy to address the members of your Association.

I have been asked to voice an opinion on the dairy produce situation in Japan, which I do with pleasure.

Milk and other dairy products were first introduced into Japan some forty years ago, at which time there were very few users of same, the majority of the Japanese people believing that milk was most injurious to the human system. At that time all milk producing cows were imported from England, but for the past twenty years practically all such cows have been imported from the United States.

It seems to me that milk is most necessary to the human system, and for that reason we have given a closer study to the milk question, with some very interesting developments. In addition to milk containing albumen, fats, etc., it was found that it contained other important chemical substances.

Three months ago we organized a milk supply company in Tokio, which is studying the milk question from a scientific standpoint; that is to say, the necessity of milk to the human body, to children, invalids and those in delicate health, and for this reason we intend to give more time to its study in the future.

My country, Japan, in many respects is adopting American customs, particularly in regard to the milk question, and we are looking forward to making still further progress along these lines.

I thank you for your kind attention.

"This is the tremendous responsibility of the inspector—showing the other fellow how to live up to his opportunity and the duty which, if he is confronted with it, he really knows he ought to do of himself."—Van Norman.

BACTERIAL CONTROL IN MILK PLANTS

RUSSELL S. SMITH, *Milk Specialist,* U. S. Department of Agriculture, Washington, D. C.

Milk inspectors and health officials cannot be assured of a safe product because of the mere presence of a milk pasteurizing plant in their city. Special attention must be given to the operation of such a plant in view of the fact that if it is not properly operated it may become a chance source of infection to the community.

In many instances, only an attempt at the process of pasteurization is being made. This is due to either a lack of proper attention and responsibility or to the absence of understanding, on the part of the operators, as to the functions and reasons for the process.

Bacteriological control of the process of pasteurization and of the condition of the subsequent containers and contact surfaces is essential. This examination should not be left entirely to the pasteurizing plant, but should be made frequently by competent officials under the direction of milk inspectors or health officials who are responsible for the condition of the milk supply and of the health of the community.

In considering the efficiency of various pasteurizing processes, it should be understood that the percentage reduction of bacteria in raw milk by heating does not form a measure of safety of the final product. After heating, the so-called pasteurized milk is changed from its original condition and any inoculation subsequent to the heating introduces an uncertain element which may be of concern and which may void the reduction in bacteria already secured by heating the milk.

In the examination of milk to determine the percentage of reduction due to the heating process, a series of samples should be taken aseptically at intervals at the points representing definite stages in the pasteurizing process. It

is only in this manner that undue changes in the bacterial content can be noted and corrections made.

An accurate thermometer should be used to note the temperature at the various stages.

The first series of samples should be secured from raw milk entering the heating apparatus.

After the heating and holding process, in which temperature and time should be noted, another series of samples should be secured in the same manner at the point where the milk leaves the holder. This point of sampling varies with different apparatus, and, especially when the inclosed type of holder is used, so that it is not always possible to secure samples immediately after the milk is held.

If milk is pumped, a series of samples should be secured before and after the pumping process.

Following the holding process, milk is usually run over a cooler, and as it comes from the cooler a series of samples should be secured and temperature noted.

The cooling process is usually followed by the bottling and a series of samples from the bottled milk should be secured and temperature noted.

In some plants the bottled milk is stored for a certain period in a refrigerator room prior to delivery. Sometimes this is an over-night storage and in such instances a series of samples of the held-over milk should be secured and the time of storage and temperature of the milk and the temperature of the storage room noted.

In general, then, we have the following points where a series of samples should be taken at intervals:

1. Raw milk at entrance to heater. (Temperature to be noted.)

2. Heated milk after being held. (Time and temperature to be noted.)

3. Milk as it comes from cooler. (Temperature to be noted.)

4. Milk in bottles or cans. (Temperature and time of delay before placed in storage to be noted.)

5. Milk in bottles or cans after storage. (Temperature of milk and air in storage room, and length of storage period to be noted.)

All samples should be iced and removed to the laboratory for dilution and plating as soon as possible. A chart showing the different stages where samples were secured can be made and the percentage reduction at each stage can be ascertained when the bacteria counts are known. A series of preferably five samples, taken at intervals of several minutes at each point, is essential in order that the true condition of the milk may be known throughout the process.

