SEVENTH ANNUAL REPORT

OF THE

AMERICAN

DAIRYMEN'S ASSOCIATION,

WITH TRANSACTIONS AND ADDRESSES AT ANNUAL MEETING,—LIST OF CHEESE FACTORIES,—LIST OF MEMBERS,—REPORTS OF FACTORIES, AND OTHER PAPERS OF VALUE AND INTEREST,

FOR THE YEAR 1871.

ILLUSTRATED.

PUBLISHED BY THE ASSOCIATION.

SYRACUSE, N. Y.:
TRUAIR, SMITH & CO., PRINTERS, DAILY JOURNAL OFFICE.
1872.

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FOR 1872.

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SECRETARY:

GARDNER B. WEEKS, SYRACUSE, NEW YORK.

TREASURER:

DR. L. L. WIGHT, WHITESBORO, ONEIDA CO., NEW YORK.

PREFATORY REMARKS.

This,—the Ninth Annual Report issued since the organization of the original society,—will be found, it is believed, fully equal in intrinsic worth and interest, to any of the volumes that have preceded it.

The introduction of cuts in illustrating the principal addresses delivered at the annual meeting, adds a new feature to these reports, and will be found invaluable in enabling members of the Association, and others who read this volume, the more fully to understand and apply the truths and principles enunciated by the speakers.

Of the eight or ten prominent addresses delivered before the convention in January, and printed in full in this volume, all are valuable, and indicate that advance steps are being taken in all directions by the members and friends of this Association. In their treatment of the various subjects, a wide range of thought and experience is mapped out, and to the thoughtful, practical dairyman they will call out thought and experiment.

Prof. Caldwell, by again giving his time to the preparation of another valuable lecture for the recent convention, as well as by being in attendance very nearly throughout the three days' session, has renewedly placed our members under special obligations.

The subject of Condensed Milk manufacture is now prominently before the dairying public, and has been for months; and the Secretary has been called upon to send out advance sheets of Mr. Willard's address on that subject to quite a large number of correspondents.

Perhaps no paper read before the late convention was more important, or will elicit greater thankfulness on the part of cheese and butter-makers, than that read by L. B. Arnold, Esq., wherein the manner in which milk becomes injured, even before being drawn from the cow, is so clearly demonstrated.

The subject of Butter manufacture received at the late meeting more attention than at any previous Convention, and the paper by Mr. Greene will be found replete with valuable information on this topic.

It is to be hoped that the committee having in charge the matter of asking the N. Y. State Legislature to appropriate money for the purchase of an experimental dairy farm, to be conducted under the auspices or direction of this Association, will push the matter vigorously; for if rightly managed, it could and would be made of great assistance to our interests.

The action taken by the Convention respecting the opening of our cheese and butter factories on the Sabbath, was creditable and right. Let it now be put in practice by dairymen all over the country, so far as at all practicable, and this stigma, which has hitherto attached to the business, will in a great measure be removed.

Notwithstanding the depression of prices of dairy products during the season of 1871, the Convention of January, 1872, was attended by numbers almost as large as at any former meeting, and was quite as enthusiastic in spirit. The discussions were entered into in right good earnest, and many valuable thoughts and suggestions were brought out.

The social meeting at Bagg's Hotel, on the evening of the second day's session, was fully attended and fully enjoyed, and was productive of hearty good-feeling between members from various sections.

Since the annual meeting the Association has lost one of its stanchest friends and most intelligent members, in the death of Mr. J. B. Lyman, of the New York *Tribune*, which occurred so soon after the Convention.

The special obligations of the Association are due to the various gentlemen who prepared special papers for the last meeting, and mostly without any charge for their services. Also to the Industrial Publication Co., of N. Y., for the use of the electrotype for the large cut of the vacuum pan, for a nominal charge. Also to Mr. E. W. Stewart, editor of the *Live Stock Journal*, of Buffalo, for the use of the plate for the plan of a condensing factory, entirely without charge.

The Secretary is also under the usual obligations to the Utica daily papers, for the use made of their reports of the Convention, in making up this volume.

Some matters of value have been omitted from this Report, owing to the depleted state of the treasury.

GARDNER B. WEEKS,
Secretary.

SYRACUSE, N. Y., March, 1872.

The following is the Law in the State of New York, bearing upon the subject of Butter and Cheese Factories:—

Whoever shall knowingly sell, supply or bring to be manufactured to any butter or cheese manufactory in this State any milk diluted with water or from which any cream has been taken, or milk commonly known as skimmed milk, or whoever shall keep back any part of the milk known as "strippings," or whoever shall knowingly bring or supply milk to any butter or cheese manufactory that is tainted or partly sour from want of proper care in keeping pails, strainers, or any vessels in which said milk is kept, clean and sweet, after being notified of such taint or carelessness; or any butter or cheese manufacturer who shall knowingly use or allow any of his employees, or any other person, to use for his or for their own individual benefit any milk or cream from the milk brought to said butter or cheese manufacturer, without the consent of all the owners thereof, or any butter or cheese manufacturer who shall refuse or neglect to keep or cause to be kept a correct account (open to the inspection of any one furnishing milk to such manufacturer) of the amount of milk daily received, or of the number of pounds of butter and the number and aggregate weight of cheeses made each day, or of the number cut or otherwise disposed of, and the weight of each, shall, for each and every offence, forfeit and pay a sum not less than twenty-five dollars nor more than one hundred dollars, with costs of suit, to be sued for in any court of competent jurisdiction for the benefit of the person or persons, firm or association, or corporation, or their assigns, upon whom such fraud or neglect shall be committed.

ARTICLES OF ASSOCIATION.

WHEREAS, It is deemed expedient to merge the New York State Cheese Manufacturers' Association, which was organized in January, 1864, into an American Association, through which, as a medium, results of the practical experience of dairymen may be gathered and disseminated to the dairying community; therefore,

Resolved, That we, the undersigned, do hereby associate ourselves together for mutual improvement in the science of cheese-making, and more efficient action in promoting the general interests of the dairy community.

ARTICLE I. The name of the organization shall be The American Dairymen's Association.

ART. II. The Officers of the Association shall consist of a President, Vice-Presidents, Secretary, and Treasurer.

ART. III. The President, Vice-Presidents, Secretary, and Treasurer, shall constitute the Executive Board of the Association.

ART. IV. The Officers of the Association shall be elected at the regular annual meeting, and shall retain their offices until their successors are chosen.

ART. V. The regular annual meeting shall occur on the second Tuesday in January of each year, and at such place as the Executive Board shall designate.

ART. VI. The payment of one dollar shall admit any person to all the sessions of an Annual Meeting,—and the additional payment of seventy-five cents shall entitle him to the Annual Report for the current year.

[One dollar constitutes a person not attending an Annual Convention a member of the society for one year, and entitles him to the Annual Report.]

☞ The next Annual Meeting will begin at Utica, N. Y., on Tuesday, January 14th, 1873.

LIST OF MEMBERS

OF THE

AMERICAN DAIRYMEN'S ASSOCIATION,

FOR THE YEAR 1872.

Alvord, Hon. Thos. G., Syracuse, Onondaga co.
Arnold, L. B., Ithaca, Tompkins co.
Allen, E. V., Groton, Tompkins co.

Brown, James P., Utica, Oneida co.
Bradley, Edward F., Delta, Oneida co.
Buckingham, J. D., Walesville, Oneida co.
Bussey, A. P., Westernville, Oneida co.
Burrell, D. H., Little Falls, Herkimer co.
Burrell, W. F., Salisbury, Herkimer co.
Bloodough, M. G., Salisbury Center, Herkimer co.
Bliss, H. M., Mohawk, Herkimer co.
Brown, S. R., Newport, Herkimer co.
Babcock, C. G., Newport, Herkimer co.
Brayton, A. A., Poland, Herkimer co.
Budlong, Wm., W. Schuyler, Herkimer co.
Blanding, G., Brookfield, Madison co.
Burdick, C. H., Brookfield, Madison co.
Bruce, B. F., Canastota, Madison co.
Burley, J. C., Fabius, Onondaga co.

Chapman, W. H., Utica, Oneida co.
Cotes, John G., Holland Patent, Oneida co.
Clark, F., Vernon, Oneida co.
Carpenter, O. R., Ingham's Mills, Herkimer co.
Conrad, Nicholas, Hallsville, Montgomery co.
Clark, Edward, Fonda, Montgomery co.
Carr, Ira J., Root, Montgomery co.
Crandall, S. W., Gouverneur, St. Lawrence co.

DeAngelis, W. W., Holland Patent, Oneida co.
Deitrich, H. V., Lowell, Oneida co.
Dunham, Geo. D., Sauquoit, Oneida co.
Davison, J. W., Frankfort, Herkimer co.
Davis, Geo. W., Little Falls, Herkimer co.

Ellis, E. G., Utica, Oneida co.
Eastman, W. H., Belleville, Jefferson co.

Fitch, N. W., Verona, Oneida co.
Felton, Merritt B., Delta, Oneida co.
Fuller, W. H., Whitesboro, Oneida co.
Field, George, Hartwick, Otsego co.
Foster, E. B., Stockbridge, Madison co.

Gates, Wm. M., Whitesboro, Oneida co.
Greene, C. A., Holland Patent, Oneida co.
Golden, R., Little Falls, Herkimer co.
Gibson, C. H., Oppenheim, Fulton co.
Greig, Hugh, Fonda, Montgomery co.

Hawkins, H. T., North Western, Oneida co.
Haas, Fred, Lee Center, Oneida co.
Howard, L. A., Utica, Oneida co.
Hand, Jephthah, Starkville, Herkimer co.
Hurd, O. F., Newport, Herkimer co.
Harison, T. L., Albany, Albany co.
House, C. C., Houseville, Lewis co.

Ashley, L. H., Corlu, Genesee co.
Allen, M. S., Eddyville, Cattaraugus co.
Adams, N. M., Kosta, Iowa co., Iowa.

Briggs, L. M., No. Pitcher, Chenango co.
Babbitt, Chester, Fly Creek, Otsego co.
Brown, J. O., W. Edmeston, Otsego co.
Backus, James, Stone Arabia, Montgomery co.
Bander, Jeremiah, Hallsville, Montgomery co.
Bander, D. D., Gilbert's Mills, Oswego co.
Blanding, Wm., No. Fenton, Broome co.
Burnham, Asahel, Sinclairville, Chautauqua co.
Burnap, N. C., Argusville, Schoharie co.
Blodgett, Orange C., Fredonia, Chautauqua co.
Baker, Benj. F., Hartford, Washington co.
Bliss, O. S., Georgia, Vermont.
Brintnall, T. M., Medina, Medina co., Ohio.
Brown, S. N., Cambridge, Dane co., Wisconsin.
Bungay, L. F., Norwich, Oxford co., C. W.
Boise, W. E., Blandford, Massachusetts.

Carpenter, James, New Hope, Cayuga co.
Coles, G. W., Byron, Genesee co.
Cohoe, John G., Fredonia, Chautauqua co.
Cole, Chas. L., Pine Run, Genesee co. Michigan.
Cook, Wm., Hesper, Iowa.
Case, Titus, Owatonna, Minnesota.
Chadwick, C. E., Ingersoll, C. W.

DeCordova, G., Box 956, New York.
Diefendorf, H. A., Port Jackson, Montgomery co.
Davison, A. E., Cadiz, Cattaraugus co.
Doxtater, Chas. H., Horse Heads, Chemung co.
Degeer, Walter B., Queensville, C. W.

Ellis, E. E., McLean, Tompkins co.

Farrington, S. A., Rock Stream, Yates co.
Fox, G. G., Groveland, Livingston co.
Folsom M., 157 Chambers St., New York.
Farrington, Harvey, Norwich, Oxford co., C. W.

Grenell, W. H., Pierrepont Manor, Jefferson co.
Gebbie, Alex. R., Lowville, Lewis co.
Gillett, Harris, Sidney Plains, Delaware co.
Greene, H. Cooley, Woodcock Boro, Crawford co., Penn.

Hawley, L. T., Salina, Onondaga co.
Hosley, Edwin, Canton, St. Lawrence co.
Hopson, E. R., Brocketts Bridge, Fulton co.
Holmes, U. N., Brookfield, Madison co.
Humason, J. J., Fredonia, Chautauqua co.
Horton, J. V., Boston, Erie co.
Holloway, J. H., Winchester, Kentucky.

Ives, James H., Salisbury, Herkimer co.
Ives, Fred, Salisbury, Herkimer co.

Jones, Chas. M., Cassville, Oneida co.
Johnson, H., Stanwix, Oneida co.
Jackson, A. G., Middleville, Herkimer co.
Johnson, Wm. A., Collins Center, Erie co.

King, A. S., Sauquoit, Oneida co.
Kingsbury, Emma, Stokes, Oneida co.
Kast, Joseph, Mohawk, Herkimer co.
Kevil, John, Minden, Montgomery co.
Kibbe, Almond M., Keeney Settlement, Cortland co.
Kinney, J. P., Schuyler's Lake, Otsego co.

Lanphear, Joshua G., Verona, Oneida co.
Lanphier, J. E., Newport, Herkimer co.
Lehine, John, Van Hornsville, Herkimer co.
La Munion, Howard, Munnsville, Madison co.
Lindsley, L. S., Pratt's Hollow, Madison co.
Lowe, John, Stone Mills, Jefferson co.
Lincoln, S. L., South Adams, Massachusetts.
Lewis, A. W., Medina, Medina co., Ohio.
Lawton, C. F., Flushing, Genesee co., Mich.
Losee, H. S., Norwich, Oxford, C. W.

Merry, G., Verona, Oneida co.
Morey, Newell, Newport, Herkimer co.
Moon, B. B., Norway, Herkimer co.
Morehouse, C. A., Cold Brook, Herkimer co.
Miller, G. S., Peterboro, Madison co.
Mead, G. S., E. Sandy Creek, Oswego co.
Merriam, H. H., Oswego Falls, Oswego co.
Macadam, Robert, Hermitage, Wyoming co.
Macadam, Alex., Fort Plain, Montgomery co.
Miller, S. T., Constableville, Lewis co.
Merrill, R. F., Norwich, Chenango co.
Merrill, H. S., Farmersville, Cattaraugus co.
Meeker, Eli S., Hawleyton, Broome co.
Mattison, E. J., So. Berlin, Rensselaer co.
Morris, T. E., So. Williamstown, Berkshire co., Massachusetts.
McCall, Jas. L., Rupert, Bennington co., Vt.
Morris, R. N., Tiskilwa, Bureau co., Illinois.
Malcolm, Andrew, Rodgerville, C. W.
McPherson, David M., Lancaster, River Raisin, C. W.

Ostrander, Wm. H., Plank Road, Onondaga co.

Peckham, W. N., Verona, Oneida co.
Phelps, C. C., Vernon, Oneida co.
Potter, Enos, Paris, Oneida co.
Prescott, Thomas, Walesville, Oneida co.
Pickard, M. A., Fort Plain, Montgomery co.
Peck, A., Minaville, Montgomery co.
Putnam, Henry, Watertown, Jefferson co.
Pratt, Gen'l T. R., Watertown, Jefferson co.
Purvis, Robert, Harford, Cortland co.
Pierce, Franklin, Cortland, Cortland co.
Potter, John, Mid. Granville, Washington co.
Parker, Ira J., Warsaw, Wyoming co.
Palmer, W. R., Wattsburg, Erie co., Penn.
Pierce, S. D., Belmond, Wright co., Iowa.
Parsons, Geo. A., Presque Isle, Maine.
Putnam, S. D., Stockton, Minn.

Roberts, T. D., Ridge Mills, Oneida co.
Richardson, C. C., Utica, Oneida co.
Richardson, Clitt W., Herkimer, Herkimer co.
Root, David, Starkville, Herkimer co.
Reed, N. H., Lowville, Lewis co.
Robinson, J. F., Pierrepont Manor, Jefferson co.
Risley, Chas., Hermon, St. Lawrence co.
Richer, Nicholas, Columbus, Chenango co.
Rose, R. H., E. Homer, Cortland co.
Ransom, P. A. B., Hempstead, Queens co.

Seymour, Hon. Horatio, Utica, Oneida co.
Shearman, J. A., Utica, Oneida co.
Schuyler, J. K., Westmoreland, Oneida co.
Sessions, R. W., Cassville, Oneida co.
Smith, John, Paris, Oneida co.
Scovill, J. V. H., Paris, Oneida co.
Southworth, W. N., N. Bridgewater, Oneida co.
Schermerhorn, J. M., No. Gage, Oneida co.
Schermerhorn, L. C., No. Gage, Oneida co.
Schermerhorn, Chas., No. Gage, Oneida co.
Schermerhorn, W. D., Poland, Herkimer co.
Smith, L. C., Cedarville, Herkimer co.
Smith, Wm. U., Herkimer, Herkimer co.
Schutz, Theo., Cedarville, Herkimer co.
Saunders, Edwin, De Ruyter, Madison co.
Stradling, Thos., Eaton, Madison co.
Stowell, T. R., Georgetown, Madison co.
Smith, Jas. H., Constableville, Lewis co.
Stoddard, A. L., Copenhagen, Lewis co.
Sheldon, C. L., Lowville, Lewis co.
Smith, B. P., Black River, Jefferson co.
Sitterly, Josiah, Palatine Bridge, Montgomery co.
Simmons, H. S., Ames, Montgomery co.
Smith, P. H., Brockett's Bridge, Fulton co.
Safford, Halsey, E. Otto, Cattaraugus co.
Smith, S. R., Springville, Erie co.
Shaut, Winslow, Bath, Steuben co.
Sheldon, Miss Lucy, Fly Creek, Otsego co.
Smith, F. B., Spooner's Corners, Otsego co.
Smiley, J. H., Slaterville, Tompkins co.
Small, James E., Coila, Washington co.
Simpson, Wm., Jr., West Farms, Westchester co.
Staples, E., Danby 4 Corners, Rutland co., Vt.
Stanburrough, Jos. D., Brookfield, Tioga co., Pennsylvania.
Simmons, L. N., Farmington, Oakland, Mich.
Stone, R. R., Elgin, Kane co., Illinois.
Smith, Hiram, Sheboygan Falls, Sheboygan co., Wisconsin.
Smith, F. C., Rochester, Olmsted co., Minn.
Sheldon, John P., Sheen, Ashbourne, Derbyshire, England.

Thomas, Stephen, Cassville, Oneida co.
Tenner, Byron I., Cold Brook, Herkimer co.
Thompson, W. R., Harrisburgh, Lewis co.
Thompson, A., Lyons, Wayne co.

Van Bramer, Wm., Cicero, Onondaga co.
Varson, John, Farmington, Oakland co., Mich.
Vroman, C. W., Rochester, Olmsted co., Minn.

Wight, L. L., Whitesboro, Oneida co.
Whittaker, Geo., South Trenton, Oneida co.
Wilson, John, Verona, Oneida co.
Williams, W. L., Remsen, Oneida co.
Weeks, Gardner B., Syracuse, Onondaga co.
Willis, George W., Newport, Herkimer co.
Willard, X. A., Little Falls, Herkimer co.
Winslow, E. J., Hallsville, Montgomery co.
Whipple, E. M., Fort Plain, Montgomery co.
Walker, Hiram, Union Square, Oswego co.
Woodruff, J. D., Keeney Settlement, Cortland co.
Wing, L. J., Unadilla Forks, Otsego co.
Wikoff, Garrett, Richfield Springs, Otsego co.
West, F. L., Palmyra, Wayne co.
Woodin, Homer, Gowanda, Cattaraugus co.
Wheaton, Allen, West Pawlet, Rutland co., Vt.
Wilder, C. H., Evansville, Wisconsin.
Waldron, Robert, Rochester, Olmsted, Minn.
Wildey, Davis, Farmington, Oakland Co., Mich.
Wade, Henry, Port Hope, C. W.

Yourden, John, North Western, Oneida co.

LIST OF CHEESE AND BUTTER FACTORIES.

New York.

ONEIDA COUNTY.

		No. of Cows.			No. of Cows.
Rome C. M. A.	Rome,	650	N. W. C. M. A. Factory,	N. Western,	
Excelsior Factory,	do	600	Crill's do	do	
Greenfield's do	do		Bronson's do	do	
Cady's do	do	300	Verona Landing do	Higginsville,	400
D. D. Carpenter's do	do	630	Doxtater's do	do	250
Dick's do	do		L. S. Davis' do	Florence,	500
Squires do	Delta,		Cold Spring do	do	400
Ridge Mills do	Ridge Mills,	300	Mad River, do	do	250
T. D. Roberts' do	do	300	Vernon do	Vernon,	720
E. Lewis' do	Deerfield,	900	Vernon & Verona do	do	
Tanner's do	Oriskany,	700	Clark's do	do	500
Mitchell's do	Remsen,	200	M. Snell's do	do	300
Thomas' do	do	400	Bronson & Co. do	Vernon Center,	300
Star Hill do	do	100	W. Canada Creek do	North Gage,	500
Weeks' do	Verona,	800	A. Blue's do	do	150
Fitch's do	do		J. C. Blue's do	do	700
Burrell's do	do	400	Briggs' do	Marcy Hill,	
Verona Central do	do	300	Wood's do	Turin,	
Willow Grove do	Trenton,	1000	Shepard's do	do	
W. W. Wheeler's do	do	350	Franklin do	E. Iron Works,	500
J. C. Owen's do	do	550	Camp's Factory do	Westmoreland,	400
Powell's do	do		Cheney's do	do	350
Whitaker's do	do	250	Hampton C. M. A. do	do	500
Wight's do	Whitesboro,	900	Marshall's do	Waterville,	700
Bagg's do	Stittville,	700	Curtis' do	do	250
Deerfield & Marcy do	Utica,	400	Shearman's do	New Hartford,	500
South Corners do	Vienna,	100	Hampton do	Stanwix,	500
Vienna do	do	350	Schuyler's do	do	300
West Vienna do	West Vienna,		Foster's do	Durhamville,	425
Blossvale do	Blossvale,	406	J. H. Brook's do	Steuben,	500
Glenmore do	Annsville,	500	Chuckery do	Paris,	150
Bagg's do	Holland Patent	500	Wilcox do	do	
J. G. Cotes' do	do	400	A. S. King do	Sauquoit,	
J. F. Pierce's do	do	550	A. Sessions do	do	
G. W. Palmer's do	N. Bridgewater,	600	A. Tucker's do	do	250
Deansville do	Deansville,	700	S. Thomas' do	Cassville,	300
Hill's do	Westernville,	200	E. A. Palmer's do	Clayville,	200
Williams' do	do	200	Union Grove, do	Camden,	150
Waldo's do	do	350	Harvey's do	Boonville,	
Kirkland do	Kirkland,	200	Reed & Co., do	do	500
Wallace's do	W. Branch,	400	Knoxboro do	Knoxboro,	400
Countryman's do	do		Rathbun's do	New London,	400
J. L. Dean's do	Hecla,	200	N. London C. M. A. do	do	300
Lowell do	Lowell,	600	Ray's do	North Bay,	
Wood's do	Lee Center,	560	Spinning's do	Taberg,	
Saxton's do	do	300	G. M. Wood's do	Stokes,	
Charton's do	do	400	Hurlburt's do	Ava,	
Capron's do	do		Jones' do	do	

CHENANGO COUNTY.

Tuttle Factory,	Columbus,	230	L. Andrews Factory,	South Otselic,	
Hiram Brown's do	do	400	Holmesville do	Holmesville,	650
A. R. Sage's do	N. Berlin Center,	800	Daniels' do	McDonough,	600
Holmes & Co's do	Columbus,	600	Lincklaen do	Lincklaen,	500
George Buel's do	King Settlement,	600	Wheeler's do	do	
Sherburne do	Sherburne,	700	Harrington do	do	
Smyrna do	Smyrna,		Norwich C. M. Co.,	Norwich,	500
Billings' do	do		Frink's do	do	
Plymouth do	Plymouth,		Leach's do	do	
Buckleys & Co's do	Oxford,		Sage's do	S. New Berlin,	
Harrisville do	Sherburne,	350	Rich's do	do	
White & Son's do	do		Brown, Sage & Co.,	do	860

CORTLAND COUNTY.

Cuyler Village Factory,	Cuyler,	600	Raymond's Factory,	Preble,	600
Cold Spring do	do	300	Kitt's do	do	425
Isbell's do	do	250	Homer C. M. Co. do	Homer,	600
Keeler's do	do	200	Tuttle's	Freetown,	400
Cuyler Hill do	do	450	Cincinnatus do	Cincinnatus,	400
New Boston do	do	200	S. Cortland do	S. Cortland,	
L. Sears' do	DeRuyter,	650	Meecham's do	Marathon,	300
Kenney do	Truxton,	1,000	Brown's do	Taylor,	400
Beattie's	do	400	Keeney Settlem'nt do	K. S.,	700
East Homer do	East Homer,	400	Whitmarsh do	do	
Wightman's	Marathon,	450	H. H. Smith's do	Apulia,	
Potter & Barber's do	Scott,	300	Harford do	Harford,	
Blodgett Mills do	Blodgett's Mills,	150			

MADISON COUNTY.

Norton's	Factory,	Eaton,		Chapman's	Factory,	Oneida Lake,	300
Morse's	do	Eaton,	600	Hart's	do	do	250
W. Eaton	do	W. Eaton,	500	Morrell's	do	do	150
Pecksport	do	Bouckville,	450	Cole's	do	Munnsville,	350
Erieville	do	Erieville,	700	Lincklaen	do	DeRuyter,	300
Seymour's	do	Lebanon,	400	DeRuyter	do	do	600
Smith Valley	do		600	Fletcher's	do	Peterboro,	750
Hill's	do	Oneida Castle,	700	Valley	do	Stockbridge,	450
Cazenovia	do	Cazenovia,	600	Adam's	do	do	
C. Bridge	do	do		N. Woodstock,	do	New Woodstock,	800
Blodgett's	do	do	200	Hunt's	do	Hubbardsville,	200
Perkins	do	do		Lamunion & Co	do	Morrisville,	400
Clockville	do	Clockville,	500	Morrisville	do	do	600
N. Cazenovia	do	Chittenango,	300	Gaige & Son	do	Nelson,	600
Chittenango	do	do		Ellison's	do	Brookfield,	200
Lebanon	do	Leonardsville,	500	Excelsior	do	do	350
Allard's	do	Georgetown,	150	York	do	do	225
Quaker Basin	do	do	300	Union	do	do	200
Torpy's	do	do	150	S. Brookfield	do	South Brookfield,	250
Mack's	do	do	160	Bridgeport	do	Bridgeport,	300
Brown & Co.'s	do	do	500	Lakewood	do	do	273
Beech & Co.'s	do	do	175	Fort Bushnell's	do	Lakeport,	400
Fletcher's	do	do	200	Gifford's	do	do	
Stafford's	do	Fenner,	200	Tucker's	do	Mile Strip,	300
Solsville	do	Solsville,	700	Lenox C. M. A.	do	Canastota,	500
Pine Woods	do	Pine Woods,	600	Merrill's	do	Madison,	
Baker's	do	Earlville,	300	Madison C. M. A.	do	do	
Chenango Valley	do	do		Siloam	do	Siloam,	400
Cowasalon	do	Wampsville,	500	Pratt's Hollow	do	Pratt's Hollow,	250
Walrath's	do	do		Shedd's Corners	do	Shedd's Corners,	250
Hunt's	do	Hamilton,		Downing's	do	Pine Woods,	
Keith's	do	North Brookfield,		Decker's	do	Oneida Valley,	
East Boston	do	East Boston,					

JEFFERSON COUNTY.

Adams,		Adams,		Heath's		Adams Center,	
Alexander's,		Henderson,		Hamlin,		Rutland,	325
Antwerp,		Antwerp,	950	Harper's Ferry,		Rutland Center,	
Ayers,		Watertown,		Henderson,		Henderson,	
Babcock's,		Champion,		Howard,		Stone Mills,	300
Barber's,		Philadelphia,		Lorraine Central,		Lorraine,	300
Bonfoy & Beltinger,		Mannsville,		Limerick,		Dexter,	300
Belleville,		Belleville,		Leffingwell's,		Henderson,	
Bent,		Antwerp,		Mannsville,		Mannsville,	775
B. P. Smith,		Black River,		Maple Grove,		Lorraine,	
Brownville,		Brownville,	100	Muscallonge,		Dexter,	
Brown,		Watertown,		Muzy's,		Smithville,	
Benjamin & Co's,		Camp's Mills,		Pillar Point,		Dexter,	
Carter Street,		Stone Mills,		Philadelphia,		Philadelphia,	
Cascade,		Rutland,		Pitkins,		Lorraine,	250
Champion Village,		Champion,		Rodman,		Rodman,	
Cooper's		Evan's Mills,		" Branch,		Burrville,	
Cold Spring,		Watertown,		Rogers,		Ellisburgh,	700
Cold Spring,		Belleville,		Rogers,		Lorraine,	
Cold Spring,		Roberts' Corners,		Rutland Valley,		Watertown,	
Campbell's		South Rutland,	150	Sherman's,		Watertown,	
Dry Hill,		Watertown,		Springer's		Redwood,	
Davis'		Smithville,		Smithville,		Smithville,	
Eames'		Rutland,	250	South Champion,		South Champion,	450
East Rodman,		East Rodman,		Springside,		Dexter,	
Earll,		Carthage,		Sterlingbush,		Antwerp,	
Ellisville,		Ellisburgh,		Tifft's		Lorraine,	
Evans Mills,		Evans Mills,	1000	Timmerman's,		Orleans 4 Corners,	
Excelsior,		Perch River,		Warner,		Adams Center,	
Excelsior,		South Champion,		Wescott,		Watertown,	375
Farr,		Pierrepont Manor,	225	Whitesville,		East Rodman,	
Forman's		Woodville,		Wicks,		Antwerp,	
Griswold & Reed,		Lorraine,		Wilson,		Watertown,	
Gardner's		Watertown,		Wright,		Depauville,	
Grinnell & Co.		Pierrepont Manor,	300	Woodville,		Woodville,	
Hadsall's		Felts Mills,		Worth,		Worthville,	500

ST. LAWRENCE COUNTY.

Olin & Smead's	Factory,	Canton,	675	Beech Grove	Factory,	Russell,	500
Southville	do	Southville,	200	W. Canton	do	Canton,	
Richville	do	Richville,	610	South Canton	do	Crary's Mills,	450
Jones'	do	do		DeKalb,	do	DeKalb,	700
Potsdam	do	Potsdam,	500	Gouverneur	do	Gouverneur,	500
Hailesboro	do	Gouverneur,	600	Pike's	do	Shingle Creek,	
Sprague Corners	do	Shingle Creek,	600	W. Fowler	do	do	
Russell Village	do	Russell,	500	Hermon	do	Hermon,	

HERKIMER COUNTY.

Herk. Co. Un'n Factory,		Little Falls,	700	Richardson's	Factory,	W. Schuyler,	
Manheim Center	do	do	600	Skinner's	do	So. Columbia,	
Manheim Turn.	do	do	500	Kling's	do	Paine's Hollow,	
Newville C. M. A.	do	do	860	Middleville	do	Middleville,	750
Rice, Broat & Co's	do	do	900	Northrup's	do	Litchfield,	300
G. W. Davis'	do	do	600	Kinney's	do	do	600
Cold Spring	do	do		Walrath's	do	N. Litchfield,	300
Top Notch		do	450	Van Hornsville	do	Van Hornsville,	215
Van Allen's	do	do		Young's	do	do	
Fairfield Associa'n	do	Fairfield,		Lackey's	do	W. Winfield,	300
No. Fairfield	do	do	600	H. C. Brown's	do	do	400
Old Fairfield	do	do	900	Wadsworth's	do	do	200
Eatonville	do	Eatonville,	600	W. Palmer's	do	do	
Locust Grove	do	do	150	Edick's	do	Mohawk,	225
Mohawk Valley	do	E. Schuyler,	150	Mort's	do	do	
Richardson's	do	do	360	J. Clark's	do	Winfield,	500
Budlong's	do	W. Schuyler,	300	B. Bartlett's	do	do	300
Warren's	do	Warren,	400	N. Winfield	do	N. Winfield;	700
Fort Herkimer	do	Fort Herkimer,	400	Moon's	do	Russia,	300
Bellinger's	do	do	400	Poland Cheddar	do	Poland,	450
Beckwith's	do	Cedarville,	300	Herkimer		Herkimer,	600
Cold Spring	do	do		Herkimer Union	do	do	250
Stewart's	do	do		G. W. Pine's	do	do	600
Howard's	do	do		Newport	do	Newport,	
Cedarville	do	do	300	Morey's	do	do	800
Smith's	do	Frankfort,	800	Cook, Ives & Co's	do	Salisbury,	400
A. G. Norton's	do	do		L. H. Carr's	do	do	
Frankfort Center	do	do		W. Peck's	do	do	159
Russell's	do	Russell's Hill,		Old Salisbury	do	do	600
Wetmore	do	do		Avery & Ives'	do	Salisbury Center,	500
D. Hawn's	do	Starkville,	800	Norway Associat'n	do	Norway,	600
Snell's	do	Russia,	600	J. D. Ives'	do	do	
Nash's	do	Frankfort Center,		Columbia Center	do	Columbia Center,	
Rider's	do	Cedar Lake,		J. Russell's	do	Graefenberg,	300
Stuart's	do	Cedarville,					

OSWEGO COUNTY.

M. Pierce's	Factory,	So. Richland,	300	Fairdale	Factory,	Fairdale,	
Gilbert Mills	do	Gilbert Mills,	430	McMullens	do	Hinmanville,	
Dick's	do	Pennellville,		Mead's	do	E. Sandy Creek,	
Volney Center	do	Volney,	310	Bauder's	do	Caughdenoy,	
Whittemore's	do	Scriba,	500	Smith's	do	New Haven,	200
Ingell & Smith's	do	Volney,	375	Daggett's	do	do	400
E. Sandy Creek	do	E. Sandy Creek,		Donnelly's	do	North Scriba,	400
Robbins Co.'s	do	do	600	S. W. Oswego	do		
Suydam's	do	do	400	Vermillion	do	Vermillion,	500
Trumbull's	do	Pulaski,	270	Smith's	do	Volney,	500
Hall's	do	do	300	Hubbard's	do		250
Cold Spring	do	do	300	Jennings'	do	Palermo,	100
Jones'	do	South Richland,	400	East Scriba	do		200
L. Willis'	do	do	300	Sweet's	do	Schroeppel,	200
Blunt's	do	Orwell,	150	Gregg's	do	do	260
Union	do	Colosse,	400	First National	do	Phoenix,	475
Union	do	Mexico,	500	Central Square	do	Central Square,	130
Weygint's	do	Prattville,	530	West Manual	do		250
Banaska's	do	Phoenix,		Granby Center	do		220
Morton's	do	Orwell,	600	Rhodes	do	Scriba,	150
Sweet's	do	Phoenix,		Union	do	Sandy Creek,	230
Smith's	do	Hastings,		Union	do	Scriba,	325
Hastings C. M. Co.	do	do		Amboy	do	Amboy Corners,	200
Oswego Center	do	Oswego Center,	400	Smith's	do	Fulton,	
Bowen' Corners	do	Bowen's Corners,		Loomis'	do	Palermo,	
Wilcox's	do	Oswego Falls,		Clough & Co's	do	Constantia,	
W. Monroe C.M.A.	do	West Monroe,		Cold Spring	do	Richland,	
Titus & Wilson	do	Hannibal,		P. Wyman's	do	Orville,	
Gardner's	do	S. Hannibal,		Molino	do	Molino,	

WAYNE COUNTY.

Walworth	Factory,	Walworth,	300	Macedon	Factory,	Macedon,	300
Butler Center	do	Butler Center,	240	Wilbur's	do	Newark,	
Williamson	do	Williamson,		Lincoln	do	W. Walworth,	
Palmyra	do	Palmyra,		Marion	do	Marion,	
Safford's	do	Savannah,	175	Lee & Sheffield's	do	Rose,	400
South Butler,	do	South Butler,		Alloway	do	Lyons,	500
				Nairgs	do	do	

FRANKLIN COUNTY.

Berry Butter	Factory,	Malone,		Malone No. 1	Factory,	Malone,	
Moria	do	Moira,		Fort Covington	do	Fort Covington,	
Keeler	do	Malone,		F. C. Center	do	Fort Cov. Center,	
Cold Spring	do	do		Sargent's	do	South Bangor,	
Union	do	Bangor,		Patterson	do	Chateaugay,	
Bombay	do	Bombay,		Barley Spring	do		

COLUMBIA COUNTY.

Hudson	Factory,	Hudson,		Chatham	Factory,	Chatham Center,	

WYOMING COUNTY.

George Hoye's	Factory,	Attica,		Tozier's	Factory,	Johnsonburg,	
Java Village	do	Java Village,	450	Sheldon C. M. A.	do	Sheldon,	
North Java	do	North Java,		Wyoming	do	Wyoming,	
Stryker & Co's	do	do		Champman's	do	Perry,	
Empire	do	Java,	400	Hermitage	do		
Arcade C. M. A.	do	do		Orangeville	do	Orangeville,	600
Nile	do	Nile,		Wilder & Co's	do	do	
Bennington	do	Bennington,	400	Strykersville	do	Strykersville,	
East Bennington	do	East Bennington,	375	E. Coy	do	Pike,	
Arcade	do	Arcade,	500	Lillibridge	do	do	
Wells'	do	do		Empire	do	East Pike,	
Castile	do	Castile,	400	Oatka	do	Gainesville,	
Gardlant's	do	Attica,		Cowlesville	do	Cowlesville,	
Chapman's	do	Paris Center,		Java Lake	do		350
Stephens'	do	Dale,					

WASHINGTON COUNTY.

North Bend	Factory,	N. Granville,		S. Granville	Factory,	South Granville,	
North Bend	do	Middle Granville,	250	Middle Granville	do	Middle Granville,	500
Granville	do	Granville,	450	Greenwich	do	Greenwich,	135
Fort Ann	do	Fort Ann,		Hawley's	do	Fort Edward,	

NIAGARA COUNTY.

Sanborn C. M. Co	mp'y,	Sanborn,	300	Middleport	Factory,	Middleport,	
Johnson's Creek	do	Johnson's Creek,		J. C. Francis'	do	do	

BROOME COUNTY.

Maine	Factory,	Maine,	250	Squires Cr.	Factory,	Kirkwood,	275
Hawleton	do	Hawleyton,		Page Br'k Valley	do	North Fenton,	500
Killawog	do	Killawog,					

ONTARIO COUNTY.

Cold Spring,	Factory,	West Farmington,	450	E. Bloomfield	Factory,	East Bloomfield,	
Flint Creek	do	Flint Creek,					

ERIE COUNTY.

Stickney's	Factory,	Collins,	1,100	Boston	Factory,	Boston,	400
W.G.Huntington	do	Pontiac,	800	Concord Center	do	Woodward's Hol.	500
North Concord	do	Concord,		Wales	do	Wales,	450
First Collins	do		800	Paxton's	do	Eden,	600
Collins Center	do	Collins Center,	1,100	Sisson's	do	Shirley,	600
Brant Center	do	Brant,	550	North Evans	do	North Evans,	500
Marshfield	do	Collins Center,	1,100	Angola	do	Angola,	360
Morton's Corners	do	Morton's Corners,	600	Stickney's	do	Brant,	400
Richmond & Co's	do	Sardinia,	500	Springville	do	Springville,	1,200
Glenwood	do	Glenwood,	400	Blakeley's	do	East Aurora,	
Dick & Co's	do	Willink,	350	Jackson's	do	East Hamburg,	300
North Collins	do	Shirley,		Hamburg	do	Hamburg,	300
Kirby's	do	Shirley,		North Evans	do	North Evans,	250
Young's	do	Alden,	300	East Evans	do	East Evans,	300
Wheelock's	do		300	Eden Corners	do	Eden Corners,	350
Staffin's	do	Collins,	200	Sardinia Valley	do	Sardinia Valley,	450
W. Smith's	do		300	Newton	do	Sardinia,	250
Ballard's	do		350	Hosmer's	do	do	
Hensler	do	Grand Island,	150	Wales Center	do	Wales Center,	400
Cotesworth	do	Grand Island,	100	Fuller's	do	do	
North Boston	do		450	South Wales	do	Wales,	450
Boston Center	do		350	Elma	do	do	300
Colden	do	Colden,	300	Burroughs & Co.	do	do	
Marilla	do	Marilla,.		Francis	do		
Kimball's	do	Lancaster,		Farrington's	do	Holland,	
Cheese M. A.	do	Spring Brook,		Moulton's	do	Protection,	

MUNROE COUNTY.

Genesee Valley	Factory,	Sonyea,	300	Mendon	Factory,	Mendon,	
Riga	do	Riga,		Perington	do	Fairport,	

CAYUGA COUNTY.

Throopsville C. M. A.	Factory,	Throopsville	450	Ira, Lincoln's	Factory, do	Ira, Conquest Center,	400
Moravia	do	Moravia,	250	P. Byron, C.M.Co's	do	Port Byron,	
Sennett	do	Sennett,	400	Meridian,	do	Meridian,	200
Carpenter's	do	New Hope,		Montezuma,	do		

TOMPKINS COUNTY.

Dryden Union	Factory,	Etna,	600	Freeville Union	Factory	Freeville,	700
Groton	do	Groton Hollow,	500	Slaterville	do	Slaterville,	
Ellis Hollow	do	Ithaca,		Pern	do	Peruville,	
Arnold's	do	Ithaca,		Ridgway Cream'y,	do	Caroline Depot,	
McLean Assoc.	do	McLean,	700				

ORANGE COUNTY.

Circleville	Factory.		400	Wood's	Factory,	Chester,		200
Collaburgh	do		220	Kidd's	do	Walden,		
Rockville	do	Middletown,	200	J. F. Vail & Co.	do			450
Unionville	do		250	Brown, Lane & Co.	do			250
Walkill Assoc.	do		375	Wawanda	do			375
D. Mullock's	do	Middletown,	250	J. B. Halsey & Co.	do			300
Orange Co. M. A.	do	Michigan,	550	E. Bull's	do	Chester,		159
do do	do	Chester,	325	Bankers Bro.'s	do	do		200
Gouge & Co.	do	Hamptonburgh,	600	F. Davis'	do	do		225
Bates & Co.	do	do	250	P. Holbert's	do	Middletown,		275
Gouge & Youngs'	do	Florida,	400	Mapes & Co.	do	do		425
T. J. Taylor's	do	do	175	Jas. Hulse	do	do		250
Carpenter Howell	do	Amity,	415	Wm. Mead & Co.	do	do		250
do	do	Warwick,	350	Christee & Co.	do	Unionville,		300
Sanford & Smith	do	do	300	O. F. Green	do	Greenville,		300
H. Milburn	do	do	250	H. Reamy	do	do		125
T. Durland	do	do	150	Finchville	do	Otisville,		375
Brown, Bailey & Co	do	Edenville,	400	J. A. Wood's	do	Slate Hill,		300
Foster Clark's	do	Wickham's Pond,	350	Howell & Co.	do	Monroe,		400
W. H. Clark & Co.	do	Minisink,	300	Sugar Loaf	do	Sugar Loaf,		550
Barton Spring	do	Monroe,	100	Union Con'd Milk Co.		New Milford,		
Parlor	do	Blooming Grove,						

GREENE COUNTY.

Towner's	Factory.	Jewett,		Smith's	Factory,	Ashland,	
Hunter's Cream'y	do	do		Kirkland	do	Durham,	

ALLEGANY COUNTY.

Simpson's	Factory,	New Hudson,	600	Morley's	Factory,	Whitney's Crossing.	
Reservoir	do	Seymour,	600	Flanagan's	do	Cole Creek.	
Rushford	do	Rushford.	1,000	Crandall's	do	Dodge's Corners.	
Forsythe's	do	Whitesville,	200	Belvidere	do	Belvidere.	
S. Sherman & Co.	do	Nile,	125	Rice's	do	do	
Richburg	do	Richburg,	100	Granger	do	Granger.	
Curtis'	do	do		Little Genesee	do	Little Genesee.	
D. T. Burdick's	do	Alfred,	400	Carr Valley	do	Almond,	400
Greene's	do	do		A .Congdon's	do	West Clarksville,	250
Friendship	do	Friendship.	400	Babbit's	do	Hume,	350
Centerville	do	Centerville,	400	Philips Creek	do	Philips Creek,	450
Ackerley's	do	Rushford,	600	Vandermarsh	do	Scio,	275
Barns'	do	Fillmore,	700	R. Smith's	do	Cuba,	350
Andover	do	Andover,	350	West Almond	do	West Almond,	
Black Creek	do	Black Creek,	400	G. West's	do	Alfred Center,	
Oramel	do	Oramel,	450	J. Wilcox's	do	Wirt Center,	150
Niel	do		250	Wiscoy	do	Wiscoy,	200
Wellsville	do	Wellsville,	300	Genesee	do	Little Genesee	120
Lyndon	do	Cuba,	700	Elm Valley	do	Andover,	150
Pettibone's	do	Alfred,		Angelica	do	Angelica.	
Dodge's Creek	do	Portville,		Olean	do	Olean,	350
Jackson's	do	Belmont,		McHenry Valley	do	Alfred Center,	300

YATES COUNTY.