Using the average of the raw milk counts as a basis, the reduction at the various points can then be computed. A record of milk temperature, time of holding and of delays in handling, time of storage with temperature of storage room, are necessary for complete information.

It is also essential that a check be made on any automatic time and temperature controlling device that may be present. By immersing the recording thermometer bulb in the same liquid with an accurate tested hand thermometer for a period of time, a comparison can be secured. Any automatic time-holding device should be checked by comparing the time of holding with an accurate watch. Continuous holding apparatus can be checked by noting the time required to fill or to empty the holder. The length of holding sometimes depends on the capacity and speed of a milk pump, the speed being under control of a steam valve. By proper regulation of the speed of the milk pump, the time of holding may be controlled to some extent.

In the case of vat holders, the length of time the entire batch of milk is held at the pasteurizing temperature should be checked. When time is required for the vat to become filled and emptied, only the length of time the entire quan-

tity of milk is held at the pasteurizing temperature should be considered. Recording thermometer charts usually record from the time the milk enters the vat and in the interpretation of the chart record, the time when the vat becomes filled should be known and the time of holding the milk at the proper temperature gauged from that point to the time the vat starts to be emptied. This may result in some milk being held longer than the required time because of the time of emptying the vat, but it is the only positive way to insure the holding of all the milk at the proper temperature for the desired period of time.

INTERPRETATION OF RESULTS

The following table has been taken as an example for interpreting results from similar tests at many pasteurizing plants. The tests were made over a period of five days and are the averages of 128 samples.

Raw milk after clarifying:		
Temperature	84°	
Count	152,375	
Heated and held:		
Time	30 minutes	
Temperature	145°	
Count	6,240	Reduction, 96%
Off cooler:		
Temperature	45.2°	
Count	8,452	Reduction, 94.4%
Bottled:		
Temperature	51°	
Count	15,592	Reduction, 89.7%
Stored 24 hours:		
Temperature	42.2°	
Count	24,386	Reduction, 83%

	Temp.	*Bact. count.*	*Per cent bact. count, increase.*
Increase due to milk passing over cooler....		2,212	35.4
Increase due to milk passing through bottler	5.8°	7,140	83.4
Increase due to milk being stored 24 hours..	*8.8°	8,894	57.0

*Decreased.

From the time of maximum reduction (96 per cent) to time the milk was in the bottle (reduction 89.7 per cent)

there was a difference of 6.3 per cent in reduction. This represents a total increase in temperature of 5.8 per cent, and a bacteria count increase of 9,352 per c.c. or 149.8 per cent.

From the time of maximum reduction (96 per cent) to the time of delivery, after 24 hours' storage (reduction 83 per cent) there was a difference of 13 per cent in reduction. This represents a total decrease in temperature of 3 per cent and a total increase in bacteria of 18,146 per c.c. or 290.8 per cent.

The reason for the increases should be sought, as there is evidence of a waste of energy in allowing increases to occur after a certain degree of reduction has been gained.

Since the milk, after being reduced in bacterial content (96 per cent), has passed over the surface of a cooler, that is the first point where attention to cleanliness and sterilization should be centered. Exposed surfaces always allow access for dust particles and bacteria which may be adhering to the same. Improper washing and sterilization of pipes and cooler surfaces allow milk to collect, sour and dry in crevices and joints. Milk passing through or over such accumulations becomes inoculated. This is easily noted when the first milk over the cooler shows an excessive increase in bacterial content. A bacterial examination of sterile water run over the cooler prior to the milk-cooling operation will reveal the source of trouble.

PUMPS

If milk is pumped, the condition of the inside of the pump may cause inoculation of milk. Securing the bacterial condition of a series of milk samples secured before and after the pumping process will determine the increase due to the agitation or inoculation caused by the pump. A bacterial examination of sterile water run through the pump when it is not in use may reveal a deposit of sour or dried milk which has become an inoculating agent.