Italy Hollow C. M. A., Italy Hollow.

PUTNAM COUNTY.

Borden's Condensed Milk Factory, Brewster.

OTSEGO COUNTY.

Wykoff's	Factory,	Richfield Springs,	500	Russell Bower's	Factory,	Exeter,	300
Bush's	do	do		Perkin's	do	do	
E. D. Lamb's	do	Unadilla Forks,	350	Hind's	do	Cooperstown.	
Center Brook	do	Otsego,	200	Hoxie's	do	do	
Stocker & Fox's	do	East Springfield,	600	Hoxie's	do	Unadilla Forks.	
Casler & Andrews	do	Springfield Center,	450	R. L. Warren's	do	East Springfield.	
Hartwick	do	Hartwick,	200	West Burlington	do	West Burlington,	350
Pitt Cushman's	do	Edmeston Center,	200	Parker's	do	S. Edmeston,	400
Col. Gardner's	do	Burlington Flats,	150	Pope's	do	do	300
Ed. Gardner's	do	do	150	L. N. Brown's	do	W. Edmeston,	600
Benj. Smith's	do	Spooner's Cor's,	400	Ed. Loomis'	do	Richfield,	150
Brockway's	do	Richfield,	400	L. O. Vebber's	do	Exeter Center,	600
Smith & Wilber	do	West Exeter,	400	H. & S. Smith's	do	West Exeter,	300
Fly Creek	do	Fly Creek,	200	J. H. Pratt's	do	do	400
Park's	do	Burlington Green,	350	Lyman Johnson	do	Burlington Flats,	500
Parley Phillips'	do	Unadilla Forks,	200	Coleman's	do	do	200
Wm. L. Brown's	do	do	200	Newel N. Talbot's	do	do	
Clark's	do	Schuyler's Lake,	200	Hartwick Union	do	Cooperstown.	
Edmeston Center	do	Edmeston Center,	750	Chamberlain's	do	Richfield Springs.	
Warren Chase's	do	W. Edmeston,	250	Cherry Valley	do	Cherry Valley,	300
Joseph King's	do	Burlington Green,	200	Tuttle's	do	South Edmeston,	250
George Clark's	do	Hyde Park,	300	Rider's	do	Schuyler's Lake,	100
Nearing & Co's	do	Butternuts.		Baker's	do	do	600

SCHENECTADY COUNTY.

Mariaville	Factory.		Rotterdam	Factory.	

GENESEE COUNTY.

Batavia Union	Factory,	Batavia,		Darien Center	Factory,	Darien Center,	400
do C. M. A.	do	do	500	Oakfield	do	Oakfield,	200
Byron	do	Byron,		W. Bethany	do	West Bethany,	
Richville	do	Pembroke,		East Bethany	do	East Bethany,	
Linden	do	Linden,		Foster's	do	Batavia,	
Stafford	do	Stafford,					

FULTON COUNTY.

Stuart's	Factory,	Oppenheim Center,		Cold Brook	Factory,	Brockett's Bridge,	
Fulton	do	do		Brockett's Bridge	do	do	
Cross Roads	do	Johnstown,	350	Perth Center	do	Perth Center,	200
Stoller's	do	do		Slate Hill	do	Ephratah,	600

SARATOGA COUNTY.

Ballston	Factory,	Ballston Center,		Galway	Factory,	Galway,	
Empire	do	South Galway,	250	Charlton	do	Charlton,	

CATTARAUGUS COUNTY.

Welch's	Factory,	Dayton,		Farmersville	Factory,	Farmersville	400
Perrysburgh	do	Perrysburgh,	550	Cook & Brothers'	do	do	
Ticknor's	do	Versailles,	500	Napaer	do	do	
Slab City	do	Slab City.		J. K. Button's	do	do	
Leon Center	do	Leon Center.		Ischua	do	Ischua.	
Randolph	do	Randolph,	200	Portville	do	Portville.	
First Collins	do	Gowanda,	700	Olean	do	Olean.	
Stebbin's	do	Cattaraugus,		Hinsdale	do	Hinsdale.	
Waverly	do	Waverly.		Cady's	do	Franklinville.	
Safford's	do	East Otto.		Union	do	Ellicottville,	600
Union	do	do		McMahon's	do	do	
Tiffts'	do	do	400	Meadow Valley	do	do	
Crump's	do	do		Little Valley	do	Little Valley.	
Ashford	do	Ashford,	600	Great Valley	do	Great Valley.	
Westville	do	Westville.		Merrilly's	do	Napoli.	
West Ashford	do	Ashford Hollow.		Lyndon	do	Lyndon.	
Machias Corners	do	Machias Corners.		Cadiz	do	Cadiz,	850
Woodworth's	do	Yorkshire,	450	New Ashford	do	New Ashford.	400
Maple Ridge	do	Fairview,	660	Yorkshire Center	do	Yorkshire Center,	500
Gowanda	do	Gowanda,	550	New Albion	do	do	600
Dwight's	do	do		Jenk's	do	Gowanda,	1000
Allen's	do	Eddyville,	350	Pigeon Valley	do	do	369
Maple Grove	do	Ellicottville,	200	West Valley	do	West Valley	400
E. Ashford	do	East Ashford,	550	Ballard	do	do	
Follett's	do	Machias	400	Bigelow's	do	Ashford.	
Lewis & Haskell's	do	Sandusky,		Vedder Corners	do	do	
Elton	do	Elton,	400	Gamp's	do	Ashford Hollow.	
Rawson	do	Rawson,					

LEWIS COUNTY.

Sulph. Springs	Factory,	Lowville,	800	Union	Factory,	W. Martinsburgh,	500
Folts'	do	do	750	Green's	do	do	400
Hall's	do	Barnes' Corners,	200	Kelsey's	do	do	450
Miller's	do	Constableville,	1,000	West Lowville	do	West Lowville,	800
Wider's	do	do		Searles'	do	do	500
McDonald's	do	do		Alexander	do	do	300
Valley		do	450	Vary	do	Harrisburgh,	590
High Market	do	High Market,	460	Clark's	do	do	600
Houseville	do	Houseville,	800	Lamphere's	do	do	500
Glensdale	do	Glensdale,	700	Knapp's	do	do	
Sugar River	do	Leyden,	940	Union	do	Deer River,	270
Wood's	do	Turin,	400	Deer River	do	do	450
Bush's	do	do	500	Austin	do	Denmark,	700
Shepherd's	do	do	250	Markham's	do	Collinsville,	400
Williams'	do	do	150	Lyon's	do	Lyon's Falls,	
Evans'	do	do	550	Leyden C. Assoc.	do	Leyden,	550
Carpenter's	do	Houseville,	150	Post's	do	Port Leyden,	
Rees'	do	Martinsburgh,	200	Whitney's	do	Copenhagen,	400
Dunton's	do	do	350	Bent's	do	do	250
New Bremen	do	Crogan,					

DUTCHESS COUNTY.

Sheldon's	Factory,	Stissing,	

CLINTON COUNTY.

Platt's	Factory,	Plattsburg,	Smith Dale	Factory,	Peru.	
Rouse's Point	do	Rouse's Point,				

ORLEANS COUNTY.

Cooley & Thompson's	Factory,	Albion,

STEUBEN COUNTY.

Spalding's	Factory,	Howard,	400	J. Davis'	Factory,	Greenwood,	250
Bennett's	do	do	500	Mason's	do	North Cameron,	400
Kanona	do	Kanona,	300	Spalding & Co.	do	Avoca,	
Wing's	do	Campbell,		Sitterly's	do	Bath.	

ONONDAGA COUNTY.

L. H. Webster's	Factory,	Fabius,	500	Belle Isle	Factory,	Belle Isle,	
Delphi	do	Delphi,	450	Sherwood's	do	Brewerton,	
Salisbury's	do	Apulia,	600	DeWitt C. M. A.	do	DeWitt,	300
Coppernoll's	do	Lysander,		Talbot	do	Fabius,	400
Edwards'	do	Manlius,		Euclid	do	Euclid,	
Hopper's	do	Collamer	160	Navarino	do	Navarino,	140
Hiscock's	do	Jamesville,		Kirkville	do	Kirkville,	450
Seneca	do	Baldwinsville,	150	Camp's	do	Otisco,	200
Spafford	do	Spafford,		Little Utica	do	Little Utica,	300
Loomis'	do	Cicero,		Cole Settlement	do	Fabius,	150
Van Bramer's	do	do		Block School Ho.	do	do	
Sternberg's	do	Cicero Center,		Southard's	do	Pompey Center,	
Delphi	do	Delphi,		Palmer C. M. A.	do	Oran,	250
Elbridge	do	Elbridge,	400	Plainville	do	Plainville,	400
Tully	do	Tully,		Young's	do	Euclid,	
Jack's Rifts	do	Jack's Rifts		Marcellus	do	Marcellus,	

SCHUYLER COUNTY.

Cook & Co's	Factory,	Havana,	Alpine	Factory,	Alpine.	

CHAUTAUQUA COUNTY.

Hamlet	Factory,	Hamlet,	1,100	Brainard's	Factory,	Hamlet,	650
J. E. Robertson's	do	Busti,	660	Coon's	do	(3) Mina,	1,250
Clear Spring	do	Fredonia,	700	do	do	Sherman,	457
Burnham's	do	Sinclairville,	1,049	Canadawa	do	Arkwright,	680
J. S. Hulbert's	do	Forrestville,	400	Gerry	do	Gerry,	500
Villanova	do	Villanova,	400	Cassadaga	do	Cassadaga,	100

CHEMUNG COUNTY.

Bunnell & Horton's	Factory,	Millport,	750	VanDuzer & Son's Rundle's	Fac. do	Horseheads. do

TIOGA COUNTY.

Speedsville	Factory,	Speedsville.	Jenksville	Factory,	Jenksville.

SCHOHARIE COUNTY.

Sharon Center	Factory,	Sharon Center,	250	Argusville	Factory,	Argusville,	600
Seward Valley	do	Seward,	200	Carlisle	do	Carlisle,	300
Hindsville	do	Hindsville,	200	Barneyville	do	Barneyville,	200
Gardnersville	do	Gardnersville,		Esperance	do	Esperance,	
Cobleskill	do	Cobleskill.					

RENSSELAER COUNTY.

Matteson's	Factory,	South Berlin.

MONTGOMERY COUNTY.

Charleston 4 Corners	Factory,		400	Root	Factory,	Root,	500
Smith Creek	Factory,	Fort Plain,	900	Wier's	do	do	
Dunkle's	do	do		Glen	do	Glen,	4 0
Root's	do	do		Diefendorf's	do	Amsterdam,	300
Empire Cheddar	do	Bartonville	300	W. Green's	do	do	
Florida	do	do	400	Dorn's	do	do	
Hallsville	do	Hallsville,	400	Florida	do	Minaville,	
Freys Bush	do	Freys Bush,	550	Minaville	do	do	450
Hessville	do	Sprout Brook,	270	Switzer Hill	do	Fonda	350
Cold Spring	do	Stone Araba,	250	Schuyler's	do	do	
Waterville	do	Ames,	600	Mohawk Valley	do	do	250
Flat Creek	do	Flat Creek,	450	Cold Spring	do	Palatine Bridge.	
Brookman & Co.	do	Fort Plain,	600	Union	do	do	550
Ford's Bush	do	Minden,	450	Failing's	do	do	
Cayadutta	do	Fonda,	600	Gatesville	do	Randall.	
Bates, Snell & Co.	do	St. Johnsville,	350	Mother Creek	do	St. Johnsville,	350
St. Johnsville	do	do	600	Buel	do	Buel	550
Charleston	do	Charleston,	350	Mapletown	do		
Charleston Union	do	do	250	Kilts	do	Canajoharie,	330
S. Zollers	do		200	Zimmerman Creek,	do		350
Wm. Dunchell's	do		350	Klock & Nellis	do		350
Sand Hill	do		330	Slate Hall	do		550
Seeber Lane	do		300	Christman	do		250
Elm Dale	do		240	Spraker	do		400
Van Epps	do		150	Grove	do		200
Maple Grove,	do		200	Dairyman	do		300
Bates	do		400	Scotch Church	do		300
A. Smith & Co.	do		450	Pawling	do		300

Ohio.

GEAUGA COUNTY.

Rocky Dell	Factory,	Bissell's	250	Spring Brook	Factory,	Welchfield,	300
Andrews'	do	do	800	Grove	do	do	300
Bartlett's	do	Chester X. Roads,	800	Munson's	do	Fowler's	400
Bartlett's	do	Mulberry Corners,	300	Pope's	do	Welchfield,	500
Hood's	do	Auburn,	500	Randall's	do	Burton,	700
Odell's	do	do	600	Hall's	do	Claridon,	400
Smith's	do	Ford,	600	Armstrong	do	East Claridon,	700
Freeman's	do	South Newbury,	500	Smith & Co.'s	do	Parkman,	600
Hall's	do	Fowler Mills,	600	Armstrong's	do	Huntsburgh,	800
Murray's	do	Chardon,	800	Randall's	do	Montville,	800
Randall's	do	Chardon,	700	Murray's	do	do	500
Russell's	do		500	Smith's	do	Thompson,	500
Colton & Co.	do	Nelson.					

PORTAGE COUNTY.

E. B. Higley, Windham.
Horr & Risden, Shalersville.
H. S. Johnson, Garrettsville.
Hurd & Bro., Aurora.
T. C. Bradley, Mantua.
I. C. Scram, Ravenna.
H. F. Hudson, Ravenna.
Beman Spring, " 250
Hinkley's, Mantua, 400
Burrows, Freedom.
Aurora Grove, Aurora, 500
Anderson', Ravenna, 300

LAKE COUNTY.

S. E. Carter, Leroy, Painesville P. O.
H. N. Carter, Perry.
R. Freeman & Co., Madison.
Hitts, Willoughby. 300
Bartlett & McKee, South Kirtland.

ASHTABULA COUNTY.

S. E. & H. N. Carter, Windsor, 500
Lattimer's, New Lyme.
Osborne's, Morgan.
G. C. Dolph, West Andover.
Austinburgh, Austinburgh.
Morley Bros., Andover.
Wire's, Austinburgh, 400
Weldon & Brown, Conneaut.
Pierce's, Eagleville.
Harrington & Randall, Morgan.
Alderney, New Lyme.

TRUMBULL COUNTY.

J. M. Trew, Newton Falls.
B. H. Peabody, Kinsman.
Cold Spring, do
Caldwell & Lewis, W. Farmington.
Farmington Center.
E. C. Cox, Mesopotamia.
do N. Bloomfield.
Baldwin's, Fowler.
Cortland, Bazetta.
Raymond's, Mesopotomia.
Cowdery & Crafts, Bazetta.
Sager & House, Bristolville.
Harshman & McConnell's, Southington.

HENRY COUNTY.

Ridgeville Factory, Ridgevil e Corners.

FAIRFIELD COUNTY.

Royalton Factory, Royalton.

LORAIN COUNTY.

Camden Cheese Company, Kipton.
Mussey & Viets, Elyria.
Horr & Warner, Huntington.
Magraugh & Whitlock, Wellington.
Snow's, Huntington.
G. H. Van Wagnen & Co., North Eaton.
Corning & Hanee, Grafton.
Penfield, Wellington.

MEDINA COUNTY.

McDowell Bros', Medina.
Fellows, Chatham.
Benedict & Brooker, Litchfield.
Crane & Co., Sharon.
Colbetzes & Co., Spencer.
Chatham, Chatham Center.

SUMMIT COUNTY.

Twinsburg Cheese Association, Twinsburg.
Wm. Wilcox, Twinsburg.
S. Straight & Co., Twinsburg.
" " " " Hudson.
Richfield, W. Richfield.
S. Straight & Co., Streetsboro.
Oak Hill, Peninsula.
M. D. Call, Hudson.

ASHLAND COUNTY.

Drake, Eaton & Co.'s, Sullivan.
Clark & Bailey, Sullivan.

HURON COUNTY.

Haviland & Conant, Greenwich.
J. W. Jenne, New London.
Wakeman Cheese Co., Wakeman.

CUYAHOGA COUNTY.

A. J. Lockwood, Bedford.
J. Q. Lander, Solon.
Wyatt's, Brecksville.

Illinois.

Hainesville	Factory,	Hainesville, Lake Co.	
Burchard's	do	Sumner, Kank'kee Co.	
Patterson & Mix	do	Momence, do	800
Wm. Keeney's	do	Mantino, do	800
W. C. Richards	do	Momence, do	100
W. A. Clark's	do	Sherburnville do	200
Wanzer & Co.	do	Herman, Kane Co.	
R. R. Stone's	do	Richmond, McHenry Co.	800
do	do	Spring Grove.	
Thompson & Abbott	do	Greenwood, do	500
Huntley Grove	do	Huntley, do	250
Marengo	do	Marengo, do	300
Greenwood	do	Woodstock, do	300
Marsh & Jackson	do	Union, do	500
Boies	do	Kingston, DeKalb,	200
Sugar Grove	do	Aurora,	300
Dunton	do	Dunton,	250
Kennicott	do	do	200
Cameron	do	do	200
Perry	do	do	150
Williams	do	do	150
Gould & Hammond's	do	Hanover,	425
Gould & Hammonds,	Factory,	Elgin.	425
Tuttle's	do	Lodi.	350
Barber & Co.	do	Polo.	300
Albro & Co.	do	Wayne.	600
Winslow	do	Shirland,	400
Kilbor's	do	Richmond.	
Buckland's	do	Ringwood.	
Jones'	do	Hebron.	
Conn's	do	Hebron.	
Woodstock	do	W'dstock, McH'nryCo	
Riley	do	Riley, do	
Buena Vista	do	Huntley, do	350
Spring Grove	do	Richmond, do	300
Garden Prairie	do	Garden Prairie.	
Mead's	do	Hebron,	300
Milk Condensing Co.		Elgin.	
Rockton	Factory,	Rockton	400
Stuart Bros.	do	Hebron, M'H'ryCo.	500
Oneida	do	Rockford.	
Belvidere	do	Belvidere, Boone Co.	
Hale	do	Hale, Ogle Co.	500
Wanzer's	do	Hanover.	
do	do	Elgin.	
Cameron	do	Northfield.	

Massachusetts.

Worcester Co.,	Factory,	Warren,	500
Union	do	Hardwick.	
New Braintree,	do	New Braintree,	542
Barre Central Cheese Co.,		Barre Center,	
Barre Cheese Co.,		Barre,	375
South West Factory,		Barre.	125
Hardwick Center Factory,		Hardwick,	500
Boise's	do	Blandford.	
Williamstown Factory,		Williamstown.	
West Brookfield Factory,		West Brookfield.	
Lanesboro'	do	Lanesboro'	
North Marlboro'	do	North Marlboro'	
Lenox,	do	Lenox,	
Hardwick Union,		Gilbertsville,	200
Warren,		Warren,	150
New Lenox Factory,		Lenox.	
Cheshire Factory,		Cheshire.	
Petersham Cheese Company,		Petersham.	
Cheshire	do	do South Adams.	
Westboro'	do	do Westboro'.	
Lewis Milk Condensing Factory,		W. Brookfield.	
Coy's Hill Cheese Company,		Warren,	300
South Williamstown Factory,		S. Williamstown.	
Walker's Factory,		Greenwich.	
Dana C. M. C.		Dana.	
Putnam's Factory,		Belchertown.	
Slater's	do	Tyringham.	
Greylock	do	South Adams.	
Pierce's	do	Peru.	
Greenfield,		Greenfield,	100

Vermont.

East Berkshire	Factory,	East Berkshire,	100
Enosburgh Factory	Co.,	Enosburgh,	600
N. Enosburgh	Factory,	N. Enosburgh,	400
East Franklin	do	East Franklin,	600
Middletown	do	Middletown,	600
Rose	do	West Rupert,	625
West Pawlet	do	West Pawlet,	475
Hill	do	Middletown,	100
West Tinmouth	do	West Tinmouth,	
Norton's	do	Wells,	
Valentine's	do	Tinmouth,	125
Otter Creek	do	Center Rutland,	200
Billing's	do	Rutland,	
Sheldon's	do	West Rutland,	
Wickham's	do	Pawlet,	
Camp's	do	Stowe,	
Missisquoi	do	North Sheldon,	
Gleason's	do	Shrewsbury,	
Mason's	Factory,	Richmond,	80
Valley	do	Hinesburg,	650
East Poultney	do	East Poultney,	300
Wallingford	do	Wallingford,	
Williams	do	Danby,	
Rutland	do	Rutland,	
West Orwell	do	Orwell,	450
East Orwell	do	Orwell,	350
Hosford's	do	Charlotte,	350
Milton	do	Milton,	
Milton Falls	do	Milton Falls,	
Ferrisburgh	do	Ferrisburgh,	
New Haven	do	New Haven,	
Shoreham	do	Shoreham,	
Union	do	Hinesburgh,	
Mankton Pond	do	do	
Lewis Creek	do	do	

Iowa.

Smith's	Factory,	Mason City,	
Hickling's	do	Mason City,	
Wyoming	do	Wyoming, Jones Co.,	
Clear Lake	do	Clear Lake,	
Strawb'ry Pt.	Factory,	Fayette Co.	
Kidder's	do	Epworth, Dubuque Co	
Pierce's	do	Belmond	

North Carolina.

Elk Mountain Factory, Buncomb County.

Wisconsin.

C. H. Wilder's	Factory,	Evansville, Rock Co.	400	D. Treleven's	Factory,	Fond du Lac,	150
Springvale	do	Nanaupa,		A. J. Smith's	do	do	75
Eldredge	do	Afton,	200	Ellsworth's	do	Rosendale,	150
Elkhorn	do	Elkhorn,	200	Johnson's	do	Kenosha,	
Rosendale	do	Ros'le, F. du Lac Co.	500	Long's	do	do	
Hazen's	do	Ladoga, do	800	Pierce & Simons	do	do	
Hazen & Co's	do	Brandon,	250	Truesdell s	do	do	
Sparta	do	Sparta,	200	White's	do	do	
Favil's	do	Lake Mills, Jeff. Co.		Ft. Atkinson	do	Fort Atkinson.	
Barrett's	do	Burnett Station.		Spring Mills	do	Somers.	
Coolidge	do	Windsor, Dane Co.		Bullock's	do	Rockton.	
Waterville	do	Wat. Waukesha Co.		Cold Spring	do	Whitewater.	
Boynton's	do	Waupun.		Coburn's	do	do	
Howard's	do	do	300	Drake's	do	Lake Mills.	
Johnson's	do	do		Gilbert & Co's	do	Hazel Green.	
Downey's	do	do	175	Tappan's	do	Morrison.	
Carpenter's	do	Kenosha,		Wilbur & Co's	do	Wilmot.	
Holt's	do	do		Strong & Co's	do	Oakfield,	350
J. Comb's	do	Ripon,	300	Cochran's	do	Beaver Dam, Dodge Co	
Hodge's	do		125	Reigart & Ross	do	Beloit.	

Michigan.

St. Clair	Factory,	St. Clair,	450	Mason	Factory,	Mason,	
Fairfield	do	Fairfield,	700	Irish's	do	Grand Ledge,	
Horton's	do	Adrian,		Spring Brook	do	Farmington,	400
Hoadley's	do	Oakford,		Gilt Edge	do	do	400
Saunder's	do	Trenton,		Ionia	do	Ionia,	
Smith's	do	Augusta,		Reading	do	Reading,	450
White's	do	Ceresco,		Fowler & Co's	do	do	
Maple Grove	do	Farmington,	600	Adrian C. M. Co.	do	Adrian,	
Canton	do	Canton,	400	Ames'	do	Hudson,	
Beal's	do	Rollin,		Sawin's	do	Mattison,	
Clayton	do	Clayton,		Utica	do	Utica,	
Isham's	do	Wellsville,		Welton's	do	No. Adams,	
DeLano's	do	Oxford,		Hillsdale	do	Hillsdale.	

Pennsylvania.

Springville Factory, Springville, Susq. Co. 158
Bridgewater, do Bridgewater, do 200
Gage, do Bridgewater, do 200
Worth's do Marshallton, Chester Co.
Damascus Creamery, Damascus, Wayne Co.
Woodcock First Preminm Factory, Woodcock, Crawford Co.
Woodcock Boro' Creamery, Woodcock Boro', Crawford Co.
Keystone Factory, N. Richmond, Crawford Co.
Cook's, Factory, Saegartown.
Logan & Co. do Hartstown.
Venango Factory, Venango, Crawford Co.
Cambridge, Factory, Rockdale, Crawford Co.
Ellis & Smith's Factory, Waterford, Erie Co.
New Milford Creamery, N. M., Susq. Co., 200
Spring Hill Factory, S. H., Bradford Co., 150
Earl's do Carthage.
Edinboro, do Edinboro.
Nash's do Crossingville,
Bentley & Co. do Randolph,

Kentucky.

Chilesburg Factory, Chilesburg, Fayette Co. 300
Clark Factory, Winchester, Clark Co. 300
Shelby City Factory, Shelby City.
Versailles Factory, Versailles, Woodford Co. 200
Madison Co., C. M. A., Richmond.

Minnesota.

Anderson	Factory,	Mower City,	Owatonna,	Factory,	Owatona,
Wells	do	Wells,	Havana,	do	Havana,
Star	do	Rochester.	Dodge City,	do	Dodge City,

Virginia.

Holston Factory, Saltville, Smith Co.
Old Dominion, Hamilton.

Tennessee.

Stratton's Factory, Crossville, Cumberland County.

Kansas.

Americus Factory, Americus.

Connecticut.

Eagle Cheese Company, North Colebrooke.

Indiana.

L. B. Merrill's Factory, Merrillsville.

Brockman's Factory, Crown Point.

Canada.

Smith & Son's, Norwich,	Oxford Co.,	C. W.	400	People's Factory,	Norwich.		
Galloway's, Ingersoll,	do		150	Lossing's do	Durham,	C. W.	250
Josiah Collins, Mount Elgin,	do		350	Kearn's, do	Oxford,	do	200
Moyer's, West Zorra,	do		100	Dodge's do	do	do	200
Adams', Nissouri,	do		450	Silverthorn's do	do	do	70
Wade's, Cobourg,	do		450	Tho. Abram's do	Norwich,	do	275
James Harris, Ingersoll,	do		400	G. Dunkin's do	do	do	200
do Branch, do	do		200	Wm. Bailey's do	do	do	175
H. Farrington's, Norwich,	do		300	Andrew Pickert, Lowville, Halton Co.,		do	150
do Branch, do	do		200	Richard Carter, Brampton, Peel Co.,		do	175
Chas. Banbury's, St. Mary's	do		300	Wilmot's, Milton, Halton Co.,		do	250
Harris & Adams, Mt. Elgin,	do		250	Cambell's, do	do	do	200
Scott's, Lobo,	do			Cochrane's, Compton,		C. E.	250
Ballard's, Norwichville,	do		300	Lawson's, Salford, Oxford Co.,		C. W.	450
Ballantyne's, Sebringville,	do		400	Degeer's, Queensville.			
Ontario, Norwich,	do		300	Pearce, Tyconnell, Elgin Co.			
Pioneer, do	do		550	Middlesex Factory, Bowood, C. W.			
E. Nissouri Factory, Ingersoll.							

Nova Scotia.

Bridgetown.	Wilmot.	Aylesford.
Middletown.	Lawrencetown.	Paradise.

AN ADDRESS

DELIVERED BEFORE THE AMERICAN DAIRYMEN'S ASSOCIATION, AT UTICA, N. Y., ON

THURSDAY, JANUARY 11TH, 1872,

BY

PROFESSOR GEORGE C. CALDWELL,

Of Cornell University, Ithaca, N. Y.

THE PRACTICAL VALUE OF CHEMICAL ANALYSES OF THE DAIRYMAN'S RAW MATERIALS AND OF THE PRODUCTS OF HIS MANUFACTURE.

Mr. President and Members of the Dairymen's Association :—The subject which I have chosen for this address, was selected because of my conviction that it might be profitable for the dairyman to resort more frequently than he now does to simple analytical tests of his raw materials, for the purpose of enabling him to form a more correct judgment in regard to their value ; these tests being either such as he can perform himself, or even such as may require the skill of a professional chemist for their execution. I shall, therefore, after describing the usual chemical composition of each kind of raw material, attempt to show in what way, and to what extent, its value is liable to vary, whether and how the dairyman may himself test it, or to what extent it might be advisable to get a chemist's analysis of it.

I am aware that the largest portion of my audience is made up of those who manufacture milk into butter and cheese, and who, provided they can get good milk in sufficient quantity, care little how that milk is produced; such persons may think that I devote too much time to the consideration of soils, manures and fodder; but it is, to my thinking, beyond question that all of you, whether working on the dairy farm, or in the cheese or butter factory, are equally interested in whatever may serve to increase the production of milk. There is a vast army of men and women, who cannot come here every year, engaged in this production, without whose co-operation the factory system which you so largely represent would have no existence; your success is closely connected with theirs, and if, besides the profitable wisdom that you carry home from here for your own use, you would treasure up whatever comes in your way that may be good for them, and impart it to them in liberal measure, the measure of your own success may be increased to a like extent,—Then this Dairymen's Convention might become a sort of a teachers' institute, and the sphere of its usefulness would be greatly enlarged.

GENERAL COMPOSITION OF SUBSTANCES.

All the materials which the dairyman handles, whether raw or manufactured, are to a certain extent alike in composition. Every soil which will yield anything that can justly be called an agricultural crop, as well as almost everything that the farmer is accustomed to put on the soil, in order to increase its productive powers, every plant that he raises for food, or for fodder for his animals, every animal that he feeds with the produce of his land, and every article that he manufactures, such as milk, cheese, butter, wool, wine, vinegar, with or without the aid of these domestic animals, is composed of a volatile part that can be driven off by the heat of a fire, and a non-volatile part, which remains behind and constitutes what everybody is familiar with as the ashes of what has been burned. The volatile part itself consists of water, which is expelled at a much lower temperature than that required to expel the other, or what may be called the combustible portion, by burning.

You fell a tree in the forest, cut it up and let it season; a part of the water with which its channels and pores were filled when you cut it down escapes, even at common temperatures, as the wood dries; you put a stick of the seasoned wood on the fire, and the great heat drives out the rest of the water, while it kindles the wood itself into a blaze; the largest part of its solid structure is entirely

broken up, and converted into invisible gases that pass away through the chimney, while a small, insignificant pile of ashes remains behind. You may have, as in the case of milk, a great preponderance of water, but, for all that, there will be something left to burn after the water has been driven off, as many a housewife has learned to her sorrow, when obliged by a call in another direction, to leave the milk for the pudding boiling on the stove; and after the residue left by the water has been completely burned, a careful examination will reveal the presence of the ashes in the bottom of the kettle. Or if it is a lump of dry soil you put on the fire, though there may appear to be no escape of water, and although what is left behind after a thorough heating may seem to be just as much in quantity as what was put on the fire, nevertheless a careful heating in the first place, at a low temperature, would cause a loss of weight, as could easily be proved with the aid of your kitchen scales, by reason of loss of water; and a stronger heating afterwards would cause a further loss of weight, as could be proved in the same way as before, by reason of loss of what was burned out. This triple constitution you will not fail to find, if you but seek for it, in all your raw materials, and the products manufactured from them; only you may find the three kinds of matter in very different proportions, in different substances.

Now, just as we have been able to show, in part by calling to mind some fragments of your own experience, that most of the substances with which you are so familiar from constantly dealing with them in your daily operations, are composed of three different parts, or kinds of matter, so the chemist, by going further finds that both the combustible part, and the ash, are themselves composed of several different substances; the number of these, however, seems wonderfully small, in comparison with the almost infinite variety of results produced with them. Whatever it may be that is burned, only twelve elements can be found in the ash left behind, in proportions worth noticing; these elements are combined together, and their most important compounds in the ash are potash, lime, magnesia, phosphoric, and sulphuric acids, and silica.

In like manner we can find in the volatile or combustible part but six elements, which are likewise united together, forming by their combination several classes of substances that are found in the products of vegetable and animal growth; four of these classes of substances, that occur in the plant, are of special importance to us;

the most convenient names for these are, fibre, soluble non-nitrogenous matters, fats and albuminoids; all of these are found in the animal also, except the one first mentioned. These four classes of substances, although requiring for their separation from one another more complicated processes than are necessary in the case of the components of the ash, and even with these more difficult processes not, after all, so sharply separable, are yet no less unmistakeably different from each other, than those. There is no more danger of a good chemist's mistaking one of these substances, whether belonging to the volatile or the non-volatile part, for another, than of your mistaking a sheep for a pig, or a milk pan for a cheese.

Now some of you, either dairymen farmers, or dairymen manufacturers, in the course of your daily practice have to deal with soils, waters, amendments or manures, fodder crops or foddering materials, and milk and its manufactured products. All these classes of materials cannot be considered at this time, as was at first intended, according to the programme laid down in the beginning of the lecture, without taxing your patience altogether too severely. I will therefore begin at once with the consideration of manures.

FERTILIZERS.

Of these the most important, by far, is barnyard manure. But every intelligent farmer knows about what his stable manure is worth; he knows, or ought to know, how much care it is worth his while to bestow upon it in order to bring its quality up to a high standard of excellence; and there appear to be no ordinary cases, when the judgment which the farmer could pass on the value of his manure on the basis of his own experience, would be enough better when aided by the results of a chemical examination, to compensate for the cost of these results.

Besides stable manure, however, he uses other fertilizers, which are sold in the market, and which he buys to make up for a deficiency in the home-made product. The most important of these is some prepared form or another of phosphate of lime, the use of which constitutes an important feature in English husbandry, in connection with the production of roots for fodder: sometimes it is nothing but finely ground bone; sometimes this bone has been treated with oil-of-vitriol in order to render the phosphoric acid more soluble, and so more easily accessible to the plant; this product is the so-called superphosphate; sometimes finely ground rock, rich in

phosphoric acid, or mineral phosphate as it is frequently called, is treated in the same manner; sometimes salts of potash, or compounds containing nitrogen are added; moreover the process of manufacturing the superphosphate can be so manipulated as to bring into a soluble form more or less phosphoric acid, according to the pleasure of the maker; and as a superphosphate gets old, more or less of the phosphoric acid that was at first soluble in it passes back into an insoluble and less valuable form again. Thus it is easy to see that under the name of superphosphate, and still more under the name of phosphate, we by no means have an article of commerce that is always of the same composition, or of the same value to the consumer.

In these commercial phosphates, and fertilizers generally, the inorganic or non-volatile part predominates, and often largely. Their value depends exclusively upon the phosphoric acid, nitrogen, and potash, that they contain; that is, there is nothing else in these manures, which, considering the comparatively small quantity that is put on the land, can be supposed to have any noticeable effect, or to contribute in any way to the return which the consumer expects to find in his increased crops, for this investment in additional food for them; and further, it is rare that there is enough potash present to add essentially to the value of the article; again, of two fertilizers equally valuable with respect to the amount of plant food which they contain, that one will be worth more which is in the form of the finer powder, or in which the lumps are softer and more easily crushed to a powder. Such are the data upon which to base the valuation of a commercial fertilizer.

The variations in these fertilizers with respect to the proportion of phosphoric acid and nitrogen are very wide; while pure bone-meal contains usually about 4 per cent. of nitrogen and 22 per cent. of phosphoric acid, there are superphosphates sold containing less than 9 per cent. of the latter, and other fertilizers not called phosphates, that contain less than 3 per cent., while at the same time there is a corresponding deficiency of nitrogen. And while a good Peruvian guano contains from 10 to 12 per cent. of nitrogen, there are fertilizers sold that contain only 0.1 per cent. Now, at a low estimate you have to pay for all the nitrogen that you buy in these manures at the rate of 25 cents a pound, and for the soluble phosphoric acid, that is for this acid in its more valuable form, 20 cents. Taking these figures into consideration, it evidently is of considerable im-

portance to you as a financial transaction, whether the Peruvian guano that you buy chiefly for its nitrogen, and for which you pay at the rate of sixty dollars a ton, or thereabouts, contains 200 pounds of nitrogen in the ton or only 20 pounds; in the purchase of a ton of superphosphate, bought mainly for its soluble phosphoric acid, it does make a difference to you whether, paying at the rate of at least 20 cents for every pound of this acid, the ton of 2000 pounds that costs you $50, contains 150 pounds of the acid, or $30 worth, or none at all. I am quite safe in saying that you might get no soluble phosphoric acid at all for your money, for such superphosphates have been sold in this State, and may be now; such a superphosphate may not be entirely worthless, for in the case referred to, there was considerable insoluble acid, and a little nitrogen; but the insoluble acid, according to all authorities, is worth at the most only a third or a fourth as much as the soluble; it must lie longer in the ground before the plants can consume it all, and the capital invested in it must remain idle so much the longer.

Deception is so easily and safely practiced in this matter of commercial fertilizers, that, as a rule, they are sold for considerably more than ought to be asked for them, and not seldom there are cases of outrageous swindling. Allowing very high values for the two forms of phosphoric acid, and for nitrogen, namely, 6 cents, 25 cents and 29 cents respectively, we find that all the phosphoric acid and nitrogen which could be found by the ordinary process which is applied in the chemical analysis of fertilizers, was, in, one case, worth but $39 in a ton of the phosphate, while $58 was asked for it; in another case $65 was asked while the article was worth but $53; in another case, the price was $50, while the real value was but $25, and finally in another case, that of a poudrette, the price asked was $28, and the real value not over $5. In saying, as in this last case, for instance, that the real value of all the plant food in a ton of the fertilizer was not greater than $5, it is meant, simply, that you could go into the market and buy as much phosphoric acid both soluble and insoluble, and nitrogen, as is contained in this ton of manure, and obtain these substances in quite as valuable forms, for less than $5; or this, that it should have cost the manufacturer of that fertilizer much less than $5 a ton to prepare it, and that he would be well paid if he gave it to you at that price, or less than a fifth of what he charged for it. So far as those not in the business of manufacturing these fertilizers can judge from a careful consideration of

the data to be obtained, they appear generally to be sold at a price which allows to the manufacturer a far more than a reasonable profit; and certainly sometimes, though it may not be often so, they are sold at such prices, as compared with their real value, that the transaction can rightly be called nothing else than a gross swindle.

Such overcharges and frauds are easy, in part, because there is nothing in the color, taste or smell, or in the appearance in any respect, of a fertilizer, to show whether it contains much or little phosphoric acid, or none at all, or much or little nitrogen. I might be met, just here, by the argument, that, as compounds rich in nitrogen often give off bad odors, therefore, the fouler the odor given off by a fertilizer, the richer it is likely to be in nitrogen. But the fatal insufficiency in this course of reasoning consists in the fact that there are a good many very bad smelling substances, and cheap ones too, that contain little or no nitrogen; and it is an easy matter, therefore, to make a fertilizer that shall have a strong, disagreeable odor, and yet shall contain no nitrogen, or only a quantity so small as to add but the merest trifle to its value.

The length of time which must elapse before a farmer can decide by his own experience in the field whether the use of a certain fertilizer is profitable to him, and the troublesome pains which must be taken in order to make such a decision perfectly satisfactory, are also circumstances which greatly favor the manufacturer in his practice of overcharging.

It is possible to ascertain the real value of a fertilizer in two ways, either by an actual trial of it in the field, or by a partial chemical analysis of it. Considering all the vicissitudes to which the crop is exposed, upon which the trial is made, a fair and satisfactory result may not be obtained without a repetition of the trial for two or three seasons; on the other hand, the results of the chemical analysis constitute quite as trustworthy data for estimation, or for mere comparison of values, as do the results of the field trial, if indeed they are not much more trustworthy. They show conclusively what there is in the fertilizer that has any value, and how much it is worth; and these results can be had in a few days.

It is safe to assert, then, that a profitable use can be made of the chemical examination of commercial fertilizers. I base the assertion not only on the course of reasoning just laid down, but also

upon the facts that this application of the chemist's skill has been found by experience elsewhere to be profitable. In Germany, where a greater amount of good results has been derived from the application of chemistry to agriculture than in all other countries put together, commercial fertilizers are most frequently subjected to the test of chemical examination, by competent chemists, and attempted swindles are very soon brought to light. I venture to say that in many localities in Germany, no intelligent farmer would think of using a superphosphate without having it examined by a chemist, if not every year, yet every few years.

And what is more, while in many parts of the country such provision is made that every farmer can have a sample of a fertilizer analyzed at very low rates, there are also laws by which the manufacturer is required to label every package of his fertilizer with a statement of the percentage of soluble phosphoric acid it contains, and of nitrogen also, or of whatever else of value he may claim that there is in it; and redress is provided for, in case any sample, taken by a farmer to a competent chemist, shall be found poorer in quality than was guaranteed on the label. Maine, famous the world over for at least one of her laws, for who has not heard of "the Maine liquor law," has a law similar in purport to the above, in regard to the commercial fertilizers offered for sale within her bounds. Connecticut has such a law, and there ought, by all means, to be one in this great State.

But even without any such law farmers could do something, especially by concert of action, for their own protection. It might not be profitable for a single farmer, using only a ton or two of commercial manures each year, to have samples of such as are offered for sale in his neighborhood examined frequently, in order to determine, not only which, if any, are comparatively worthless, but also which one is the best. But if there should be a dozen or two, or more such farmers, who, all together, would invest from $600 to $3,000 in a good fertilizer, if they were sure of getting one that would give them a reasonable return for their investment, it surely would be worth their while to expend a half of one per cent. or less for a chemical examination of what they intend to purchase at so much cost, and at no slight risk, provided they depend only on manufacturer's guarantee and recommendation, for guidance in deciding upon the comparative merits of the different brands of manure. The analysis of half a dozen samples could be made to

answer just as well for a score of farmers as for one; and when so many could unite together in paying for the work, the chemist might be well remunerated, while each farmer's share of the cost would be a mere trifle, in comparison with the advantage gained; for of three or four fertilizers offered for sale in a neighborhood one may be worth two, three or four times as much as another, while the same price is asked for all; the chemical analysis will show beyond a doubt which one that is.

Supposing that this idea is to be carried into execution by twenty or thirty farmers, or by some farmers' club, it is of the first importance that the sample selected should be a fair representation of that which is offered for sale; the best that the chemist can do is to give a true and faithful report of the analysis of what is sent to him. To this end, your representative, who is to make up the samples and dispatch them to the chemist, should go himself to the dealer, and take each sample from one of the packages of the fertilizer; for greater surety, it would not be amiss to take a little from each of several packages of the same kind of fertilizer; thus he might obtain six or eight pounds of each kind, out of which quantity, after mixing it thoroughly together, he would take from half a pound to a pound for analysis; this should be put in a stout paper bag, and this package again in another, and the label attached. All the samples should then be packed in a small box, and dispatched at once. Usually, all to be required in return will be the percentage of soluble and insoluble phosphoric acid, if the article is claimed to be a superphosphate, although it may be well to have the nitrogen determined also; but no account should be taken of the potash, unless it is specially claimed by the maker of the fertilizer that its value is due to a considerable extent to that substance.

When your return comes back, multiply each percentage by twenty, and you have the number of pounds of each of the valuable constituents of each fertilizer in a ton of it; then, taking the highest value per pound for these, that has been allowed by any good authority in this country, namely, those fixed by Mr. Goodale, Secretary of the Maine Board of Agriculture, and recognized in the statute of that State regulating the sale of commercial manures, values that are certainly high enough, and multiplying the number of pounds of insoluble acid by six, the number of pounds of soluble acid by twenty-five, of nitrogen by twenty-nine, and of potash by six, and adding all these products together, you will get a fair

estimate, in cents, of the value of a ton of the manure. This calculated value will not be likely in any case to come up to the price asked, even though estimated on so liberal a basis; but your best policy will of course be to buy that fertilizer whose calculated value approaches nearest to the selling price.

The cost of the analysis will depend upon the number of substances determined in each sample. The ordinary charges for each substance, such as insoluble phosphoric acid, soluble acid and nitrogen would be from $10 to $15.

FODDER.

The kind of raw material that naturally comes next for consideration, with respect to the practical value of its chemical analysis, is the fodder which, with the aid of a good soil, judiciously cultivated and supplied with plant-food, the dairyman produces for the support of his cows. This, although produced from a soil in which the non-volatile matter very largely predominates over everything else, and with the aid of manures in which the non-volatile matters also often greatly exceed the volatile in quantity, is itself in all cases composed mostly of volatile and combustible matter, and it owes its value as fodder almost exclusively to this. The material with which to make all this combustible substance has been derived by this plant largely from the air.