BOTTLING MACHINE

The bottling machine in a milk plant is sometimes a difficult piece of equipment to clean properly. The rubber parts and filling mechanism should be taken apart and thoroughly cleaned after each day's run. If valves are not removed, an accumulation of drain-water occurs, and unless this is disposed of before the filling begins, the first bottles filled may show excessive bacterial counts as well as added water. Such a condition has been noted quite frequently and is due to carelessness. An instance has been noted of the use of a strong disinfectant in an attempt to sterilize the bottling machine, and the presence of the disinfectant in the first milk bottled and delivered to consumers. This shows the extent of carelessness that may be attained in this respect.

A bacterial examination of the drain-water or of sterile water run through the filling valves will help to determine the source of inoculation.

BOTTLES

The transparent glass bottle is the most common container for milk. Probably it is the most misused container of any used for marketing perishable food. The cost of glass bottles is so great that their continued use is necessary.

It is a discouraging thing to know that sometimes when an empty milk bottle looks to be clean, in reality it is not. It is this deception which caused many bottles to be refilled with milk with no special attention being given to their washing and sterilization.

The washing and sterilization of returned empty milk bottles in a city milk plant has become a difficult and expensive problem. In order to secure the best results, there must be several inspections and then a final inspection for the detection of the visibly unclean bottles so that the business may not be injured by loss of trade or publicity because of unclean containers.

Returned bottles should be sorted before any attempt at washing is made. Those which contain visible dirt should go to the soaking machine for special attention, and those which are passed as washable should go to the rinsing, washing and steaming machines which have been developed to a high degree of proficiency. The makers of bottle-washing machines do not claim that unwashable bottles can be made clean, neither do they insure the condition of the bottles after they leave the washing machine. Improper storage or handling may void the utmost previous precautions against inoculation.

Bacterial tests for the condition of the empty bottles which are to be filled should be made frequently. The method employed usually consists of rinsing empty bottles with about 30 c.c. of sterile water. Test tubes containing this quantity can be prepared in the laboratory and taken to the milk plant. Bottles ready to be filled are selected at random from the supply and the 30 c.c. of sterile water poured in each. A milk bottle cap is then placed in each bottle and a thorough shaking given. Some of the rinse water is then drawn off into sterile test tubes and a bacteriological examination made of it in the laboratory. The total count of 1 c.c. of the rinse water can be determined and then the bacterial condition of the bottle as affecting 1 c.c. of milk poured therein can be computed. While the inoculation per c.c. of milk may in some instances be small, it must be remembered that the results show initial inoculation which may develop, under favorable conditions, with an undesirable effect on the milk.

The inoculation of the milk from the milk bottle itself can be reduced to a minimum by thorough washing, steaming and draining prior to filling. Such reduction of the chances of inoculation should be the object of milk plant operators and milk inspectors alike.

Under various conditions of washing and steaming of milk bottles at different milk plants, the inoculation per 1

c.c. of milk that would come from bottles varied as the conditions varied. In order to show the effect of different methods, the following tables were prepared by differentiating between conditions where good methods were in practice, and conditions other than good which were associated with high inoculation.

BOTTLE WASHING

(No mechanical washer or steamer.)

Plants.	*Bottles.*	*Ave. initial inoculation per c.c.*
9	30	2,636
1	15	1,192.4
1	20	568
1	10	395
7	90	167
1	25	78.1
20	190	Average, 458.2

Range: 0 to 9,005.

(Mechanical washer and steamer present.)

Plants.	*Bottles.*	*Ave. initial inoculation per c.c.*
1	12	238
1	8	149
1	10	137
1	10	115
3	24	92.9
2	45	72.3
1	10	4.8
1	20	Less than 1
1	15	Less than 1
12	154	Average, 78.8

Range: Less than 1 to 900.

Total plants, 32.

Total bottles, 344.

Average initial inoculation, all conditions, 288.3.

Difference of 82.8 per cent in favor of mechanical washer and steamer.

When mechanical bottle washers and steamers were used and special attention paid to the inspection and storage after washing, the average inoculation per c.c. was 78.8, the range being from less than 1 to 900. When other conditions for washing were used, the results showed a higher average and a wider range.