This combustible substance is composed, mainly, of four classes of substances, fibre, or insoluble non-nitrogenous substances, starch, sugar, etc., or soluble non-nitrogenous substances, fat, and albuminoids, or nitrogenous substances, this last class being particularly distinguished from the four others in that it contains nitrogen, while they do not.

These different substances have different nutritive functions and values. The albuminoids are the most valuable, in part because the most costly; every pound of albuminoids which the farmer stores in his barn in the fodder that he has harvested, has cost him more than the pound of starch, sugar or fibre; these albuminoids are the most valuable, also, because they have certain important nutritive functions to perform, for which no other class of substances can answer. The fat, starch and sugar are more valuable than the fibre, in part because a much smaller expenditure of the vital forces of the animal is required to assimilate them, and convert them into a part of its own substance.

Carefully conducted experiments have shown that in order to get

the most profitable results from the use of fodder, there should be, firstly, a certain amount of dry substance given to the animal; that is, supposing all the fodder supplied each day to be thoroughly dried, by exposure for a considerable time to the temperature at which water boils, the weight of this dried product should bear a certain proportion to the weight of the animal. Further, in this weight of dried fodder there should be a certain relation between the respective amounts, first, of the albuminoids or nitrogenous substances, second, the fat, and third, the soluble non-nitrogenous substances. It has also been determined that the relative proportions of these three substances should vary according to the purpose for which the animal is used, whether for draft, for milk or for fattening.

For instance, it appears to result from these experiments that for 1,000 pounds of live weight, a milch cow can daily use up profitably from 22 to 30 pounds of dry substance, and which should not contain less than 2.5 pounds of nitrogenous substances, nor more than 3.1 pounds; and it should contain also, from 0.8 to 1 pound of fat, and 12 to 15 pounds of soluble non-nitrogenous substances, the remainder of the dry substance consisting mainly of fibre, and non-volatile matters. It appears, further, on comparing the proportion between the nitrogenous substance and the sum of the soluble non-nitrogenous substances, and two and a half times the amount of fat, that there is a certain relation between these quantities which is most advantageous; it is that of 1 to from 5 to 6.

The reason for all this is, that while a supply of all these substances is essential to the health of the animal, and while some one of them can perhaps perform the function of another in the animal economy, provided the one is supplied in superabundance and the other is deficient in quantity, yet each class of substances is utilized to the best advantage, and most profitably, when required to perform only certain functions that properly belong to it. For instance, the costly albuminoids have certain important functions to perform, and, while nothing can take their place, they can serve the same purpose as the starch and sugar do, and they will be consumed in doing the work of the cheaper materials, if called upon to do so by reason of an insufficient supply thereof. If, by an injudicious system of feeding, you give your cows two pounds of nitrogenous substances with every six of non-nitrogenous, only about one pound of the former would be utilized by the animal for the proper purpose, while the other pound would go to make up for the deficiency of non-nitro-

genous nutritive matters; and your system of feeding would not be an economical one, because you could have supplied another six pounds of non-nitrogenous materials, at less than the cost of the one pound of albuminoids that was thus wastefully used for an unsuitable purpose. Again, supposing that for every pound of nitrogenous matter in the dried fodder of each animal there are ten pounds of non-nitrogenous; there are two or three pounds more of the latter than can be utilized, with the amount of nitrogenous material supplied at the same time; this excess cannot be converted into albuminoids; such a transformation is utterly out of the question. What can be done with it by the animal? She can use a part of it to make fat, but a part will be apt to pass off, unused at all, in the excrements. What goes into fat on the animal's carcass is, to be sure, not a total loss; but you are feeding the animal for the production of milk and not for the butcher; and, in that case, a system of feeding which results in less milk and more fat, is not so economical as one which, while it keeps the cow in a good condition, gets the largest possible yield of good milk for the cost of keeping it. The non-nitrogenous matter that goes into the manure, although it may go back on the land again, is yet as good as a total loss; it adds but a mere trifle to the value of the manure, for it contains neither of the three substances, phosphoric acid, potash or nitrogen, that render a manure valuable. Therefore, in this system of feeding, you have, with some trouble and expense, produced a certain quantity of a foddering material, and stored it up in your barn, only to give your animals the trouble of carrying it through their digestive organs and into the manure pile; and after all this trouble it is not worth carrying back to the field again; such a system is certainly not economical.

To make the most out of your foddering materials then, you must acquaint yourself with its chemical composition, and use a certain amount of care, so as to make up a daily ration in which there is the right proportion of straw, with its abundance of dry substance to give a suitable bulk to the food, of hay with its large proportion of dry substance also, and of non-nitrogenous nutritive substances, of grain, rich in nitrogenous matters, of roots, rich in sugar and starch, and of oil-cake rich in albuminoids and fat. With a ration thus carefully made up with a due regard to its chemical composition and the special needs of the animal, all the different kinds of foddering substances do the work in the animal economy for which

they are best fitted, respectively, and nothing is wasted. All good stock-feeders, without doubt, do this to a certain extent; but unless they have at least an approximately correct knowledge of the composition of the various materials with which they make up the ration, they must work somewhat blindly, and as is the case with all guess-work, are liable to fail widely of the mark.

But in order to accomplish all this, it is by no means necessary to send samples of all your stock of fodder to the chemist every year, for analyses of it. The chemical composition of each of the various kinds of fodder produced on the farm is about the same, when grown under ordinary circumstances. Well-cured clover hay always has about the same composition, if the growing crop is treated in about the usual way; so of meadow hay, turnips, oats, corn, etc. All of these articles of fodder have been carefully analyzed, and the results recorded. In Prof. Johnson's "How Crops Grow" there is a very complete and valuable series of tables, showing the ordinary chemical composition of the materials which the farmer handles in the course of his operations, including all articles of fodder. In Germany, where this idea of the advantage to be derived from a more careful consideration of the chemical composition of the rations of the stock seems to have been received with considerable favor by the agricultural community, little books are published, giving not only the composition of every article that can be used as fodder, but a number of tables so arranged, that at a glance, and with but little or no calculation, one can ascertain how much non-nitrogenous matter, or fat, or albuminoids, or dry substance, there is in any given number of pounds of any kind of fodder; with the aid of such tables, it is easy to make up a ration out of the greatest variety of materials, that shall have any desired composition with respect to the relative amounts of the different classes of nutritive substances contained in it.

But even with these tables to consult, there may sometimes be occasion to have special chemical analyses made; the composition of any one kind of fodder, though usually about the same, nevertheless varies somewhat with the season, soil, and mode of culture; and in case one should have a large supply of some one kind, but yet should have to buy something in order to carry the stock through till spring, a comparatively small difference in the chemical composition of this large supply might make a considerable difference in what it would be necessary to add to it, in order to make

up the kind of ration which could be most profitably fed. Or even if nothing need be added to the stock of fodder in store, yet, knowing more accurately the composition of some one kind which makes up a large proportion of it, the other smaller portion might be more economically used.

Suppose it to be a root crop, of which you have this large supply. There might be, in case the crop had received a good liberal culture on a good soil, an unusually large proportion of nitrogenous matter. You suspect this, knowing that with your treatment of the crop its quality is improved; and, if your suspicion is correct, you may have several hundred pounds more of the costly and valuable albuminoids, than would be indicated if you estimated it by the tables. There is nothing in the appearance of the root to show this, and no one can test the matter except an experienced chemist; if, by sending a sample for analysis, you have your expectation fully confirmed, you may save much more than the analysis would cost by buying, instead of fodder rich in nitrogenous matter, much cheaper articles that are rich in non-nitrogenous substances, and at the end of the year your animals will be in just as good a condition as if kept on a richer and more expensive fodder.

Let me illustrate these principles by an example, taken from a prize essay on stock feeding by Kuhn, director of the agricultural school at Halle, in Germany, an essay so well received by the German public as to have passed through three or four editions. As the example is taken only for illustration, I have not considered it necessary to give our current values, instead of the German prices in thalers, for the various articles of fodder mentioned; the thaler is worth about 75 cents.

It is supposed that fifty cows whose average live weight is about 950 pounds, are to be kept over winter, and to be stall-fed for the space of 200 days. The first step taken is to ascertain how far the stock of fodder in store will meet the demand. We have enough meadow-hay so that we can give each cow 400 cwt.; we have also 400 cwt. of good clover hay for each cow, of barley straw 100 cwt., of wheat straw 500, and of rye straw 1,200 cwt.; but having enough of these coarse materials without the rye straw, we will use that for litter. Of chaff, mostly wheat, we have enough for 400 lbs. for each cow, and of roots 5,000 cwt. We have also 2,500 bushels of potatoes; the price they will bring in the market is low, and it must

be carefully considered, whether it will be more profitable to sell them, than to feed to the stock.

As to the quality of our foddering materials, three-fourths of the meadow hay were stored in an excellent condition, while the remaining one-fourth was somewhat injured. The clover grew on a strong rich soil, and was moreover manured with wood ashes; it was cut just as it was beginning to bloom, and stored in the best condition; we feel justified in expecting it to contain a large proportion of nitrogenous substance; consulting the tables we find that this proportion may vary between 7.2 and 14.8 per cent.; we think our clover is almost as good as the best, and that we shall be safe in assuming that it contains 14 per cent. of albuminoids; for the same reason we allow for it 3.5 per cent. of fat and 38 per cent. of soluble non-nitrogenous matters. As to the good meadow hay there is no reason to suppose that it is any better than usual, and we take the average composition as given in the tables; upon the injured one-fourth we must set a lower value, and allow that it contains only 8 per cent. of nitrogenous substances, and, fat and non-nitrogenous substances, in corresponding proportions. The straw and chaff are of about the usual quality. As to the roots, finally, they are of a good size, but not overgrown, they were well manured and cultivated, and the season was propitious; as the supply in hand is large, and we think there is good reason to suppose that the crop is unusually rich in nutritive matters, it seems best to have positive knowledge in regard to the matter; we send a sample to the chemist, and his report of the analysis shows that the roots contain 1.5 per cent. of nitrogenous matters, instead of only 1.1 per cent. as usual, 0.35 per cent. of fat instead of 0.1 per cent. and 10.4 instead of 9 per cent. of soluble non-nitrogenous substances.

Now, with this certain knowledge in regard to the composition of one of our most important articles of fodder, we can go to work more satisfactorily to ascertain what sort of a ration we can make up for our cows, out of the supply of strictly foddering materials in hand.

The following table shows the composition of the ration:

	Dry subst.	Nitrog. subst.	Fat	Non-nitrog. subst.
4 lbs. Clover Hay.....	3.33	0.56	0.14	1.52
3 lbs. Good Meadow Hay	2.57	0.25	0.09	1.15
1 lb. Poor " "	0.86	0.08	0.016	0.24

7 lbs. Barley Straw.....	6.00	0.45	0.14	2 29
5 lbs. Wheat Straw.....	4.29	0.10	0.075	1.43
2 lbs. Wheat Chaff.....	1.71	0.09	0.03	0.64
50 lbs. Roots.....	7.30	0.75	0.175	5.20
Total.....	26.06	2.28	0.666	12.47

For various reasons it is considered best in the case of these cows that the dry substance in the ration of each one should be about 28.5 pounds, and that the quantity can somewhat exceed that with profit; that the fat should not be less than 0.8 of a pound, and may without danger of waste be carried up to 0.95, and that the soluble nitrogenous substances, the starch, sugar and gum, should amount to from 12 to 13 pounds.

Our ration therefrom is deficient in every respect, except as regards the soluble, non-nitrogenous substances. To make up this deficiency, we may use our potatoes. But we learn from the tables of the composition of the foddering materials that, in order to supply 0.57 of a pound of nitrogenous substance, the quantity needed for a suitable ration, we would have to use 28.5 pounds daily for each animal; and we doubt whether it is best to do that, because our stock of potatoes would be insufficient, and we should still have to buy something more, and because, also, in adding 28.5 pounds of potatoes to each ration, we should carry the amount of dry substance up to 33 pounds and over, which would be altogether too much.

What else shall we do? On consulting the markets, we find that we can buy rye bran for $1\frac{1}{3}$ thalers, or oil cake at $1\frac{2}{3}$ thalers per cwt., or rye itself at $1\frac{1}{2}$ thalers per bushel of 84 pounds. The cheapest course would appear to be to get the rye; we ascertain from the tables that an addition of $3\frac{1}{2}$ pounds of rye-meal to each ration would bring the proportion of nitrogenous substances up to 2.66 pounds, or a little above the lowest limit that was considered consistent with judicious feeding. Let us see what will be the composition of the ration in other respects:

	Dry subst.	Nitrog. subst.	Fat.	Non-nitrog. subst.
	26.06	2.28	0.67	12.47
3.5 lbs. Rye-meal.....	3.00	0.38	0.07	2.35
Total.....	29.06	2.66	0.74	14.82

The ration is certainly improved, but it is not quite what we would like to have; it will cost us 630 thalers for the 420 bushels of rye that will be needed.

It may be more economical to follow this plan than to pay more for a better ration. But it will not take long to calculate the cost of supplying the deficiency by the purchase of rye-bran or oil-cake. As 100 pounds of rye-bran contain 12.5 pounds of nitrogenous substances, 4.5 pounds will be required to supply the 0.57 of a pound of these substances that is needed to complete the ration in this respect. On making this addition, we have a ration whose composition is represented in the following table:

	Dry subst.	Nitrog. subst.	Fat.	Non-nitrog. subst.
	26.06	2.28	0.67	12.47
4.5 lbs Rye-bran.....	3.94	0.56	0.16	2.25
	30.00	2.84	0.83	14.72

As in the preceding case, we have too much dry substance and non-nitrogenous substance, but yet a very good proportion of both nitrogenous substance and fat; the ration is better than the other, on the whole; on reckoning the cost of the 450 cwt. bran that will be required, we find it to be only 600 thalers; after all, we were mistaken in our guessing, for by the use of bran we can get a better ration at a cheaper rate than by the use of rye-meal.

Perhaps, then, we may do still better by using oil-cake; at any rate, before we go into the market and make our purchase, we will calculate the cost of the quantity of this article of fodder that would be required. Oil-cake varies considerably in composition, and, like all other commercial articles, may be liable to adulteration. It might be well, if there were a number to combine together, to have some samples analyzed so as to know for certain what we buy. But still, the sample before looks good, and we will venture to assume for it the average composition. On that basis 2.4 pounds will amply make up the deficiency in albuminoids, and on adding this to our home ration we shall have a result represented in the table following:

	Dry subst.	Nitrog. subst.	Fat.	Non-nitrog. subst.
	26.06	2.28	0.67	12.47
2.4 lbs. Oil Cake.....	2.04	0.67	0.23	0.58
Total.....	28.10	2.95	0.90	13.05

This result leaves nothing to be desired. Everything is in good proportion, and the ratio of the nitrogenous substances, to the sum of the non-nitrogenous and two-and-a-half times the fat, is 1.5, also very good.

Now how much more money have we got to pay for this perfect ration, than for the good but still quite imperfect ones which we should get by adding rye-meal or bran to our home ration? In order to add 2.4 lbs. of oil cake to the daily ration of each animal, we shall have to purchase only 240 cwt., which will cost us but 400 thalers. The result astonishes us, and we resolve that we will never buy fodder in the future, without figuring our way beforehand to the best attainable result.

I might go on and continue the account of this illustration to the end, and give others that seem as interesting and instructive; but I have already wandered too far from the special subject of my lecture, and I have gone far enough to show that in the preparation of the food for your cows, the chemist's services can often be made profitable to you. And although no combination can be made, in order to cheapen the cost to each individual of the analyses of fodder produced at home, yet, as when several in a neighborhood wish to purchase fodder, there might be occasions when such a combination could be advantageously made.

In the examination of an article of fodder with reference to its use in making up a ration, the estimation of the albuminoids is of the first importance, and next, that of the fat. Nevertheless, under the circumstances which make any analysis at all desirable, the complete analysis, including the estimation of the total dry substances, and the non-nitrogenous substances, together with the albuminoids and fats, would appear to be of sufficient importance to justify the additional expense. For these estimations, severally, the charge will be from ten to twenty dollars each; for the whole analysis, about fifty or sixty dollars would probably be asked.

The sample of hay or straw for analysis, in order that it may fairly represent a large quantity of the fodder, should be made up of handfuls taken here and there from different parts of the pile, till 15 or 20 such portions are obtained; cut the whole quantity very fine with the straw cutter, mix the product together in the most thorough manner by stirring it over and over with the hands, and take out about a pound for the chemist. A fair sample of

about 5 pounds of potatoes, or 10 pounds of roots, picked from various parts of the pile, should be sent, in case such bulky articles as these, with a large proportion of water, are to be examined.

MILK.

I come now to the consideration of a substance which is both a raw material, and a manufactured product. Milk, while it is the raw material of the manufacturing dairyman, is the manufactured product of the dairyman farmer. The latter cultivates and manures the soil in order to get fodder with which to keep the machines in good running order, with the aid of which he manufactures the products of his soil into milk—which machines are his cows.

Milk, as all know, is composed mostly of water, holding in solution a certain very small amount of non-volatile matter, and a much larger amount of volatile nitrogenous matter, and some soluble non-nitrogenous substances, as sugar; so far as these substances affect its appearance, milk is nothing but a clear, transparent liquid; but, further than this, it holds in suspension very finely divided particles of fat that render it opaque, and give it its white or yellow color. Considered as a material for direct consumption, the non-volatile substances or the salts, and the sugar in it, are of great importance, for they are required in order to make the milk what it is, a perfect article of food. But considered as a raw material for further manufacture, the only ingredients of importance are the albuminoids and the fat, and the variations in the proportions of these substances are the only ones that affect its value essentially.

In one of the best works on chemistry, the average composition of milk is give as follows:

In 1,000 Parts.

Water	857
Casein	48
Albumen	6
Fat	43
Sugar	40
Non-volatile Salts	5

On looking over a large number of analyses, we find that the proportion of fat or butter may vary from 21 to nearly 100 parts in 1,000, and the casein from 20 to 60 parts.

Milk is so variable in composition, although not ordinarily to such an extent as just stated, and so easily adulterated, while, at the same time, its value, both as an article of food and for the manufacture of butter and cheese, is so much affected by these variations, that simple and easy methods of estimating the fat and albuminoids, such as any one with ordinary intelligence can carry out, have been very much sought after; hardly any special branch of practical chemical analysis has been more thoroughly investigated, in the course of the last few years. But, it must be confessed, a great deal still remains to be done, for no one of the methods yet devised is free from defects, nor have those which are best been compared with each other enough, so that we can decide which one of them all is least liable to error.

The method of estimating the fat or butter by measuring the thickness of the layer of cream deposited by a certain amount of milk, in a tall glass cylinder with a graduated scale on the upper end of one side, was very naturally one of the first to be used. It was based on the assumption that all milk, under the same circumstances, would deposit its cream with the same facility, and that the cream so deposited would always have the same proportion of fat in it. Careful trials of this method, made with different samples of milk, whose composition was determined by accurate chemical methods, have shown that it is untrustworthy. Baumhauer, in Amsterdam, examined 20 different samples of milk in this manner. Nos. 1 and 3 were found by chemical analysis to have, respectively, 2.7 and 3.5 per cent. of fat, while the cream guage indicated no difference between them. Nos. 5, 10, 15, 18 and 20 were found by the accurate chemical method to contain 3.3, 3.0, 3.9, 2.3 and 2.7 per cent. of fat, but the thickness of the layer of cream formed by all of them was the same. Evidently enough different sorts of milk do not, under like circumstances, deposit their cream with the same facility; and the inaccuracy of the method appears to be greater, the higher the column of milk through which the fat has to make its way to the surface.

Very much better results were obtained when the milk was set in shallow vessels, but two or three inches deep, from which the

cream was afterwards transferred to a slender glass cylinder with a graduated scale on its side, in which graduated cylinder the amount of cream produced by each sample of milk could be accurately measured. In Krocker's simple form of apparatus, devised for this purpose, the dishes in which the milk is set for the cream to rise are supported in iron rings attached to an upright stand; they taper down to a narrow orifice at the bottom, closed by a ground glass stopper, the long handle of which reaches up through the milk; on lifting this stopper, the milk under the cream flows off, and it is easy to mark the precise moment at which the cream begins to flow out, then to crowd the stopper into its place and close the opening till the graduated cylinder can be placed to receive the cream.

Krocker compared his form of apparatus with a cream guage of the ordinary construction, 18 inches deep, with the following results: Nos. 1 and 6, which contained, respectively, 3.3 and 3.18 per cent. of fat, gave by his method the same per cent. of cream, 12.5; by the older method, with the deep cylinder, they gave 11 and 12 per cent., and the milk which was poorer in fat gave 1 per cent. more of cream. Nos. 7. 10 and 11 contained also nearly the same proportion of fat, namely, 3.43, 3.14 and 3.23 per cent., respectively; by Krocker's method they gave the same (12.4) per cent. of cream, but by the other method, 12, 8.5 and 16 per cent.; this last result furnishes another striking proof, in addition to those already given of the unsatisfactory character of that method of testing milk. It was found, further, that in Krocker's apparatus the cream would rise in less than half the time that had to be allowed when the deep cylinder was used.

But even this method, though so much better than the older one, leaves much to be desired for accuracy. For instance, Nos. 10, 8, 5 and 11 containing nearly the same proportion of fat, namely, 3.14, 3.15, 3.18 and 3.25 per cent., respectively, gave of cream by Krocker's method 12.4, 13.25, 12.5 and 12.4 per cent. With the deep cylinder, however, the case was so much worse that the new method seems excellent in comparison, for by that method 8.5, 13, 12 and 16 per cent. were obtained.

We come to consider next the method of testing the goodness and purity of milk, that is based upon the estimation of its density, and for which the hydrometer is used, or, as the instrument is usually called when arranged with a scale specially adapted for this purpose, the lactometer, or better still, the lacto-densimeter. It is not

necessary for me to stop to explain the principle of the operation of this simple and useful instrument, with which you are all so familiar. You all know that the richer a sample of milk is in casein, sugar and inorganic salts, the greater its buoyant power, and the less the depth to which the hydrometer will sink in it, and that, on the other hand, the richer a milk is in fat the greater the depth to which the instrument will sink; and that there is a certain mean level between these opposing tendencies, at which it stands in pure milk. The results obtained with the lacto-densimeter are, as all know, liable to error, not because of any imperfection in the instrument, or the principle of its operation, but because of the complex composition of the milk. When water is mixed with but one substance, as alcohol, or sugar, the richness of the solution in that one substance can be as accurately, as it can be quickly ascertained with the aid of the hydrometer; but when, instead of only one substance, there are several mixed with the water, that affect its density, and especially when some of these substances make the mixture less dense, while others make it more so, the liability to error in estimating the proportion of any one of the substances with the hydrometer becomes very serious.

This being the case with milk, it can readily be believed that, as has been proved by experiment, a fresh milk, poorer in fat than another, may show a better grade with the lacto-densimeter; that, as Voelcker has shown, an addition of from one to ten per cent. of water to fresh milk may escape detection with this instrument, and that skimmed milk, with 1-11 of water added to it, should show the same richness in fat, when tested with the lacto-densimeter alone, as fresh, unadulterated milk.

The unsatisfactory character of this method of testing milk appears most plainly, when it is attempted to test the milk of several cows separately; when such a series of tests has been combined with estimations of the fat by accurate chemical processes, the results obtained with the lacto-densimeter have been found to be entirely untrustworthy. What the dairyman wants, however, is not a means of testing the milk of single cows, but the mixed milk of several cows of a herd, such as is brought to him by each of his patrons; in this case the hydrometer is generally considered to yield much more satisfactory results. In such a mixture of the milk of several cows, the peculiar character of the milk of each cow by itself, which affects the rising of the cream in such a

singular manner, and consequently makes the readings of the cream-guage erroneous, and the proportions of sugar, casein and fat, peculiar to each kind of milk, all become so merged together, that the mixture is supposed to be tolerably uniform in its character; and any important departure from this uniform standard shows itself at once when the milk is tested with the lacto-densimeter.

Quevenne, as chief apothecary to the hospitals in Paris, had occasion, during a number of years, to test the quality of milk supplied to the hospitals, and to the city. He concluded, as the result of these long continued and careful examinations, that by the use of a properly constructed hydrometer, the readings of which were corrected for the temperatures at which the tests were made, combined with the use of the cream guage in doubtful cases, a sufficiently trustworthy estimate of the purity of the milk could be made, as well as an approximate estimate of the extent to which it was watered, in case such adulteration was detected.

Quevenne's instruments, and tables for correction for the temperature, are extensively used at least in some parts of Europe. I have among my books a little pamphlet from Berne, Switzerland, on testing milk, in which the satisfactory results obtained with them are described; after a little experience in the use of the lacto-densimeter, it is said to be rare that there is any necessity for using the cream-guage, except to confirm suspected cases of watering; and the evidence of adulteration furnished by these tests is considered as sufficient ground, without further examination, for confiscation of the milk.

The method of using the instruments is pretty much the same as that described for the use of the lactometer and cream-guage by Mr. Willard, in his work on butter making, or by Mr. Arnold in the last annual report of this Association. The glass cylinder is held in an inclined position while the milk is poured down its side, so as to prevent the formation of a layer of foam on its surface; the lacto-densimeter is sunk in the milk up to the 30th degree, and then allowed to take its own level; after reading this level on the graduated scale, and removing the instrument, a thermometer is immersed in the milk, and the temperature noted after the space of one or two minutes; then, on the accompanying table for the correction of the temperature, where the vertical column against the observed temperature crosses the horizontal column against the observed density, the number measuring the real richness of the

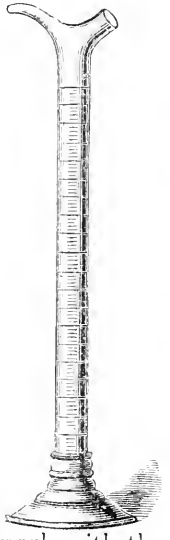
milk is found; thus, if the reading on the scale of the lacto-densimeter was 32 and the temperature 77° Fahr, the real richness of the milk is 34.7; or if, with the same reading on the lacto-densimeter, the temperature was 68° the real richness would be represented by 33.3. If this corrected reading falls between 29 and 33, the milk is regarded as pure; if between 29 and 26, then the milk has been diluted with 1-10 its bulk of water, and so on; if it is desired to carry the test still further, the same cylinder, now to be used as a cream-guage, is carefully filled up to the zero mark, and set aside for 24 hours. The thickness of the layer of cream is then noted, the cream carefully taken off, and the lacto-densimeter again plunged in; the level at which it stands is again noted, the temperature of the milk ascertained with the thermometer, and on another table, arranged for skim-milk, the real richness of the milk will be found, in the same way as in the case of the whole milk; if the result falls between 32.5 and 36.5, pure skimmed milk is indicated; if between 32.5 and 29, 1-10 of water has been added, and so on. The two results, obtained with whole and with skimmed milk, should confirm each other.

If this correction for the temperature is not made, the milk should always be at as nearly the same temperature as possible when the lacto-densimeter is used. I would urge the importance, in this as well as in all other respects, of the careful observance of a rule that we follow in the chemical laboratory, especially when working with processes of analysis which, like this, are liable to error; the rule is to conduct the process, every time we use it, in as nearly the same manner as possible. Differences in temperature alone will cause variations, not only in the density of the milk, but in the readiness with which the cream will rise, as well as in the thickness of the layer occupied by the same amount of cream; therefore, the temperature of the different samples of milk should also be as nearly the same as possible, while set for cream to rise. Voelcker recommends, as a temperature at which the cream rises readily enough, and one that is easily maintained, 62° Fahr. The cream-guage should always be as carefully cleaned as any of the utensils about the factory; and, considering that some liability to error attends this method of testing milk, even when executed with care, the same result, indicating that some particular patron tampers with his milk, should be obtained more than once before taking any action in the case. It would be well, also, to keep a

careful record of all tests made, so that reference can be made at any time to the past character of any patron's milk.

It should be remembered, further, that the more the milk is shaken up, in the course of its transportation to the factory, the less readily it deposits its cream, and that, therefore, one patron's milk may appear to be poorer than another's when tested with the cream guage, only because it has been carried further, or over rougher roads.

Another important method for testing milk is known as Vogel's Optical Milk test. It is easily and quickly executed, and if it can be perfected, as it seems to me it may be, so as to make it equal or superior in accuracy to the combined test with the hydrometer and cream-guage, it would deserve to be generally adopted. The method depends upon the principle that the richer a sample of milk is in fat, the less of it will be required to make a thin layer of water so opaque that a light cannot be seen through it. To apply this principle according to Vogel's method, a measured quantity of water is put in a small vessel, or test-glass, with parallel glass sides, the inner surfaces of which are only 2-10 of an inch apart, and this vessel is placed at one end of an oblong wooden box, at the other end of which, and about 18 inches distant, a burning candle is placed against a dark back-ground; the end of the box at which the test glass is placed is so cut out to fit the face, that while an observation is taken all side light is shut off from the eye. The milk to be tested is put in a graduated glass tube, provided with a small opening at its upper end, so that its contents can be poured out drop by drop, or faster, as may be desired. We will suppose that the graduation, like that of all the graduated vessels generally used in the laboratory, is on the basis of the French system of measures, and marks cubic centimetres.



To perform the test, exactly 100 cubic centimetres of water, or about 6 cubic inches, are put in the test glass, and the graduated tube is filled to the zero mark with the

milk; then three cubic centimetres of the milk are poured into the water, and the mixture of milk and water is well stirred with a glass rod; then, setting the test glass at the end of the box, and applying the eye close to the outer glass, it is observed whether the light can be seen; if it can be, ¼ or ½ a cubic centimetre more of milk is added from the graduated tube, and after stirring well, another observation is taken, and so on, till the water is rendered entirely opaque; then the amount of milk required is read off on the scale of the graduated tube, and the corresponding richness of the milk in fat is given in a table calculated for the purpose. After a little practice the whole analysis can be executed in three or four minutes, even to the cleaning of the apparatus to have it ready for another trial. Kuhn, in his prize essay on stock feeding, from which quotations have already been made, says that, as he has proved by his own experience, this method enables one in a short time, and with but little trouble, to determine the fat in a large number of samples of milk with accuracy.

The method has been very highly commended for its accuracy by other good authorities; but some do not get such good results with it. There appears to be reason to hope that a simple, and at the same time perfectly trustworthy, practical method for testing milk may be developed out of it, and, indeed, I am not sure but that it is more to be trusted, even as it stands now, than the methods commonly used.

It is not worth while to notice still other short methods which have been devised for testing the purity of milk; for one reason or another, no one of them is what we want, nor does any one give promise of better things.

The proportion of casein in milk is of as great importance to the dairy interest as that of the butter; it may vary, as already stated, when the milk of different cows is considered, from less than two to over six pounds in an hundred; but, in the mixed milk of several cows of a herd, it is probable that the variation is small, perhaps hardly large enough to make a test worth the while, even if there were any that could be applied; but in regard to this we need more data. At any rate, however, even if a test could be profitably used, there is no simple, short-hand process of estimating the casein; no one but a skilled chemist can do it, and I presume he would charge fifteen or twenty dollars for the work. You would not, therefore, think of having recourse for his services,

excepting in some extraordinary case, involving a considerable amount of money.

Concerning the sugar, it cannot be easily estimated except by a professional chemist, or by the use of somewhat expensive apparatus; and it has no such value as to warrant the trouble or expense of its determination.

In regard to the salt that you use, you quite properly depend upon the reputation of particular brands. Its purity, and fitness for the uses to which it is put are easily tested by the chemist, and the cost of the analysis would vary from five to tweny-five or thirty dollars, according to the completeness of the analysis desired.

As to the annatto, since the coloring matter is composed entirely of organic or volatile matter, an estimation of this furnishes an approximate test of its purity; but, as it may be adulterated with starch or other likewise volatile substance, the test is not altogether a safe one; it does not necessarily follow, that because a sample of annatto is rich in volatile matter, it is also rich in coloring matter. This coloring matter itself cannot be estimated without considerable trouble. The services of a chemist would not therefore be resorted to here, unless in unusually important cases.

It is not necessary for me to say, except by way of completing the treatment of my subject, that the value of a sample of butter, or cheese, is not estimable by a chemical analysis. Nobody would pay a farthing more for a pound of butter, or a piece of cheese, with a label attached to it showing the result of even the most complete chemical examination that could be made. In fact, no one would buy it at all, unless he could taste of it, or know who made it. The skilled chemist, with all the appliances of a good laboratory at command, especially if he can readily resort to a well conducted factory, or creamery, and a good dairy farm, for his materials for examination, or to have his experiments tried on a larger scale, may contribute much to the knowlege of the principles involved in the processes of manufacturing dairy products; and he may thereby contribute to their improvement, either by enabling the manufacturer to obtain larger and better products at less cost, or showing him how to avoid the evils which now so often do him great harm. I should expect much from such a union of practice with science.

A few words more and I am done. The prices of chemical analyses which I have given in the course of my lecture are the

usual chemist's prices, and perhaps even lower than some would charge. They are very high, but, considering the comparatively small demand for such work, they cannot perhaps be put much lower by those competent to do the work, and who make it their special business. Manufacturers can afford to pay them; but they are altogether too high for farmers and consumers generally on a small scale; and if there were no other possible resort on the part of the farmer, or dairyman, than to the professional consulting, and analytical chemist, I should not have held it worth the while of this Convention to spend an hour of its valuable time, in the consideration of the practical value of chemical analyses of the dairyman's raw materials, and manufactured products. But I think there is another resort.

In England, membership of the Royal Agricultural Society, or in Scotland, of the Highland and Agricultural Society, entitles one to the privilege of having agricultural chemical analyses, at rates a half or three-fourths lower than these I have given. In Germany there are thirty or more agricultural experimental stations, at each one of which an able chemist and one or more assistants is placed, and at many of these institutions agricultural chemical analyses are made for farmers at very low rates. In this country most of the States have their agricultural colleges, at each of which is a chemical laboratory, with all the necessary means and appliances for such analyses as may be useful to the farmer. Each one of these colleges should stand in a similar relation to the farmers of the State in which it is located, to that in which those experimental stations do to the farmers of their respective neighborhoods, or that the great English and Scotch Agricultural Societies stand to their members. Any farmer or dairyman in the State, or any community of such, would then be enabled to procure chemical analyses of raw materials, or manufactured products, or chemical advice in regard to his operations, at such rates as could well be afforded, and of a scientific man presumably well acquainted with his profession, and interested mainly in the promotion of the agricultural interests of the State.

The great mission of these agricultural colleges is to improve the agriculture of the whole country. In the way just now indicated, as well as many others, they can contribute much to the attainment of this most desirable end, while still fulfilling their

main duty of educating young men for the business of agriculture, and its associate arts.

TABLE

For estimating the per cent of butter in milk by Vogel's Optical Milk Test.

Cub. cwt. of milk Required.	Per cent. of Butter.	Cub. cent. of milk Required.	Per cent. of Butter.
2.50	9.51	6.00	4.09
2.75	8.73	6.25	3.94
3.00	7.96	6.50	3.80
3.25	7.41	6.75	3.66
3.50	6.86	7.00	3.54
3.75	6.44	7.25	3.43
4.00	6.03	7.50	3.32
4.25	5.70	7.75	3.22
4.50	5.38	8.00	3.13
4.75	5.13	8.25	3.04
5.00	4.87	8.50	2.96
5.25	4.66	8.75	2.88
5.50	4.45	9.00	2.80
5.75	4.26		

TARIFF OF PRICES

For chemical analyses in the Agricultural Chemical Laboratory at the Cornell University.

FERTILIZERS.

For the estimation of sand and other worthless matters	$3.00
Total volatile matter	3.00
Moisture	3.00
Total phosphoric acid	8.00

(The proportion of *insoluble* acid in this total amount can be ascertained by subtracting from it the per cent. of *soluble* acid, estimated as below.)

Soluble phosphoric acid	$6.00
Potash	6.00
Nitrogen	8.00

FODDER.

Total dry substance	$ 3.00
Albuminoids	8.00
Fat	6.00
Soluble non-nitrogenous substance	10.00
For these four estimations together	24.00

This scale of comparatively low charges is not applicable to the case of persons living out of the State of New York, or of persons engaged in the manufacture or sale of fertilizers. It is intended for the benefit exclusively of farmers and dairymen residing in the State.

The money in payment for the analysis must accompany the sample, and all charges for carriage be prepaid.

Make up the samples as directed in the foregoing address, and direct the packages to Professor G. C. Caldwell, Chemical Laboratory, Cornell University, Ithaca, N. Y.

AN ADDRESS

DELIVERED BEFORE THE AMERICAN DAIRYMEN'S ASSOCIATION, AT UTICA, N. Y., ON

WEDNESDAY, JANUARY 10TH, 1872,

BY

X. A. WILLARD, A. M.,

Of Herkimer County, New York,

LECTURER AT CORNELL UNIVERSITY AND AT THE MAINE STATE AGRICULTURAL COLLEGE.

CONDENSED MILK MANUFACTURE.

ORIGIN AND EARLY HISTORY OF MILK CONDENSING IN AMERICA.

The history of experiments for condensing milk in America dates back to 1846. Possibly the idea of reducing milk to a solid may have occurred earlier in Europe, but if experiments were made in that direction they obtained no success, or at least were of no practical importance. For many years preparations under the name of "Dessicated Milk," "Milk Powders," and "Milk Essence," have been put upon the market, but they were too imperfect to meet the conditions required for general introduction. They were articles prepared from milk, and not the actual milk.

It became evident at an early day that if milk could be

eliminated simply of its water, leaving the other constituents unimpaired, unaltered—in other words, if milk could be converted into a solid, so as to be easily kept for long periods, and then by the addition of water could be brought back again to its original consistency and flavor, such form of milk would prove a boon to consumers, and must find a ready sale if put upon the market at reasonable prices. To Mr. Gail Borden, of White Plains, New York, must be awarded the credit of essentially accomplishing these results. It is true his milk is not reduced to a solid or dry state, but three quarters of its bulk in water have been eliminated, while the other conditions are very perfectly met, and in the present form it is better adapted to the manifold uses and wants of consumers than if it were in a dry state. The history of Mr. Borden's labors and ultimate success has been well portrayed by a writer in the MILK JOURNAL, from which I quote, correcting the errors and giving dates as related to me by Mr. Borden.

It is affirmed that "all the brands of good, or even fair quality now sold, are prepared substantially under the system originated by him (Borden.) As long ago as 1849 he began his experiments, simultaneously with others whose aim was the preservation of meat. It may be mentioned here that in the London Exhibition of 1851 the Council Bronze Medal was awarded to Mr. Borden for his meat biscuit. He did not at this time exhibit his condensed milk. It was not until about 1853 that he himself arrived at the conviction that he had obtained the quality he had been seeking. Meanwhile he had expended energy, time, and quite a fortune in his experiments, for he at length saw that to experiment to advantage, a large amount of material, involving much expense, must be used in each instance.

At an early stage of his experiments he decided that milk could not be preserved in a dry form as "dessicated," or "powdered," or "solidified," but must be left in a semi-liquid state. That some preservative agent must be added, and that nothing but water must be eliminated also became apparent.

The result is that condensed milk, as known to the trade and consumers, consists of milk from which only water has been taken, and to which nothing but sugar has been added, the product being of the consistency of honey, and by a dilution in water reconvertible to milk itself, somewhat sweetened. It may be stated in this connection that all the dry preserved milks require to be

dissolved in hot water while the condensed milk, prepared under the Borden system, readily dissolves in cold water.

By 1861 Mr. Borden had quite extensively introduced his article, and four or five factories were in operation, capable of producing in the aggregate, five thousand cans, of one pound each, per day.

During the war of the Rebellion large quantities were required for the Northern armies, the officers and many privates purchasing it of the sutlers, while the hospitals were supplied by the Government and the various Christian and Aid Societies. This gave an impetus to the trade, at the same time that shipping demand steadily increased.

About 1857 Mr. Borden put upon the market for city use, what he calls *Plain Condensed Milk*. This is prepared in the same way as the other, except that no sugar is added, and it is not hermetically sealed. It will remain sound from one to two weeks according to the temperature in which it is kept, and it is so convenient as well as economical that it is stated that now a large quantity of the milk used in New York City is of this kind.

With the end of the war and the dissolution of the armies the demand for sugared condensed milk fell off and the manufacturers who had been stimulated to too great a production turned their attention to this *Plain Condensed Milk*."

We have no means of estimating the present extent of the manufacture of condensed milk in the United States. For this we must wait for the returns of the census of 1870. However, we know that the capacity of the factories on the Hudson, in Connecticut, Pennsylvania and Illinois, is not less than five hundred cases of four dozen one pound cans per day, equal to eight million, five hundred thousand pounds per annum. It may be stated that one pound of the condensed milk is equivalent to three or four pounds of crude milk.

In 1865 an American gentleman who had noted the advantages of the article in the American army during the four years of the war, became resident in Switzerland in the capacity of U. S. Consul. Remembering the cheapness and richness of Swiss milk, the cheapness of labor and other facilities afforded in that country, he conceived the idea of preparing condensed milk in Switzerland.

He communicated his views to a gentleman late of the U. S. Patent Office, who visited several factories in America, producing

the condensed milk under the Borden patent, where he learned the art of manufacturing the milk under the Borden process, and commenced manufacturing the same in Switzerland. The Swiss condensed milk has always been made under this process, and from what I can learn, the manner of obtaining information relating to the process was not such as Mr. Borden approved.

The ultimate success of this project has abundantly proved the soundness of this Consul's conception. He promoted the *Anglo-Swiss Condensed Milk Co.*, the extent of whose present business is set forth in the following extract from the "Grocer" of Dec. 31, 1870. The facts seem to have been compiled from statistics procured at the Board of Trade, which were doubtless obtained from the Report of the British Legation at Berne:

"In the Canton of Zug there has of late grown up a new mode of preserving milk, which, owing to the good pasturage of that locality, is very excellent in quality. In the Commune of Cham the *Anglo-Swiss Condensed Milk Co.*, with a capital of $60,000, employ about sixty operatives in their factory, the tall chimney of which may be seen by the railway traveler passing over the line from Lucerne to Zurich. The number of cows hired for the year is 1,440, and the average amount of condensed milk prepared daily during three hundred and sixty-five days of the year—as it is necessary to include the Sundays—is one hundred and ten cases of four dozen each of one pound cans; these equal one million nine hundred and twenty-seven thousand two hundred cans, as the product of the year.

The price of crude milk is about two cents (1d) per quart, and the daily cost of the cans made at this establishment amounts to £16 10s or a trifle over 1½c. for each can.

About one-half of the produce is sent direct to London, where one-half of this is consumed, while the remainder goes for ship-stores, is exported to the colonies and sent to the provincial towns of England. The half of the product not sent to London is distributed over Germany, and there is some demand from France and Russia. It should be remembered that this Company was the first in Europe to introduce condensed milk to family use. Until its advent the article was known only for ship-stores and colonial consumption. By extension and systematic advertising, and through the boundless energy which characterizes your business Yankee, this Company has received a large demand for ordinary family consumption, not

only in England, but also in Germany and Russia. In this respect its success may be largely attributed to the fact that Baron Liebeg and other authorities on questions of food, supported it heartily from the first, and allowed the patronage of their names for publication. Its success led naturally enough to the springing up of competition companies.

These have been established at Gruyeres and half a dozen other places in Switzerland, in Bavaria, in Holstein, in Ireland and in England. But failing to produce a standard quality, and wanting in *prestige*, they have nearly all ceased to manufacture.

All now known to the London trade are the "Anglo-Swiss," Mr. Newman's "Irish Condensed Milk," at Mallow, near Cork, and the "English Condensed Milk Co.," whose works are at Aylesbury, Buckinghamshire. The two last put their milk in the market during the year 1870, and it is stated upon good authority that neither the Swiss nor the English Company has lately been able to supply the call for their products."

PRE-REQUISITES.

I have now given some general features in the history of condensed milk manufacture, and before entering upon details of factories and the process of manufacture, the essential requisites for success may be discussed. In Mr. Borden's early experiments, and indeed up to within a few years past, the nature and cause of a peculiarly bad behavior in milk from time to time were imperfectly understood. Under certain circumstances and conditions the milk could be readily handled, and gave no trouble in its manipulation. When in this state comparatively inexperienced operators, men who simply followed a set of rules, with little or no knowledge of principles, were enabled to turn out a good product, whether it was butter or cheese. Sometimes these conditions would continue for days, for weeks, or for months; but there was no reliability of its continuing for any specified time, or indeed in different localities during the same time. The milk might be easily worked one day, and the next would refuse to be controlled under ordinary treatment. The fault was at first supposed to originate in some want of cleanliness either at the factory, or among those who produced and delivered the milk. This was a part but not the whole trouble.