Taking all conditions, good and poor, of washing and steaming bottles at city milk plants, as shown by the following table, the average inoculation per c.c. found by examining 344 bottles at 32 plants was 288.3, varying from less than 1 to 9005.

Under commercial conditions, it seems reasonable to expect the average bacterial inoculation of bottles to be confined within the average range secured when standard mechanical washers and steamers are in use, and care is given to storage prior to filling. Should the bacterial inoculation fall outside this average, it would be well to consider changes in methods and equipment, and to devote more attention to this part of the plant operation.

An experiment was conducted at one milk plant to determine to what extent, if any, the bacterial condition of bottles would be changed by rinsing with cool water just prior to filling. In this instance, the rinsing was desired because of a faulty storage consisting of upright bottles and a warm room. The following table shows the results of the tests on a case of bottles half of which were tested before rinsing and the other half being tested after rinsing.

Before rinsing.		*After rinsing.*	
Total bottle count.	*Ave. initial inoculation per c.c. milk.*	*Total count.*	*Ave. initial inoculation per c.c. milk.*
120,000	240.0	16,000	3.2
3,840	7.5	5,200	6.4
15,200	31.0	2,000	4.0
31,200	62.4	4,800	9.6
44,400	88.0	6,600	13.6
Ave., 42,928	85.8	3,720	7.4

Difference due to rinsing, 91.4 per cent.

While a reduction of 91.4 per cent was secured by the rinsing and a slight cooling of the bottle resulted, the operation may be called impractical in that it constitutes an added expense of water and of equipment and handling, as a substitute for correct storage by inverting bottles in a cool

room. It also causes the handling of wet cases and bottles at the filling machine, and because of the rinsing admits a chance for inoculation if the rinse water becomes contaminated.

CANS

The initial inoculation per c.c. of milk which may be given when it is poured into a milk can should be a matter of concern. The inoculation thus acquired is governed by the condition and number of cans used in the transportation and sale of the product, and in many instances the degree of inoculation becomes sufficient to seriously injure or ruin the milk.

Since the milk can is the recognized last container which is used for transporting milk between the milk shipper and the city dairy, the responsibility of the condition of this container should be definitely fixed. Inoculation from cans varies with the efficiency of washing, steaming and drying and the length of time between the washing process and filling of cans with milk.

The proper apparatus to be used in efficient can washing seems to be a wash tank with brushing facilities, rinsing tank, steam jet, and air blast. Accompanying this equipment, there must be a proper storage space. No system of handling the cans is complete unless the metal can covers and lids or wooden plugs receive a thorough washing and drying.

In the examination of milk cans under various washing and steaming conditions, it has been found that while some of the essential equipment was present, the entire operation was carried on so hurriedly as to make the method ineffective.

The usual procedure in the bacterial examination of empty milk cans is to secure a sample of drain water in the can, if sufficient is present; otherwise 200 c.c. of sterile water is poured into the can. After a thorough rinsing, a

sample of the rinse water is secured by pipette, placed in a sterile test tube and removed to the laboratory for bacterial examination. If the drain water is sampled, the count per c.c. is multiplied by the quantity of the drain water to secure the total number of bacteria in the can. If the sterile rinse water (200 c.c.), has been introduced into the can, the bacteria count of the sample should be multiplied by 200 in order to secure the total number of bacteria in the can.

When the total number of bacteria per can is known, the number is divided by the volume of the can in cubic centimeters, in order to determine the probable initial inoculation per c.c. that would result if the can were to be filled with milk or other liquid.

The following tests were carried on under three conditions, classified as follows:

CONDITION 1

Cans from milk plants where tanks, hand brushes, cleansing powder, and steam jets were present. Examined at the railway station as they were being sent to shippers.

Plants.	*Total cans.*	*Condition.*	*Ave. inoculation.*	*Range.*
29	146	Wet: 108	547,994	52 to 4,332,000
		Dry: 38	1,870	2 to 19,632

Inoculation in wet cans 99.7 per cent more than in dry cans.

In conjunction with the above conditions, it may be interesting to note the effect of a complete change of method and equipment such as was installed in one milk plant during the course of the investigations.

Bacteria counts were made on a series of 10 cans as they were delivered to the railroad, before the new apparatus was installed, as follows:

Cans.	*Ave. amount of drain in cans.*	*Ave. inoculation per c.c.*	*Range of inoculation.*
9	83 c.c.	88,500	23,700 to 178,000

After the can-washing machine with attached air blast was installed, bacteria counts were made on a series of 12 cans delivered to the railroad as follows:

Cans.	*Condition.*	*Ave. inoculation per c.c.*	*Range of inoculation.*
12	5 dry 7 damp	122	52 to 634

Difference of 99.8 per cent in condition of cans delivered to the railroad for shipment, due to the installation of can-washer, steamer and dryer.

CONDITION 2

Freshly washed cans at city milk plants, just prior to filling or shipping back to producers. Tanks, hand brushes, cleansing powder and steam jets were present. All cans slightly moist inside.

Plants.	*Total cans.*	*Ave. initial inoculation.*
4	29	684
10	131	86.7
3	6	1564
1	11	196.7
6	30	162
1	16	20.7
1	11	205.8
1	10	18.7
27	244	Average, 614

Range: 5.2 to 2,750.

In conjunction with the above conditions, it became possible to secure comparative tests when one milk plant installed a can steamer during the investigation.

Bacteria tests were conducted on a series of 10 freshly washed cans when no facilities for thorough steaming were present:

Cans.	*Condition.*	*Ave. initial inoculation per c.c.*	*Range.*
10	Slightly moist	206.3	60 to 675

After a new can steamer was installed, a series of bacterial tests was made on 9 freshly washed cans, as follows:

Cans.	*Condition.*	*Ave. initial inoculation per c.c.*	*Range.*
9	Slightly moist	97.3	1.5 to 441

The series of tests showed a difference of 53 per cent in favor of the installation and use of a can steamer.

CONDITION 3

Freshly washed cans at milk plant. Washing machine and air blast used for washing and drying cans.

Plants.	*Cans.*	*Ave. initial inoculation per c.c.*	*Range of inoculation.*
2	10	18.6	0 to 62
1	34	9.7	0 to 331
1	16	20.2	1.3 to 91.5
4	60	Average, 14.0	Range, 0 to 331

From the foregoing conditions, it may be concluded that it is possible and thoroughly practicable to secure a comparatively low initial inoculation in milk cans when the proper apparatus is installed and in constant daily use.

MILK BOTTLE CAPS

The milk bottle cap may well be considered as a part of the final container of milk. While it may not be possible to measure the degree of inoculation given to milk by the bottle cap, it must not be overlooked as a source of inoculation.

The possibility of inoculating milk by introducing infectious disease germs from the fingers of persons inserting milk caps into bottles must be recognized as a chance source of infection.

The use of machine cappers for inserting caps and the proper storage of the caps in sealed tubes must be recommended as preferable to capping by hand. The bacterial

condition of milk-bottle caps poorly stored in bulk lots and exposed to moisture, dust and flies has been compared with bottle caps properly stored in sealed tubes ready for the capping machine. While the initial inoculation is necessarily small because of the limited surface in contact with milk, nevertheless a difference of 88.8 per cent in initial inoculation per c.c. of milk in favor of caps in sealed tubes was noted.

The usual method of procedure in determining the bacterial condition of milk bottle caps is as follows:

Secure a bunch of from 20 to 30 bottle caps as constituting a fair sample of those being used, taking care not to inoculate the surfaces. In the laboratory, the entire number of caps are placed in a sterile glass beaker.

Sterile water, 100 c.c. or 200 c.c., is then poured over the caps and a sterile pipette or rod used to separate and stir the contents for several minutes. A sample of the wash water is then drawn into a sterile pipette and an examination carried on, the same as for bottle and can rinse water.

The total bacterial count per c.c. is multiplied by the quantity of sterile water used, and the total count secured is then divided by the number of caps tested. This will give the approximate number of bacteria per cap, but as only one-half of the cap surface is exposed to the milk in the bottle, it is necessary to divide again by 2, to secure the approximate initial inoculation resulting from the cap contact surface.