The importance of cleanliness, and what seemed to many to be "an absurd, fastidious neatness," became apparent to Mr. Borden at

an early stage of his investigations. He therefore instituted a set of rules for the government of dairymen in the care and management of milk; and as he bought only such milk as would pass the closest scrutiny of an expert, he was able after a time to enforce an observance of his printed regulations among dairymen. I shall presently refer to these rules and give them in detail, because they strike home to some of the leading principles for obtaining good milk, and they are such as should be a guide to dairymen generally.

He adopted also the practice of cleaning and steaming at the factory his patrons' delivery milk cans, because he feared, and with good reason, too, that this work might not be properly done at the farm. But when farmers had become educated, and all his conditions of cleanliness had been observed and carried out to the letter, milk not unfrequently came to his factories, which, though apparently perfect, or at least so perfect as to pass the rigid scrutiny of his experts, was in a condition that rendered it impossible to be converted into a good product.

The reason for this was not of easy solution, and it has been the cause of heavy losses and the closing up of factories altogether—factories not under Mr. Borden's immediate supervision.

It may be observed here that good condensed milk is more reliably clean and healthy than most milk that goes to city consumers. Dirty milk, milk foul with the drippings of the stable, cannot be condensed into a clean-flavored product. The success of the condensing factory depends entirely upon the ability to put a fine flavored, perfect article upon the market. The milk must be uniformly good. An inferior condensed milk is more readily detected than an inferior article of cheese. At least, imperfections in cheese may be tolerated and the article may find a place in the market, but a factory sending out imperfect or badly flavored milk, must soon cease to be remunerative, and must inevitably close its doors. To attain any success in this business there is an absolute necessity for clean, healthy milk in the first instance, and when a knowledge of this fact becomes familiar among consumers, condensed milk must take the place of the vile fluid under the name of milk, which is now hawked about in all our leading towns and cities.

And it may be well to warn those who propose to enter upon condensed milk manufacture, that more than ordinary difficulties lie before them. In the first place arrangements must be perfected for obtaining good clean healthy milk and this imposes a sort of edu-

cation upon those producing milk of the greatest importance, and and which, at least in the United States, does not generally obtain. This may be properly discussed under the head of the

FUNGI THEORY.

I have said that farmers need to be educated in the production of milk, to be so well grounded in a knowledge of facts and principles that a high moral responsibility shall obtain.

I have no Utopian theories for regenerating the world, and I have no hope but there will always be more or less bad men, even among dairymen, but I have faith to believe that most farmers when they know a thing to be morally wrong—when they are convinced that right pays best, will generally choose the latter. I assume that no fair minded man will go deliberately to work administering poison to his domestic animals to make their meat bad and unwholesome, when there is no reason to hope that such meat will sell in market for any more than sound meat, while there is probability that it must sell for less, or be a total loss, while at the same time there is the fear of detection and of being held in the estimation of his neighbors and community as a knave and a cheat.

Why then should farmers who have the means at hand for making good milk persist in making that which is bad and unwholesome, if it be not from a lack of knowledge in regard to principles? It is not sufficient to be *told* that he is making bad milk, the *reasons* must be given plainly and the conviction firmly established in his mind as to the truth of the principles enunciated. Then with this knowledge and conviction before him by day and by night, his moral sense is brought into action, and permanent improvement may be expected.

The investigations of Hallier and Pasteur with the microscope have explained the nature of causes in operation to change milk from its normal condition, or render it filthy and unwholesome. They show that this state is brought about by living organisms—that these pervade the atmosphere, and the germs absorbed in the milk from this source multiply and increase with wonderful rapidity, and take complete possession of the fluid, changing it into their own nature. The germs from cesspools, from decomposing or putrid animal matter, when introduced in the milk, carry their own peculiar taint, and by their growth and multiplication soon convert the milk into a filthy putrifactive state similar to that of the substance from which they emanated.

"The micrococcus, for instance," says Professor Caldwell, "appear only in substances rich in nitrogen, but when it does appear, no matter from what fungus it may come, it causes putrifaction. The cryptococcus not only causes the particular kind of decomposition called alcoholic fermentation, but appears only in solutions that are fit for that kind of decomposition," and so on.

The wonderful rapidity with which these fungi produce new cells, each one of which can act as a starting point for new and distinct growth, also increases their power of making their influence for good or evil to be felt everywhere.

"The Penicillium Crustaceum can run through its whole course in forty-eight hours at the most, at a temperature of 50° to 60° Fahr., and produce a new crop of several hundred spores for each old one; and in forty-eight hours more, each spore of this crop of several hundred will produce several hundred more, and so on. At such a rate of multiplication it would take but a few days to reach numbers too great for an adequate conception.

And what is more, this is not the only way, nor even the most rapid way, in which the Penicillium can propogate itself. A Penicillium spore will, in the course of an hour, at a moderately elevated temperature, produce from 20 to 100 micrococcus cells; each one of these cells will sub-divide into two in another hour, and so on. At this rate of increase, we should have, at a low estimate of fifty cells from one spore to start with, four hundred million micrococcus cells from this one spore in twenty-four hours."

Again he says, "From the moment the milk leaves the cow, the work of the fungi commences. They begin to increase, and simultaneously the milk begins to change, both operations going on with a rapidity that varies according to the circumstances of the temperature and exposure, and never ceasing entirely till the milk or its products are digested in the stomach, or have putrified and decayed in the air, producing results that vary according to the product, whether butter or cheese, or simply the milk itself, and what is very important and more pertinent to my subject, according to the kind of fungus that gets a foothold in the substance. The elements of fungi that are already in *pure clean milk*, to begin with, or that are added in the rennet, (when cheese is to be made,) appear to do no harm, but on the contrary, by their legitimate growth and action on the substance in the midst of which they find themselves, to

bear at least an important part in the elaboration of the very principles which give the final product its savor and its value.

"But the case is quite different in the case of such fungi as are introduced from without, and which originate in *putrid matter* of any kind; their whole influence is harmful in a high degree, and so readily can these minute germs make their way anywhere and everywhere, that if the air containing them in unusual quantity *is inhaled by the cows, their milk will be infected before it leaves the bag.*"

We find this consistent with numerous well authenticated facts. Milk from cows inhaling bad odors has been found to be tainted and incapable of being made into good cheese. The fact was first brought to notice by Mr. Foster, of Oneida, whose herd of cows inhaling the emanations from the decaying remains of a dead horse caused their milk to be unfit for making cheese; and not only the milk from the cows inhaling the odor, but that from a large number of other cows, when mingled together in the cheese factory vats. All the circumstances and facts concerning the case were so carefully noticed and investigated that it left no doubt as to the cause of the tainting of the milk.

Repeated observations by members of the American Dairymen's Association establish this principle beyond peradventure.

Again, I have seen numerous cases where the milk was tainted from cows having passed through sloughs of decomposing vegetable matter. Particles of dirt adhere to the udder, or other parts of the animal, and becoming dry some of the dust perchance falls into the milk during the milking, thus introducing germs which make rapid work in decomposing and putrifying good healthy milk. A most notable example of this came under my observation while on a visit to the cheese factory of Mr. L. B. Arnold of Tompkins County, in 1870. When the milk was received at the factory there was no reason to suspect taint from any particular dairy. The delivery from the several patrons went into the vat together, and was set in the usual manner with rennet. But during the process of heating up the curds a most intensely foul and disagreeable odor was emitted. The cheese maker sent for Mr. Arnold and myself and we went down to the factory together. We found the curds then about half scalded and were giving off a stench exceedingly offensive,—a smell like that coming from a nasty mud hole stirred up and exposed to the air in hot weather.

There was no mistaking the peculiar odor, and I suggested at once that some of the patrons were allowing their cows to slake their thirst from stagnant, filthy pools. He afterwards traced the milk to its source, and found the trouble to come from one patron, who allowing the cows to cross a narrow slough, when particles of mud adhering to the udder and becoming dry, the dust entered the milk during milking, had introduced a class of fungi, which by their multiplication had spoiled the milk.

The patron had meant no harm. He had taken every precaution so far as his knowledge extended for the delivery of good milk, and on correcting this fault the trouble ceased.

Another case is in point and which occurred during the past summer, 1871.

Professor Law, of Cornell University, gets his supply of milk from a "milk man." One day, during the hot weather, he observed a peculiar ropy appearance in the cream which had risen on the milk. He examined it under a powerful microscope and found it filled with living organisms of a character quite foreign to good milk. He immediately called upon his milk-man to enquire concerning his management of stock and general treatment of milk, with a view of accounting for the trouble. There was no fault discovered at the dairy-house or in the milking or general treatment of the milk, but on looking through the pastures he found that the cows, for lack of clean running water, were compelled to slake their thirst for the most part from a stagnant pool. This water he examined under the microscope, and discovered the same class of organisms as those in the cream. He then took some of the blood from the cows, and examined it under the glass, when the same organisms made their appearance.

He next obtained a specimen of good milk—milk which on examination was free from animalculæ—and into this he put a drop of water from the stagnant pool. In a short space of time the milk developed an infinite number of these living organisms, and became similar in character to the milk obtained from his milk-man.

He examined the cows and made the usual thermometer tests for determining health and disease in animals. The cows were found to be hot and feverish, thus evidently showing that the organisms, entering the circulation, had affected the health of the animals.

I have called attention to these facts because it has been very

commonly supposed among milk producers that so long as a due degree of cleanliness in respect to dairy utensils has been observed, the responsibility of bad milk can be shifted upon other parties.

I have said that it is important that the milk producer who delivers milk to the condensed milk factory be thoroughly educated in all the leading causes which injure milk,—that he have a moral sense of the dishonesty and wrong he would be doing in delivering milk which he has good reason to believe would spoil the whole product of the factory for the day.

No system of inspecting the milk as it comes to the factory will reach all the causes affecting milk or determine imperfections often contained in it at the time of delivery.

The milk of cows in heat, of cows over-exercised on account of this disturbance, cannot be used with safety. Yet when such milk comes to the factory mingled with the other milk of the herd, it will be very likely to pass the scrutiny of the expert and be accepted.

Under the best management and most careful examination, losses will inevitably occur from time to time on account of imperfect milk, and a certain per centage must be allowed in making up an estimate of expenses to cover this item. But unless there be some reliability for obtaining good, clean, healthy milk it would not be advisable to enter upon condensed milk manufacture. To this end the character of the country where the milk is produced should be studied. The pastures should be upon high undulating or well drained soils. The farms should have an abundance of clear, sweet, running water while extra attention must be given to the care and management of herds, never over-driving in hot weather, milking with regularity and with fastidious neatness, together with absolute cleanliness in dairy utensils and dairy buildings.

I am told that Mr. Borden's success has resulted in a great measure in locating his factories in the most favorable districts for obtaining good milk, and in every instance he selected for milk producers persons whose long experience in furnishing milk for city consumption had taught a higher appreciation in the care of milk than is common among the cheese dairymen.

Upon this element he commenced and inaugurated a set of rules for guidance in the delivery of milk, a faithful performance of which was rigidly exacted.

These rules are as follows :

I. The milk shall be drawn from the cow in the most cleanly manner and strained through wire-cloth strainers.

II. The milk must be thoroughly cooled, immediately after it is drawn from the cow, by placing the can in which it is contained in a tub or vat of cold water deep enough to come up to the height of the milk in the can, containing at least three times as much water as there is milk to be cooled ; the milk to be occasionally stirred until the animal heat is expelled, as below.

III. In summer or in spring or fall, when the weather is warm, the bath shall be spring water, not over 52° temperature, (a day or night after a heavy rain excepted,) constantly running or pouring in at bottom, necessary to reduce the temperature of the milk within forty-five minutes to below 58° ; and if night's milk, to remain in such bath until the time of bringing it to the factory, to below 55°. The morning's milk not to exceed 60° when brought to the factory.

IV. In winter or in freezing weather, the bath shall be kept at the coolest point (it need not be running spring water) by the addition of ice or snow sufficient to reduce the temperature of the nights' milk speedily below 50°.

V. In spring and fall weather a medium course will be pursued, so that nights' milk shall be cooled within an hour below 50°, and mornings' milk below 55°.

VI. The bath and supply of water shall be so arranged as to let the water flow over the top to carry off the supply of warm water. The can in which the milk is cooled shall be placed in the water immediately after the milking, and shall remain therein until the process of cooling shall be finished.

VII. The nights' and mornings' milk shall be separately cooled before mixing.

VIII. No milk shall be kept over to deliver at a subsequent time.

IX. The milk shall be delivered on the platform at the factory in Elgin every day except Sunday.

X. Suitable cans of proper dimensions to transport the milk from the dairy to the milk works, shall be furnished by the seller, and the cans must be brought full.

XI. The Company shall clean and steam the cans at the factory, free of charge, but customers shall keep the outside clean. The

pails and strainers employed shall be by the seller thoroughly cleaned, scalded in boiling water and dried morning and night.

XII. Immediately before the milk is placed in the cans they shall be thoroughly rinsed with clean cold water, and great care shall be taken to keep the cans and milk free from dirt and impurities of any kind. When the cans are not in use they shall be turned down on a rack with the tops off.

XIII. All the "strippings," as well as the first part of the milk, shall be brought. No milk will be received from a cow which has not calved at least twelve days, unless by consent of Superintendent or Agent, who may determine its fitness sooner by a sample of the milk.

XIV. The cows are not to be fed on turnips or other food which would impart a disagreeable flavor to the milk, nor upon any food which will not produce milk of standard richness.

XV. It is further understood and agreed by the parties hereto, that if the Superintendent or Agent of the Company shall have good reason to suspect, either from evidence furnished or from the state of the milk itself, that water has been added, or that it has not been cooled as provided, or that it has been injured by carelessness, he shall have a right to refuse to receive such milk or any other further quantity of milk from the person so violating these direcrections and stipulations.

EXPELLING THE WATER BY MEANS OF FANS.

Mr. Borden's plan for condensing milk is to eliminate the water "in vacuo," a description of which will be given further on. This plan involves the employment of machinery somewhat expensive and complicated, and efforts have been made from time to time to accomplish the object by more simple methods and at less cost. Among the most successful methods brought to my notice was that adopted by Provost, of Orange County, New York.

During the year 1865 I visited this factory and made drawings of its ground plan.

The process of evaporation was different from that of Borden, and was claimed to be less expensive, and to be effected with less heat.

In this plan the engine and boiler room is lower than the floor of the evaporating room, and the steam pipes leading to the heating vat and condensing pan are carried along in the basement under the evaporating room. Above the evaporating pan is a chimney-

like ventilator, extending above the building, in which are placed the revolving fans, driven by power supplied by the engine.

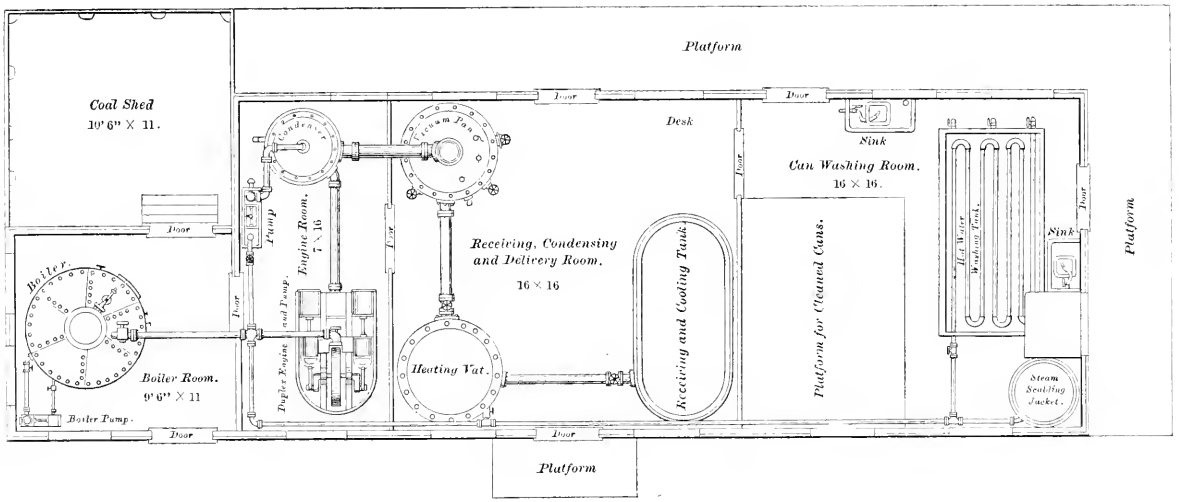
THE PROCESS FOR CONDENSING.

The leading features in the treatment of the milk are briefly as follows: The milk, as it comes to the factory, is carefully examined, and if all right it is received and weighed. The cans are then placed upon the car, which runs on rails to the cooling vat. Here the milk is drawn into long tin pails 8 inches in diameter and 18 inches long, holding 20 quarts each. About 18 quarts are put in each pail, when it is placed in the vat containing cold spring water. After the milk has been cooled to 60°, the pails are immediately plunged into the water of the heating vat, which has a temperature of 185° to 190° Fahr. The best refined white sugar is now added at the rate of four pounds for each pail. It is kept in the vat of heated water about 30 minutes, when it is poured into the large condensing pan. This pan has fifty corrugations, and sets over water and upon a furnace in an adjoining room. Directly above the pan are arranged the the two large pans previously alluded to, and which are kept in motion by machinery. The temperature of the milk while evaporation is going on is uniform at 160° Fahr.

The fans carry off the water, forcing it through ventilators out of the building as fast as it is formed into vapor. Under this process it takes about seven hours to condense the milk, seventy-five per cent. of its bulk in water being driven off. The faucets at each end of the pan are then opened, and the condensed fluid passes through fine wire strainers, or seives, into large cans. These cans, when filled, are rolled away to the tables at the back side of the room, where their contents are drawn off into small tin cans holding one pound each, and are then immediately sealed up to exclude the air.

The condensed milk has the consistency of thick syrups; it has a rich, creamy taste, rather sweet, with a flavor of boiled milk, but by no means unpleasant. Dr. Crane informed me that milk thus prepared had been preserved in good order for years, and he opened cans in my presence containing milk a year old, and it was apparently sound and of good flavor.

For shipping, this establishment packed its cans in barrels, with sawdust between the packages, a form which ensured their safe arrival in market. During the war these pound packages were sold at the rate of 40 cents each, and the price paid for crude milk at



Plan of

Building and Apparatus

for

CONDENSING MILK.

the factory during summer was about five cents per quart, but in winter the price ranged from seven to seven and one-half cents per quart.

At this factory, like those under the Borden process, two kinds of condensed milk were manufactured: that which has been described and the plain condensed milk, in which no sugar is added in the manufacture.

This factory is not now in operation. Whether this plan can be made successful in furnishing a uniform product equal to that under the Borden method, is a question upon which I have not sufficient information to give an opinion..

COST OF FITTING UP A FACTORY ON THE BORDEN METHOD.

It is charged as a prominent characteristic of Americans that among the first questions they ask concerning any particular object, is its cost. Perhaps this may not always be in good taste, but among practical men who are investigating a business with the view of investing capital and taking risks, it is always well to look expenses fair in the face.

The building is 16 x 50 feet, with veranda, or shed, 4 feet wide, on two sides. The ground floor is divided into four departments; the first to the right is the can-washing room, 16 x 16 feet, containing the hot water washing tank, with coil of steam pipe; the hot water sink and scalding jacket, the cold water sink and platform for cleaning can. The steam pipe leads from the boiler to this room.

The next is the receiving, condensing, and delivery room, 16 x 16 feet. It contains the receiving and cooling tanks, the heating vat and the vacuum pan. Then comes the engine room, 7 x 16 feet, containing duplex engine and pump, with steam pipes leading to the other rooms. The rooms to the left are the coal shed and boiler room, 9 x 11 feet, where is situated the boiler (60 horse power) and the boiler pump.

Communication is easy from one department to the other by wide doors, and the whole is arranged for convenience in doing the necessary work. The cost of an establishment is put by Prof. Chace of Cornell University, who obtained the estimates for parties proposing to build, as follows:—

Erection of the building, 16x50 feet ready for machinery, &c., &c....	$ 2.500
Vacuum Pan and Condenser, from 4 to 6 feet in diameter.....	1.800
One Duplex 14 inch Pump and Engine.....	1.500

Piping and fitting out	1,500
One boiler, (60 horse power,) and fitting up	3.000
One Pump for Boiler	100
Outside water pipes	not estimated
Water pipes, &c	500
One Cooling tank for receiving and storage	500
One Heating tank and pipes for milk	300
Hot water tank and steam pipes for washing cans, and two rinsing sinks	600
One steam bath for scalding cans and pipes	150
Making a total of	12,450

The daily running expenses of this establishment may be estimated as follows:—

5000 gallons crude milk, say at 12 ½ cents per gallon	$ 625.00
One superintendent per day	5.00
Two men at $2 per day	4.00
One engineer per day	2.00
One-half ton Coal per day	3.00
Wear and tear per day	2.00
Taxes and Insurance per day	.50
Interest on Capital	3.00
Incidental expenses, say	5.00
*Total daily expenses	649.50

To this may be added value of crude milk, say 200 gallons, as an offset against waste, occasional bad milk, &c.

Taking out the 200 gallons crude milk per day as waste, we have remaining 4,800 gallons milk which is condensed at a total cost, (counting the original value of the 5000 gallons,) at the rate of only a fraction above 13½c. per gallon, or say 1c. per gallon more than the original cost of the milk. This would be at the rate of ¼c. per quart for condensing. On 2080 gallons, 80 gallons being allowed as daily waste, the cost of condensing, with the same expenses as before, would be nearly one and three-quarter cents per gallon or less than half a cent per quart. This it must be understood is for *plain* milk. When sugar is added the expense of the sugar must be added, but as sugared milk is sold by the pound, and as the addition of sugar adds to the weight, the increased weight more than pays the cost of the sugar.

In a well conducted factory, and where milk can be purchased at 12 1-2 cents per gallon, (3 1-8c. per quart,) the cost of condensing

*Note.—On submitting the figures for cost of Condensing Milk, &c., to Mr. Gail Borden, he states the estimates above are put altogether too low. To condense 5000 gallons of milk he says would require a larger capacity—of vacuum pans and much more labor than we have estimated. That no one may be misled by low estimates, we may add, say twelve more men at $1.50 per day and daily expenses for coal and larger vacuum pans, $6.00, making $24.00. This sum subtracted from net daily profits, as given, I thir k must more than cover the case in point.

is from a quarter to a half cent. per quart, and this includes the value of a certain number of gallons of crude milk, daily set apart to cover waste which possibly may not occur.

When the milk is put up in pound cans, the 5000 gallons of milk condensed, allowing for waste as previously estimated, would require ten thousand and forty tin cans, which at $30 per thousand, the estimated cost, would amount to $300,00, or three cents for every two quarts of crude milk condensed. The whole expense then of condensing and canning the 5000 gallons would be at the rate of one and three-fourth cents per quart of crude milk ; for the 2000 gallons it would be two cents per quart. The daily expenses then may be summed up as follows :—

Cost of 5000 gallons milk	$625.00
Daily running expenses of factory as previously estimated	24.50
10.040 Cans	300.00
To this must be added expenses of sealing up and labelling the cans, at say 1c. per can	100.00
Making a total of	1,049.50

The daily product of the factory would be ten thousand and forty pound cans of sugared, condensed milk, which at 29c. per can amounts to $2,911.60, leaving a balance of one thousand, eight hundred and sixty-two dollars and ten cents above expenses, for the day's operations. But the milk must now be marketed, and of this I shall treat in another place.

The delivery of 5000 gallons crude milk per day, would require the product of sixteen hundred and sixty cows, allowing each to yield on an average, three gallons of milk per day. If we estimate for a smaller number of cows as within an easy reach of most factories in the dairy districts, the 2080 gallons would represent say 660 cows. For this quantity the account would stand thus :—

Cost of 2080 gallons of milk at 12½c. per gallon	$ 260.00
Daily running expenses of factory as before estimated	24.50
4,016 tin cans at 3c.	120.00
Filling, sealing and labeling cans, (1c.)	40.00
Making a total of	444.50

The product would stand :—

4,016 cans of sugared, condensed milk at 29c. per can	$1,164.64
Leaving a daily balance above expenses of	720.14

Having presented this general survey of the business, we may now turn our attention to some of the details in regard to machinery and manufacturing, and the first that claims attention is

In order to show how milk is condensed "*in vacuo*," it may be well perhaps to give an illustration of some of the modern improved machinery employed for this purpose.

The drawing represents an improved cast iron vacuum pan. Different liquids, as is well known, boil at different temperatures, and the same liquid may be made to boil at any temperature from the freezing point up, according as the pressure upon its surface is taken off or increased. If by reason of boiling in confined space the pressure upon the surface is increased so that steam cannot readily pass off, the heat accumulates to a greater degree than 212° till the steam acquires sufficient elasticity to overcome this increase of pressure. At the bottom of deep mines the increased pressure of the air has the same effect, and steam is not generated at so low a temperature as at the surface. As the pressure is diminished either mechanically by the use of the air pumps, or by ascending elevations, steam is generated and passes off more freely and at a lower temperature. On high mountains it may be difficult even to produce sufficient heat in open vessels to boil eggs.

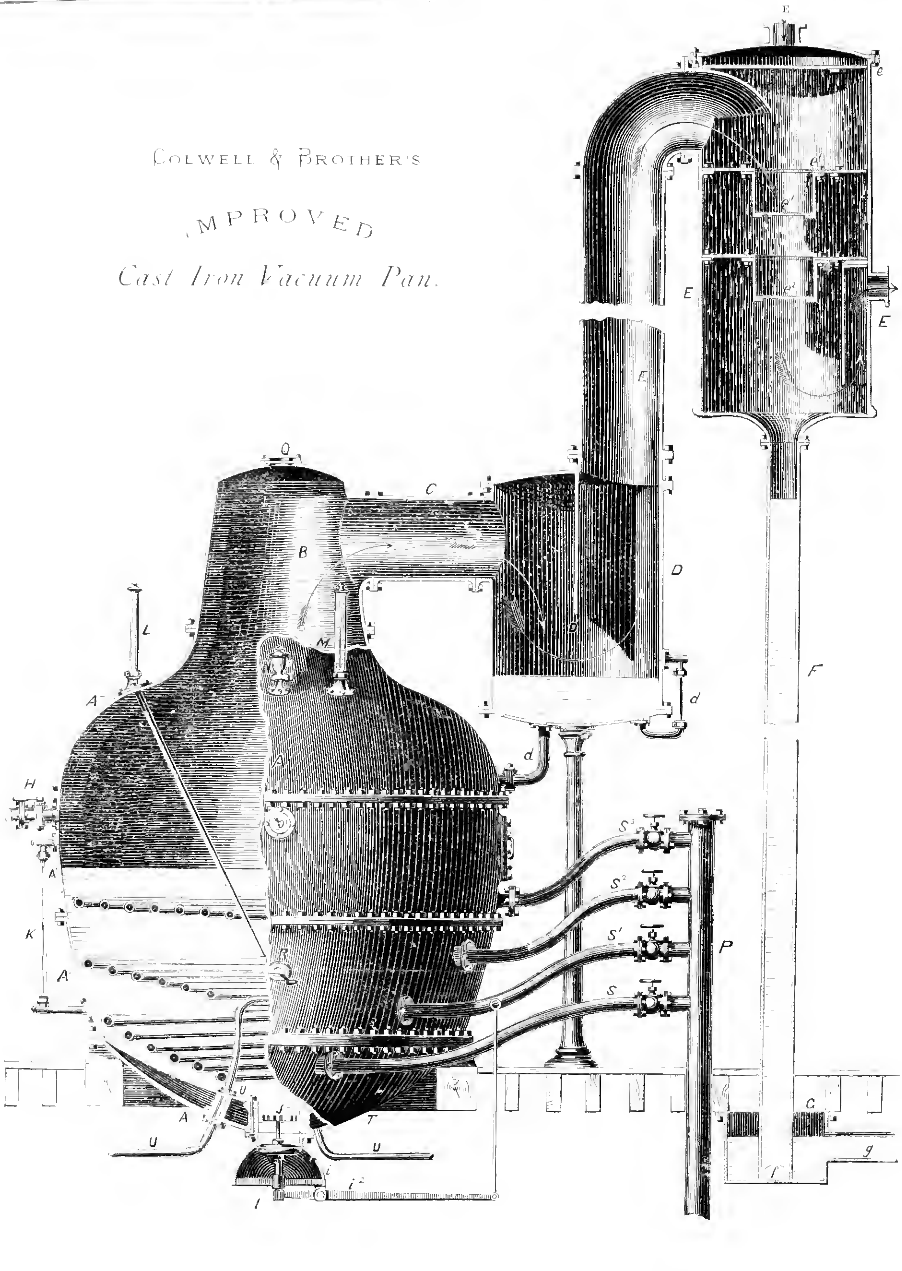
Darwin was led to notice this when he ascended with his sailors one of the mountains of Patagonia. They took with them a new pot, in which they attempted in vain to boil potatoes. But for the pressure of the atmosphere the ocean would boil and evaporate with heat equivalent to that of the sun's rays. Several ingenious experiments have been devised to illustrate these facts. The simplest is in making a glass of warm water boil under the receiver of an air pump. The pulse glass, consists of two glass bulbs, connected by a glass tube. The fluid in one is made to boil by holding one of the bulbs in the warm hand. This property of being converted into vapor at different temperatures, is made to serve important purposes.

Liquids intended to be evaporated are sometimes partially freed from the pressure of the air, and are thus boiled "in a vacuum" with economy of fuel. This process is adopted with great success in sugar refining. When the temperature of the usual boiling point would injuriously affect the liquid to be evaporated, as milk for instance, it is advantageously boiled with reduced pressure at a low temperature. Syrups are evaporated as in the refining of sugar in vacuum pans, or vessels in which the atmospheric pressure may be partially

COLWELL & BROTHER'S

IMPROVED

Cast Iron Vacuum Pan.



Drawn and engraved for "The Technologist."

taken off by air pumps. A low degree of heat only, is thus required, producing economy in fuel and avoiding the risk of overheating and burning the syrup.

With these well known principles in mind, dairymen will be able to see the advantages obtained by Mr. Borden in using the vacuum pan in expelling the water from his milk. It will be observed too that from the moment the milk enters the pan it is protected from various harmful influences, such as dust, flies and other insects which are liable to be caught in the liquid when evaporation is carried on by an open exposure, like that under the Provost method.

In Europe and indeed in the United States until quite recently, vacuum pans have been formed of copper, but owing to the high price of that metal, the temptation is to make them as thin as possible, and the collapse of the pan, owing to the external atmospheric pressure, is not an unfrequent occurrence. In America the substitution of cast iron has in a great measure obviated this difficulty. I am told that the cast iron pans for condensing milk are employed with quite as much success as those made of copper, and the illustration is that of an iron pan, showing one of the best forms of construction in this material. The illustration shows three coils of pipe, but for condensing milk but one or two—the lower coils in the pan,—are used and the coils are arranged in a circle around the pan instead of across as represented in the cut.

I am indebted to the *Technologist* which furnishes me with the illustration and description of its parts. The drawing is so well arranged to give a good idea of the manner in which solutions of sugar and other organic substances may be evaporated at comparatively low temperature that I deem it important in this connection to a clear understanding of what I shall have to say in regard to condensed milk manufacture.

The pan A, is ten feet, six inches in diameter, and is cast in four pieces, A1 being the bottom, A2 and A3 shells, and A4 the dome piece, B is the dome connected by the vapor pipe C, to the catcher D,—the latter being a cylindrical vessel, divided part way by a partition or apron D1, against which, in case of boiling over, the liquor would be dashed and would gather in the bottom, where the amount can be seen at the glass gauge d1, and if necessary, emptied into the pan by means of the faucet and pipe d. From the top of the catcher D, the vapors are conducted by pipe E to the condenser E1, which is placed 33 feet above the water level in the basin G, to which the

condenser is connected by the stand pipe F. The water rises in the latter to about 30 feet, more or less according to the amount of vacuum, and is held therein by atmospheric pressure on the surface of the water in basin G, the condensing water added flowing off from G, by overflow g. The water enters the condenser at E2, falls over the seive plates e, e1, e2, and comes in direct contact with the vapors which have to pass also through the openings in the seive plates e1, e2, by which arrangement the greatest condensation is produced with the least amount of water.

At E3, the vacuum pump, in this case a dry one, is connected. To prevent the condensing water from being drawn along with the vapors to the pump, the opening E3 is guarded by an apron. H is the pipe through which the liquor enters the pan. I is the drop valve composed of a rubber disk, i, between two plates on the end of lever i2,—a simple and most effective construction, the pressure of the outside air holding the valve perfectly tight; i1 is a semi-globular casing which prevents the liquor from spreading too much when it is discharged. On the end of the valve stem is fastened a scraper J, intended to break any crust of crystalized sugar that may have formed, as any such crust unless removed would of course obstruct the exit of the liquid.

The regular mountings of the pan consists of a man-hole; a thermometer L, the tube of which is enclosed in a pipe l, and reaches to the centre of the boiling liquor; a vacuum gauge M; a glass gauge K, by which the quantity of liquor in the pan is observed; a butter cup N, butter quieting the liquor if it shows a tendency to boil over; an eye glass O, opposite to which is another similar glass through which a lamp gives light to the interior of the pan. Q is a light glass on the top of the pan, through which the entire surface of the boiling liquor may be illuminated, and R is the tester by which proofs are drawn to see how far the process has advanced.

Heat is applied in the following manner:—The bottom of the pan is double, and steam is admitted thereto by the pipe P; the upper shell which forms the heating surface being generally of copper. The steam also passes through one, two, three or even four coils, according to the size of the pan and the amount of water to be evaporated in a specified time. P is the steam branch. The pipe S leads to the bottom, S1 to the lowest coil, S2 to the middle coil, and S3 to the upper one.

As fast as the steam is condensed, the water is led by the pipes U U from the bottom and coils to a steam trap.

It might at first sight be supposed that cast iron would fail to resist the corroding action of solutions, but the results of practice show that the scale which in every case covers the metal, protects the pan completely; and as the liquor is in all cases, charged to some extent with lime, the pan speedily becomes covered with a fine scale or fur, which effectully prevents all injurious action. This is especially the case if the pan be worked continually, but if long stoppages are made, copper possesses decided advantages over cast iron.

Under ordinary circumstances, however, the cast-iron vacuum pan answers every purpose, and they can be constructed in such a perfect manner that one similar to that described, will retain a vacuum of 29 inches for a space of 12 hours without losing more than one inch.

PROCESS OF CONDENSING.

In some of the recently erected factories an improvement has been made in heating tanks, cooling vats, and in the manner of locating these appliances, whereby the milk can be manipulated with more ease or be turned to other purposes besides condensing. The plans of factories previously given, are arranged for the condensing process alone. The new factories are more elaborate in their arrangements, and combine all the conveniences of the cheese and butter factories, as well as those for condensing milk. I shall presently describe one of these establishments, the best built of its kind in America and designed to be a model in all its internal machinery and appliances; meanwhile the general features of the condensing process may be briefly stated.

The milk is delivered morning and evening in small cans, holding about 40 quarts each. They are filled quite full and have a tight-fitting cover. It is understood, of course, that the treatment of milk at the farm, shall have been in accordance with the rules previously given. Then as the cans are placed upon the factory platform the covers are removed and each subjected to a rigid scrutiny by the factory manager, with a view to discover any imperfections. Imperfect milk can sometimes be detected immediately after removing the can cover, from its odor, but if left for a few moments thus exposed to the atmosphere the odor escapes so that the milk, though imperfect, might pass undetected. The examination of the milk as

it comes to the factory, and the faculty of the manager in detecting its condition, will have much to do in securing an uniform good product and it is important that this matter be well understood. The examination should be rigid, and the manager should have sufficient decision of character to reject every sample of milk which is not found to be in good order. After the milk is received it passes through a strainer to the receiving vat. From this it is conducted off, going through another strainer into the heating cans, each holding about 20 gallons. These cans are set in hot water, and the milk is held here till it reaches a temperature of 135° to 140°. It then goes through another strainer into a large vat at the bottom of which is a coil of copper pipe, through which steam is conducted and here the milk is heated up to the boiling point.

Then the best quality of white, granulated sugar, is added in the proportion of one and a quarter pounds of sugar to the gallon of milk, when it is drawn into the vacuum pan having a capacity of condensing three thousand quarts or more at a time. The milk remains in the vacuum pan, subjected to steam for about three hours, during which time about seventy-five per cent. of its bulk in water is eliminated, when it is drawn off into cans holding 40 quarts each. The cans are only partially filled, and are then set in a large vat containing cold water, the water being of a height equal to the milk in the cans. Here it is stirred until the temperature of the condensed fluid is reduced to a little below 70°. It is then turned into large drawing cans with faucets in order to facilitate the filling of the small cans. The drawing cans stand in a room set apart for the purpose, and around the outside of which runs a table or work bench. Here the milk is drawn from the faucets into the small tin cans holding one pound each, when they go to the table, and are immediately soldered to exclude the air. The cans next have the proper labels pasted upon them, and are ready for market. The work of filling the cans, soldering the tops and labelling is usually performed by females. A number of small soldering furnaces are located along the tables where the girls, each with a set of soldering irons, seal the cans as fast as they are brought forward by the fillers.

This is the plan of operations at the Elgin factory, which is somewhat noted for its fine product. In one of the upper apartments of the Elgin factory is the tin room. Here a number of females are employed making the small tin cans. There are machines for cutting out the circular parts of the can at a blow and the putting to-

gether and soldering are very expeditiously effected at the least expense, since all the material is purchased at wholesale, and the employment of females is less expensive than males, while at the same time the work is quite as neatly and substantially made as at the regular shops where males are employed.

THE BORDEN FACTORY AT BREWSTER.

In December, 1871, I visited Mr. Borden at his home in White Plains, spending a couple of days with him and inspecting all the departments of his factory at Brewster. Mr. Borden is three score years and ten, tall, thin, a little stooping from age, and with locks as white as the snow. He has a pleasant, hazel eye, and the whole cast of his face is one of benevolence. He has a hearty, frank, agreeable manner, that is very attractive and puts one at ease from the first. He is a ready talker and has an immense fund of information and anecdote. He gives away large sums of money in charity, and for worthy objects no one appeals in vain. Those who know him best speak of him as the model pattern of a large hearted, kind and christian gentlemen. His integrity is of the sternest kind, and he hates shams and deceptions. He has met with great success in the sale of his condensed milk and deservedly so, because he puts upon the market always a perfect article. The factory at Brewster is an immense establishment and every part of the business is conducted with the regularity of clock-work. The building is located on a small stream where there is a seven foot fall and the water is thus utilized for running the pumps, which is a considerable saving during the year, by way of fuel. The factory has two vacuum pans, but only one was in operation at the time of my visit. It is a six foot pan with two coils of pipe, and 2000 quarts of milk per hour, is the usual rate of condensing. Mr. Borden now believes in doing the work rapidly, and says the sooner you can get the milk from the cow into a condensed form the better. He therefore uses two boilers of 55 horse power each, for supplying steam to the pan. The average pressure of steam in the pipes, at the pan, is 55 to 60 pounds to the square inch. The evaporation goes on best in clear, dry weather. In damp, foggy weather it takes a little longer to get the milk out.

About 10,000 quarts are now being condensed per day. The milk as it is received, goes into square-like boxes or vats; the receiving room being four or five feet higher than the bath and heating room. The bath tubs are circular and have a coil of steam pipe at the

bottom. The bath tubs are filled within six or eight inches of the top, with water. The heating wells are of copper, egg-shaped and stand opposite the bath tubs, a raised platform running between the two. The milk is drawn through a hose from the receiving tanks into copper cans, setting in the bath tubs, each can holding about 40 quarts. Here the milk is heated to from 150° to 175°. It then goes to the heating wells, which have a jacketed bottom for steam, and is heated up to the boiling point. It is then immediately drawn to the vacuum pan, a stream of milk is kept flowing into the pan about as fast as the evaporation goes on, or at the rate of about 2000 quarts per hour. When the sugared milk is to be made, the amount of sugar is calculated for the given quantity of milk, and then turned into a moveable tank or well, and here the hot milk is poured upon it till it is thoroughly dissolved. The hot sugared milk is drawn up last in the pan, and mingles with the milk which has been partially condensed in the pan. The sugared milk must be eliminated of more water than the plain milk, since the addition of sugar partially liquifies the mass—a curious fact.

Three pints of milk makes a pound of sugared milk. The three pints of raw milk will weigh on an average 3 pounds, 3 and $\frac{8}{8}$ ounces. Now by eliminating 75 per cent of water, (38 520-1000 ounces,) we have remaining 12 ounces and 855-1000 of an ounce; add to this the proportion of sugar now used, 6 3 4 ounces, and we have 19 605-1000 ounces, or about 3 and 6-10 ounces more than a pound. So it will be seen this 3 6-10 ounces in water has to be eliminated in addition to the 75 per cent. of water in the first instance.

Mr. Borden told me that the matter of getting the right proportion of sugar was the result of long study and numerous experiments and no other proportion gave such good results in the product. The plain condensed milk is reduced from 4 to 1. It is treated in the pan precisely like the other except near the close of the operation, when the vacuum in the pan is broken and the mass super-heated or raised to a temperature of 190° to 200°. The super-heating process was discovered in 1862, and this is one reason which gives the Borden brands their superiority in the market. The super-heating not only helps its keeping qualities, but prevents granulation. During the super-heating process, the water which passes off has an intensely disagreeable odor. The heat in the vacuum-pan throughout the whole of the Borden process, apart from super-heating, is kept at a temperature of from 135° to 145° Fahr.

At the Brewster factory they have a filling machine by which two women will fill 10,000 pound cans per day, of ten hours. In the old way the two would fill but 3000 cans in ten hours. Two women will put the labels on 10,000 cans in a day, and one woman will seal or solder up 1200 cans per day. The machinery for making cans here is very complete, 14 boys at tops and bodies, and soldering on machines, with one man cutting bodies, will make 11,000 cans per day; the expense being about 2 3-4 cents per can for labor and material all told. This factory sends about 50 forty quart cans of Plain Condensed Milk to New York daily, which is sold at from 40 to 50 cents per quart. The question may occur, why is the milk heated in the bath and then in the wells? and why not heat all in one place? Mr. Borden says milk cannot be heated to the boiling point in one vessel, except at great loss from adhesion to the metal, and besides causing great trouble in cleansing. The heating in two places avoids this. At this factory they have a "can washing machine," which does the work in a moment by machinery.

Mr. Borden in describing his process to me, said, (and I give his exact language,) as follows:—"The milk is brought up to 150° to 175° in the bath, then poured into the heating well where it is brought to a boiling heat and from thence drawn into the pan by atmospheric pressure, by the air pumps. The sugar is dissolved with a portion of the boiling milk taken from the heating well. The making of a good article of milk depends not so much upon the formula in the best specification, *as upon the condition of the milk when brought to the factory*, and the care and attention given to every part of the process, from the washing of the vessels and the thorough cleanliness which should be observed in every department. The success of the milk manufactured at our three factories, known as the 'Gail Borden Eagle Brand,' is due to the attention which we give to the personal inspection of every department of the dairies on the farms, which is assigned to one person at each factory; the constant examination of every man's milk by samples taken and subjected to tests as to cream, sweetness and the time it will keep after being brought from the dairies.

In short there is nothing manufactured requiring so much care and everlasting vigilance and attention as that of milk. From the time it is drawn from the cow, until hermetically sealed in cans, it requires that everything should be done with the utmost integrity.

I am assured from what I see in your writings on the subject of

milk as applied to the making of butter and cheese, that you fully concur in all I have said in relation to this subject. We both realize that it is for want of a full understanding of the delicate character of milk, that so many have failed in producing a good article either of cheese or condensed milk."

After condensing the milk and drawing from the vacuum pan, the pan must be thoroughly cleaned. For this purpose there is a man-hole by which a person can enter the pan and do the work with brushes, sand paper and water. I am told that Mr. Borden for a long time experienced considerable difficulty in having the pans properly cleaned, as the milk during the process of condensing would adhere to the metal, and bake or harden into a crust. After a while it was discovered that by oiling the metal on the inner surface of the pan this difficulty could be obviated.

The discovery was made through merely accidental circumstances and from observing an old housewife grease the pot preparatory to making "minute pudding." On applying the principle to the vacuum pan, it was found to prevent the milk adhering to the metal, and a patent was at once secured upon it. This is one of the secrets of the condensing business. Mr. Borden informs me that by having water in the pan before drawing on the milk the same object is effected as by greasing the pan.

GAUGING THE MILK.

Difficulty is sometimes had in determining when the milk has been reduced to the proper consistency. In regulating this, samples of condensed milk are drawn from the pan, and from its appearance on cooling, the amount of water eliminated is judged. Errors not unfrequently occur in carrying the condensing process too far, especially with persons who have not a correct eye, or who may become a little careless at times.

I am told that a gauge placed in the pan is an important aid in this matter. The quantity of milk when it enters the pan being noted, the gauge indicates the amount and rapidity of the evaporation, and thus renders great assistance in regulating this important point in the process. For it must be observed, if the reduction is carried beyond 75 per cent. there is not only a loss in weight, but the consistency not being uniform will have its influence on sales, besides the quality is liable to be deteriorated.

PLAIN CONDENSED MILK.

The plain condensed milk has the same amount of water eliminated and is treated in the same way as that which has been described, except that no sugar is used in its manufacture. It is not put up in sealed cans, but will keep sound for several days, and is intended for present use. It is sent to market in cans holding 40 quarts each.

Recently a "non conducting can" has been invented for shipping this kind of milk. It is of tin and nearly the same form as the carrying cans, but double, with a space of two inches between the outer and inner surface, which is closely packed with ground felt. In these cans the milk goes to market in sound condition.

THE COMBINED FACTORY.

I have alluded to the modern plan of combining with the manufacture of condensed milk, that of cheese and butter. In other words, the fitting up of a factory in which either one or the other or the whole three products can be made from the daily delivery of the milk. Experience has shown that the combined factory is the safest and in most cases should be adopted. There will be certain seasons of the year when it will be more difficult to make good condensed milk than at others. There are times, too, when the milk received does not prove to be in that prime condition that would be advisable for condensing, but which might suffice for the manufacture of cheese. Again, the breakage of machinery might render it impossible to condense the milk for a day and perhaps for longer periods. Changes in the market also may possibly render it advisable to run a smaller quantity of milk through the condensing process, for a day, a week or a month, than at other times. These, and a variety of other circumstances occuring or liable to occur, demand that ample means be had at the factory for manufacturing the milk into some other form than that of condensed milk. For it must be observed that after a number of persons have been engaged to deliver milk at the factory, it must be received, if in good condition, and unless provision be made for its manufacture, in some form, heavy losses will entail. Where arrangements are perfected for turning the milk into butter or cheese, or condensing it at pleasure, advantage may be taken of any unfavorable circumstance, and the milk is properly disposed of without loss. There are other reasons for the construction of factories on this plan,

which I shall name hereafter under their appropriate headings. The factory plans here referred to are those of the Middletown factory on the Erie Railway, about 60 miles from New York City. This establishment was erected during the year 1870, at a cost of more than $50,000, and is probably the most convenient and best furnished in its internal fittings of any condensing factory in America. The lower story or basement is partly below the surface of the ground. The basement rooms are about nine or ten feet between floors, and the lower floor being about six feet below the level of the ground, built in with heavy walls and thoroughly underdrained, gives a low, even temperature the year round. The floor is covered with stone flagging, nicely laid in cement, so as to make a perfectly tight bottom, and where no accumulation of water or filth can find an entrance. And it may be observed here that all condensing factories should have basements similarly constructed, since by securing a low and uniform temperature, the milk can be kept in better order and a better product be secured. The main building is 40x68 feet, three stories, with wings 22x22 feet on the left, and 22x50 feet on the right and two stories high. The basement is divided into churn and butter room to the left, 22x22 feet, vat room 40x68 feet, containing the cooling vats, cheese vat, elevator, presses, &c., with steam pipes and hose leading to various parts of the building. The room to the right is the pump and wash room 22x22 feet with scalding and cold water vats, vacuum pumps, &c., &c., and containing the lower portion of the vacuum pan, projecting through the ceiling from above. Out of this and along the side of the main building is the boiler and engine room. The boiler is of 60 horse power. On the second floor of the main building is the delivery room 40x68 feet. Here are the heating tanks of galvanized iron or of tin with jacketed bottom of copper, in which steam is admitted to heat the milk. They are each four feet in diameter and about six feet long, rising about eighteen inches above the floor, and extending through the floor and into the room below. They have a capacity of holding about 400 gallons each. Between each two tanks there is a ventilator communicating with the room below and running to the roof. Openings are provided in each room so as to give thorough ventilation. A track for milk-car runs from the delivery window along side of the tanks, and extends to the elevator, so that as fast as the milk is delivered, the cans are placed on the car and thus conveyed to the tanks and dumped, or the milk may be placed on the elevator and

lowered to the room below. This room is double floored,—the floors laid in cement, so as not to allow leakage. On the left is the office 22x22 feet, provided with desks, &c. On the right is the vacuum room 22x22, with vacuum pan in the centre, the lower part of the pan extending through the floor and into the room below, where the condensed milk is drawn from the pan. The communication between the rooms is by stairs Here also is the condenser and pumping machinery. Back of the vacuum room is the canning department where the milk may be drawn from the filling cans into pound packages and then sealed and labeled. The third or upper floor is the cheese curing department, provided with racks or tables for the reception of the cheese.

Near the ceiling of the basement are iron shafts connected with gearing to the engine by which the churns are driven, the elevator raised or lowered at will, and all other work requiring power transmitted. Cold spring water flows in and out of the cooling vats and other water tanks, while steam is conveyed by pipes from the boiler to the heating tanks, and to other parts of the building as desired. The whole structure above the basement walls is of brick and the boiler chimney, 126 feet high, is very substantially laid. Of course, a factory embracing the same ground plan could be erected much cheaper, as everything connected with the building and fixtures has been made upon the most expensive scale.

CONDENSING SKIMMED MILK.

Plain condensed milk is varied in manufacture:

I. By using "whole milk," or milk containing all its own cream.

II. By mixing skimmed with whole milk, and when this is done the skimmed milk is first drawn into the vacuum pan, and after its volume is reduced considerably, the whole milk is added and the mixture then reduced to the required consistency.

III. By condensing the skimmed milk alone.

TREATMENT OF THE MILK.

At the Middletown factory skimmed milk is extensively used for condensing. After the milk is taken from the delivery window and dumped into the heating tanks, steam is admitted to the jacketed bottom and the milk heated to 130°. A small quantity of alum and saltpetre is sometimes added to the milk, for the purpose of more readily clarifying it. During the heating process the impuri-

ties in the milk rise to the surface and are skimmed off, and when this is effected (the time of heating ranging from one and a half to two hours) the milk is ready to be drawn either into the vacuum pan or cooling pails. These pails are eight inches in diameter by twenty-two inches long, with iron bails, and are set in the vats containing cold spring water. The vats are placed in the basement as before described, and the pails of milk are constantly surrounded with flowing spring water. The pails are filled by attaching a rubber hose to the bottom of the heating tank, where there is a faucet with tube going through the jacket to the milk. The operator then carries the hose from one pail to the other and they are thus rapidly filled.

The cooling vats, four in number, are each twenty one feet long by four feet wide, made of three inch pine plank and separated into three divisions. Here the milk sets from eight to twelve hours, according to the character of product which it is desired to make. After the cream is taken off, the milk may be drawn at once into the vacuum pan, simply by running a rubber hose from the milk to the pan, as the pressure on account of the vacuum in the pan is sufficient to draw the milk through the pipes. During the process of condensing, the temperature of the milk in the pan is kept at about 135°, a vacuum of 22 to 25 inches being maintained. The milk having been reduced to its proper consistency is drawn from the vacuum pan into the cooling pails, which are immediately plunged into the vats containing cold spring water. The pails are about half full, and the average temperature of the water is 52° Fahr. When thoroughly cooled it is ready to go into the non-conducting shipping cans to be transported to market. The condensed skimmed milk brings 25 cents per quart. Under this process, in the month of July, when the daily delivery of milk was between five and six thousand quarts, eight quarts of milk yielded one quart of cream, and the whole quantity of cream made 400 pounds of butter per day. When whole milk and skim milk are used together for condensing, the evening's milk having been strained and placed in the small tin cooling pails, they then go to the water pools or tanks and are surrounded with flowing spring water on the same plan as at the butter factories. Here the milk sets until morning, when the pails are taken out, the cream dipped off and the skimmed milk immediately drawn into the vacuum pan. In a vacuum

of about 24 the milk will begin to boil when the mercury indicates 100° Fahr. The heat soon rises to 135° or 140° and is allowed to go no farther. The morning's milk as fast it is delivered goes to the pools in the same way as the night's milk, and after the milk in the vacuum pan has been somewhat reduced in volume, the morning's mess is taken from the pools and is drawn into the pan and the mixture then reduced. By this process a good product of plain condensed milk, it is said, can be made; while for sugared milk some operators think a more uniform product, or the "smoothest milk," is made from milk that has had about half its cream removed before going to the pan. One of the leading difficulties in the condensing process, is to carry the milk along and draw it from the pan, before it is in a condition to granulate in cooking. It should be "smooth" and not gritty under the tongue, the latter state arising from the sugar-of-milk assuming a granulated form. When milk is treated in this way no saltpetre is added, or indeed any other chemical. The use of such substances to clarify the milk is believed to be of doubtful expediency, since it is always better to have the milk in such good order, that these clarifying aids may be dispensed with.

Under this latter plan butter factories have been successfully turned into condensing factories at small cost; since a copper vacuum pan 4 feet in diameter with all the fixtures complete may be had for $1,500, and a single vacuum pump of suitable size for the pan, $800, or a duplex pump, $1,000, making for the pan and pump either $2,300 or $2,500.

RESULTS FROM THE SKIMMED MILK PROCESS.

From the foregoing statistics it appears that 15 quarts of milk were required for one pound of butter, while a pound of butter was made on an average from less than two quarts of cream. The butter in 1871 was marketed at 40 cents per pound, and the buttermilk at 1 cent per quart; 750 quarts of cream taken from the 6,000 quarts of milk would leave 5,250 quarts skimmed milk, and this eliminated of 75 per cent. of water makes 1,312 quarts of plain condensed milk.

Without taking any account of the buttermilk, the daily receipts may be very nearly estimated as follows:—

400 pounds butter, 40c	$160.00
1,312 quarts condensed skimmed milk, at 25c per quart	328.00
From this we deduct cost of 80 gallons of crude milk allowed for waste, 12½c	10.00
And we have a total of	$478.00

The daily expenses on the basis of former estimates would be as follows :—

6,000 quarts of milk, or 1,500 gallons, at 12½c per gallon.	$187.50	
Daily running expenses of factory	24.50	
Making	$212.00	
Which leaves a daily balance above expenses of		$266.00

Perhaps it may be said that my estimate of factory buildings in the first instance, $2,500, is too low. This is a matter which cannot well be regulated here, but the other expenses, with additional estimates as referred to in the note, $24.00, will give sufficient data for determining the profits to be derived from the business.

Providing one-half of the skimmed milk be made into skimmed cheese, we should have as before :

400 pounds butter, 40c	$160 00	
656 quarts condensed milk, 25c per quart	164.00	
2,625 quarts milk, or say 525 pounds of skimmed cheese, at 10c.	52.50	
Making a total of	$376.50	
Less 80 gallons for waste	10.00	
Leaving	$366.50	
The daily expenses as before, 600 quarts milk, 3½c	$187.50	
Running expenses of factory	24.50	
Making total	$212.00	
Leaving a daily balance above expenses when butter and cheese, and plain condensed (skim) milk are made, of..		$154.50

It will be seen that the profits from the business must vary considerably according to the character of product manufactured, and under the combined factory plan here described, great latitude is given to vary the manufacture of the milk into such products, as shall seem most advisable from time to time.

It may be observed in this connection, that when milk is set for cream during 8 to 12 hours only, and is then skimmed, the skimmed milk contains considerable butyraceous matter, and makes a good-tasting and palatable article of condensed milk ; since by varying the quantity of water for the purpose of returning it to its original consistency, or by using less water it can be made to assume the appearance of cream, while it contains more nutrition, bulk for bulk, than the milk in which all the cream is retained. For invalids or those in delicate health the skimmed milk is decidedly preferable, and is so recommended by physicians.

MARKETING.

The question of markets and marketing is perhaps the most serious of any concerning this business. I have given the prices at which the different kinds of condensed milk are sold. But can these prices be maintained, and is there a demand and a market for a large or indeed any considerable increase in these products? These are grave questions and of serious import to those who are proposing to embark upon condensed milk manufacture. So far prices have been maintained, and the Borden factories have met with abundant success. I do not hear of any complaint among consumers that prices are exorbitant, but, on the contrary, many affirm that condensed milk is cheaper than the milk-man's crude milk, inasmuch as the latter is largely adulterated with water, is liable to sour on your hands,—besides from its frequent imperfections losses are entailed upon the consumer which amount to more, during the course of a year, than the difference in price between crude and condensed milk.

City consumers who have become accustomed to the use of condensed milk generally prefer it to the crude milk, as more uniform in quality, more convenient for use, more reliable in flavor, and more healthful as an article of food. But the class using condensed milk in America, as compared with that using crude milk is very small. Indeed, there are thousands of people who have never tasted, or even seen or heard of condensed milk. Doubtless if the public generally could be made acquainted with the cleanliness required, and the freedom from impurities or adulterations in condensed milk, it would soon take the place of crude milk in all our leading towns and cities. Immense sums are now expended in carrying the crude milk to market, 75 per cent. of which would be at once saved if condensed milk could be made to take the place of crude milk. But should the water with which the milk-man dilutes his milk, be also taken into account, the saving on transportation would be much greater. Up to the present time, the condensing business has been in a few hands, and as little has been known generally concerning its manufacture or profits, prices have been controlled and maintained. Is it not to be feared that any large and sudden increase in condensing milk (especially before people have become somewhat educated as to its use and character) would have a tendency to glut the market, and thus prove disastrous to manufacturers?

With an increase of the business, there is little probability that

present prices can be maintained, and here the question occurs whether a considerable reduction in rates could not be made, and yet a fair profit be realized in the business. The price of crude milk in all our large cities will average nearly, if not quite, eight cents per quart. Say that one cent per quart be allowed the factory for manufacturing the plain condensed milk, and four cents per quart as the cost of crude milk at the factory, then there are three cents per quart which remain to be expended in transportation and delivering it to city consumers. Upon this basis, four quarts of crude milk reduced to one quart of condensed milk would be worth twenty cents at the factory. This would give a living profit to manufacturers and to producers.

And now the question occurs, how much is it worth to transport and market the quart of condensed milk? Call it four cents, and we have the quart of condensed milk in the hands of consumers at twenty-four cents, which is equivalent to crude milk at six cents per quart. But as the condensed milk is cleaner, purer, and will remain sweet and sound longer than the crude milk, the consumer realizes the boon long sought for in obtaining a cheap, nutritious and healthful food.

In the higher and more philanthropic aspect of life, the cheapening of food for the masses, and especially the poor, is a consideration not to be overlooked, and cannot be well over-estimated.

Looking at this question of markets in all its relations, we should say that the safest plan to be adopted would be to establish combined factories, where the main business at first would be the manufacture of butter or cheese, or both, entering upon condensed milk gradually, and making no more than could be marketed in the nearest cities and surrounding towns.

I have no doubt that in every country village where crude milk is peddled, plain condensed milk could be readily introduced, and if an uniformly good article were furnished at reasonable rates, I am of the opinion that it would supplant, in a great measure, the crude milk.

I cannot tell how long it may take to introduce this form of milk into general consumption. That must depend upon the activity and energy with which it is placed before the public. People are wedded to old usages, and do not readily change unless urged, or convinced of the advantages resulting from such change. But I am persuaded that condensed milk, like other practical methods for improving the

comforts and healthfulness of mankind, must in the end be triumphant. City consumers have for years endured the bad milk brought to their doors as a necessary nuisance, from which there was no ready way of escape.

The new method opens the remedy for this difficulty, and as people become acquainted with it we may reasonably suppose they will adopt it.

CONCLUSION.

In conclusion we may say that the condensing business requires considerable capital, great labor, unceasing care, and minute attention to details, which paid workmen will neglect if not constantly watched. Mr. Borden thought he could get an extension of his patent if he tried, but he would not try. He preferred to rely on his skill and faithfulness in the manufacture in open competition. The product made at his factories has never been surpassed. In his early experiments scientific men told him that it was useless to think of retaining the (oil) cream, but he said it would not be milk then, only "skim milk," and so he kept on experimenting, and finally succeeded in retaining all the cream. To do this successfully under his process, the milk is brought to a temperature of 212° Fahr. before it goes to the pan, as I have described in the early part of this paper.

Some think that the condensing process must necessarily make slow progress, on account of the difficulty of getting skilled labor and the constant watchfulness required to make an unexceptionable article. Factories have been started from time to time and abandoned on this account. But Mr. Borden has kept steadily on, and he has met with merited success, because he has never allowed a poor article to go upon the markets. And this should be a rule among all those who propose to enter upon its manufacture.

AN ADDRESS

DELIVERED BEFORE THE AMERICAN DAIRYMEN'S ASSOCIATION, ON

THURSDAY, JANUARY 11TH, 1872,

BY

L. B. ARNOLD, Esq.,

Of Ithaca, N. Y.

POISON CHEESE.

With the great expansion of the cheese interest in the United States and Canada, there has been a steady improvement in the quality produced, but there have also sprung up some other results not so desirable; among them is the occasional development of poison cheese, concerning which I have been invited to speak to-day.

The first case of poison cheese that I can recollect, which attracted the attention of the public or the notice of the press, occurred some fifteen or sixteen years ago. It appeared first in Philadelphia, and afterwards in New York City, and, I believe, some other places. The symptoms produced were very distressful, and indicated mineral poison, which it finally proved to be. It was easily distinguished from cheese not poison, by its containing black spots, which were traced to the white lead with which the cheese tubs and milk pails of the dairy were painted. The painting scaled and rubbed off into the milk or whey, and mingled with the curd, and by the agency of the lactic acid, developed in the curing of the

cheese, was converted into lactate of lead. The cause becoming known, it was at once removed by painting dairy utensils with zinc instead of lead. Since that time cases of poison cheese have occasionally made a wave of excitement in the public mind. Lately, since the introduction of the factory system, they have become more frequent. That they should now and then occur is not strange. Cheese, in its best estate, is poisonous to some people. Persons to whom cheese is so distasteful and poisonous that they cannot eat it at all, are often met with. I once knew a case of most distressful vomiting from a child's eating a bowl of bread and milk, in which had been accidentally dropped a piece of cheese about the size of a pea. The cheese was not eaten. The vomiting was produced from the influence of the cheese imparted to the milk, as, upon examination, it was found in the bottom of the bowl. This poisonous action of cheese was not confined to this single instance. It had manifested itself before, and continued the same from childhood to middle age, when the patient was lost trace of.

I have heard of other cases about as striking as the one described. It was not the fault of the cheese, in the case related, that it became so obnoxious. Other members of the household ate of the same cheese with no unusual effect. One of the most singular facts in this case was, that while cheese was so offensive in taste, and poison in effect, milk, and even curd, were eaten with a good relish and with perfect impunity. As long as the curd remained such it was agreeable and harmless; but the moment it became cheese it was distasteful and poisonous. It was therefore nothing in the milk, nor anything in the rennet that converted the milk into curd, that produced the peculiar result. It was evidently due to the cheesy fermentation in connection with a constitutional peculiarity of the individual.

But the cases of poison cheese that are occurring now-a-days are not just like the one described, for they occur with people who have been in the habit of eating cheese without any bad effect. Cases of this kind are not peculiar to the present day; they have occurred at intervals for fifty years or more, both in this country and Europe But they seem to be of more frequent occurrence recently than at any time before. They are peculiar in their nature, and have undoubtedly one common cause. They are all alike in having no connection with any mineral poison. The most rigid analyses by different chemists have invariably failed to find in them any evidence

or trace whatever of any mineral poison, though those analyses have been many times repeated by able professors. The characteristics of the cheese, too, though not such as to attract much attention, are all similar and uniform in all the cases, no matter how widely scattered. It appears riper and richer than usual for its age, has a salvy and fatty appearance, and a strong flavor that is rather acid. Such are the common points of the descriptions so far as received.

The symptoms are equally uniform. Pain in the stomach and nausea, and vomiting in moderate cases; extreme distress and cramping in severe ones, followed with diarrhœa; death rarely, and only in extraordinary cases. The symptoms generally appear within three hours, and are in most cases very intense. As a little five year old boy who was poisoned last summer in Batavia expressed it, they are "awful sick." It is a very singular fact, in most of the cases that have come to my knowledge, that though the poison is so very virulent in some stomachs, others can eat of the same cheese that is so poisonous to some, without any deleterious effects, especially after it has stood a few days with the cut surface exposed to the air.

Cases of cheese-poisoning are becoming quite common, much more so than is generally supposed. Interested parties have preferred to hush them up rather than publish them, for fear of the effect upon the consumption and price of cheese. But this is hardly a fair way of treating the matter. Better face the difficulty squarely; better take the beast by the horns, and master it if we can.

The poison in cheese appears to be very variable in its efficacy. Besides affecting persons differently, cases may be observed of every conceivable shade of strength, from slightly nauseating to those that produce the extremest symptoms. It may be interesting to refer to some of the severer cases that have lately occurred. In St. Lawrence County, New York, a case occurred in October, 1869, that was noticed at the time by Mr. Willard in the *Rural New Yorker*. From the account there published it appears that the poisoned people traced the cheese, through the dealer who purchased it, back to the dairy, where nothing in the making, or about the dairy, was different from usual. All appeared cleanly, and everything done in the usual manner.

"No deaths," he says, "came from eating the cheese, but the persons who ate of it were taken suddenly ill with pains and cramps,

and excessive vomiting, showing evident indications that they had been poisoned." Samples of this cheese were sent to Professor Jackson, of Boston, who, after a rigid examination, reported, as usual, no poison found in any of the samples, but appended the following to his report: "But there is a small proportion of offensive putrifying animal matter, which has been separated here, that does not belong to good cheese." Other facts appeared in the account of this cheese which would be interesting to those who care to investigate this matter. A case appeared in Fairfield, Michigan, last May, the effects of which were more wide-spread and severe. I have no authentic account that any deaths occurred, but a large number of persons were made deathly sick. It was a very serious occurrence, and the most extensive of any that has come to my knowledge. All the cheese made in one of the three vats in a certain factory for three days, not always consecutive, proved to be poisonous. The cheese, when cured, was scattered about the State and out of the State, and spread the poison over a wide extent. Persons partaking of it were made sick in the same way as before described. The effects produced, as the proprietors of the factory related, were nausea, excessive and protracted vomiting, most excruciating pains in the stomach and bowels, followed generally by diarrhœa. And yet, they say, though so many people were made so terribly sick from using this cheese, others partook of it with no unusual effect. A sample of this cheese was sent to Cornell University for Professor Caldwell to analyze. By his kindness a piece of it was presented to me for inspection. It presented no very unusual appearance. It was salvy and rich, and apparently more thoroughly cured than usual for a cheese of its age, being about two months old when I saw it. Though it had ripened rapidly, there was no appearance of huffing, being pretty compact, and exhibiting a few gas holes which were pretty large. It had the same strong, sourish smell that has been said to belong to other poison cheese, but it did not appear to be stronger, I thought, than I had seen in cheese not poison. After inspecting, I ate a piece the size of a hickory nut. It was followed with a little pain in the stomach and feeling of heaviness, as is common in cases of indigestion, which soon passed away, followed by no other effect than offensive breath. The next day I ate more, with less effect; and in a few days, the cheese being exposed to the air all the time, I could partake of it as well as any other cheese, except the unpleasant breath that followed every trial of using. It

was not used long enough to determine whether this peculiarity would also have died away or not.

Professor Caldwell ate of the same, sparingly at first, with no noticeable effect; but increasing the quantity gradually for a few days, vomiting followed, which at the time was thought to result from nothing but an ordinary case of indigestion, but inasmuch as this was one of the customary symptoms of that peculiar poison, I suspect it was due to the cheese.

Last winter a pretty bad case broke out in the city of New York, the particulars of which I have not learned, except that a careful analysis by different chemists in the city failed to find any indication of poison.

Another serious case of the kind is said to have occurred at Anamosa, Iowa, by which a considerable number of persons suffered terribly with the same symptoms that followed the Michigan and other poison cheese.

Five members of a family were, not long since, poisoned in Batavia, N. Y., some very severely, others slightly. Symptoms as usual, distressful vomiting that lasted three hours. The appearance of the cheese was nothing different from usual except the strong odor before mentioned, and also quite ripe and rich. It was highly colored, and said to be a Hamburg cheese.

These instances are sufficient to show the general character of the cheese and its effects. They are some of the strongest cases that to my knowledge have transpired. The milder cases that are occurring more frequently about the country seldom attract attention, or are even suspected of having a poisonous character. But I find them quite often, especially in low situations, and I conclude that cheese buyers do also, for I notice that in trying cheese they seldom *taste*, because they soon find that tasting, to use a mild expression, does not agree with them; and I have tasted enough to understand why. Similar cases have also occurred in Europe. Dr. Voelcker reports having analyzed several samples with no more satisfactory results than have been obtained in this country. The description he gives of the cheese is the same as is given of poison cheese here. It is rich and fatty, and strong and acid, and its use is followed by the same results. The cause is evidently the same there as here, and chemical analyses there, as well as here, have settled one point pretty conclusively, viz: That it proceeds from no mineral or other poison that the chemist can reach. It is of some other character; some-

thing that dissolves in his crucibles and eludes his search. What, then, can the cause be? is a query that will very likely be raised in the mind of every hearer. But to that query I can only reply as Agassiz did, when he was asked if the human race had a plurality of origin: "I wish I knew."

I propose now, for a short time, to call your attention to some of the circumstances that might be supposed to vary fermentation in cheese, that you may judge for yourselves whether there is any probability that the poison originates in that quarter.

The subject of fermentation in connection with the dairy interest, is both interesting and important. Everything in cheese-making goes on by fermentation. By fermentation we curdle the milk and extract the whey; fermentation ripens the curd in the vat; and the conversion of that curd into cheese in the curing-room, whether it be palatable or unpalatable, wholesome or unwholesome, is the work of fermentation only. This subject was very clearly and ably presented to this Association two years ago, and by those who heard it is doubtless well remembered now.

Every one present, it may be presumed, has a general idea of the nature of fermentation; but I may remark in passing, that the changes it occasions are always accompanied with the growth and development of myriads of living microscopic fungus plants, and that their growth and multiplication are regarded as the *cause* of the changes produced, and that these microscopic plants, or rather the germs or spores from which they originate, take the general name of *ferment*; so that when the terms ferment and fermentation are used, you will refer them back in your mind's eye to the germs as the moving cause.

I may further remark in regard to these fungus plants, that they are susceptible of great variation from changes in temperature, or from the composition of the substance in which they may grow. It is the same species of fungus, growing under different circumstances, that raises our bread, makes alcohol, beer, vinegar, wine, and cheese. This fact has some significance in looking for the cause of poison cheese. If changes occur from a change of conditions, if the same germs by a change of circumstances can be made to produce wholesome cheese in one case, and alcohol in another, it will require no very great stretch of the imagination to suppose that they *might* be so varied as to produce some *other* poison; and it is possible, at least, that the poison in cheese may be thus origi-

nated. The variations in cheese from temperature alone are very great. If two green cheeses from the same vat are placed to cure, one in a temperature of 70° and the other 50°, the one may become a fine, palatable cheese, the other bitter, offensive and unwholesome. But I must not stop to trace the changes further. I must turn to the examination of milk as the more probable cause of contamination, and from the crucibles of the chemist I appeal to the microscope to aid in the investigation.

I have prepared here some illustrations to show how milk appears, both in its natural and diseased condition, when viewed with the microscope, and also to show some of its natural, as well as unnatural, ferments, and how the latter get into it.

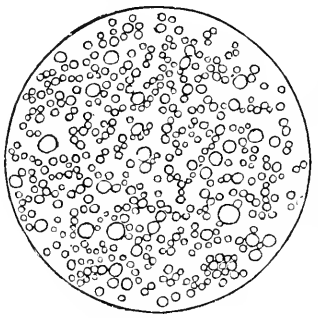


Figure 1 is a greatly enlarged view of the cream globules as they appear in healthy milk. It was taken from the milk of a large number of cows mixed. I wish you to take notice of the great inequality in the size of the globules, as it is an evidence of its healthy condition. This inequality may be a little greater than is common, the sample being taken from the milk of a large number of cows mixed together. The globules in some cases are much larger than in others, but I have seen a difference even greater than this in the milk of a single cow. You will notice also how evenly they are distributed over the view. This is another evidence of healthfulness. In healthy milk the globules are not only evenly distributed through the milk, but they are separate from each other, and move about in the watery mass in which they are suspended with as much freedom and mobility as the particles of the liquid in which they float.

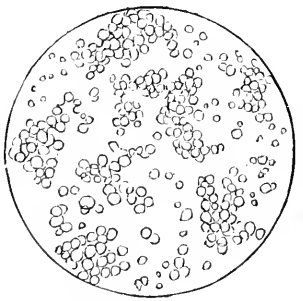
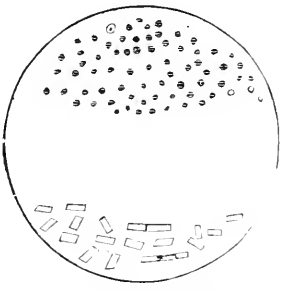


Figure 2 shows a sample of tainted milk, with the globules nearly all in clusters. This was caused by a little fever in the cow. When cows become feverish from any cause, as improper food or water, or exposure to too much hot sun, or by worrying with dogs or flies, their milk under the microscope takes on this appearance. The cream globules change at once when fever occurs, and, probably from incipient decay, their surfaces become viscid and adhesive, and they stick together in

little bunches or clots, and make cream appear thick and ropy.



Milk, whether healthy or unhealthy, always contains more or less organic germs that act as ferments. Those peculiar to healthy milk are represented by figure 3. The circular ones, on the upper part of the illustration, are what are called Micrococcus cells, or spores, and are always present in the milk when it is sweet, and are in it when drawn from the cow. The cylindrical ones, on the lower part of the view, are the germs concerned in the production of sour milk. They are the same species as those above. They have only assumed a new form from the altered condition of the milk. They are the only germs that necessarily belong to healthy milk. Others will be shown by-and-by.

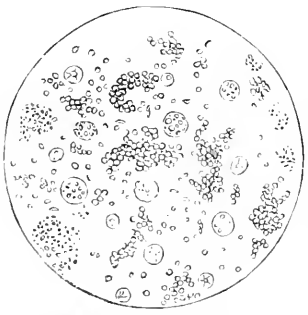


Figure 4 exhibits an aggravated case of diseased milk. It was drawn from a sick cow in a distillery stable in Williamsburg, at the time of the notorious swill-milk exposition in the city of New York in 1858 or 1859. The view is taken, as are three others, from a microscopic representation made by Dr. S. R. Percy, of New York City, as it appears in the Annual Report of the New York State Medical Society for 1860.

The sickness of the cow was very high fever and inflammation of the bowels. The milk was scanty and blue. Under the microscope it showed the milk globules cohering, and also little bunches of them broken down and decaying. Some of the decaying globules showed a yellow color; others of an olive green, and scattering spores of confervae. The milk also contained blood globules, which do not appear in the drawing.

Figure 5 is a view of a sample of the same milk, after standing closely corked for twenty-four hours. You see the spores of confervæ have grown to perfect plants, with branching stems. They afford a good illustration of the rapid growth of ferments in closely covered vessels. This progress was made in twenty-four hours at the temperature of

the air. Had it been warm and slightly agitated, they would have made as much progress in one hour as they did in twenty-four. The cream globules have been omitted in this drawing for the sake of distinctness. They appeared the same as in the other view. There were also the clusters of decaying globules, and those of a green and yellow color. Blood globules with a dark center were also seen; and at the upper side on the right hand appears a mass of reddish matter, which appeared to be a fragment of the mammary gland, that had sloughed off and been carried along in the milk.

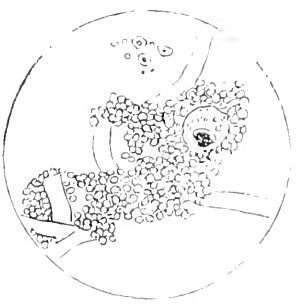
Under the high magnifying power with which these views were inspected, but a mere speck of milk could be brought under the field of vision—probably not more than one five-hundredth part of a drop—and yet in this small amount there appear nine whole plants and six parts of plants, the unseen portions of them running outside of the view. This, for a whole drop, would give seven thousand five hundred plants and parts of plants. This may give some idea of how numerous they were in the body of the milk. These are extraordinary cases, such as do not often occur in the country. I have introduced them here, not from any fancied connection with poison cheese, though the hygienic effect of this milk was somewhat analagous to that of poison cheese. Wherever I have learned the particulars of poison cheese, it has appeared that children have sickened under its use more readily than adults; the feeble sooner than the strong; and so with this diseased milk: children were made sick with it and infantile death followed in its train, when adults ate it without complaining. I have introduced them here, first, because they confirm my own observations in regard to the cohesion of the cream globules of tainted milk; and, second, because they show the termination of disease in milk, the incipient stages of which are very common; and, third, because they corroborate what I have before believed to be true, viz: that the germs of fungus plants, which in their growth become ferments, may be, and often are, taken into a cow's stomach in her food or drink, or even in her breath, and pass into her blood and thence into her milk, where they grow and multiply and inoculate with disease if they are of a malicious character. There can hardly be a doubt that the germs of the plants here shown were derived from the distiller's slops.

Early in my experience in cheese factories, I became satisfied of

the transfer of ferments from the water of pools, mud-holes, swamps, &c., into the milk of cows drinking such water. I had noticed repeatedly that when cows drank from such places the peculiar smell of the water reappeared in the curd and whey in the advanced stages of the curding process. It did not often appear in the milk when it first came to the factory; but when it came to be warmed up, and especially when it approached blood heat, the exact odor of the stagnant water increased with great rapidity. It was not one uniform odor that appeared on every such occasion, but each swamp, mud-hole, or pool, from which the cows happened to drink, reproduced its own peculiar smell in the ripening curd and warm whey, giving satisfactory evidence that the germs which had given flavor and odor to the water had, with their vitality retained, passed, in each case, to the milk of the cow, and by their marvelous multiplication developed their peculiar effects in the warm curds and whey.

From such observations I had become so thoroughly convinced of the passage of living spores into the milk of cows from bad water and food and air, that I had determined, so soon as I could procure a suitable microscope for the purpose, to test the fact by ocular demonstration. You can easily imagine, then, with how deep a satisfaction I received the following facts from Professor James Law, of Cornell University, with permission to copy the sketches he had made for his own use, which are presented to your inspection to-day. They afford the desired proof, and their application comes directly home to us as dairymen.

On the first day of October, 1870, a man who regularly furnished the people of Ithaca with milk, left some of his goods at the house of Professor Law. It was set away for the cream to rise, which, when it came to the surface, did not appear just right; it was more adhesive than usual, and half inclined to be ropy. Others might not have noticed any peculiarity; indeed, I have not learned that any one else observed anything unusual, though other parties were furnished from the same vessel. But under the observant eye of that distinguished Professor, such a fact could not be allowed to pass without investigation. The microscope was brought into requisition, and here is what it re-

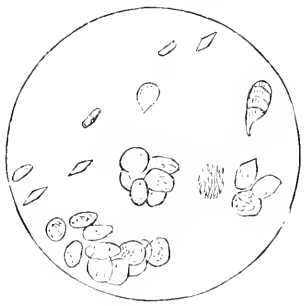


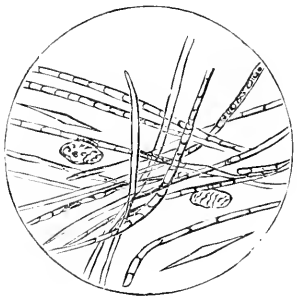
vealed. The first thing that will strike your attention is this large stem of a fungus plant. Whence the spore of that plant reached the milk was a mystery that needed a solution.

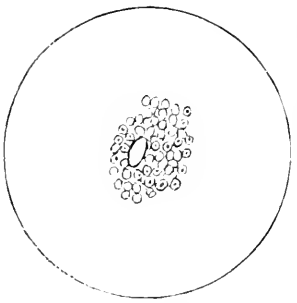
The next thing to notice is the great adhesion of the milk globules. They are closely stuck together, all in a mass, and overlapping each other and apparently piled up, so as to cover the fungus stem. This is a striking characteristic of tainted milk. Then there is a large spore laying bare on the adhering globules; and out a little aside are a few small spores and some blood cells.

On the 5th, when the milk was four days' old, and had become sour, another examination was made, and there appeared two species of algæ, (fig. 7,) a few spores and arthrococcus, or sour milk cells, a few of which only are represented. On the 8th a further examination brought out similar results, (as shown on figure 8.)

Did the spores from which these plants sprung come from the water with which the milk vessels were washed, and, adhering to their sides, infect the milk and fill it with their numerous progeny? or did they come from the water the cows drank, and pass through their blood to reach the milk? The water used by the cows, and which made its way over the mossy ground, showed the same germs found in the milk. Examined October 9th under a magnifying power of three hundred diameters, there appeared an abundance of spores and diatoms, the latter only being common to spring water. (Fig. 9.) After standing closely corked thirty days, full grown plants like those found in the milk appeared in the water. (Fig. 10.) Having found the same spores in the water the cows drank, and in their milk, it was now desirable to know positively whether they passed through the vascular system of the cows. On the same

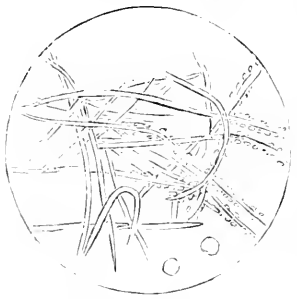






day, October 9th, blood was taken from one of the cows giving tainted milk, and lo! the same kind of spores were seen there. (Fig. 11.) A sample of this blood was kept closely corked six days, and there were developed in it the identical forms that were produced in the milk and in the water from which the cows slaked their thirst. (Fig. 12.) Could any demonstration be more conclusive?

Further experiments were made by putting a drop of blood in an ounce of healthy milk, and shaking it well and corking closely. Three days afterward the milk was filled with the full grown plants. (Fig. 13.)



A drop of water from the spring, shaken with an ounce of pure milk in the same way, and standing the same time, showed the same growth. (Fig. 14.)

When the blood was drawn from the cow giving tainted milk, her pulse was found to run sixty to the minute, and the temperature of her body to be 102. This, it will be remembered, was in October, after the heat of summer was past, and this extraordinary temperature could not be ascribed to external heat. It was evidently caused by the germs carried into the vascular system from the water she drank, and, acting there as a ferment, and by interrupting the circulation, produced fever. This is a significant item. It is just what happens with cows giving tainted milk, so called. The case investigated by Professor Law was just an ordinary case of tainted milk, such as occurs every year, and which was so frequent in 1870. From the very first of that kind of milk I met with, down to the last, every instance has been accompanied with indications of fever, so that in this demonstration we

have satisfactorily accounted for a large share of the infected milk, and the means of avoiding it are suggested.

The results which have appeared from the facts illustrated, have a direct bearing in relation to poison cheese. That cheese is made poison by unnatural fermentation hardly admits of a doubt. You have seen how the seeds of fungus plants, which act as ferments, reach the milk and infect it. You have seen that cows eating or drinking food that contains spores carry them into their milk, and how quickly they spring into a vigorous growth and change the characteristics of the milk. How often are cows allowed to slake their thirst in swamps or stagnant pools, which always abound in the seeds of miasma, which are sure to produce new or modified fermentation in the milk or resulting cheese. It would seem from what I have shown that there is but little difference between one's drinking from the pool himself, or eating the milk or cheese derived from the cow that has drank the water. It is not so strange, it appears to me, that poison cheese should now and then occur with the chances, which we know exist, of carrying poisonous ferments into it, as it would if it should not occur. Cows are too often exposed to chances of imbibing ferments not to get some poisonous ones once in a while. And then, instead of obviating the difficulty by our treatment of the infected milk, we take the most efficient means to aggravate it.

Some of the fungus plants, whose growth causes fermentation, are so tenacious of life that neither frost, nor wetting and drying repeatedly, will affect them. Of this kind is our cherished friend, the micrococcus cell, that is always in milk, and is so abundant and efficient in rennet, and in digestion generally. But it happens that the organisms that modify unfavorably the fermentation in cheese, maintain life by a more feeble tenure. They can only live under water, or in some envelope that will protect them from the oxygen of the air. Though, like all other plants and animals, they require oxygen in their growth, they can bear but very little of it. For the same reason that a fish dies when out of water, do these growing fungi perish in the air. Instead of destroying them in the milk, on its way to the factory, we take the most efficient means to cultivate them. We cover our milk cans tightly to protect our enemies from the air, and nourish a serpent in our bosoms. If we would expose milk to the air we would kill, not the germs, or spores, but

the growing plants, as soon as they germinate. Nature purifies water in this way. Fungi grow only in still water, for in such only can they be protected from the air. The waves and currents of the mighty ocean are constantly rolling its waters to the surface, to be cleansed by æration; and the babbling brook as it leaps over its miniature cataracts and rolls over, and winds along its pebbly bottom, is cleansed of all that æration can destroy. If we would all follow the example that Nature has set us, and expose our milk to the air instead of shutting it away, in place of being injured, it would be improved for the purposes of cheese-making by an hour's ride to the factory, and such a thing as tainted milk or poison cheese could hardly exist.

TRANSACTIONS

AT THE

SEVENTH ANNUAL MEETING

OF THE

AMERICAN DAIRYMEN'S ASSOCIATION,

HELD IN THE COURT HOUSE, UTICA, N. Y., ON

TUESDAY, WEDNESDAY AND THURSDAY,

January 9, 10 *and* 11, 1872.

At half-past eleven o'clock on Tuesday morning the Convention was called to order by the President, Hon. Horatio Seymour.

Mr. Hawley, of Onondaga, moved that the Chairman appoint the usual committees to prepare the business of the meeting.

The motion prevailing, the Chair appointed the following gentlemen on the committees named:

COMMITTEE ON ORDER OF BUSINESS.

Dr. L. L. Wight, of Oneida; J. L. McCall, of Vermont; Holdredge, of Otsego; Merry, of Oneida; H. Farrington, of Canada West.

COMMITTEE ON NOMINATION OF OFFICERS.

L. B. Arnold, of Tompkins; S. A. Farrington, of Yates; H. C. Greene, of Pennsylvania; L. T. Hawley, of Onondaga; David H. Burrell, of Herkimer.

COMMITTEE ON FINANCE.

A. Burnham, of Chautauqua; Alexander Macadam, of Mont-

gomery; F. Ives, of Herkimer; C. C. House of Lewis; D. Hamlin, of Jefferson.

At the request of the President, the Secretary now read the programme of the Convention, as set forth in the circulars announcing the meeting. In calling attention to the address that was expected from Professor Caldwell, the Secretary stated that some members might question the advisability of engaging the same speaker for three successive annual meetings. Professor Caldwell himself expressed his doubts as to the wisdom of appearing at this time, but had consented to waive his own views and yield to the solicitations of the officers of the society, who felt that the unusual satisfaction which members had expressed respecting the two addresses heretofore given by that gentleman before this Association, and the frequency with which references were made to those addresses by speakers in these meetings and agricultural journals, fully justified themin asking him to read another paper at this time.

Adjourned until 2 P. M.

AFTERNOON SESSION—TUESDAY.