It is not uncommon to find the initial inoculation per c.c. of milk ranging from 0 to 400 for each cap, but the usual limits, where care is taken in storage, may be found between 0 and 6.

CONCLUSION

Bacterial control of pasteurization and of the factors which may subsequently affect the milk are essential to the industry. Laboratory facilities where bacterial tests may

be conducted should be associated with every milk plant, because of the check that is thereby made possible on equipment and labor and on the quality of the product received and the product delivered.

The initial inoculation given to milk, resulting from the bacterial condition of exposed surfaces, coolers, bottling machines, pumps, pipes, milk bottles, milk cans, and bottle caps should be reduced to the minimum. This is only possible when strict daily attention is given to cleaning and sterilizing these contact surfaces.

The knowledge of the degree of development of bacteria under favorable conditions causes a realization that initial inoculation given to milk may ultimately spoil it, and from an economical standpoint, at least, precaution is of value.

Under proper conditions, it is possible and thoroughly practical on a commercial scale to secure in subsequent containers a comparatively small range of initial inoculation. This is evidenced from the foregoing tests which are fairly indicative of common practices, as found during investigations, observations and bacterial examinations, personally made, in 92 milk plants located in 27 cities.

After a certain degree of reduction in bacteria content of milk has been secured by heating and holding for the specified time, it is poor business to allow the result to be made void or nearly so because of subsequent inoculation.

The process of pasteurization of milk and all of the factors which may influence the milk after it has been pasteurized should be under bacterial control, either by the milk plant bacteriologist or an experienced bacteriologist employed by the city board of health, for it is only when control is present that desired results are obtained.

"What the fool does in the end the wise man does in the beginning."

BOTTLES FOR LABORATORY PURPOSES

IVAN C. WELD, Washington, D. C.

Four-ounce bottles, such as are ordinarily used for bottling grape juice, etc., have been found very satisfactory for several laboratory purposes.

(a) Sealed and sterilized, they are convenient containers for use in collecting samples of milk from various sources.

(b) They are especially convenient containers for samples of milk for bacterial examination that require transportation under ice.

(c) They are convenient containers for distilled water to be sterilized for dilution purposes.

(d) They are convenient containers for plain agar culture media.

(e) They are especially adapted as containers for Endo's culture media, which is ordinarily put up in lots of 100 c.c.

Bottles of the kind above mentioned are easily secured for a low price from soda fountain and soft drink places. The quality of glass used in their manufacture is such as to permit repeated sterilization under steam pressure without breakage.

Metal caps, such as are ordinarily used for sealing bottles containing soft drinks, but with paper rather than cork disks, may be secured from manufacturers, who also manufacture a device for firmly pressing the caps in place and tightly sealing the bottles.

The bottles referred to possess some distinct advantages over the use of flasks with cotton stoppers or bottles in which ground glass or other stoppers are used. When used for culture media or when used for water for dilution purposes, no loss is likely to occur, either during the sterilizing process or from evaporation later, almost regardless of the time the sterile water or culture media may be kept. Such containers also possess a distinct ad-

vantage, inasmuch as the top or lip of the bottle is protected by a sterilized cover.

In using such bottles it is essential that the bent wire type of bottle opener be used, rather than those types of bottle openers which mutilate caps in loosening and removing them from the bottles. If removed carefully the caps can be replaced, and with the hand or with a small device constructed for the purpose they can be again pressed tightly enough in place so that there will be no loss even when the bottle and contents are vigorously shaken.

Such bottles and caps have been used by the writer for seven years or more, with uniformly good results. Their use has resulted in lessening the expense ordinarily represented in laboratory equipment. Their use has also resulted in saving much time and labor.

"It is far more difficult to be simple than to be complicated; far more difficult to sacrifice skill and cease exertion in the proper place, than to expend both indiscriminately."
—Ruskin.

New York City, April 26, 1919.

A special meeting of the International Association of Dairy and Milk Inspectors was called to order by President James O. Jordan at 2 o'clock.

Dr. Charles E. North, Managing Director of the National Milk and Dairy Farm Exposition, gave a brief address of welcome, to which President Jordan made a brief but appreciative response.