The reports of the respective committees were first in order, but as they were not ready to be given, a short opening address was made by the chairman of the convention, Hon. Horatio Seymour, who spoke as follows:—

At this time, when the farmers of our country are forced to take low prices for the products of their toil, I cannot congratulate you upon a year of profitable labor. Those have done well who have been able to come out with small gains. On the whole, dairymen have less reason to complain than those who raise grain, or who sell beef and pork. There is one view of their business which should give them courage. Within the past ten years, with all the drawbacks of heavy taxes, high interests and costly labor, the manufacturers of cheese have made their product one of the leading articles of exportation. They have won a foothold in the European markets, and they have made themselves felt in the commerce of the world. The landholders of Great Britain have been forced to look about them to see how they can ward off the blow to their interests. A distinguished nobleman has warned the farmers of England of the danger which threatens them in this branch of agriculture. A struggle is going on for the control of the European market for this great article of food. We shall win in the battle. We have gained ground in the past, under all the disadvantages which ever attend the working out of new methods of production and new channels of commerce. Having gained a strong position in the markets of England, we put down our prices, in 1871, about one-fifth. This is hard for us, but we can stand it; but can the farmers of England do so? It will not cost us as much hereafter as it has done heretofore to carry on our dairy farms. Labor, food, clothing, and feed for our cattle, are coming down in price. We are not only going to make at a less cost, but we are to make a better article. This hard year, in the end, will help us. It will give us wider and more cer-

tain markets. We have this advantage over all other kinds of northern farming, we have a steadily growing demand for our products from Europe. It does not depend upon accidents or failures of crops abroad, or war or any other calamity to our fellow-men. It grows out of the fact that we have won it and hold it by making the best use of our cheaper lands and better methods. We do not expect to make the highest priced article of cheese. It is not, at this time, profitable to do so. These are used by a limited number. We wish no ill to our brother farmers of England. But we can and ought to make cheese cheaper than they. They have the advantage of us in their own markets in selling grain and many other articles of food. In producing these the price of labor is the great element of cost. In dairying, the price of land is the great element of cost. We have the cheapest lands, and upon the fair principles of free trade we ought to rule the English cheese markets. The past proves that we can do so. We have fought with success for a foothold on their ground, with all the drawbacks of the want of skill, high interest account, heavy cost of everything we bought or hired. As these drawbacks disappear or become less, we make a better article and sell it at a cheaper price. How, then, can the English farmer hold his ground? We strike off about one-fifth from our prices this year. Can he do this? If he cannot, he must then turn his labor into other channels, in which, we hope, he will be prosperous and happy. I do not say we have yet gained our points, but we shall do so if we hold out as we have begun. I have full faith in the future prosperity of this branch of farm industry, not only on account of the facts I have glanced at, but for another reason. I think I have a right to say that in the whole history of agriculture, not in this, or in any other country, or at any other time, has there been seen the same degree of intelligent co-operation that is now exhibited by the cheese manufacturers of the United States. They not only have national and State conventions, but there are numerous town and local associations, which hold frequent meetings in the winter months, to talk over everything which concerns their branch of industry. They do not merely discuss the mechanical process, and the question of price and pay. Taking a large view of their business, they call upon chemists to come before them, and teach the mysteries of the subtle elements of good or evil which enter into the processes of their factories; they call upon those who are skilled in the laws of animal and vegetable life to tell them how to keep their animals in health and vigor, so that they may get the largest amount, in the best condition, of the milk which they use in making their product. They advise with buyers and carriers as to the best ways of getting their products into the markets of the world. More than this, we have heard valuable and interesting discourses upon the social and other outlying influences of this branch of business. This large way of dealing with their products is followed up constantly and vigorously over all that section of our country which is engaged in dairying. Can all this be said truthfully of any other branch of agriculture? Nay, never can it be said that the men engaged in commerce, mechanics, manufactures,

or any other business product, are acting with the same degree of co-operative activity or intelligence.

We meet here to-day, members of the American Dairymen's Association, to carry on the work to which I have alluded, and to this end able lecturers have been engaged to read papers which will not only be interesting when delivered, but which will be of still greater value to study, when they are published in the reports of your proceedings. Such papers have given interest and dignity to the action of this society. We must not forget how much we owe to those who wield the pen in stirring up the interest of the public in our pursuits, and we must bear in mind that without them we could not have brought about the co-operation of the dairymen, which gives them their strength and success as a class.

The debates of this Association have always been spirited, pointed and useful, and they will continue to be the chief attraction of our meetings. It is hoped all will take part in them. A few well-considered words on points which have been thought over, are always valuable, no matter how they are uttered. It is not oratory but facts we want.

As there are many of our best cheese-makers who will not talk to us in public, we have added a new feature to our proceedings, so that we can get at their wisdom. One evening is to be given to a social meeting. At this, the members are supposed to be introduced to each other, and each is at liberty to speak to and to question others, with respect to any matters connected with the business of cheese making. He is at liberty to draw out from the silent men of wisdom their stores of knowledge and experience. We hope to gain two points by this social meeting. In the first place, that those who do not speak in public will tell us in private conversation what they know. In the next place, we hope to meet the wants of many who come to get some special information upon particular points, and who cannot gain it from debate which may touch upon such points. At this social meeting, each one has a right to go to any member, although they may be strangers, and put to them any question they may wish to have answered.

We have now entered upon another year of labor and care in our respective pursuits. Industry, carefulness and intelligence are commended to us, not only by interest, but by high considerations of duty and religion. The Almighty co-operates with honest toil, wherever it is exerted. He is the fellow-laborer of the farmer; He gives seed time and harvest; the rain in due season, and the light of the sun to bring the fruits of the earth to perfection. He cares for all living things. I trust and pray that He will be with us in the work of the year, and that He will crown our labors with success, and give us peace and prosperity and happiness in our homes.

The Committee on Order of Business reported the following programme:

TUESDAY AFTERNOON.

Reports of Committees:—

On Sunday cheese-making.

On juster apportionment of milk at factories.

On the establishment by the State of an experimental dairy farm.

On the best crops for soiling.

An address by Dr. L. L. Wight on the "Lessons of my experience in cheese-making in 1871."

An address by T. D. Curtis, Esq., on "The standard of excellence in cheese-making.

TUESDAY EVENING.

Professor X. A. Willard's address on "The manufacture of condensed milk."

WEDNESDAY MORNING.

Address by H. Cooley Greene, Esq., on "The manufacture of butter in creameries."

An address by Wm. Blanding, Esq., on the question "Is it policy to take any cream from the milk before making it into cheese,—and if so, how much?"

Address by M. Folsom, Esq., on "The commercial aspects of the cheese market."

WEDNESDAY AFTERNOON.

Report of Committee on Finance.

Report of Committee on Nomination of Officers for the ensuing year.

Address by S. A. Farrington, Esq., on "Dairy-farming and grain-raising in connection."

Address by Hon. Harris Lewis on "Winter Food of Dairy Stock."

Factory Reports.

WEDNESDAY EVENING.

Address by Professor G. C. Caldwell, of Cornell University, on "The practical value of chemical analyses of the dairymen's raw materials and of the products of his manufacture."

THURSDAY MORNING.

Cooking food for dairy stock.

General discussion.

The report of the committee was adopted.

The following committees were called upon for reports, but asked for further time:

On Sunday cheese-making.

On a juster apportionment of milk at factories.

On the establishment by the State of an experimental dairy farm.

Mr. J. B. Dick, of Erie County, being chairman of the last named committee, the Secretary called the attention of the Convention to the death of Mr. Dick, which occurred in the autumn, and moved the appointment, by the Chair, of a committee of three to prepare suitable resolutions in reference to his death. Carried.

The Chair appointed Messrs. Weeks, of Onondaga, Safford, of Cattaraugus, Smith, of Erie.

The President then announced that an address by Dr. L. L. Wight, of Oneida County, was now in order. On being introduced, that gentleman read the following paper:

THE LESSONS OF MY EXPERIENCE IN CHEESE-MAKING IN 1871.

Strange indeed, would it be, if, while surrounded by new inventions, discoveries and improvements in all other branches of science and art, cheese-making alone should remain unprogressive. In order, however, that cheese-manufacturers may avail themselves of the advantages of individual observation and experience, these conventions have been instituted, on which occasions it would seem fitting and proper to compare notes and give to each other the benefit of such discoveries, improvements and changes as our individual experience has caused us to make in our respective dairies. However slight and unimportant, as isolated facts, they may seem, their aggregation my tend to advance our interests one step farther forward, and whatever has a tendency in this direction may well occupy a certain portion of our time and attention.

The difficulty encountered by our religious and moral teachers, seems to be not so much to impress upon their charge the truths of their particular sphere of thought, as to induce them to will and act according to their highest convictions of piety and morality. So, too, in our sphere of activity. The difficulty with dairymen is not so much that they are ignorant of the morally imperative obligation to preserve the milk product pure, as the lack of will to take the requisite trouble to do so. There is one consolation, however, in all these departments, and that is, that the evils which are certain to recoil upon themselves—their own condemnation—is just. The impoverished and impure state of the milk, resulting from poorly kept, dogged, pounded, filthily milked cows, is nothing new. These preliminaries having been faithfully and sedulously attended to, however, there is still sometimes found to be a loss by the milk not retaining its sweetness and purity as long as is desirable, especially in very hot weather, when it is transported considerable distances. But we have lately found that the forcing of atmospheric air into and through milk, thoroughly, has a wonderfully purifying and preservative influence. Should every dairyman, besides thoroughly taking all the usual precautions which every one advocates, aerate his milk well before taking it to the factory, it would increase both the quantity and quality of his cheese at least one tenth, during the warm weather, and thus add one-fifth to his income. Were all the patrons sending milk to a factory to conform rigidly to these rules, a forty-cow dairy thus conducted would pro-

duce as large an income as that of a fifty cow dairy, managed as they ordinarily are. This, at an average allowance of forty dollars per cow, increases his income four hundred dollars during the season.

Some may think this an unfounded assertion. If any skeptic, however, will test what I affirm, by setting a vat of perfect milk side by side with one which has too much acidity, or one which is tainted, in a hot day, he will find that on weighing his cheese, nine and one-half pounds of the pure milk has made as much cheese as ten and one-half and sometimes eleven pounds of the imperfect milk. Let him, furthermore, keep his cheese thus made in separate lots until he sells them, and he will find the dealers will sooner give eleven and one-half cents per pound for the cheese made from the perfect milk than ten cents per pound for the cheese made from the milk which had been only just perceptibly soured or tainted.

I think I have learned some things about the use of rennet. It is stated by some old cheese-makers that more rennet than necessary, provided it is pure, does no particular harm, but passes off in the whey. And if sufficient rennet is used to commence coagulation in twenty or twenty-five minutes, we formerly thought it was enough. It seems, however, that there is much importance to be attached to the quantity as well as the quality of the rennet used. And that the quantity should be changed as the condition of the milk and the temperature of the weather may vary. Skim-milk requires more rennet than new milk. The reason given for this being that the presence of the buttery particles induces a more rapid action of the rennet. Milk in the spring of the year—or when cows are poorly fed—or in a very dry time—as in all these cases the milk is impoverished—or in cool weather, requires more rennet than under opposite conditions. If too small a quantity of rennet be used, the cheese, although it may appear well when removed from the press, will remain longer without the curative process proceeding. It will tend to be hard, dry, white, crumbly and sour, and very likely will begin to leak after it is two or three weeks old. The manufacturer wonders what is the matter with his cheese, as the milk seemed good and the curd was apparently all right, and the cheese appeared nice when taken from the press. When these phenomena appear, a little more rennet would improve it. If, on the other hand, too much rennet is used, the cheese will cure very rapidly—will be soft, buttery, salvy, and very tender when not more than ten or twelve days old, and will continue to cure too rapidly and to decompose too early. Such cheese must be consumed soon, and not be kept very long. The proper time for milk to commence to coagulate is in from eight to fifteen minutes after the mixing in of the rennet, according to the condition of the milk and the temperature of the air, as before stated. The dairy community suffers greatly from the need of good rennets. Our imported rennets are extremely uncertain, and the native production is seldom saved and cured with sufficient care. Herkimer County cheese owes its celebrity to the care the farmers take in saving and curing their own rennets, not less than to the character of their soil

and the quality of their grasses. The whey taken from a vat whose milk was pure, and scalded and refined, with the albuminous impurities removed, is the best known liquid to soak rennets in.

The next subject I would call your attention to is the recent improvement in the mode of pressing cheese. The gang-press, which at first seemed to be a failure, has, during the past season, been so much improved and so fully perfected as apparently to leave nothing farther to be desired in the line of hoops and presses. The advantages to be derived from the use of this device are many and important. The largest part of the labor of pressing cheese is saved. Considerable press-room is spared—the use of all press-cloths and press-boards is avoided—the bandage is adjusted to its place previously to the filling of the hoop, thus superseding all after bandaging—the curd of each cheese can be accurately weighed with very little trouble, thus insuring a very near uniformity in the size of the cheeses—one single screw will furnish all the force required by this method and do the work better than ten, fifteen or even twenty screws in the ordinary method of pressing. All cheese thus pressed, with due care and attention, will be very nearly perpendicular in appearance, of the same height, having a smooth, fine rind, with no pressing out at any corner, and will, in every respect, be at least equally well pressed as in the old method, and present on the counters a uniformity and beauty of appearance not to be attained in any other way I have ever seen. The cheese being of nearly identical size, can be put into the same sized boxes without any cutting down of the boxes. The cheese are also more easily removed from the hoops than they usually are. On the whole, I think the factorymen may congratulate themselves on the success thus attained for them.

As regards the most fitting time to market American cheese, there seems to be a diversity of opinion. Some of our most eminent American writers on dairying, and of deservedly high authority in most particulars, strongly urge that our factorymen should enlarge their curing-houses, and hold their cheese to accumulate during the warm weather, and then dispose of them in large quantities at a time late in the season, or in the following spring. The arguments of these gentlemen appear to me more plausible than wise. They assume that we now urge our cheese off when it is not needed—that shipping in warm weather greatly injures the product; that the dealers and shippers take advantage of our anxiety to sell, and fleece us without mercy. Now it seems to me, there is another side to this question. We all know that English cheese is held up to the emulation of Americans for its keeping qualities, and like all else English, it is solid, permanent, enduring. The nature of their climate and the habits of their people, naturally tend to produce this quality of cheese. The English people, however, need large quantities of cheese to consume before their own dairies are naturally ready for the market. Their taste has also been very much modified by the introduction of American cheese, so they now demand a much more mild, and more recently made article than formerly. America is just adapted, both by her favoring climate,

and the natural versatility and celerity of the habits of her citizens to fill this growing demand. An American in what business soever he may be engaged wishes to turn his commodities rapidly—to use his money often—and to make up by rapidity what he may loose by lack of permanency. Then, again, some cheese retain their good qualities, although shipped in hot weather, and hence all cheese may, when we have learned the best methods of caring for our milk, and manufacturing and curing our cheese. So this difficulty may be nearly obviated by making the right quality. My advice would be to make such cheese as will be rich, mild, buttery, sweet-flavored, and ready to be consumed in from thirty to forty days after having been manufactured, and to send this to England as soon as they think they need it, and thus save ourselves the expense of large curing-houses, the labor of caring for so many cheese during the season, the loss by shrinkage, the danger of depreciation from loss of flavor and becoming skippered during our long and intensely hot summers, the use of our money, the satisfaction of knowing what success we are having, and the certainty that our brethren over the water have paid for and consumed our cheese, what success or failure soever may betide their own. I have observed that those factories which invariably sell with the market as soon as their product is in a good condition to be forwarded, usually succeed the best one season with another. Perhaps I am altogether mistaken on this subject, but I believe our interests lie in the direction hereby indicated

Perhaps it is not inopportune at this time to refer to the credit system in the marketing of cheese. A correct history of the system of marketing cheese which has obtained in central New York during the last score of years, could not ignore many a sad disaster and deplorable result arising from the credit system. The last season's business has been no exception to this impressive lesson. A sudden, unexpected, and unhealthy inflation of prices, clearly resulting from this cause, soon collapsed with the loss of thousands of dollars to many, and a dull, dragging market to all, out of which we have not yet escaped. Although we have all felt this general shock, and individual sufferers are to be greatly commiserated, still, if we will profit by past experiences, the condition of the trade may be rendered more healthy, as the air is purified by earthquakes and tornados, which devaste large tracts of country and destroy many lives—or, as the universal weal is supposed to be promoted by the banishment to eternal misery of certain portions of the human race.

A few years since there seemed quite a rage to divide up the factories into smaller ones, and to organize branch factories. In my opinion, all this has worked against the interests of dairymen. Although they thus transport their milk shorter distances, it is evident to reason as well as conformable to experience, that a factory of from one to three hundred cows can ill afford to pay the price for the skilled experience which a factory of from five hundred to one thousand cows can do. And again, the proprietor or salesman can not expend as much care and time managing the factory and effecting sales. Furthermore, one or two hundred cheeses will not attract

the competition of the buyers as much as one or two thousand will. Hence, although something is saved in time in transporting the milk, it is more than counterbalanced by losses in these other various ways.

I will encroach upon your patience to touch upon but one more theme, and that regards the prices charged by the manufacturers to the patrons for furnishing materials, making, curing and marketing the cheese. Heretofore, these prices have been various, arbitrarily assumed, and fixed definitely for the season, regardless of the prices obtained for the product. The thought has suggested itself to my mind that some sliding scale of charges might be agreed upon between the manufacturer and the patrons, which would be just to all parties, and then, if the sale price of cheese should be high the patrons would pay a higher price for the making, and if the sales were lower, then the making and furnishing price would be decreased accordingly and proportionally. As an illustration of this theory, we will suppose the price for making to be ten per cent. on the sales, and if the furnishing be also done by the factory that five per cent. more be added, as the furnishing expenses are, one year with another, about one-third of the entire expenses. This would be fifteen per cent. on all sales. Then when the cheese sold for eight cents per pound, the entire expenses would be one dollar and twenty cents on every one hundred pounds of cheese. Should the sale price be ten cents per pound, the expenses would be one dollar and fifty cents per one hundred pounds of cheese; and if the sales should reach twelve cents per pound, the expenses would be one dollar and eighty cents for every one hundred pounds of cheese sold. And the same ratio for higher or lower sales would still appertain. This system would make the factorymen share equally with the dairymen in the profits or losses of a good or bad season. It would also hold out inducements to manufacturers to make the best possible quality of cheese and to sell it at the highest obtainable price.

Mr. Greene wished to inquire if any member or members of the convention had had any practical experience to prove that skim-milk required less rennet than new milk, for, as near as he could remember, such had not been his experience.

Mr. Arnold replied that he had had quite an extensive experience in the matter, and all of his observations and experiments substantiated Dr. Wight's statement. At first thought, it appeared that as the milk approached acidity, less rennet was required to coagulate it, but the rising of the cream took along with it that portion of the milk the most actively seized upon by the rennet, hence, it took skim-milk longer to coagulate than new milk.

Mr. Davis, of Herkimer, heartily indorsed Dr. Wight's remarks with reference to the adoption of a scale of prices, as, in his opinion, the system would be conducive to a fair uniform rate.

Mr. Hawley, of Onondaga, remarked that, as the question of cooling and aerating milk was an important one, and one that had been somewhat discussed at former conventions, and also by the press, without arriving at any definite conclusions with reference to

it, he would inquire if any one knew of any factory which had been benefited by these processes.

Dr. Wight replied that these processes had been successfully tested at his own factory. It was found that merely airing the milk without cooling it would cause it to keep pure and sweet twenty-four hours. This process necessitated the carrying of milk to the factory but once a day. If the quantity of milk is over two hundred pounds weight, cooling as well as airing is, perhaps, necessary; otherwise airing, simply, is sufficient. Aerated milk not only makes more cheese than milk not aerated, but also far better cheese, and he had his own experience to prove it.

Mr. Scoville, of Oneida, wished to know if airing milk prevented the cream from rising; and another gentleman inquired what process Mr. Wight adopted in airing the milk at his factory.

Mr. Wight replied that, with reference to the question of the first gentleman, he had made no experiments in that direction, and therefore could not answer the gentleman. In reply to the second gentleman, he said that the milk at his factory was aired by forcing air through it from the bottom by means of an air pump, connected with a perforated disc in the bottom of the can.

S. A. Farrington, of Tompkins, had had no experience in aerating at the dairy, but had had some experience in aerating on the way to the factory. Arnold's ventilators had been used in many of the cans brought to the factory, and his maker could readily tell which milk had been aerated and which not.

Mr. Moon, of Herkimer, had found that he made more cheese, of better quality, when he used a dipper to aerate milk, both stirring and aerating it. Experience had shown him that in using an agitator, the milk was stirred and cooled, not aerated. Aeration he thought a necessity.

Mr. Hawley said Professor Caldwell, of Cornell, had said that decomposition of milk commences as soon as drawn from the cow, and therefore aerating milk should commence as soon as possible after the milk is drawn from the cow. Unless perfect cleanliness is observed, too, milk cannot be kept perfectly pure, even if aerated and cooled, though aerating and cooling will better it. Dairymen, to profit by observations, must not go home and fold their arms, but must go to work and put them in practice.

A letter from Mr. Hill, a Madison factoryman, setting forth the great value of aerating and cooling, was read by the chairman.

Dr. Wight, in reply to an inquiry, said he had had but little experience with floating curds; when the milk in the vats had been aired, there had been no trouble with floating curds, and when not aired, but little.

Mr. Greene, of Pennsylvania, urged that patrons should aerate and take all measures to keep the milk in pure and sweet condition. Factory proprietors ought to ascertain what is required to keep the milk good, and then insist upon it. They should resolve to receive no milk from patrons which had not been aerated.

Mr. Smith, of Wisconsin, gave it as his opinion that a large proportion of trouble in making cheese was owing to the factorymen's

ignorance as to how much rennet should be used, he thought altogether too much rennet had been used in days gone by, and if less were used the cheese would be milder and otherwise better. He had made forty-eight tons of cheese from one hundred and forty-four rennets the past year.

Mr. Farrington, of Canada, had little experience in aeration, but he had little doubt that Dr. Wight's theory of the value of the process was correct. There is much volatile matter in the milk when it is warm; pass the air though the milk and this substance is eliminated. He doubted if, however, air would accomplish this good effect alone. He would cool it also. Milk, like butcher's meat, contains nitrogen and moisture; add heat and decomposition takes place. Remove the heat and the meat will keep. Remove the moisture it will keep also, for it becomes dried beef. Nitrogen, moisture and heat all exist in the milk; remove the heat, and one condition necessary to decomposition is gone.

Hiram Walker, of Oswego County, urged the importance of dairymen practicing at home what they can learn in the convention. He also urged the importance of dairymen informing themselves fully on all subjects. They can secure this best by taking a good agricultural paper.

Mr. Hawley, of Onondaga, referred to a visit which he made in 1862 to the celebrated butter dairy of Hon. Zadoc Pratt, of Greene County. At that time Mr. Pratt sold all his butter for sixty-five cents per pound, because he cooled and aired his milk, and made his whole process a model for cleanliness and neatness, while neighboring dairymen, who neglected these precautions, obtained only thirty to fifty cents a pound for the product of their dairies.

S. A. Farrington, of Yates, urged that care should be taken that cows do not eat leeks or weeds which will taint the milk, or breathe an impure atmosphere which will also effect it.

Mr. Greene, of Pennslyvania, related an instance where a dead cow, left as carrion, affected the milk through tainting the atmosphere.

Mr. Davis, of Herkimer, had found that uncleanliness had the most deleterious effect on milk. Care should be taken that the milk is not odorized by the stable.

Mr. Schermerhorn, of Oneida, discovered veins of blood in milk from cows run by a dog. He had also found that milk from those cows tainted soon. He did not think that milk was tainted through carrion lying in a pasture, and gave instances in support of his opinion. He had traced taint in milk to covering cans of milk and cows feeding on weeds in woods.

Mr. Thompson, of Wayne, referred to his experience, in former years, in making cheese in a Massachusetts factory. There the patrons were supplied with small milk cans, which, when filled with milk, were immersed in cold, running water. He had no bad milk in his factory when his patrons thus carefully cooled their milk, and the cheese made from this milk, brought an extra price.

Alexander Macadam, of Montgomery, said cooling milk will keep it from souring. He did not think that aerating would keep it

from souring. Aerating would remove the taint; cooling would prevent souring. Combine these and your milk will remain in good condition. He would not pump the barn air into the milk, for by so doing impurities and germs of decomposition might be carried into it with the air. He would pump in the air at a distance from the barn. He thought it might be well to pump in air all the way from the barn to the factory.

Mr. Holdredge, of Otsego, differed with all. They were right in some points, but were only right when they coincided with Nature's law. He had found that milk warm just as it came from the cow was the best for making cheese. He had made a good cheese from curd so tainted that it fouled his fingers on touching it.

S. A. Farrington said the reason Mr. Holdredge made good cheese from such bad curd was because he had exposed the curd to the air—aerated it. He urged the value of aerating curds.

Mr. Hawley, of Onondaga, again urged the importance of aerating and cooling milk as a preventive of growth of spores and keeping it pure and sweet. If farmers can be induced to be neat and cleanly, and aerate and cool the milk, the cheese would bring one or two cents more per pound.

Mr. Schermerhorn inquired if milk would not keep better by heating to 130 or 140 degrees, and then cool to the required point.

S. A. Farrington replied that was merely another method of aerating.

Alexander Macadam thought the way to get at the cause of floating curds would be to try to make, in October, a floating curd from pure milk as it came from the cow.

Mr. Hawley thought heating milk would spoil it for cheese or butter-making.

Mr. Schermerhorn said English makers who practiced heating made the best butter and obtained the highest price for it. He had made the best butter the same way himself.

Mr. Hawley said he had heated milk, but it drove off the aroma. He defied any man to heat milk without driving off the aroma. If you cannot retain the aroma it were useless to talk of making fine butter.

Robert Macadam, of Oneida, said in making Devonshire butter, or clouted cream, the best butter sold in London, more heating of the milk is practiced than Mr. Schermerhorn indicated.

Mr. Ellison, of Herkimer, urged that rennets must be prepared properly to be good. He considered that worthless rennets in a case he instanced was owing to the butchers bleeding the calves to make the flesh white until the strength of the rennets was gone. He urged also that patrons must keep their milk in pure state to expect the factorymen to make the best cheese.

Mr. Farrington inquired whether rennets do not vary naturally, in strength, one year as compared with another.

Mr. Moon asked Mr. Smith, of Wisconsin, how he prepared his rennet to make seven hundred pounds of cheese from one rennet.

Mr. Smith, of Wisconsin, detailed his method of making cheese. He soaked six rennets a week in whey, for 4,200 lbs. of cheese, adding

about as much fresh whey each day as he removed from the earthen vessel for coagulating purposes. He was fully satisfied that a rennet from a four days' calf would make all the cheese two cows could produce. It was three-quarters of an hour before coagulation, and he scarcely ever put the knife in less than an hour after the rennet is applied. His cheese has been firm, mild, and brought the highest price.

Alexander Macadam said Wisconsin milk must be much different from New York State milk, or else the rennet works different there from what it does in this section. Here the milk begins to thicken in ten minutes after the rennet is put in, and it is ready to cut in forty minutes.

Dr. Wight, of Oneida, said these questions of time of coagulation and of cutting the curd are of the most important character. New York dairymen had been hurrying coagulation, and expected it sooner than twenty minutes after putting in the rennet. If the Wisconsin theory be correct, we must go back again.

Mr. Schermerhorn, of Oneida, asked Mr. Smith if the cream rises when the milk stands so long before coagulation. Mr. Smith said the cream would rise, but he prevented it by agitation.

Mr. Moon, of Herkimer, said there was a law which governed the action of the rennet. Half the amount of the rennet will take double the time for its action.

Mr. Babcock, of Oneida, had had rennets which would each make 600 lbs. of cheese, and other rennets prepared in a different way which would not make 250 lbs. The rennets one man brought to him one year were dried, stretched on a stick, and made 500 lbs. of cheese each, and last year the rennets brought by the same man were prepared in salt, and would not make half the amount.

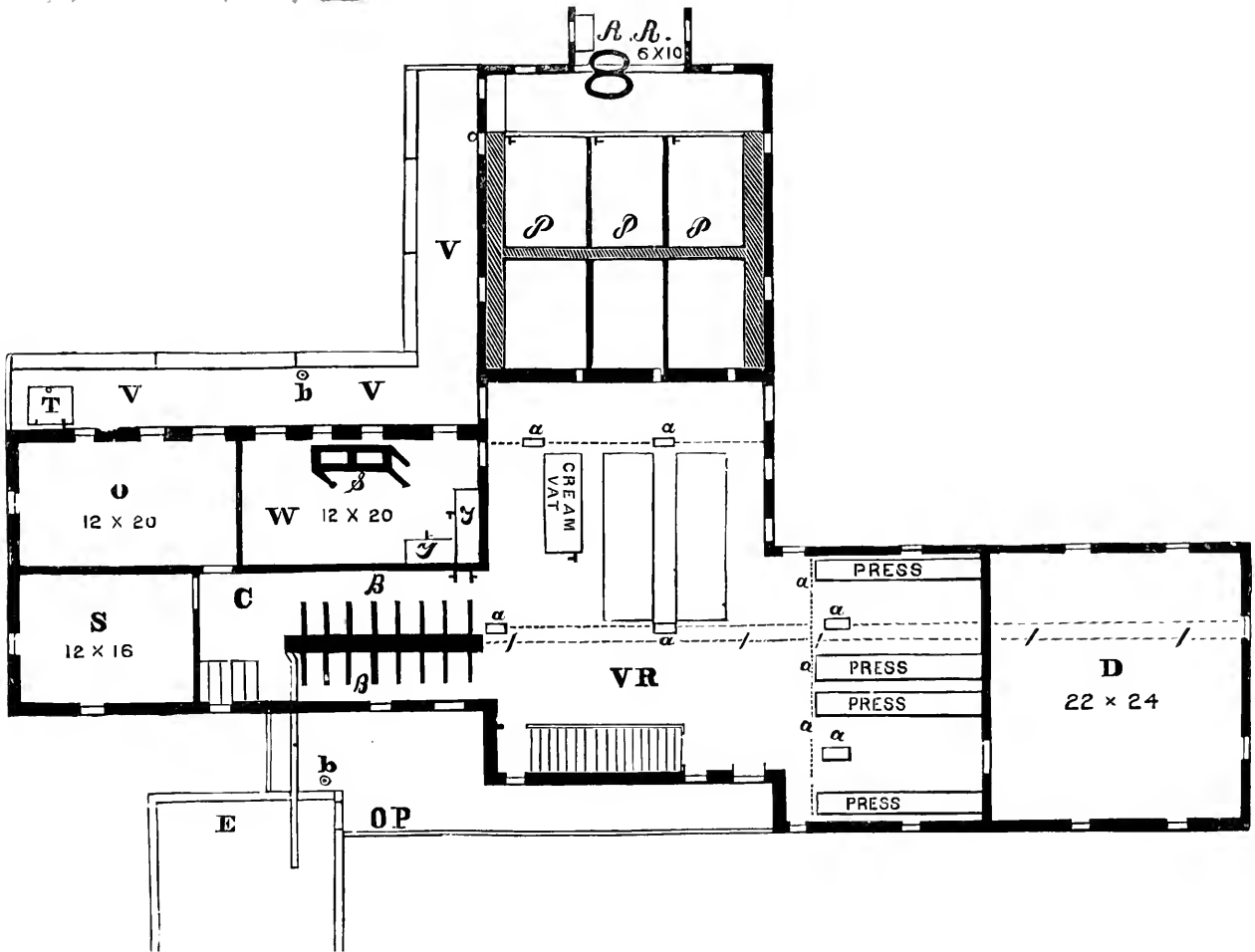
Dr. Wight asked Mr. Smith what his average yield was and what was his record of sale.

Mr. Smith, of Wisconsin, replied that he had bought his milk, paying ninety cents per one hundred pounds, ten pounds being allowed for a pound of cheese. His yield had so far exceeded this as to enable him to pay for nearly all his cheese boxes from this excess. The prices at which he sold this cheese were 10, 12 and 12½ cents—average price 11⅛ cents. His directions to those who saved his rennets were to crowd full of salt as soon as taken from the calf, and hang in a chamber. Some he had stretched on a bow, which he considered a very good way, but he uniformly filled with salt. He used the rennets of four days' old calves. The calves are killed twelve or fourteen hours after sucking. He uses the Oneida vat.

Adjourned until 7 o'clock P. M.

TUESDAY EVENING.

Vice-President X. A. Willard called the Convention to order at seven o'clock, and introduced H. Cooley Greene, Esq., of Pennsylvania, who proceeded to explain in detail a plan for a creamery, which he had drawn upon a large scale, so as to be readily seen by the entire audience. The fundamental ideas in his plan were: 1.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Convenience; 2. Such an arrangement of drains as to insure perfect cleanliness of premises and purity of atmosphere prevailing in the building; and 3. Completeness of apparatus and thoroughness in the construction of the structure.

MODEL PLAN FOR A COMPLETE FACTORY FOR 500 COWS, BY H. COOLEY GREENE.

[SEE PLAN.]

Upright 24 x 60 feet; wings each 24 x 40; ground descends towards the right and rear.

R R. Receiving room, 3½ feet above the floor of main building.

P P P. Pool in three apartments, separated by 3-inch plank, which are tied by a cross plank 10 inches wide.

The milk-room opens by sliding doors to the vat-room, V. R., which is open to press-room and churn-room, C.

B is walking beam with arms for attaching sixteen churns. Motive power in engine-house, E.

D. Curing-room for new-made cheese.

S. Store-room. O. Office. W. Wash-room. S. Sink, on castors. V. Veranda with pail-racks. P. Steam jets for scalding pails, churns, &c.

T T. Water tanks, lower one for cold and upper one for hot water, with faucets in either room.

T. Trap for elevating butter from cellar, which is under left wing.

A A A are traps to drains for slops.

I is drain for whey and buttermilk. All liquids carried beneath the floor.

O P. Open platform for airing churns, &c.

Second floor devoted to curing-rooms, separated by rolling doors at each aisle.

The speaker called attention, among other features, to a cream vat constructed on the same principle as the regular cheese vat, and holding about 200 gallons. Into this the cream is poured, thoroughly mixed and warmed or cooled, as required, by the steam and water connections.

Mr. Greene now proceeded to read the following paper on

THE MANUFACTURE OF BUTTER IN CREAMERIES.

I am to speak of butter-making in creameries, as distinguished from dairy butter-making.

Although the system of butter-making in factories has not developed as rapidly as that of cheese-making, it is nevertheless well adapted to popularization.

Its advantages over the old system, (which in reality is no system,) are such that it must soon be more generally adopted. The chief of these advantages are, first, the provision of better facilities for keeping the milk in proper condition, and, second, greater skill and closer attention in its management.

It is not claimed that the agitation of the milk in delivery is any advantage to it; neither does experience show that the yield of butter is ordinarily lessened thereby, while the quality of creamery butter is such as to command from ten to fifteen cents per lb. more than average dairy butter.

I am not here to decry the manufacture of whole milk cheese, nor to speak ill of any other branch of the dairy business.

Our land is broad and free. Our population is numerous, and rapidly increasing, and is composed of elements from every nationality on the earth, and is therefore marked by an endless variety of ideas, tastes, wants and prejudices. These require, in every branch

of industry, variety of method and product. The Swede will adhere to his wooden shoes, and the Chinese to his cue. The Switzer loves his Switzer-kase, and the Pennsylvania Dutchman his Smeir-kase and his apple butter.

We need have no contention for our own peculiar ideas. Popular demand, as expressed in the market prices of our various productions, is a a safe criterion in the matter.

It is not expected, neither is it desirable, that the manufacture of cheese should be generally supplanted by that of butter.

Yet while there is generally plenty of gilt-edge cheese in market, the supply of gilt-edge butter is somewhat short of the demand.

This being the case, it will, in certain localities and at certain times, seem to be more profitable to convert milk into butter than into cheese. And by having the means for so doing at the factory, the patronage of such as are partial to butter may be secured, when otherwise, as the scale turns in the market, they will withdraw their milk from the factory, to make butter at home. Many a cheese factory has proved a failure solely from this cause.

While in some localities patrons are partial to cheese, in others they are partial to butter, and it is well to adapt our system to these local wants and preferences. For instance, in Herkimer County milk is seldom withdrawn from factories to make butter. In Cortland County this is so frequently done as to prove a serious obstacle to the success of cheese factories.

While in Northwestern Pennsylvania, where cheese making has been but little practiced and the philosophy of butter-making little understood, and while twenty cents per pound has been the ruling price of dairy butter, we have sold creamery butter at thirty-five to forty cents in New York markets, it is not difficult for the people to perceive the advantages of the creamery system.

The subject of the proper construction of factories ought to receive greater attention and to be considered in the light of a more liberal intelligence than heretofore.

The prevalent idea that cheap, loose-jointed, half-finished structures are good enough for the cheese and butter business, must disappear before a more rational idea, and such structures must make room for those of a more convenient and permanent character. The system has attained prodigious proportions, and is annually assuming a character of greater permanency.

It is now seen that it is not a transitory speculation, and that it is not likely to be overdone. Why not carry this idea of permanency into the construction of factory buildings? In other branches of manufacture men invest money with the expectation of only a reasonable return for their capital, while in the matter of milk factories they display a speculative spirit, rather than that of a legitimate business, and the aim has been to cover a given amount of ground with the least possible investment, having little or no regard to symmetry of proportion or convenience of arrangement—as if the nature of the business were incompatible with æsthetic indulgence.

These things call loudly for reform. The prominent idea should

be that of adaptation to the needs of the business, in connection with architectural taste.

Every cheese factory should possess facilities for keeping the milk received on Saturday evening and Sunday morning until Monday, so as to avoid, as far as possible, Sunday labor. Much has been said, and much is yet to be said, against the practice of Sunday cheese-making. It is well to have a moral element introduced into the discussions of this body, but it will be far better to remove from the factory system the stigma of immorality which at present attaches to it. We do not desire to be classed among scorners, Sabbath-breakers and infidels. We do not relish the fact that many pious people look upon our place of business as injurious to the public morals and a stumbling-block to Christianity.

We would not willingly mar the Sabbath enjoyment of the most scrupulous. Our seeming offense is not wilful and malicious, but compulsory. We are men and women, possessing the hopes and aspirations common to the citizens of an enlightened Christian land. We would fain enjoy their privileges also. The day of the abolition of this practice is coming and coming soon.

It will yet be seen that by providing every cheese factory with a creamery attachment, the wishes of the public will be met, and the business conducted more acceptably to all interested. A full discussion of this question is not called for at this time, but I cannot forbear saying that the practice of Sunday cheese-making imposes burdens upon the operatives too heavy to be borne. By this means provision will be made for setting the milk on Sunday morning quietly away, to remain till Monday, then let the factory be closed, and superintendent and assistants may attend church, or enjoy a day of rest, and restoration of muscular and nervous force.

On Monday, extra help may be required to do the work, but labor ought to be as cheap on Monday as on Sunday.

This plan supplies the patrons with buttter for family use, while the skimmed milk will make a grade of cheese which ought of course to be marketed separately, or entire butter may be made. Not only will no loss be sustained by this plan, but it will generally be found that Sunday's milk is worth more than that of week days. Independently of the Sunday consideration, the facility with which a change can be made from the manufacture of cheese to that of butter, or butter and skim-cheese, to meet the demands of fluctuating markets, recommends the plan of combined, or as they should be styled, complete factories.

CARE OF MILK.

In all branches of manufacture, the quality of material used is of prime importance. Especially is this true of butter making. Our raw material is of a perishable nature, containing within itself the germs of its own destruction, and only by carefully studying its nature, and the operation of these destructive agents, and applying the proper means to control them, are we enabled to do a satisfactory business. By giving milk the proper care as soon as drawn, it

may be preserved sweet, and in good condition, long enough for all practical purposes, while early neglect is fatal ; and often renders futile, all subsequent efforts at preservation. With good milk it is comparatively easy to obtain a good product, but with bad milk it is impossible.

That person would be treated as insane, who should provide his cook with stale steak, and hold the cook responsible for producing therefrom a palatable dish. Yet it is not at all unusual for patrons to deliver at the factory, milk which is in very much the condition of stale meat,(though they are of course ignorant of its true condition) and frown furiously at the foreman, when they find in their firkins or upon their shelves, an unsaleable article. It is not the mode of manipulation alone, by any means, that fixes the character of the product. Could we but work out our ideal in this matter, we should anticipate better profits, and better satisfaction, for patrons.

The proper care of milk to secure the greatest profit therefrom, has been ably and prominently set forth, before this body, at previous sessions, and yet it seems to me it is deserving of still further notice. It is emphatically a vital matter. Upon the extent to which the dairy public give heed to the teachings of experience and observation in this respect, depends to a very great extent the ultimate success of the factory system. There is already in many localities a marked improvement in this regard,while in others scarcely one in a score of factory patrons is willing to bear the expense and pains, necessary to the delivery of his milk in prime condition, although the advantages thereof would accrue directly to the owners of the milk. Their argument is, that they cannot afford to take so much pains, and then divide the profits with their neighbors who take no pains, and there is some force in this logic, unless all are required to take equal pains. We have in most communities a class of people who should never be received as patrons. We can never be in a high degree successful, while we admit them. Slack, heedless, filthy and dishonest, they have no just claims to the fruits of their neighbor's intelligence, thrift, punctuality, neatness and carefulness. It is only by the slow process of "line upon line, and precept upon precept" that we can hope for reform; therefore let us give the people "line upon line, and precept upon precept," and that continually. I believe in making stringent regulations in regard to the care and delivery of milk, and in enforcing such regulations rigorously. I believe we ought to refuse to receive milk from people who will not come up to a high standard of neatness and carefulness in this regard. There is a pernicious practice prevailing to quite an extent in some sections, which I am sorry to see is advocated by many writers upon the dairy. I refer to the delivery of milk but once a day. The cream being generally taken from the night's milk and carried to the factory separately in pails. There is but one argument in favor of the practice, which is convenience of delivery; while over against this are the facts that it is very dangerous, and that it courts dishonesty. Many people have not and can not procure the means of preserving milk at home over night. Then, when skimming is practiced, there is opened a door by which avarice

enters, and theft may enter and carry away quantities of cream, with comparative impunity. We have no instruments or process by which we may determine whether one, two or more quarts of rich cream have been withheld from a can of milk twelve hours old, when the cream is delivered separately. We may easily obtain the standard quality of each dairy, for new milk, by comparison with which we are able to detect frauds, but we can never obtain such a standard either for cream or skimmed milk. Without some standard we can prove nothing; and can merely suspect frauds, and suspicion without proof, works a vast deal of mischief, and ought not to be encouraged either in manufacturer or patrons.

Let me briefly state the conditions which I regard as essential to the delivery of a proper material from which to expect with skill, a prime article of butter or cheese, and without which no subsequent skill can with certainty produce even a tolerable article. The conditions essential in cheese-making, are more vitally essential in butter making.

1st. The milk should be drawn from well bred, well fed, healthy cows.

2d. It should be drawn in a neat, tidy manner, into clean tin pails, as rapidly and quietly as possible, and at regular hours.

3d. It should be at once strained, and the animal heat and odor expelled as quickly as possible, by a process of combined cooling and aerification.

4th. It should then be delivered at the factory as quickly as convenient, and should be protected from dust and the rays of the sun in the meantime.

5th. No milk from diseased cows, or injured, inflamed, udders, no milk from cows in heat, and in short no milk which our neighbor would dislike to use in his own tea or coffee, is fit to be sent to the factory.

If we would enforce neatness and cleanliness on the part of our patrons, it will be well for us to see to it, that when they visit the factory they shall find no occasion to charge us with violating our own rules. Let everything be done in a systematic manner, and when any vessel is washed let it be thoroughly cleaned in every part, so that the most scrutinizing inspection would fail to discover any imperfection in the work. This is not an easy matter by any means. One of the most difficult tasks for me, has been to teach girls to do their cleansing so thoroughly as to satisfy me.

An inspection of the drawing cans at almost any factory in July, reveals the fact that very many women, who pride themselves upon the neatness of their house-keeping, do not comprehend the full force of the term "*thoroughly cleansed.*"

This matter of cleanliness, upon which we are constantly harping, is not merely a matter of taste. The sensitive nature of butter causes it readily to absorb any unpleasant odor from the atmosphere. We all have known butter to be ruined by the odor of the skunk. It will also absorb the odor of onions, decaying cabbage or other vegetables kept in the same cellar. If kept in unclean or tainted vessels it quickly receives taint, which soon developes so as

to injure the flavor. No other feature of a creamery seems to make its impression upon visitors, so quickly as that of tidiness.

The manufacture of fine butter depends largely upon conditions which are too commonly overlooked. Very frequently the character of the product is injured beyond remedy, before the cream is taken from the milk, and perhaps more frequently it is injured by the manner of keeping the cream; by allowing it to get too warm, too cold, or too sour. Many people seem to think that the secret of making good butter is to be found in the process of churning, or in subsequent manipulation. I need hardly say here that this is a serious misapprehension. Probably more butter is ruined before the cream enters the churn, than afterward.

The three first essentials after the native quality of the milk, are light, air, and temperature as applied to the milk while the cream is rising. Light is necessary, first, because it is essential to neatness, and secondly, because it developes color in the cream, and color is not less an element of good butter than flavor or texture. A proper circulation of air is needed to carry off the odors which arise from milk that has not been properly cooled and deodorized previously, while a right and uniform temperature is required to preserve the milk sweet a sufficient length of time to allow the cream to rise, and also to secure the rising of the cream soon enough to prevent its becoming bitter. If kept at a temperature of 58°, the cream will nearly all rise in 36 hours. It ought to rise at least in 48 hours. If kept at 65° the milk will usually become sour in 24 hours while the cream will have become entangled to a greater or less extent in the coagulation and can never make its way to the surface. At 46° to 50° milk will remain sweet 60 to 72 hours, and even then it may be converted into a tolerably rich skim cheese, because at this temperature, it is held in a thickened condition approaching that of syrup, a condition unfavorable for the rising of those minute particles of oil which, when collected upon the top, constitute cream. To secure the greatest amount of cream, the milk must be kept in a condition of sufficient thinness, to permit those particles which are the lightest portion of the milk to reach the top, and at the same time it must be sufficiently cool to retard the formation of acid. It is found that these conditions are more effectually and more cheaply secured by the use of cold water than by any other means. It was formerly supposed that shallow pans presenting a broad surface to the air, would produce the greatest yield of butter; but experiments seem to prove otherwise. We not only get as much cream by using the deep pans with small surface, but we get cream much better in quality and producing a better quality of butter. Probably this fact is owing in part to the cream not becoming dried on the surface with the pails as it does with the pans. Contrary to the theory of some writers that milk will keep sweet longer when exposed to the air than when not so exposed,—that the cells of the ferment plant having access to the air feed upon it rather than upon the sugar of milk, we find that the surface uniformly sours first. We frequently find the top of the cream distinctly acid, when upon removing the same, the milk is still in good condition, and causes

no trouble in the curds. This is often the case with milk which is 36 or 48 hours old, but seldom with that which is but 24 hours old, and never with that of 12 hours. Either for butter or cheese, the younger milk is when it sours, the more worthless it is. Such milk is destroyed chiefly by putrefactive fermentation, while that which only becomes sour after setting 48 hours or more, is more naturally matured. It is a well known fact that a certain degree of maturity in the milk is requisite to produce best cheese. And it is equally true that a proper degree of maturity in the cream is requisite to produce best butter.