Mr. Ole Salthe, Assistant Director of the Bureau of Food and Drugs, Department of Health, New York City read a paper on the development of dairy and milk inspection for New York City.

Dr. Wm. H. Price, of the U. S. Public Health Service, discussed the bacteriological laboratory as a factor in the improvement of milk supplies.

Dr. Harry W. Redfield, Bacteriologist, Bureau of Chemistry, U. S. Department of Agriculture, read a paper on the subject of remade milk and cream.

Dr. L. F. Koonce, of Raleigh, N. C.; Prof. James A. Gamble, of the Maryland State College of Agriculture; Dr. Maloney, of Fall River, Mass.; Mr. Thomas Holt, of Hartford, Conn.; Mr. James E. Thomson, of New York City; Mr. John F. Johnston, of Newport, R. I., and others participated in the conference, in which thirteen States were represented.

The conference was one of unusual interest, and it was not until 7 P. M. that a motion was made to adjourn.

No business was transacted at this conference.

CONVENTION OF INTERNATIONAL ASSOCIATION OF DAIRY AND MILK INSPECTORS

Park Avenue Hotel, New York City, April 26th, 1919

Address of Welcome, by DR. CHARLES E. NORTH, *Managing Director,* National Milk and Dairy Farm Exposition

Gentlemen:

On behalf of the Committee on Exhibits of the National Milk and Dairy Farm Exposition it is my pleasant duty to welcome you to this city and as guests of our Committee. It is most fitting that you should be present with us on the occasion of this exposition and the meetings which accompany it. Your organization has as its chief purpose the cultivation and development of competent dairy and milk inspection. The object of our exposition is to educate the milk consumer to appreciate the food value of milk and its vital importance to the health of the community. Milk inspectors are in this sense not only the guardians of the sanitary character of milk, but also the guardians of the public health dependent on milk.

We are facing a new era in the milk industry. This has been created by the discovery that milk contains not only food substances, but certain vital substances necessary to the growth of the infant and for maintaining the strength of the adult. The discovery of these protective substances, or vitamines, has enormously increased the importance of milk and dairy products so that we now know these are not incidental foods, but positively necessary foods to maintain the vitality of the human race.

The added importance which these facts have given to the already recognized value of the milk supply to all communities has stimulated public interest in the dairy industry to such a degree that public inquiries are now being made as to the possibility of securing cheaper milk and reducing the cost of production and distribution.

The rise in the price of milk, while it has accompanied the rise in the price of other foods, has been brought into question, and this question has made the subject of economy and efficiency a matter of greatest importance to the maintenance of the established industry.

In the face of this situation, milk inspectors must recognize the larger responsibility which the future holds for them. The milk inspector, in addition to his interest in the sanitary character of milk, must add to it an understanding of its vital food value and of its economic relations. The efficient milk inspector cannot ignore questions of cost, since these are so closely interwoven with questions of quality. Price and quality must be considered together. The education and development of milk inspectors so that they may properly assist in furnishing to each community a sufficient quantity of milk of good enough quality, including food value as well as safety from disease, and at the same time at a price within reach of the pocketbook of the rank and file of citizens, gives to this Association a larger field of influence than ever before. The position of milk inspectors is destined to become more important. The position of this Association is destined to become more important. It seems certain that the public demand for competent and efficient guardians of public milk supplies will bring to this Association a large membership and a success which as an organization it has well deserved.

I regret that pressure of duties in connection with the exposition will make it impossible for me to listen to your attractive program. The educational features of the exposition, which I hope you can all find opportunity to study, are aimed to develop a better understanding of the dairy industry in all of its departments not only by milk consumers, but by all of the separate branches of the industry. We have tried to make the lesson of the food value of milk paramount. We will be glad to welcome you at the exposition at the adjournment of this meeting.

THE MILK SUPPLY OF NEW YORK CITY.

OLE SALTHE, *Assistant Director of Bureau of Food and Drugs,*

Department of Health, New York City.

(Read at a special meeting of the Association in New York City, April 26, 1919.)

At the period of the beginning of the movement for a better milk supply, the question of improvement of quality was the only one considered. The early history of milk sanitation contains little reference to costs of production or distribution.

Because of economic conditions which have recently reached a more acute stage, it would seem that this question of economy must be consideerd coequally with that of enforcement of sanitary regulations.

When the Health Department of New York City commenced its work of sanitary education among the dairymen supplying this city, it was practically the first department in the field, and sanitary conditions at a great majority of dairy farms were extremely lax. Indifferent methods prevailed regarding the housing of dairy cattle, and little attention was given to sanitary methods of caring for milk. It was extremely fortunate that this work was commenced at a time when labor and materials were comparatively plentiful and cheap, and the results of this early work performed by the inspection force of this city's Health Department will remain a lasting monument.

Through its efforts, concrete construction in flooring of stables, platforms for wells and curbing for springs were installed, permanent milk and ice houses erected, and milk utensils of a sanitary type were provided. At the present time it is only necessary to step across the imaginary line bounding the milk shed of New York City into Canada,

or into any other section of the United States, to note the vast improvement which has been accomplished through the inspection or missionary work conducted by the New York City Health Department, and its effect in the quality of milk distributed in New York City is apparent.

The work thus accomplished has been of permanent value to the dairymen. There is no doubt that none of it was unnecessary, but there is also no doubt that refinements of improvement in construction of dairy buildings were requested and obtained which benefited the farmer much, but the milk little.

Gradually during the past dozen years it has become known that methods of cleanliness in handling milk, caring for utensils and equipment and quick cooling of the fresh product, all of which cost comparatively little, are of vastly more importance than elaborate construction of dairy buildings, and during the past three years the attention of our inspection force has been devoted to educational work along lines of the strictly essential in sanitary methods.

The great European war has brought its problems and its benefits. A benefit which we are slow to realize, or even to consider a benefit, is the great lesson of economy which we are slowly and reluctantly learning.

It has also brought the problem of the increased cost of living, with the result of the curtailment in the dietaries of all but the very wealthy of many articles of food. Milk, although still comparatively a cheap food, has advanced approximately 100 per cent in price since 1916. Thus it seems that the Milk Inspection Service cannot be considered complete unless the work includes teaching economy in production and distribution of milk; and while no effort must be relaxed in maintaining the high reputation for quality which the milk supply of our city now justly enjoys, the work of lessening its cost will be vigorously prosecuted.

The Milk Inspection Service should conduct the work of lessening cost of production through its rural inspectors. A beginning has been made by the New York Department of Health. Data regarding cost of production has been gathered, and the figures obtained are being analyzed with a view to formulating methods of instruction. It may not be amiss to say here that educational work in milk sanitation is in itself an economic measure. In the old days reports were frequent that much milk spoiled in the hands of the farmer through insanitary stable conditions, carelessness in handling and lack of cooling facilities. This, of course, added immensely to the cost of production. Reports of this kind are happily much less frequent now.

I also desire to say that the work of caring for the lives and health of the city's population is a municipal one and is work that the Health Department of the city of New York cannot afford to shirk, and does not dare to delegate to others.

The work of effecting economy in city distribution presents many serious difficulties, but there is no doubt that this perplexing question will be solved in the near future. At the suggestion of and through the efforts of the Department, the distributers have commenced this work. As an instance it may be cited that several large companies have consolidated for the avowed single purpose of effecting economies through the reduction of overhead expense. Consolidation, however, was not suggested by this Department. Advertising expense has been cut down, the payment of bribes to janitors and others has practically ceased, and many overlapping delivery routes have been cut out.

There is no intent of riding roughshod over vested interests of perfectly legitimate business, but the work thus commenced by the milk companies will be aided in every possible constructive way. No measures will be taken to

conflict with established business unless the dealers fail in their work of cooperation.

The fact must not be lost sight of, however, that New York City must have an absolutely wholesome supply of milk at a price within the reach of all. The babies of the city demand a plentiful supply of food and the city authorities must see that they are fed.

"The one person who furnishes the motive power that operates the entire system for the production and distribution of the milk supply is the consumer. It is he who pays the bills. It is his sense of decency that is outraged when filth is mixed with the milk that is left at his door. It is his health and life that are placed in jeopardy when an unwholesome milk is put upon his table."—Woodward.