Respecting the length of time required to throw up all the cream, experiments have shown variable results at different times, and under different circumstances. I have obtained the greatest yield of butter by taking off the cream just at the point of souring, although there is but little gain during the last twelve hours. The bulk of cream rises quickly, while the residue rises very slowly. Let a graduated test-jar be filled with new milk, and in a few hours the line of separation between the cream and milk may be distinctly observed. In 12 hours it has generally reached its greatest thickness as marked by the per cent. lines, but it is now mingled considerably with milk. At 24 hours the milk has passed downward, and the cream becomes more dense, the point of separation is more distinct, but higher than before. The time at which to obtain the greatest amount of the best butter is the period at which the cream has become densest, and while it is yet sweet. It may then be more perfectly separated from the caseine, therefore the butter will contain a greater per cent. of oil, and less of curd. Still it cannot be denied that there is at this point a very considerable amount of butter left in the milk. If milk is skimmed just at the souring point, and after it is in the curd-vat it is found too far advanced to make a curd, and steam is applied, raising its temperature to 68° or 70°, there will be thrown to the surface an amount of cream well worth saving. Such cream when churned separately, will yield of butter about one fourth as much as ordinary cream, but it will be of inferior quality. In June, 1870, while exchanging a small inefficient engine for one better adapted to our needs, I had two vats of milk become sour for lack of steam to convert it into curd. I finally applied steam, warming it gently to 70° and thus obtained therefrom one hundred pounds of butter. This milk had already been skimmed after standing 12 to 24 hours.

The process of skimming milk at most creameries, is this: The pails having been immersed in water within an inch of the top, and about an inch above the milk, are lifted out and set for a short time upon the walking plank to drain, and then carried and set upon benches one foot high at the head of the curd vats, where the skimming is done. At many creameries the benches are not used, but the skimming is done on the floor. This is needlessly tiresome.

The skimmer is a cup in the form of a cone, with a flat handle similar to an ordinary skimmer handle, and contains nearly a quart. It is immersed in the milk, the cream flowing into it, and is thus dipped off. This operation is repeated till there is no cream seen

upon the surface of the milk. The process is of course somewhat imperfect, as there is some milk taken with the cream. A more perfect process for separating the cream may soon be made known. The milk is now turned into the vat for curds, and the pails are carried to the wash-room. The cream is poured into the cream-vat through a strainer of finely perforated tin, which not only thoroughly mixes it, but separates from it any flies or other foreign substances which one would not like to see in his butter. In this vat the cream remains till next day, when it is to be churned.

Meantime, if the weather be cold, steam is applied to slowly warm the cream. And if the weather be very warm, it is surrounded with cold water that it may neither become too warm or too sour. It is covered with a close fitting frame, upon which is stretched a piece of muslin to exclude dust, heat and flies. In most creameries cream is kept in pails and set into water, but in the absence of the cream-vat there is no adequate means for warming the cream when too cold. The cream-vat is in form and arrangement the same as the curd-vat, but is provided with a brass faucet for drawing off the cream. I have not known it to be used except by myself, though it may be. Its advantages are :

1st. Cheapness. It costs less than pails of the same capacity.

2d. Economy of labor and time in handling cream.

3d. It enables one to control the temperature of his cream more perfectly, and to give it uniformity of character.

4th. It admits of straining the cream conveniently, while sweet and thin, and keeping it neatly thereafter, and

5th. It is not patented.

The strainer is a simple strainer with no patent forcing attachment, and it needs none. It is questioned whether spiders and other insects are converted into desirable food by a process of grinding ; I prefer to leave them in the strainer entire.

The temperature of cream should never be allowed to rise above 60° if you wish to preserve a rich color, and perfect texture in the butter. A temperature of 70° affects very sensibly both color and texture. Neither should it be kept so cool as to prevent the formation of the proper degree of acidity. Cream taken from milk 24 hours old will generally become sufficiently sour in 24 hours if kept at 62° to 64°. Experiments repeatedly tried have fully convinced me that it is not profitable to churn sweet cream, notwithstanding that it is practiced by a *few* skilled persons with success. Not, as many suppose, because sweet cream requires more labor in churning than sour, for the reverse is true ; but because I have in all my experiments, when fairly tried, obtained a yield of 20 per cent. more butter from sour cream, and the difference of quality is also in favor of the same. Sweet cream butter is of a fine texture and a delicious flavor, but lacks solidity, and in a warm room melts down very quickly, while sour cream butter has a coarser and firmer texture, retaining a chemical element not found in sweet cream butter, and though its flavor and aroma may not be quite as fine, they are longer retained ; although it is an easy matter to ruin either by carelessness in handling. Sweet cream

butter especially requires gentle handling to preserve its texture.

As to the advantage of using sweet buttermilk in curds, I consider it no advantage whatever. I admit that it tends to mellow the cheese and give it the appearance of being more buttery than it really is, but there is a buttermilk flavor uniformly attached to the cheese, to a greater or less extent, which is objectionable, while the amount of butter floating upon the whey is proof that those globules of the butter which are enlarged or have coalesced by agitation of churning are not held by the rennet, but are wasted. It is assumed then that the cream is to be churned the morning after it is skimmed. If it becomes so sour as to form whey at the bottom of the vat, it has become injured. Too much acid reduces the yield, pales the color, injures the texture, and gives the butter a sour taste. The proper degree of acidity is that which thickens the cream slightly, and gives it a taste purely and distinctly sour. Before the cream is drawn from the vat it is thoroughly stirred, and the temperature graduated to the proper point. The temperature and character of the entire mass thus becomes perfectly uniform—a consideration of great importance, both as regards convenience and the attainment of desirable results.

CHURNING.

No modern invention has succeeded in supplanting the dash churn. The country has been flooded with numberless patents, all claiming superiority, most of which have been laid aside, and it is as true to-day as it was fifty years ago, that for economy, facility of handling and cleaning, and the production of good butter, there is no other equal to the dash churn. It is used at nearly all creameries, and with it is made probably nine-tenths of the prime butter in the markets. The operation of churning should be conducted with great care and moderation. The proper temperature for sour cream is 60° to 62°, according to the temperature of the room in which churning is done. Sweet cream is churned at 56° to 58°. If the cream is too warm when put into the churns, it may be tempered by the use of cold water in the cream. This practice does not in the least extend the time of churning, but if the cream be quite thick it favors the agitation and facilitates the operation. In the absence of the cream-vat it is a most convenient way of attaining exact and uniform temperature. The strokes of the dasher should be so regulated as when rising it may meet and disperse the falling cream which was displaced by the downward stroke and is returning down the middle. The stroke being thus regulated will cause the cream to escape less at the lid than a more rapid stroke, while it will fetch the butter as quickly as is desirable. The time should not be less than forty minutes to an hour or more. The churns must not be so full but that, as the cream expands in the earlier stage of the operation, the dasher may still rise above it. Will any advocate of the theory that aerification of the cream while churning is of no account, please explain why it is, when a churn is too full and the dasher does not rise to the surface, it requires so much more time to bring butter than when the dasher rises clear of the cream? This fact seems to

argue that the amount of air forced down through the cream performs a chemical office in the operation, of no small importance.

The cream which appears on the lid should be kept rinsed down, that it may come uniformly and avoid waste. When the pellets of butter have become as large as peas, the churn is detached, to stand until the butter in all the churns are in like condition, when they are again connected and the motion given to the dashers made as slow as possible. This will gather the butter more quickly and easily than by hand. It is now transferred to large bowls of cucumber-wood, containing each one hundred pounds or more. The churns are now emptied of butter-milk, which is passed through a rather coarse strainer of perforated tin, by which means all particles of butter that may be floating upon the buttermilk are saved. The saving by this simple expedient is a considerable item. Two churns are now rinsed and two-thirds filled with clear water, at a temperature of 56°. The butter is now returned to the churn in quantities of fifty to seventy-five pounds, and washed by a few movements of the dasher; when the operation is repeated in the second churn the butter is supposed to be freed from buttermilk. The second water should not be allowed to become milky.

The various operations have thus far been conducted in the churn-room, which in warm weather is too warm for further handling of the butter, and it should lose no time in passing to the cellar. It is here weighed in parcels of forty-eight pounds each, put upon the butter-worker, slightly pressed to expel the water which may remain in it, and to each parcel is added three pounds of pulverized Ashton or Onondaga salt. Three-fourths of this amount is sufficient for fall butter, if it is to go at once upon the market. The salt is now thoroughly incorporated with the butter, using the lever alone for the purpose. The hand should never be used in working butter, for it will inevitably injure the grain, giving it more or less of a salvy appearance. I know of no other cause of streaked butter than the imperfect mixture of the salt at this time; therefore it is all-important that it should be thoroughly done. There is comparatively little danger from over-working now. The great danger from over-working is in doing at the second working what should have been done at the first. After butter has been set away and become set—hardened—it is not possible to work out the streaks without injury to the texture. The butter is now packed in bowls, to stand till next day, when a very slight amount of working expels the surplus brine and brings it to the proper texture, when it is ready for packing. Should it appear too dry, a trifling amount of salt is sprinkled over it just before the close of the operation, which, when dissolved, will give it a better appearance; for it is more common for butter to be too dry than too briny. While the principal element should be oil and not caseine, the spaces between the oily particles should be filled with pure brine to preserve it. Any process which mashes or grinds the butter tends to destroy the grain. This is the character of most of the patent butter-workers, and a large proportion of the butter made suffers in this respect.

The true theory is that it should be done more by pressing than by friction, though in the act of pressing ever so gently there is an attrition of the particles composing the mass as it moves from under the lever. This attrition, rightly proportioned to the pressure, is what constitutes working proper. It is the movement of particles by which the brine filling the interspaces is forced to the surface and passes off. To accomplish this object it is necessary that the butter be not too warm, or those particles are ground down and the texture destroyed; nor too cold, for then the attrition will be imperfect. Experience and close observation are the best teachers in regard to this point.

Butter should be packed as soon as it is worked. It is then pliable and can be packed more easily and more closely than after standing. Whether packing in firkins, in pails, or in tubs, the best implement I have found for the purpose is a good ladle. The butter should be pressed firmly into the package, so as to fill the entire space, that when the trier is drawn it may show solid butter its entire length. No rubbing or drawing of the ladle is allowable, only a direct pressure, and no more of this than is necessary, for this is another process of working, and the butter has been already sufficiently worked, and a trifle more will perceptibly injure the grain. If in firkins, and the design is to hold it, a cloth is laid on the butter and on the cloth is put an inch or more of salt, and upon this is put water enough to form a pickle. The pickle must not be allowed to soak away so as to expose any portion of the butter. There must not be so much water used as to entirely dissolve the salt, thus exposing the butter to the action of light. If the salt dissolves more must be added. Sometimes the firkin is headed up and a hole bored in the head, through which pickle is supplied. In preparing for shipment the pickle is turned off, the cloth, which will be stained and look untidy, removed, and a new one neatly fitted in its place, a handful of salt sprinkled thereon and the head put in, retaining as much as possible of the pickle which surrounds the butter. It is seldom necessary with well-made firkins to loosen the quarter hoops to insert the head. If tubs or pails are used, and are to go to market at once, (and unless they are to go at once to market they should not be used,) the package is filled quite full, covered with muslin, a little salt sprinkled upon it, and the cover put on tightly at once. All wooden packages should be soaked in brine forty-eight hours before filling. The salt, while it has a preservative nature, at the same time penetrates the pores of the wood and extracts the color.

In my opinion there is less skill displayed in packing and marketing than in any other department of the butter business. One very important demand of the trade, it seems to me, is very inadequately met. I refer to a convenient form of package for retailing, and more especially for fresh made, fancy butter.

The amount of time and butter wasted by retailing as now practiced, to say nothing of the uncomely appearance of the butter as received by the consumer, argue strongly for the adoption of packages of size and form to obviate the necessity of cutting by the retailer, and at the same time preserve the native flavor unimpaired.

The common form of rolls is anything but satisfactory even for local use, and utterly unadapted for transportation; besides, exposure to the air very soon destroys the fine flavor.

There is a caddy which has been introduced to a limited extent, and which promises to supply a want long experienced by people who wish to use only fancy butter, and for such, in convenient form, are willing to pay a remunerative price. There are thousands of such people in our villages and cities, and their complaint is that they find it impossible to provide their tables with a uniformly good article. The supply in the markets is of such a mixed character, even from good dairies, that there is no brand which they can purchase without close personal inspection and not be liable quite frequently to have an inferior article put upon them at an exorbitant price. The prevalence of this ground of complaint has made the best class of consumers exceedingly suspicious and difficult to deal with.

Let producers be governed by a principle of strict honor in this matter, using fancy packages only for a strictly fancy product, and ordinary packages for all goods of second grade, assorting carefully and marketing each quality separately, making for it no false claim, but allowing it to go upon its intrinsic merits, and they will realize more for their products than they do under the present unsystematic and unpolitic practice of straining up the price of inferior goods by offering them in connection with a better article, thus losing more upon the good than is gained upon the bad, while the principle of just discrimination is not recognized, and the reputation of the brand suffers a still greater prospective loss.

The creamery system has supplied the markets with an article adapted to the wants of the fastidious, in greater quantities than heretofore. It is believed that those creameries which have put their goods regularly upon the markets fresh made, have been best satisfied with the results.

Each year the difference between first and second grades is becoming more marked, proving the correctness of my position, and rendering it highly improbable that the supply of prime butter will ever exceed the demand. It is always safe to manufacture a first-class article, because for such there is always an active demand, even when it is difficult to sell the lower grades at all.

Another, and a strong argument for the early sale of creamery butter, is found in the fact that the very best butter rapidly loses flavor, and at sixty or ninety days old would hardly be recognized as the same that it was when first made. Few families use more than ten pounds of new butter before it deteriorates in flavor perceptibly. Our patrons soon learn this fact, and call for their butter in smaller quantities and oftener. The particular aroma which is especially sought after is essentially characteristic of new butter. Some device will yet be discovered for meeting the great want above alluded to. The caddy referred to promises an advance in this direction. It is chemically prepared so as to neither impart taste or smell to the butter, nor detract from it, and is encased in a coating of lead foil, rendering it impervious to external moisture.

It is rectangular in form, opening at the end, and is made in sizes to contain three, five and ten pounds respectively. They are readily packed for transportation in boxes containing fifty to one hundred pounds. I see no reason why they may not be advantageously used, exclusively for fancy butter, by labeling them with a certificate of the character of the contents, over the name of the manufacturer, as a guaranty of quality. However, should this device prove to be deficient in any important respect, time and inventive genius will remove the difficulty, and an urgent want of the trade will ere long be satisfied.

The greatest advantage from the use of this or any other form of package, can only be secured by those who make greed subservient to honesty, and use no tricks to palm off inferior goods for better than they are. Under the present imperfect condition of earthly affairs, any person is liable to produce an article the quality of which is not satisfactory. Such goods should be sold upon their own merits, and ought never to be allowed to give character to the general make. This is worse than the total loss of the objectionable portion.

Manufacturers will do well to give special attention to the attainment of a high degree of excellence in manufacture; to studying the wants of consumers; to nicer discrimination in classifying their goods; and to be willing to accept for fresh-made butter the prices which fresh-made butter will command. They will thereby secure more uniform and better prices, and aid in establishing the character of the system upon a more satisfactory foundation.

Mr. Willard, chairman, then read the following reports from butter factories, of the amount of milk required to make a pound of butter:

The Union Factory, in Bangor, Franklin County, reported 96 days' milk, 233,161 pounds. They sold 9,522 pounds of butter, or 24½ pounds of milk was furnished to one of butter made.

The Barley Spring Factory, of Chateaugay, Franklin County, reported 270,811 pounds of milk for 12,012 pounds of butter, or 22.55 pounds of milk to one of butter.

The Cold Spring Factory, of Malone, Franklin County, reported 441,267 pounds of milk for 19,776 pounds of butter, or 22.31 pounds of milk for one of butter.

Mr. Farrington, of Yates, from a factory where both cheese and butter were made, reported 27⅛ pounds of milk to one of butter.

Mr. Stradling, of Madison County, reported 27 pounds of milk to one of butter, and 12½ pounds of skimmed milk for a pound of skimmed cheese; and also that 30 pounds of milk yielded one pound of butter and 2½ pounds of skimmed cheese.

Mr. Hawley, of Onondaga, referred to the natural variation of milk as regards richness as affecting the yield of butter or cheese made therefrom. He also remarked that better butter could be made from the first rising of the cream. Better churn twice than to wait for the last particle of cream to rise before churning.

At this point the Convention adjourned until 10 A. M. Wednesday.

SECOND DAY—MORNING SESSION.

In the absence of the President, the Convention was called to order by General B. F. Bruce, of Madison, one of the Vice-Presidents of the Association.

It was announced by the Chair that the first business in order was the address of Mr. Folsom, of New York. Mr. Folsom not being in the room, Mr. T. D. Curtis, of the Utica *Herald*, read the following valuable paper on

THE STANDARD OF EXCELLENCE IN CHEESE-MAKING.

My observations among factorymen and cheese-buyers, have convinced me that the standard of excellence existing in the minds of all, is vague and variable. No two seem to have exactly the same conception of excellence. What is first rate in the mind of one is second or third rate in the mind of another, and *vice versa*. One wants it a little softer; another a little firmer. One wants it flakey, and to show the grain, like good butter; another wants it to work down, smooth and silky, when broken and rubbed between the fingers. One makes flavor a hobby; and another does not mind flavor so much, if the quality is all right. These and other differences exist in the minds and judgments of buyers. Let half-a-dozen visit a factory on the same day, and very likely the cheese-maker will hear half-a-dozen different criticisms, favorable and unfavorable. In some instances, possibly nothing will be said, when the most ought to be said.

These contradictions and incongruities arise in several ways. There is the real difference in judgment, based on a difference in the natural perceptions. There is the difference in experience and knowledge. There is the difference in the demands of different markets. And there may be a difference growing out of the desire to make the article appear as inferior as possible, in order to buy it at a low price; but I must, in justice to the buyers with whom it has been my fortune to come in contact, say that I have seldom seen what I consider a deliberate effort to depreciate a lot of cheese by unfair criticism. They are generally content to indicate their judgment by their offers, and base their arguments on the condition of the market rather than on the condition of the cheese.

What wonder that, with such confusion of judgment, and contradiction in comment, among buyers, there should be indefiniteness of idea in the minds of cheese-makers as to the standard of excellence which they should aim at. How can they suit all, when no two, perhaps, want the same style, quality, or kind of goods?

A few cheese-makers know their business well enough to pursue the even tenor of their way, accept all criticisms kindly, use their own judgment, and make their cheese according to the standard of excellence existing in their own minds. But by far the greater number have no definite or fixed standard, and do not know when they make a good article. They pursue a certain routine, which is seldom varied, and trust to luck. They may have "good luck" or "bad luck," but are likely to have variable luck.

The importance of every cheesemaker's having a correct and fixed standard of excellence in his mind, and of knowing how to reach it, and when he reaches it, I think, will be apparent to all. In whatever business men engage, they should have a clear idea of the end to be reached. Without this, all is vague and uncertain, and the end reached finally is likely to be different from the one most to be desired. Or, if we have a clear conception of the end, and are ignorant of how to reach it, we are very likely to be disappointed. We must work intelligently and understandingly, using the proper means to accomplish a definite end. Cheesemaker's cannot be made an exception to the general rule. They must comprehend all the *modus operandi* of their business, understand the material which they work with, and have clearly in their minds a standard of excellence at which they must constantly aim.

But how is this standard to be attained? What shall it be? These are questions more easily asked, perhaps, than answered; but, for all this, a correct standard is none the less necessary. I can only make a few suggestions in reply to these questions.

What standard? This must be determined by the market which you make for, and the demands of the times. Are you making for a home market and immediate consumption? Then use rennet freely and make a rather soft cheese. Are you making for a foreign or distant market, which requires an article that will transport safely and keep well? Then you must be more sparing in the use of rennet, raise your temperature higher, develop more acid, and stir in more salt. Your cheese must be firmer, and be started on its journey before it is ripe enough to eat. Keep clearly in mind the demands of your market. Find out what they are by every means within your reach. Watch the factories that sell best in the same market. Ascertain what their standard of excellence is, and then equal or better it. It is folly to make cheese fit only for a home market and immediate consumption, and then sell it to export. It may not be wise to make a good exporting article and sell it for home consumption—certainly not for early consumption. But it is safer to make a good keeping article, which will improve by age—for cheese that is soon ripe is soon rotten: and if not used up at once, it depreciates rapidly in value.

All these things should be taken into consideration, and the cheesemaker understand his business well enough to make that class or standard of cheese which is wanted, or which he aims at. But I have observed a tendency to depreciation in the standard of excellence existing in the mind of the cheese-maker. He may be all right to-day; but the next time you see his cheese, you find he is off the track. Somehow, he has unintentionally changed his hand, and is making quite a different article, without being aware of it. This characteristic is not peculiar to the cheese-maker, but belongs to human nature. It is impossible for any one to shut himself out from the world without danger of retrograding. The cheesemaker, confined to his own character, has only himself with which to compare himself, and his standing imperceptibly lowers while he has no evidence of the fact.

The remedy for this evil clearly is, intercourse with his fellow-cheese-makers. He must make frequent visits to other factories—and especially to those which out-sell him—compare his own work with what he sees there, ascertain any variation in process, observe the later improvements in implements and apparatus, and keep himself thoroughly posted. At least one day in each month should be spent in this way. It would well pay patrons to defray all expenses of such visits of inspection; and I throw out the hint hoping it may lead some of them to take more enlightened, liberal and progressive views.

In conclusion, I would say, be sure that you adopt a correct standard of excellence; raise it high, so that it can float freely in the breeze of success, and never allow it to lower and hang at half-mast.

At the conclusion of Mr. Curtis' address he stated to the Convention that he had received a letter from a reliable person of his acquaintance, introducing to him a Mr. Briggs, of Chenango County, who claimed to have made a valuable discovery respecting the cause and prevention of abortion in cows. Mr. Curtis moved the appointment, by the Chair, of a committee of three to confer with Mr. Briggs, who was in attendance at this meeting, and to consider and report upon the matter.

This motion prevailed, and, subsequently, Messrs. Willard, of Herkimer; Hawley, of Onondaga; Farrington, of Canada West, were appointed—Mr. Curtis preferring to be excused from serving.

Mr. S. A. Farrington, of Yates, moved that a committee of three be appointed to examine the cheese-turning apparatus now on exhibition in this city by a gentleman from Ohio. Motion carried.

The Chair appointed Messrs. Farrington, of Yates; Kibbe, of Cortland; Merry, of Oneida.

Mr. M. Folsom, of New York, was then introduced to the meeting by the chairman. His subject was

THE COMMERCIAL VIEW OF THE DAIRY INTEREST.

Mr. President and Gentlemen:—In responding to the invitation of your Secretary, which affords me both the opportunity and the pleasure of meeting those gentlemen whose mutual interests have ever rendered the principal products of our trade their chief care and protection, it is not without the fullest sense of the great honor you do me, as well as of my utter inability to contribute anything of interest in the presence of these old and time-honored faces, who have made it the study of a life, and who, presided over by New York's eminent and respected statesman, present an array of wisdom which my somewhat limited experience can scarcely hope to enlighten or increase. But, gentlemen, the deep interest I feel in everything that appertains to the products which are the especial care and object of this Convention, must be my apology for trespassing upon your indulgence; and if the few years of untiring devotion to its necessities and requirements, which it has been my pride and pleasure to afford, give me any claim to your considera-

tion, then I beg to present a few remarks, which the contact with these great products of our country have inspired.

As we shake hands with the new year, and cast a parting look at the retreating form of the old one, we are reminded for the moment that more than two thousand of these years have passed away since the first introduction of butter and cheese; and if we may credit the assertion of some historians, nearly three thousand years, or one thousand before the birth of the Saviour, have elapsed since our forefathers produced, in primitive incipiency, the first coagulations of an improvised churn, and mankind were endowed with these wholesome and life-giving luxuries. This was destined in the future not only to tickle and appease the appetite, but as an article of traffic and commerce to take rank with the mightiest of Mother Earth's offerings; and this truth is more fully realized as, assembled together here this day, we look back and examine the statistics of year before last, as reported by Wells, (if my memory serves me correctly,) the immense sum of six hundred millions of dollars accredited to the dairying interests. This enormous sum entitles you to a position among the most important of domestic productions, and crowds close upon the precedence accorded to old King Cotton, so long honored. The calling of the herdsman is among the oldest and most honorable known to mankind, and is as simple and unostentatious in its now almost unparalleled prosperity of to-day, as when Abraham of old tended his own flocks and reared his family to do the same. From these primitive times it has sprung, and continually increasing, it has reached its present immensity; and while it is my proud privilege to meet you here and address you, banded and mutually cemented together, representing the one great interest of which this Convention is composed, I regret that I cannot go further and announce myself as a dairyman by profession as well as being interested in its results. But as a factor for the sale of your product, although but a small and humble one, it has afforded me much opportunity for observation. And perhaps few of you are fully aware of the immense machinery, the amount of capital, and what is of far greater importance, the hundreds that find employment in moving this product of your industry, and bringing it to a point within the reach of the consumer; these points are scattered over almost the whole civilized world. But prominent among them all stands New York, acting in the capacity of a general clearing-house, if I do not misapply the term; and those who are familiar with the banking regulations of the city, and even all through the country, must be struck with the similarity of the system which checks and balances the distribution of your product, from the great central market to the most foreign climes, to that which regulates and controls the monetary operations of a large city. Each acting upon independent principles, which the necessities of commerce have brought about, harmonize so nicely when brought in contact, that the fullest compensation is the result of the dairyman's industry. The majority of your merchants will tell you that you have the use of their capital and experience on too small a margin; but if so, it must be their fault—certainly not yours. It

must be true, after all, that the producing, financial and commercial interests are mutual, and so blended that each derive the greatest support from the other; and from this unity, together with the market and credit reporting systems, the dairyman receives his best protection. The banks, merchants, commercial agencies, market reporters for the press, all vigilantly co-operate in demonstrating to you what is reliable as to your banking institutions, the responsibility and integrity of your merchants, and market reports, &c., together with that stimulus which honorable competition ever lends to trade, the article commands its highest value. You scarcely realize the test that the merchant in our line of trade must constantly undergo, in order to maintain an honorable position in the trade; and few, perhaps, ever knew the difficulties that beset the young merchant in his first struggles to obtain an honorable footing. Should he confine his operations to a limited scale, these hardships he may, to a greater or less degree, escape; but the moment he appears in the great arena of extended transactions, the gauntlet is thrown to him from almost countless competitors, and he thus realizes some of the obstacles which he must meet and combat with. Prominent among these, and which in my judgment cannot be too severely censured, is the insinuating and double-edged remarks of old established concerns when speaking of any new aspirant, and which strike more deeply and deadly at his very vitality than the openly expressed opinions (be they ever so damaging) of the honest and fearless competitor. To the one he can reply, but to the other there is no defence, for, like the assassin which steals upon you in the dark, he stabs and flees, leaving his victim suffering from the wound, which knows no author. And what occasions this? Does it owe its existence to necessity? Clearly not; the moment a new concern appears in New York, it at once comes under the observation of its bank or bankers, and as it becomes known among the merchants of its own line of trade, makes the acquaintance of the mercantile agencies—institutions whose sole business it is to ascertain the standing and reputation of merchants and organizations in all branches of industry.

The wants of commerce have created, and in a measure rely on, mercantile agencies, to ascertain and report all information respecting the history, reputation and responsibility of all concerns throughout this and other countries. They are independent and numerous, competing with each other in giving the most reliable intelligence, and altogether aim at impartiality. It is an immense machinery, employing armies of reporters throughout the country, gathering information on credits. These organizations and their reporters are at the service of all who, by virtue of membership, enjoy their privileges, and the standing of any concern, new or old, is a matter of easy and rapid ascertainment.

Upon what principle, then, does this desire to belittle young concerns rest? Deprived of the old, worn-out excuse of the necessity of placing them right before the business community, through the agencies the evil is stripped of its mask, and pregnant within the whole lies the true and real cause, which—candor compels the con-

fession—is nothing more than a small, petty jealousy, which seeks upon every occasion to underrate by insinuation what it dare not openly assert. That this is a natural inheritance of poor human nature, we shall not deny; and if any good were apparent in the system, we should be the last to reprobate it; but if we meet the issue square in the face, it must be frankly admitted that rich, old, conservative concerns, having reached that acme of prosperity and power which sets at naught the justice due from man to man, seem to think it their duty to make the road as thorny for the young merchant to pass over, as that which it has been their lot to ascend. It is against such odds as these that the new beginner enters this department of trade, which are but among the least of his difficulties.

The greatest skill is required first to secure such agencies through the interior as will act with promptitude and judgment in the selection of qualities, which, when they arrive on the market, will pass the test of keen foreign buyers, whose terms are extremely exacting as to both price and quality. Such a corps of experienced and reliable agents, versed in all the producing sections, and who will deal honorably in all respects with their principal, defies competition as against other houses not equally represented. We cannot take from you the article of cheese, at the least deviation in quality or price, and escape the error; and when we delegate the selecting of purchases to our agents, the utmost care is requisite. Perhaps there is nothing more rare than men suitable for this purpose, and the competition for such is greater than for the merchandise. A house that is so fortunate as to possess these qualifications, has always a market for your best productions, at the highest quotations, with corresponding rates for the lower grades.

And while this close discrimination on the part of the agent may sometimes bring him unfavorably in connection with the producer, yet the advantage is secured in New York. In that market the combined interests of the world are represented by resident partners and agents of foreign houses, and I believe no more honorable class of merchants exist than those in our city connected with the exporting trade in dairy products. Their dealings are characterized by honor, economy, and skill, which readily places their patronage where they are alike honorably dealt with. On both sides it is found that the best card is fair dealing, and this prevails in the largest extent in the handling of your products. This brings us to the subject so often discussed—the closer connection of the producer with these gentlemen, in the belief that thereby much economy and saving would be the result, as it would to a large extent save the profit secured by middlemen in the distribution of the product. But this we believe to be a mistake, and if any advancement is possible in this direction, it must be through those sources entirely beyond our control, as in the reduction of freight and the minor expenses, which considerably decrease the net value. Much has been said pro and con on this subject, the producer asserting in favor of, and fully believing that it is not only necessary but possible to retrench the cost of handling; while on the part of the factors it is as

stoutly maintained that unless a new order of things, which does not at present seem at all probable, is brought about, it cannot be done. And representing as I do the latter class, I am compelled to say, and the experience of the trade the last few years would seem to bear me out, that the percentage in the handling of butter and cheese has reached a point about as low as it will profit the capital and ability represented in this line to work for. The rather Eutopian dream, as enlarged upon by some of the leading dairying interests in the country, to the effect that producers should become their own agents, sellers, and exporters, through regularly established houses of their own in the city, would, in my opinion, as signally fail in our business as it has in every other line where it has been tried. I scarcely think any one will deny but that the ability at command in the city, which receives and places before the consumer, to the best advantage, and at a per centage of two or two and a half per cent,, is about as cheap and economical a commodity as anything which could be hoped to be maintained by the producer becoming his own agent. At all events, should the interior interests ever differ with me, so far as to attempt the experiment of this idea, I trust their success may be more commensurate with their expectations than has been the fortune of the majority of factors for the past several years.

I have endeavored to submit to you something of the features and commercial phases of your production, and before closing feel it my duty to say a word on the subject of the market reports. Too much merit cannot be accorded to these mediums of communication between the city and country; and I believe there is nothing more essential, or more consulted by purchasers and all interested, than the market reports. All are familiar with the extreme difficulty of arriving at anything like reliable information, where the real facts are distorted and made to serve a hundred conflicting interests; and how fully, then, should we appreciate any attempt which aims at fairness and reliability, by ignoring the interests of either party, and accepting their opinions for no other purpose than to gain a truthful report. To you, whose home interests render you more dependant on these reports, it is inestimable that the markets should be fairly and justly represented. Yours is a vast interest, and the journals generally acknowledge this by the space given in their columns to the publishment of everything connected with the market. Conspicuous among these journals, the New York *Weekly Tribune* may be mentioned, as the most reliable and comprehensive in this particular, and which I believe does as much to commend it to the fireside of every farmer throughout the State, as any other topic of which it takes recognizance. Punctual with every Wednesday morning, this paper presents a full and accurate report of all articles of produce; and the ability with which this department is managed, the correctness and estimate of values, its suggestions and comments upon the general tendency of trade, have long since stamped it as the champion of the agricultural interests. Prominent beside the *Tribune*, the Utica *Herald* stands as the faithful reporter of your local markets, which ever renders it a valuable and

trusty means of information. And now, Mr. President, although I feel I have touched but lightly upon a few of the topics which interest us all as representatives of the dairy interests, yet I believe they are among the most important of those which solicit the care and attention of this convention, and which I trust to hear so much more ably presented and elaborated from the lips of those gentlemen whose long and intimate connection among you surround their teachings with more than prophetic wisdom. In conclusion, then, let me once more thank you for your kindness, and particularly for the attention with which you have honored my few remarks; and if the future shall realize but half the interest I feel in your success, then it will be as bright as the best friend of the convention of 1872 could have wished it.

General Pratt, of Jefferson, was, on motion of Mr. T. D. Curtis, invited to address the Convention. He said he did not intend to occupy much of the time of the Convention. Forty years ago he had discontinued farming, and had but recently resumed it, and in the pursuit of it he had made what he considered valuable discoveries in the matter of dairy cows.

In trying blooded stock, he had found Short Horn Durhams worthless as milkers. He obtained a cow three-fourths Ayrshire and one-fourth Durham. He purchased another seven-eights Durham, and he found her a first-rate milker. He obtained another known as Alderney, and also procured a Devonshire. He experimented in making butter from these cows. He detailed these experiments, and found that the butter from the Alderney cow retained its solidity and firmness, while the butter from the others became oily. From the experiments he came to the conclusion that if the Alderney were graded with the Ayrshire or Durhams, more butter and of better quality would be obtained, the Alderney improving the quality and the Ayrshire or the Durham increasing the quantity.

ANNATTO.

Mr. De Cordova, of New York, was, on motion of Alexander Macadam, invited to address the Convention in regard to annatto. He said annatto grows in seeds, on trees, in Brazil and other tropical countries. The seeds are used by the natives in soups, gravies and for coloring rice. It imparts a rich color and aroma. The seeds, when ripe, are gathered and dried. They are then placed in a vat of water and allowed to remain until the coloring matter is absorbed by the water. This process occupies some months. It is during this soaking period that adulterations are added. Pure annatto is perfectly harmless. Birds will eat it. But in preparing it, it is adulterated. Arsenic, red lead and copper have been found in adulterated basket annatto. Annattoine is also made from the annatto seed.

VALUE OF CORN FOR SOILING.

Mr. Arnold, of Tompkins, said he had not been aware until late that he had been appointed as chairman of the Committee on For-

age Plants, and was not prepared to speak fully, but would prepare some remarks for the press at a future day. He considered corn first-rate as a soiling plant if properly grown, cared for, and fed.

Hon. Harris Lewis, of Herkimer County, offered what he styled a minority report. He believed corn infinitely better than starvation, but grass was infinitely better than corn. Mr. Lewis illustrated his position with natural diagrams, consisting of a hard, woody corn-stalk and a handful of sweet, fragrant hay. Mr. Lewis' method of presenting his arguments was novel and striking, and was loudly applauded. Besides the tangible proofs, Mr. Lewis fortified his position with the following reasons: 1st. Because grass is the natural food of the cow, and corn is not. Cattle will refuse corn when they will not grass. 2d. It costs less to grow grass than corn. 3d. It costs less to cut grass than corn. He would say it, but without meaning any offence, that the instinct of the cow is better for her than the reason of some dairymen.

Mr. Farrington, of Canada West, had experience with fodder, corn and with grass. He stated that there were times when grass could not be had. Corn should not be overgrown, nor should it be too thick and fine. It should be medium growth. He had kept oxen six or eight weeks on corn fodder alone, and worked them all the while without loss of flesh. There is substance in corn fodder. The cattle relish it.

Mr. Curtis, of Oneida, asked what time he cut his corn for his oxen.

Mr. Farrington said the corn was sowed in drills and cut all along for six weeks, as it was needed. Some of it was older, some less advanced in growth.

Mr. Staples, of Vermont, said last summer he had ten acres of corn, and he fed it to cows, and they thrived on it. He believed corn an advantageous crop for cows.

General B. F. Bruce believed the truth laid between the two assertions. Cattle could not be fed on grass advantageously together as it now stands. But there was a remedy, he believed. That remedy was the steam-box. He advocated cutting and cooking corn and grass together. He urged the advantages of the cutting and cooking process, and hoped it would be adopted universally. The foreman of a farm owned by Mr. Avery, near Syracuse, and where the cutting and cooking process is practiced, informed him that the saving and cooking process was $10 per cow per year, and as Mr. Avery kept sixty cows, there was a saving of $600 per annum. The cattle, too, were in capital condition.

General Pratt, of Jefferson, told how he got rid of quack grass by ploughing deep, harrowing and using the cultivator three times in succession, and then sowed Southern corn broadcast. The quack grass was annihilated. He urged that sowed corn was more valuable than grass for cattle.

Hon. Harris Lewis, of Herkimer, facetiously, and at the same time pertinently, replied. He said the cows would have preferred the quack grass to the corn. Mr. Farrington had not understood

his position. A cow will maintain herself in better condition, give more milk, and the butter and cheese would be of better quality when fed on grass than when on corn.

Mr. Walker, of Oswego, supported Mr. Lewis. He said corn is good where grass cannot be secured, but if grass can be grown, it should, as it is better than corn.

Mr. Hawley, of Onondaga, also supported Mr. Lewis. Where you cannot get grass, use corn. But if you can get grass, use it in preference, for grass is the natural food of the cow. He advised using sweet corn, when necessary, with grass, instead of Ohio corn. He had found by experience that one acre of sweet corn was worth two acres of Ohio corn.

Mr. Staples, of Vermont, had found Virginian corn the best.

Mr. Scoville said that corn could be grown ten feet high, making 120 inches of fodder; he would ask Mr. Lewis if his grass could show so much material.

Mr. Lewis said quack grass will give a crop of about one hundred inches a season; orchard grass, about eight feet; Lurcerne, about one hundred inches. He urged again the greater value of grass.

COLORING CHEESE.

Mr. Farrington, of Canada West, was, on motion of Mr. Arnold, granted leave to speak on annatto. He was glad to know that annatto, if pure, was harmless. But it is much adulterated, doubtless. He looked upon the necessity for artificial color in cheese as an indication of an uncultivated taste. He again regarded the cost of color as a waste. He would oppose the use of color on the high grounds of truth and a freedom from all misrepresentation.

Mr. Staples advocated coloring cheese. He colored cheese and obtained the highest price for it.

FINANCE COMMITTEE REPORT.

Alexander Macadam, of the Committee on Finance, reported that they had found the Treasurer's report correct; and would suggest for the consideration of the Convention the possibility of establishing a life membership, $10 or other sum to be required to constitute a life member. The report of the committee was accepted and adopted.

On motion, the Convention adjourned until 2 P. M.

AFTERNOON SESSION—WEDNESDAY.

The Convention assembled shortly after two o'clock, Vice-President Bruce in the chair.

The Chairman introduced X. A. Willard, A. M., who addressed the Convention on the subject of Condensed Milk Manufacture. This valuable address will be found in full in this volume, commencing on page 55. The lecture was illustrated throughout with large plans and diagrams, which made every part of the description

clearly intelligible and very interesting. At the conclusion Mr. Willard was greeted with applause.

President Seymour said this industry would open a new outlet for the milk of the country, and the interesting address would be published. He then referred to the social meeting to be held in the evening. He said he was glad to observe many present from our own section, as well as other States, who were not in the habit of attending these conventions, and he hoped all would attend the social meeting and mingle in pleasant intercourse with each other. The social meeting would take place at Bagg's Hotel, at 8 o'clock. The President then declared all introduced to each other, [applause], and he said he should feel free to speak to any one he might meet at the social gathering. He closed by referring to the address of Mr. Willard, who, he said, had placed all under great obligations by the thorough manner in which he had evidently investigated the subject.

ELECTION OF OFFICERS.

L. B. Arnold, of Tompkins, chairman of the Committee on Nomination of Officers, reported as follows:

The Committee on the Nomination of Officers being satisfied for themselves, and feeling assured that the Association has, equally with themselves, been pleased with the manner in which the officers of last year discharged their official duties, see no cause for any essential change, and therefore recommend

For President—Hon. Horatio Seymour, of Oneida, N. Y.

For Vice-Presidents—Hon. Thomas G. Alvord, of Onondaga, N. Y.; Henry Wade, of Canada West; O. S. Bliss, of Vermont; C. H. Wilder, of Wisconsin; T. L. Harison, of New York; B. F. Bruce, of Madison, N. Y.; C. E. Chadwick, of Canada West; J. V. H. Scoville, of Oneida, N. Y.; X. A. Willard, of Herkimer, N. Y.; John G. Cohoe, of Chautauqua, N. Y.; Alexander Macadam, of Montgomery, N. Y.; R. R. Stone, of Illinois; S. D. Putnam, of Minnesota; Harvey Farrington, of Canada West; M. Folsom, of New York City; S. R. Smith, of Erie, N. Y.; J. H. Holloway, of Kentucky; Halsey Safford, of Cattaraugus, N. Y.; Hiram Smith, of Wisconsin; S. L. Lincoln, of Massachusetts; Gen. T. R. Pratt, of Jefferson, N. Y.; A. Burnham, of Chautauqua, N. Y.

Secretary—Gardner B. Weeks, of Syracuse, N. Y.

Treasurer—Dr. L. L. Wight, of Whitesboro, Oneida County, N. Y.

L. B. Arnold,
S. A. Farrington,
L. T. Hawley,
H. Cooley Greene,
D. H. Burrell.

Mr. Burrell, of Herkimer, one of the Nominating Committee, presented the following additional names for Vice-Presidents:

L. B. Arnold, of Tompkins, N. Y.; S. A. Farrington, of Yates, N. Y.; H. Cooley Greene, of Pennsylvania.

President Seymour said he was very much gratified at the esteem shown him by a renomination, but he hoped the Committee would present the name of another for the position, as he felt that he might not be able to be as useful in the office of President as some others.

Hiram Walker, of Oswego, moved that the entire report be adopted. The report was then adopted unanimously.

The President then thanked the Convention for the mark of esteem shown him.

The next order of business was the address of Hon. Harris Lewis, of Herkimer County. Subject:

THE WINTER FOOD OF DAIRY STOCK.

The subject of winter food, for dairy cows, is one of great importance to dairymen, and what I may say on this subject, at this time, will be said more for the purpose of drawing others out, and thereby obtaining knowledge from them, than from any hope of mine to impart information to this Association. All I can hope to do, is to give the conclusions arrived at, from an experience more limited than many of you possess. The more I have consulted the wise and great, the more have I become befogged, on the question of winter food for dairy cows. One chemist tells me that oat straw has so much nutritive element of this kind, and so much of some other kind. But they do not tell us at what stage of growth the straw was cut from which the analysis was made. We all know without any analysis whatever, (or ought to know,) that oat straw cut and nicely cured at a certain period of its growth, is better relished by cows than hay cut at another period of its growth, and badly cured.

The conditions of growth and the degree of maturity, ought always to be given with an analysis of hay and straw. The conditions of these plants are always changing very rapidly after flowering, in a climate like ours. Again, herbaceous plants, and the straw of all our grains having a slow and small growth are much more nutritive, taken bulk for bulk, or ton for ton, than those having a large and rapid growth. Plant growth in Europe is often so different from plant growth here, that an analysis which would guide them into truth, would lead us into error. I have often thought, therefore, that our European chemists, by their analysis of cattle food, would mislead as many of our dairymen as they will enlighten. We must look to our own agricultural colleges for light upon this subject, not only by careful analysis, but also that furnished by careful, practical experiments. In order to show the degree of reliance we may place on the analysis of European chemists, and European experiments to obtain the value of different kinds of cattle food, I will compare the statements of two chemists and seven experimenters as given in a table of nutritive equivalents by Charles L. Flint in his "Milch Cows and Dairy Farming," on page 126; and how such an able author as Mr. Flint should have indorsed such a table of equivalents I cannot imagine.

Taking English hay at one hundred, lucern has a theoretical

value, or value by analysis of 83, that is 83 pounds of lucern equals 100 pounds of hay. Two experimenters put its feeding value at 90, and two at 100, or just equal to hay.

Red clover one chemist puts at 75, the other at 78 or 77.9, three experimenters at 100, and two at 90. Red clover (green) is varied from 311 to 450 by the chemists and feeders.

The analyzed value of rye straw is given by one chemist 479, by the other only 527. The experiments in feeding give its value as high as 150, and as low as 666, which I believe is twice too high.

Oat straw has a theoretical value given by one chemist of 383, by the other 445, and a practical value is given by one experimenter of 150, another 400; while four give the value at 200, or of half the value of hay.

Mangel-wurzel is given a theoretical value of 391 1-3, and a practical value ranging from 250 to 460, by the different feeders. The value of potatoes ranges from 330 to 150, by this table of nutritive equivalents.

Indian corn ranges from 70 to 52, and buckwheat is given a nutritive value by one chemist of 55 and by the other chemist of 93 and 5-12ths. The value of barley is made to range from 33 to 76, but Black, the English experimenter, who makes 33 pounds of barley equal to 100 pounds of hay, probably had all his barley brewed into ale, and drank it himself, to obtain this nutrition. And Schweitzer, the German experimenter, makes 35 pounds of barley equal 100 pounds of hay, I conclude, from his love of lager. Oats are made to vary by this table of nutritive equivalents from 37 1-2 to 86. Rye from 33 to 71. Wheat from 27 to 64, and oil-cake from 22 to 108.

I regret that Mr. Flint gave this table of nutritive equivalents a place in his excellent work, which he designed as a "light to our path, and a lamp to our feet." For the more light of this kind we have, the more dark and doubtful will the subject of winter food for dairy cows become.

Many dairymen are now raising grain to some extent, and how to use their straw and corn-stalks to the best advantage, is a question of no small importance to them, and, in fact, to all who are pursuing a system of mixed husbandry. A very few (in proportion to the whole number) advocate cutting and steaming all the coarse feed, with the addition to it of ground grain of some kind, sufficient in quantity to render its nutritive value about equal to good hay.

I believe that dairymen are almost unanimous in their opinions, that, to secure the desired thrift of the cow through the winter, and also to insure her usefulness throughout the coming summer, her winter food should be at least equal to good meadow hay, in nutritive value.

For those dairymen keeping large herds, and feeding large quantities of coarse fodder, it may be economical to cut and steam the food. As I have no practical knowledge of cutting and cooking cattle food, perhaps silence on this subject would have been the wiser course for me.

But as I desire light upon this subject, into which I have often

desired to look, and have hitherto found it more difficult than it is to look through a mill-stone having a big hole in the middle, I will make the following estimate for the purpose of drawing out discussion upon the subject:

First. A complete apparatus for cutting and cooking coarse fodder for fifty cows, will cost at least $600.

Second. The annual depreciation by wear, rust, &c., 20 per cent	$120 00
Third. Extra labor	75 00
Fourth. Fuel	20 00
Fifth. Average annual repairs	10 00
Total cost each year	$225 00

This sum would purchase about eighteen tons of hay, at the average price here in Utica for the last fifteen years.

Some dairymen who have tried cutting and cooking food for stock, regard it as very economical, saving at least one-third of the ordinary cost of wintering their dairy stock.

Again, others have tried the system and regard it not only as non-paying, but injurious to the cows. The great saving claimed by the advocates of cutting and steaming food for dairy cows, reminds me of what one of our members of the Central New York Farmers' Club said in a very able paper on the winter food and care of farm stock, at our meeting last Friday. As near as I can remember, he said that "one class of farmers claimed a saving of one-third of their winter fodder by keeping their stock in warm stables, and another class saved one-third by cutting and cooking the food, and when some cute Yankee would invent some way by which the other third might be saved, dairying would become an inviting and lucrative business."

That a saving may be made by cutting and steaming coarse fodder, I do not doubt, but I do beg leave to doubt so great a saving as some of the advocates of this system claim, over and above the extra expense incurred. We are too much inclined to shape facts in accordance with theories accepted, or practices adopted. The cow has a very perfect apparatus for cooking, cutting and grinding her food, mouthful by mouthful, slowly chew it over, with her eyes half closed, and apparently without effort on her part, presenting at the same time a picture of perfect contentment and unalloyed happiness, I conclude that He who made the cow, with her wonderful food-preparing apparatus, fully understood all her wants in this respect.

To those dairymen who have coarse fodder sufficient for one feeding per day through the winter, I would suggest to feed all the good hay the cows will eat clean, night and morning, and the coarse food at noon, with a sufficient quantity of roots to render the coarse fodder fully as succulent as good early cut hay.

The internal arrangement of the cow is unmistakable evidence that green grass is her natural food, and so long as she can obtain it in sufficient quantity to satisfy her desires, without too much effort on her part, no additional food will add to her usefulness or

contentment. But the cow in this latitude can not obtain her natural food, nor can we supply it, during our long, cold winters. In supplying her winter food, we can approximate, however, to her natural requirements, to such a degree that her health, thrift, and general usefulness, will be secured. To do this, let us secure a sufficient amount of grass cut during that stage of its growth, when it contains all its nutritive elements for her winter food, in addition to this, just roots enough to keep her good natured, or in other words, just roots enough to give to her dried grass the required succulence. Some dairymen may object to this kind of food for cows, on account of its cost. Let us consider the question of cost for this kind of winter food for dairy cows. The hay costs me about six dollars per ton, and about two tons are required to winter a cow. The mangel-wurzel costs about three dollars per ton, when the crop is good, and the land on which they are grown well prepared. One ton of mangels will keep a cow good-natured all winter, but double that quantity may be fed to good advantage. We will then estimate the hay at twelve dollars, and the roots at six, making the cost for the winter food of each cow eighteen dollars, which all will agree is not very expensive for the best winter food for dairy cows attainable. If hay and roots should be adopted as the winter food for dairy cows by any dairyman present, allow me to suggest that the hay cut last be fed first, as the earlier cut will be the most succulent. Roots have the largest amount of water, or succulent matter, in the fall and early winter, so that by feeding the roots when they contain the most succulent matter with the hay containing the least, and the hay containing the most succulent matter with the roots when they contain the least, will balance the food all winter. Roots possess a value as winter food for dairy cows far above the theoretical value given by any chemist, for the simple reason that they aid mastication, digestion and assimilation by rendering the food more succulent. Any food capable of doing this, will promote the health of the cow, in addition to the satisfaction and gratification it affords her. I judge that the mangel-wurzel is worth, as cattle food, as many cents per bushel as hay is worth dollars per ton; that is, if hay is worth ten dollars per ton, mangels are worth ten cents per bushel, and when hay is worth twenty, as it is here now, mangels are worth twenty cents per bushel. And as hay will never be likely to range below ten dollars per ton, in this vicinity, hence, roots costing less than ten cents per bushel can always be grown at a profit, as winter food for dairy cows. After several trials, on a small scale, with carrots and turnips, I have come to the conclusion that with my soil, the most value in cattle food, and at less expense, can be secured by growing the mangel-wurzel than any other roots.

I do not wish to undervalue the turnip, or carrot, as winter food for dairy stock, for both possess a value far above their ordinary cost, and are worthy of much more general cultivation. The Long Red, Mammoth Red, or Elvethom beet, will, without doubt, produce the most cattle food per acre, and will do first-rate to feed during the winter. The American Improved Imperial sugar beet, will

yield large crops and grow well, on the same land year after year; are excellent to feed while the cows are giving milk, and will keep well, until late in the spring. The Yellow Globe will yield less per acre than the Imperial or Elvethom, but, like the Imperial, is better than the Elvethom for cows giving milk, and for late keeping. I have not been able to decide in regard to the feeding value between the Imperial and Yellow Globe; the Imperial stands upon its merits, while the Globe is yellow and suits the eye, like yellow butter and cheese.

I will conclude this paper, which is longer than I intended, by saying that the American Imperial beet seed can be obtained of Henry Lane, at Cornwall, Vermont, and all the other seeds of Batchelor Brothers, of this city. But these men have not asked me to advertise their goods, and I should not have done it, except for your accommodation.

ROOT CULTURE AND STEAMING FOOD.

Mr. J. B. Lyman,* of the New York *Tribune*, on invitation of the President, spoke of the winter care and food of animals. He said in his observation he had noticed that the advancing farmers of the country have adopted root culture for winter food for stock, and in no case had he known of any farmer who, having once adopted root culture, ever regretted it. The most advanced farmers also were adopting steaming food, and they are pleased with the result. He thought Mr. Lewis had overstated the cost of a steaming apparatus. Mr. Lewis placed the estimate for cooking food for 50 cows at $690. The speaker had visited the estate of Wm. Crosier, of Long Island. He had prepared for steaming. He proceeded cautiously. He bought the Prindle boiler for $60. The pipe from the boiler went into a home-made steam box costing, perhaps, $5. In the box he placed the food, the steam rising from below. His fire was kept under the boiler about four hours. It had a cooking capacity for forty bushels. His outfit cost about $75. He hired a "new hand," or cheap laborer, for $12 per month and board, to attend the cooking. His apparatus supplied food for one hundred cows. There was no expense beyond the outfit and the labor to run it. He is strong in his advocacy of cooking food. He fed it warm, not hot. He supplied just as much as the cattle would eat. They would nibble away at raw food and consume the cooked. Mr. Crosier thought by cooking he secured the same elements in his winter food that existed in his summer food. Speaking of stock, Mr. Lyman thought one thoroughbred Alderney to ten others would produce the most desirable selection of stock for making butter. Mr. Lyman urged cultivation of roots. They can be grown at from 3 to 5 cents per bushel. It can be shown that roots are more profitable food for cows where cows are to be kept in a thriving condition, and milk well. The advantage of steaming and cutting has been expressed again and again at 25 and even at 33 per cent.

*The sad and sudden death of Mr. Lyman, soon after this Convention, adds a mournful interest to what he said on this occasion.—SECRETARY.

Mr. Lewis considered that steaming corn-stalks would not render them more nutritious.

Dr. Wight, of Oneida, urged that neither side of the question should be exaggerated, but that all should be represented in a fair manner.

Mr. Hawley, of Onondaga, said his stock did better on well cured hay than on cut and steamed food. He would not advise discontinuing cutting and steaming for large stock, but would advise getting along without steaming and cutting for small stocks. He was satisfied Mr. Lewis did not overestimate the cost of cutting and steaming, but rather did not estimate it high enough.

Mr. Lewis, in reply to an inquiry, said his beets cost him 5 3-10 cents per bushel last year—this year a little more than 4 7-10 cents. He regarded one feed of carrots per day to horses the most valuable feed that could be given them. More than twice as many bushels of beets can be grown on the same piece of land as can be grown of carrots.

Mr. Schermerhorn urged difficulty in raising mangels, and that mangels were injurious feed for horses.

OBITUARY RESOLUTIONS.

The committee appointed to draft proper resolutions on the death of Mr. J. B. Dick, a member of the Association, presented the following:

Whereas, Since the last annual meeting of this Association the death of J. B. Dick, Esq., a member of this society, has occurred, therefore,

Resolved, That this Association has heard with deepest regret of the death of Mr. J. B. Dick, of Erie county, N. Y.

Resolved, That we recognise in Mr. Dick one of the most energetic and earnest members and upholders of this organization, and one who was eminently intelligent and successful in his calling as a cheese-maker, justly popular in this society, as well as a man bearing an enviable record throughout Western New York.

Resolved, That these resolutions be printed in the annual report of this Association, and that a copy be sent to the family of the deceased.

GARDNER B. WEEKS,
HALSEY SAFFORD,
S. R. SMITH.

The report of the Committee was adopted.

SUNDAY CHEESE-MAKING.

Mr. Blanding, Chairman of the Committee on Sunday Cheese-Making, presented the following report:

The Committee appointed to report to this Convention on the resolution presented at the last Convention by Rev. Dr. Fowler, of Utica, in regard to carrying milk to cheese factories on the Sabbath, would respectfully submit the following report:

First. We heartily indorse the views expressed in the resolution

offered, and would recommend that dairymen keep their Saturday night's and Sunday morning's milk at home, setting it away in pans, with as much convenience and as little trouble as possible, for the purpose of making it into butter. That the Sunday night's milk be aerated and cooled in such a manner as to preserve it in good condition until Monday morning, when it may be carried to the factory.

Your Committee would also suggest the propriety of delivering the Saturday night's milk at the factory at an earlier hour than usual, and having the same worked up in the evening.

WM. BLANDING,
D. H. BURRELL, } Com.
C. C. HOUSE,

DISCUSSION.

It was moved and seconded that the discussion of the subject be postponed until to-morrow morning.

Mr. Hawley, of Onondaga, moved that it be laid on the table.

After considerable discussion, both motions were withdrawn.

Mr. Farrington, of C. W., thought that principle, the right of the thing, should settle this matter. If every factory-man would refuse to receive milk on Sunday, some means would be devised to take care of the milk; nor did he believe that any pecuniary loss would result to any, while the moral effect would be salutary.

Mr. Babcock, of Herkimer, said the products of our combined labor amounts to millions of dollars annually, and needs to be performed by skillful hands and intelligent minds. If those hands are overworked, or those minds overtasked, the results are less satisfactory. Must it be said that the leading interests of our country are represented by those who disregard the command to "Remember the Sabbath day and keep it holy." Are the interests of the few dollars gained by the present custom of desecrating the Sabbath, of more value to us than the quietude of a well kept Sabbath, or its influence upon the rising generation? Is it true that to get any action upon such an important subject as the one now before this Association, we must show that there is a gain, or at least no loss in dollars and cents, or that dollars and cents are of the first importance to us? Can we expect the blessing of the Almighty upon our labors if we disregard his express command? I believe if we would go to work as earnestly to remedy this evil as we have to improve the products of our labor in other directions, and can have the co-operation of all who desire such a change, the evil can be remedied with but little loss in dollars and cents, while the products of our labor would be improved in quality, by giving the manufacturer his proper rest.

Mr. Greene, of Pa., did not believe in working Saturday nights; its result is greater weariness of body and mind. He thought that Yankee ingenuity could devise some means of keeping milk from Saturday night to Monday morning.

Mr. Schermerhorn could see no means by which Sabbath cheese-making could be safely evaded.

Dr. Wight argued on the same side of the question.

The discussion ended with the adoption of the report by a decided vote.

The meeting then adjourned until 9 o'clock Thursday morning.

SUPPER.

A large number of those present at the Convention assembled in the evening for a social reunion and supper at Bagg's Hotel. The occasion was one to be long and pleasantly remembered.

THURSDAY—MORNING SESSION.

The Convention was called to order by Vice President Bruce, about 9 A. M.

He introduced to the meeting Prof. Geo. C. Caldwell, of Cornell University, who proceeded to read the address which will be found in this Report beginning on page 25. This lecture was illustrated with extensive and numerous diagrams, which added much to its value. At its conclusion the speaker was heartily applauded.

Mr. L. B. Arnold, of Tompkins Co., of the committee on the juster apportionment of milk delivered at cheese and butter factories, read the following report:

JUSTER APPORTIONMENT OF MILK.

The committee appointed at the last convention to mature a more equitable mode of adjustment of the proceeds of butter and cheese factories, have found themselves too widely separated to admit of concerted action, and hence have not perfected any plan as fully as they could desire.

That there is a difference in the value of milk is generally conceded; but that the difference is much greater than is usually supposed, the committee have no doubt. The amount of dried curd in 100 parts of milk, in the milk of a factory having eleven patrons, varied from 6 1-2 to 11 1-4, each dairy being tested by itself; and the cream, as it arose in the per cent. glass, in June, varied from 7 to 13 per cent.; and in the different cows of a dairy, in November, it varied from 11 to 22 in one instance, and from 12 to 32 in another. That milk varying so widely in value should draw equally from the returns of a factory, is hardly in accordance with the law of equity. For a more equitable adjustment of the proceeds of cheese factories than obtains by regarding only the weight of milk, we recommend the following:

Take some certain quantity of milk and curdle it in the usual way, with rennet, and weigh or measure the dried curd as a basis for dividing the products of the factory. We would suggest doing this as follows: Take a per cent. glass and fill it to the top of the graduated scale with milk from the mess of one patron, and turn it into some convenient vessel, as a tin basin, to be treated by itself.

Do the same with the milk of each patron, and place them in any situation where they will be equally warmed. A vat of warm water is the best, if convenient, if not, the basins may be floated in a vat of warm milk. Apply rennet to each alike, and when curdled drain off the whey and let the curd be dried in any convenient way. It will usually dry in 24 hours by exposure to the air. If kept warm in the basins, it may be dried sooner. The most accurate way of comparing the curds would be to weigh them, but as the conveniences for weighing in such small quantities are usually not at hand in factories, the following method is suggested: Put in a per cent. glass some certain quantity of water, say 30 parts, and then drop in the dried curd broken in small pieces, and note how much the water is raised by adding the curd, and the rise will show the per cent. of curd in bulk. Proceed in the same way with each mess of milk till the per cent. of bulk in each is ascertained. In some experiments made in this way by one of the committee, the per cent. of curds varied from 6 1-2 to 8 1-4 in a factory having eleven patrons. This, it will be seen, showed the curd in one patron's milk to be worth 25 per cent. more than another. The mode of adjusting the proceeds of factories from the value of milk thus ascertained, is to make several trials during the season, once a month, or oftener if desired, and take the average value of each man's milk as a basis for distribution. Suppose the milk of patron No. 1 is found, from the several trials made, to average seven parts of curd in 100 parts of milk, then his whole number of pounds of milk may be multiplied by seven, and this product used to estimate his share of the factory's proceeds. If the milk of patron No. 2 shows 7 1-2 per cent., multiply his milk by 7 1-2, and use the product in estimating his share. If patron No. 3 had milk that would yield by the tests only 6 1-2 per cent. of curd, then multiply his milk by 6 1-2, and so on with all the patrons, multiplying each patron's milk with the number indicating the parts of curd, and using the several products, instead of the whole number of pounds of milk in apportioning the proceeds of the factory.

In apportioning the proceeds of butter factories, we can recommend no better method than to ascertain the per cent. of cream by the use of the cream gauge, and to multiply the whole number of pounds of milk delivered by each patron by his percentage, and use the products as in apportioning the proceeds of cheese factories.

By this method of distribution, each patron will get, with great exactness, the relative value of his milk. If it is rich, he gets a higher percentage; if poor, a lower one; and if he waters it, he can hardly fail to get paid in his own coin. It will offer a stimulus for every one to make his milk as good as he can.

L. B. Arnold,
T. D. Curtis,
J. V. H. Scovill,
Harris Lewis.

The report of the committee was accepted and adopted.

After the disposal of the report Mr. Arnold proceeded with his address on poison cheese, which address will be found in full in this

Report beginning on page 90. Unfortunately Mr. Arnold was obliged to leave the Convention soon after the close of his address. Many of the members, appreciating the value of the facts which he had brought to the notice of the meeting, desired to question the speaker respecting them. He found time to reply to the following questions from different gentlemen:

1. Is there any other way to destroy germs in milk than by aeration?

Yes. Agents may be used for that purpose. The sulphites are generally destructive to ferments. The sulphite of soda was applied to the milk examined by Prof. Law with complete effect. But it is not desirable to use chemicals in milk of which butter and cheese are to be made, however harmless they may seem to be. The best and most effectual remedy is heat.

2. What degree of heat will destroy them?

Different germs die at different temperatures. The Arthrococcus or sour milk spores, require a boiling heat and are not always killed at that, while the Micrococcus lose their vitality at 140°. The ferments detrimental in cheese making, at least those that are notoriously so, die at a heat varying from 130 to 170 degrees.

3. Does killing the ferments in milk make it as good as milk that does not contain them?

No; the dead organisms give an altered flavor to the milk, and to the butter and cheese made from it, and hasten their decomposition.

4. Does all tainted milk contain fungi, such as those illustrated, or something like them?

Not necessarily. The kind of milk that is recognized and known as tainted milk, is made so from a feverish condition in the cow; and that feverish condition may be caused by the introduction of ferments from slough-holes, stagnant pools or swamps, &c., when something of the character of what has been exhibited will be carried into the circulation of the cow, and cause fever, and be present in the milk. But milk becomes feverish and induces taint by worrying the cows in any way, as by driving with dogs, the annoyance of flies, too much exposure to hot sunshine, &c., &c., when such organism as exhibited do not appear.

5. Will airing milk destroy all the germs in it?

No. The spores or seeds of fungi in milk seem not to be destroyed by contact with the air; but after germinating, the growing plants are killed by exposure to the air.

6. How can you distinguish between micrococcus cells and milk globules when both are in the milk?

By their external appearance. The cream globules are unequal in size, larger and more rotund in form. The micrococcus are minute and a little flattened.

7. In the case of milk examined by Prof. Law, do you know whether all the cows in the dairy give such milk, or only one; and was there any appearance of disease in the cow, or cows, producing it?

The cows did not all give such milk, but I did not learn how

many were affected. There was no appearance of disease other than what was detected by the thermometer.

[Note from Mr. Arnold.—Since the Convention, I have learned by a statement from Prof. Law, that several cows were affected, but not all at once; two or three at a time; and that the milk was discovered to be faulty by the dairyman, and was taken to the Professor for examination, and was not put on sale;—that the water issued from a spring in a mossy bank, and was collected into a wooden gutter and discharged into a wooden trough. It did not appear to be bad.—L. B. A.]

8. Does not all water contain living germs, and how are we to know what water is safe to use and what is not?

All stagnant water contains organisms, either animal or vegetable, that make it unsafe to use, or to allow cows to drink. Though there are often found in spring water certain kinds of germs, there is seldom anything hurtful in cool spring or rock water, or in water that keeps in motion.

9. If germs can be carried in water, through the body of a cow into her milk, and retain their vitality, can they not be introduced into the body of the cow through other means, and be in like manner carried into her milk?

I have already shown that they reach the milk from feeding cows distiller's slops. The yeast plant, peculiar to brewer's yeast has been found growing in milk from cows fed with brewer's slops. The acidifying germs in sour whey, when fed to milch cows, retain their vitality in the milk of such cows, causing it to sour prematurely. Mow burnt hay, or hay that has been heated in the mow, produces the same result. There are plenty of authenticated cases in which they have been carried into the milk through the lungs by the cows breathing foul air.

It is notorious, that tainted milk has a *cowey* smell, or a smell like the stall, especially when it is confined in a tight can or warmed up to blood heat, or nearly. Now, if the fungi shown, or something like them, are the cause of tainted milk, why does the milk have this *cowey* smell instead of the odor produced by the fungi? In other words, why does not milk smell like the cause of the taint, instead of having, as it usually does, a very strong *animal* odor?

This *cowey* smell or *animal odor*, as it is called, is an *effect* rather than a *cause* of tainted milk, and its intensity may generally be taken as the measure of the disturbing cause. This kind of odor which always, to some extent, belongs to milk, is the greatest when the temperature of the cow is at fever heat. If a cow drinks swamp water it will become a disturbing cause of health and produce fever, and reproduce in the milk the smell of that water. In such a case the increasing fever produces a corresponding increase of animal odor, and it often becomes so strong as to obscure the odor from the direct cause of taint.

A cow drinking from a stinking mud-hole will retain the smell of the muddy water prominently in her milk, because it will be stronger than the cowey odor produced by the fever occasioned by drinking the muddy water. Animal odor is usually the leading

odor developed in tainted milk, and in the whey and curd in the process of scalding, as it is termed, because it is itself a ferment that increases with marvelous rapidity under favorable circumstances, such as occur in warm milk and whey.

RESOLUTIONS.

Dr. Wight, of Oneida, offered a series of resolutions, which, on motion of Mr. Scovill, were made the special order immediately after the opening of the afternoon session.

The next speaker introduced to the convention was Mr. William Blanding, of Broome county, who addressed the Association on the question,—

"IS IT POLICY TO TAKE ANY CREAM FROM THE MILK BEFORE MAKING IT INTO CHEESE,—AND IF SO, HOW MUCH?"

I propose to make but a few remarks and suggestions on the subject before us, and then leave it for discussion by the members of the Association.

One of the first points, on the negative of this question, that meets us is,—the quality of the cheese will be injured by skimming. We all admit that a skimmed "white oak" cheese is hardly worthy of the name, and the lover of good, rich, nutty-flavored cheese would think it in a more appropriate place if stored in our arsenals as munitions of war, than placed on our tables as an article of food. If we depend on butter as the principal product of the dairy, we, of course, take all the butter we can from the milk, and make the residue net whatever we can, whether in skim cheese or by feeding. But not much of this kind of cheese finds its way to the European markets. Our best cheese, or that mostly exported, comes more directly in competition with the English product, and by it, more than any other, is its good or bad qualities measured. And any factory that makes a cheese that compares favorably with the best English make, secures a reputation which yields an extra percentage in dividends to its patrons. But does the English cheese contain more butter than ours? On the contrary our cheese, by analysis, shows richer in butter than theirs. When the American cheese reaches the other side of the water—if poor in *manufacture*, ever so *porous* and *spongy*, or ever so poor in *flavor*—it is *not* poor in *butter*, but is richer in that quality than the goods we are striving to imitate or excel. This would seem to indicate that the excess of butter might be saved and the quality secured by *good milk*, careful *manufacture* and *curing*. It is a question with some whether all the cream will work into the cheese if it once becomes separated from the milk. I have had an opportunity for some observation by working up the milk twice a day, as compared with once, and have had as good results in both quality and quantity in the latter case as the former, and in both cases had, as far as I could see, an equal amount of cream rise on the whey vats. I think it must be evident to all cheese makers that there is a loss of butter in the process of making. The whey may rise above the curd, green and clear, but

after standing a few days, a heavy cream appears, from which, in some factories, hundreds of pounds of grease are made and sold every year, while the great bulk of it goes to the swine. In our factories, where we receive the milk twice per day, we take off what cream rises on the night's milk, the morning milk is added and made up. Where we practice this, we are obliged to buy all the grease for our cheese ; our whey does not furnish any. It seems to me we had better save this cream and make it into fine butter, than let it pass into the whey vat. We have been satisfied with our results under this plan, and our goods have given good satisfaction in the market.

Prof. Caldwell told us last year in regard to the best of Swiss, French and Holland make of cheese, and one of the thoughts he suggested for the consideration of members of this Association was that some of the best and most highly prized cheeses are made from wholly or partly skimmed milk, so that an additional income is derived from the cream worked into butter. In our process we take about one pound of butter from every one hundred pounds of milk, or about five and one-half pounds of cream.

Our product of cheese is lessened about one pound in ten. But adding the butter to the cheese, calling it all cheese, our product is about the same, so the advantage is the difference between the price of a pound of butter and a pound of cheese on each one hundred pounds of milk.

The member from Vermont asked if the milk could not be so agitated that no cream would rise in the vat, but that it would all be worked into cheese.

Mr. Blanding said he wished to hear that question discussed.

Mr. Walker, of Otsego, asked if leaving in all the oil did not cause the cheese to be "off flavor" sooner.

Mr. Blanding had noticed that a rich cheese lost flavor soonest. He thought the oil was not fully incorporated in the cheese, but remained by cohesion merely.

Mr. Farrington, of Canada, had had forty years of experience. He thought, by keeping over night, the cream became chemically changed. It will pass off in the whey and be lost, so far as the cheese is concerned. He had no difficulty in getting whey oil to grease his cheese, if the whey were left to stand in a clean vat, where no acid remained to cut the oil. He had found out that hogs could be fed to just as good advantage with whey from which three-quarters of the oil had been removed. The albuminous matters remain in the whey. It does not coagulate with any thing. You can discover this by boiling the whey and obtaining a whey curd. The sugar also remains in the whey. With whey as food, without any grain, his hogs had been kept in good condition. He advised taking off what cream rises over night. It will be found a saving. To leave the cream in the milk from which cheese is made, is to waste it, for its nature changes and you can not secure it in the curd.

EXPERIMENTAL DAIRY FARM.

The report of the committee on the advisability of soliciting an

appropriation by the Legislature of funds to establish an experimental farm being called for, Mr. T. D. Curtis, of Utica, stated that the committee had not given the subject consideration. The chairman, Mr. J. B. Dick of Erie, had died. No consultation had been held with Mr Platt, the other member of the committee. Mr. Curtis deemed the matter of universally recognized importance, and thought it might be brought directly before the convention without the formal report of the committee. He introduced a resolution that the matter be immediately brought before the Legislature. That Hon. Horatio Seymour, of Oneida county, General B. F. Bruce, of Madison, and Secretary T. L. Harison, of the State Agricultural Society, be suggested as the committee in whose hands the appropriation be placed, and that this committee should act under the directions of the Dairymen's Association. Mr. Curtis advocated his resolution earnestly and fittingly. General Bruce advocated the measure strongly, speaking of the great importance of the dairy interest, and claiming that it merited the material support of the State. Hiram Walker, of Oswego, and other gentlemen, made favorable speeches, and the resolution was unanimously adopted. The convention then took a recess till afternoon.

AFTERNOON SESSION—THURSDAY.

The closing session of the convention began at 1:45, with Gen. B. F. Bruce, of Madison in the chair.

On motion of Mr. Hawley, of Onondaga, Hon. Harris Lewis, of Herkimer, and Mr. T. D. Curtis, of Oneida, were added to the committee to solicit an appropriation from the Legislature for the purchase of an experimental farm.

The following resolutions originally offered by Dr. L. L. Wight, of Oneida, were now presented by different members :

Resolved, That at the expiration of each year, $200 be drawn from the treasury and paid to the Secretary for his services in compiling and issuing the annual report, and such other services as he may be called upon to perform.

The resolution was adopted.

Resolved, That $200 or so much thereof as may remain in the treasury at the close of the year, be offered as premiums on essays to be read at the convention of the Association, in 1873, on subjects appertaining especially to the interests of the manufacture of butter and cheese. Such premiums to be awarded by a committee of five, appointed by the chair for such purpose, in the following proportions.—Best essay, $100 ; second best, $50 ; third, $25 ; fourth, $15 ; fifth, $10.

The resolution was laid upon the table.

Resolved, That when the convention do adjourn, it adjourn to meet in Utica, on the second Tuesday in January, 1873, and continue three days. Adopted.

By Mr. Scovill, of Oneida—

Resolved, That we consider as an essential pre-requisite to good cheese-making perfect neatness as connected with every utensil used in connection with the dairy, and do especially recommend the use of tin milking pails, from the facility with which they may be cleansed with boiling water; and we recommend as essential that the milk be immediately aerated and cooled as soon as drawn from the cows.

Resolved, That we confidently believe that if the above requisites are carefully followed patrons may expect an increased yield and improved product.

The following resolution was offered, and after discussion was adopted:

Resolved, That Article 6 of the articles of the Association be so far amended as to read: "The payment of $1.00 shall admit any person to all sessions of an annual meeting, and that the additional payment of 75 cents shall entitle him to the annual report for the current year." Adopted.

The following report was then read:

The committee appointed to examine "Brintnall's Revolving Cheese Turner," having examined it, regard it as an evidence of inventive genius which we would be glad to encourage in behalf of dairy husbandry, but we do not feel sufficient confidence in its merits to warrant us in giving it an unqualified recommendation, but would rather recommend it to the attention of those desiring labor-saving apparatus of that kind.

S. A. Farrington,
A. M. Kibbe,
G. Merry,
Com.

Mr. Farrington, of Canada West, next moved that the resolution relating to appropriating $200 for prize essays be taken from the table. Carried.

Considerable discussion of the matter ensued, after which the previous question was ordered, and the resolution was then lost by a decided vote.

Mr. S. A. Farrington, of Yates county, was now introduced to the convention, and read the following address on

DAIRY FARMING IN CONNECTION WITH GRAIN RAISING.

The experience of the past season, has convinced the farmer, the grain raiser, as well as the dairyman, that if he would have his receipts sufficient to cover his legitimate expenses, he must husband his resources, or in other words, he must make every hour's labor count, and every acre produce to its utmost. As a natural outgrowth of this state of things, the subject of "mixed husbandry," has forced itself upon the minds of the thinking portion of the farming community.

The danger of the farmer of relying entirely upon a single branch of industry, as is quite generally the custom throughout the oldest dairy districts, is being apprehended to a certain extent. Mr. Willard has, for several years, recommended to the dairymen of Herki-

mer and vicinity that they raise more grain in connection with dairying than is customary. That each farmer ought, at least, to produce sufficient wheat for his family; a sufficient amount of coarse grain to feed his teams, and a liberal supply for his herd in the spring of the year, assuming, of course, that a sufficient of his land was adapted to raising grain. But the receipts to the dairyman for several years past having been quite satisfactory, this advice has quite generally fallen upon unheeding ears. While upon the other hand, the grain farmers of this and the Western States, not being satisfied with their receipts, and perhaps being stimulated very much by what dairymen were doing, have gone to making cheese or butter. And in many cases, both in connection.

Factories, almost without number have been built in these sections within the past few years, and cheese-making has been rushed into many localities to the abandonment or neglect of their accustomed business, and from not having realized the fact that their lands were not naturally as well adapted to grazing as the old dairy lands, besides too much of it having been almost continually plowed and cropped, and the elements that should be in the soil necessary to produce a fine flavored and meaty cheese, having been very much exhausted, and in most cases not having provided against the exigency of a drought, which is so common in most of the grain regions, and, as might be expected, when an individual or community go into any business they don't understand, and run it to the extreme, the result has not been as remunerative as was anticipated.

With the experience of the past before us, it seems to me that to adopt the mean between the two extremes is the best course to pursue to produce the most satisfactory results. For the purpose of showing what may be done by connecting both branches of industry under consideration, I will first take a grain farm and show its usual receipts and profits, and then connect dairying therewith and show the result. I will take a farm of 100 acres, arable land, and will suppose it to be rich enough to produce 35 bushels of corn to the acre, 25 bushels of barley and 15 bushels of wheat, and that a rotation of crops is followed by two years of seeding. It would then contain three fields of 20 acres each, and 40 acres of grass land to be divided between pasture and meadow. At present prices the products of such farm would be:

20 acres of corn, 35 bushels per acre, 75c.	$ 525
" " barley, 25 " " 60c.	300
" " wheat, 15 " " 1 50	450
And 15 head of young cattle could be kept summer and winter (besides cows sufficient to furnish milk and butter for family use) that will make an annual gain of $15 per head	225
And we have total product	$1,500

At customary rates of renting such farms, it costs one-half the products of such land to raise them, leaving proceeds with which to

pay taxes, repairs, &c., $725. (The price of wool and mutton having materially advanced within a year or so, undoubtedly some more could be made by substituting a part or all of the young stock with sheep. But from this not being the general custom among farmers, I have left them out of the calculation.)

We will now suppose the same farm be devoted to grain and dairying in connection. We will divide the farm into three 18 acre fields for corn, barley and wheat, respectively, and 6 acres for soiling crops, roots, etc., and 40 acres for pasture, upon which we will keep 20 cows, which should make 400 lbs. of cheese each, at 10 cts. per lb., after deducting cost of manufacturing, etc.,

8000 lbs. cheese at 10c net	$800 00
20 lbs. of butter to each cow, at 25c.,	100 00
20 " " pork " " " 6c.,	24 00
20 calf skins, " 1 00	20 00
18 acres of corn, at 35 bush. to the acre, at 75c.,	236 25
18 acres of barley at 25 bush. to the acre, at 60c.	270 00
18 acres of wheat at 15 bush. to the acre, at 1 50	405 00
Total receipts,	$1855 25
It costs on a dairy farm for two-thirds of the cheese and butter $360, and one-half the grain and pork $477.62. Deduct depreciation of stock $100, making whole expenses	$937 62
Net proceeds,	$918 63

Leaving a balance in favor of grain and dairying, of $193. You will see that I have given the grain and dairy farm credit for but 9 acres of corn sold. Neither has there been any meadow allowed, as I have calculated that the 9 acres of corn, with the fodder from 18 acres, and the barley and wheat straw from 36 acres, would be abundantly sufficient, without any hay, to winter all the cows and necessary teams, which a moment's reflection will satisfy any thinking person is correct, without giving the value of the different grains and fodder in figures, which I have dispensed with as much as possible. I will now take a dairy farm of the same size and value, and show its products as ordinarily conducted. Such a farm will keep 30 cows (and the necesary team) that will produce

400 lbs. cheese each, 10c	$1200
20 " butter " 25	150
20 " pork " 6c	36
30 calf skins " 1 00	30
Total products	$1,416

For expenses 2-5 cheese and butter.....$540
For expenses, 1-2 pork and calf skins,..... 33
Depreciation on stock..... 150

Total expenses.....$723
Net profits.....$693

Some years since, Hon. Geo. Geddes, at one of the State fair discussions of this State, was credited with saying that more stock was kept upon grain farms than upon dairy farms. Whether or not this is entirely correct as a general principle, I have not the statistics to show. But the statement certainly comes from high authority, and is sufficient to show that a much larger amount of grain may be produced on dairy land than is now common.

I will now connect upon the same farm, grain-raising with dairying, which will keep thirty cows. Allow me to say right here that a farm of the same value per acre in the dairy districts, from its more natural adaptation to grass, will keep more stock upon the same number of acres, if fed upon grass and hay mainly, than can be kept in the same manner upon a farm in the grain districts. We will suppose that 40 acres for pastures, 5 acres to soiling and 55 acres to meadow and grain. We will select fields from the whole farm to plow that are best adapted to tillage and grain, or such as may require re-seeding. But a small proportion of the dairy lands are naturally as well adapted to grain raising as the grain farms of the same value; but in a farm of this value we will suppose that there is enough from the whole farm to furnish thirty acres of good, productive grain every year, and arranging it so that none of the land should be in grain more than three years in succession and into grass less than two years in succession. Then we will have 15 acres of meadow, and 30 acres of corn, oats and wheat—either winter or spring wheat, as the land or circumstances require—and we have for

10 acres of wheat at 15 bush. per acre,				1 50..	$225 00
5 "	corn	" 35	"	" 75...	131 25
5 "	oats	" 50	"	" 50...	125 00
30 cows at 400 lbs. cheese each				.10c	1,200 00
	20 "	butter	"	..... 25c	150 00
	25 "	pork	"	..... 6c	45 00
	30 "	calf-skins		.....1.00	30 00

Total product.....$1,906 25
For expenses, 2-5 cheese and butter, $675 00
Grain, pork, &c.....278 13
Depreciation on stock,.....100 00

Total expenses,..... $1,053 13
Net profit.....$853 12

The 15 acres of meadow is supposed to produce 22 1-2 tons of hay; 10 acres of corn fodder, equivalent to 10 tons of hay, leaving necessary to winter the 30 cows (estimating two tons of hay or its

equivalent. The 10 acres of corn and oats not credited to the farm as sold will furnish at the yield given 18 1-3 tons of meal, which, with the oat and wheat straw from 20 acres, you will readily see is much more than equivalent to the 28 1-2 tons of hay lacking, and is abundantly sufficient to winter the herd and the necessary teams. Thus I show a balance in favor of sowing grain in connection with dairying over that of dairying alone of $160. In these estimates I have supposed the farms were rented, which, if conducted by the owner, would increase his net receipts, as no tenant is expected to work for just day wages. In addition to this balance from a mixed husbandry, there is another of vital importance, which is far too little thought about, viz : the converting so much of the grain and fodder into cheese and butter, and thereby drawing upon his soil lightly. While the grain farmer, in disposing of his grain or converting it into beef and selling it off the farm, is constantly drawing heavily upon his land, and while the dairy farm may and should be improving in fertility, the grain farm must naturally be diminished in productiveness, and I believe the facts will substantiate the statement.

Thus I have given the course usually adopted by farmers generally, while I am well satisfied the profits might be very much enlarged if a judicious system of soiling and high feeding were to be adopted.

A number of years since, A. L. Fish, Esq., of Herkimer, desiring to ascertain the result of high feeding, reduced his herd from 60 to 30 cows, and in addition to giving them the same range that the 60 herd formerly had, fed them liberally with shorts and whey all the season, and the result was 847 lbs. cheese to the cow, while he had formerly produced from the 60 cows 400 lbs. to the cow. He told me that for five years in succession his herd averaged over 700 lbs. to the cow.

Another very important matter to insure successful dairying, especially in the grain districts, is that of soiling. A large portion of our country is subject to a drought of longer or shorter duration, nearly every season, and hence a part of the season there is no reliance to be placed upon ordinary pastures, and some soiling crop becomes all important, if for no other reason than to supply this deficiency.

But this brings to my mind another thought, which is this. We, as farmers, have been, and are too much of the opinion that nothing save the ordinary pasture and meadow is profitable. But I suppose no one doubts that an acre of land equally well adapted to grain or grass, will afford very much more feed than if devoted to grass. To illustrate, suppose an acre will afford one and one-half tons of hay, and the usual allowance will keep a cow 150 days, and if in pasture will keep a cow 90 days. Now we will suppose it to be planted to corn, and that it yields 35 bushels, and the equivalent in fodder of one ton of hay, which is only an average yield for good land. It is laid down that 5 lbs of corn meal is equivalent in nutriment, to 15 lbs. of the best hay, and 35 bushels of corn will make one ton of meal, which will be equivalent to fodder and meal, to 3 1-4 tons of hay, which would keep the cow 350 days. But it may

be said that after deducting the cost of extra labor over that of producing the hay, we have not made anything. Let us see: Suppose it cost $3 to cut and secure the 1 1-2 tons of hay. Now suppose it costs $12 to raise and secure the acre of corn, and assuming that the interest on the land in each case is $7, and we have the cost of the hay, 1 1-2 tons, $10, against the corn and fodder (which is equivalent to 3 1-4 tons of hay,) at $19; costing 5 1-2 cents per day to keep the cow, against 7 cents per day if kept on hay. From the experience of several farmers, with whom I am acquainted, it has been ascertained that four pounds of wheat bran per day, with what straw a cow will eat, will keep her equally as well as 21 pounds of hay per day. If more grain, soiling crops, roots, &c., were raised and fed upon our farms, (instead of hay,) of course a much larger amount of stock could be kept, and the more stock the more manure there is made, and the more manure the more productive will be the land. And not only so, but unquestionably the stock would be much healthier than as usually kept; and as 20 tons of mangolds may be produced from the acre, and as it has been ascertained from analysis and experience, four pounds are equal to one pound of the best hay, shows that it will pay the dairyman well to raise them.

I believe the chief reason why the English farmer is able to produce so much more from his land than is usual with us, to be from the fact that he raises and feeds more roots in connection with rich, concentrated food, with hay or straw, to get the bulk, and consequently manure heavily. In the oldest dairy districts, undoubtedly, the yield of grass and hay many times might be very much increased if the land was plowed oftener and re-seeded. Soil is frequently very much benefited by simply plowing, thereby loosening and dissolving it. If soiling was more generally adopted by dairymen, the amount of stock kept might be very much increased. Mr. Fish, in experimenting as to the value of soiling, produced from an acre of land, 36,000 pounds of corn fodder (green). He put one cow in the stable, and fed her exclusively on the corn, and she ate 100 pounds per day; and the acre at this rate, would keep her 360 days. This cow, while eating the corn fodder, gave 30 pounds of milk per day. Take the average of dairy lands, and four acres are required for the summer and winter keep of one cow; while those who practice soiling tell us that by that method one acre is sufficient. Another saving to the dairyman might be made by cooking the food for his stock during the winter. Hon. W. I. Skinner, of Herkimer, cooked the food for his herd of 40, and found that after deducting cost of extra labor, interest on money invested in cooking apparatus &c., that he had made a saving of 25 per cent. over the usual method.

In the examination of this subject I have avoided giving the value in nutriment of the different grains, hay, roots, &c., in figures as laid down by scientific men, deeming the experience and observation of practical men sufficient. I have taken this opportunity to throw out a few suggestions in relation to subjects which, as farmers of to-day, when lands, labor and taxes are so high, we need to

investigate. The farmer should bring his brain into action as well as his muscle. He should not cling with such tenacity to his accustomed habits because his father or grandfather did thus and so. But he should break away from the antiquated opinions, notions and habits, and launch forth upon the vast and unexplored regions of thought and action.

Mr. Seth Bonfoy, of Herkimer, moved that speakers who deliver addresses before the Association at its next convention be limited to thirty minutes' time.

This brought on the making of several amendments, and a long and quite animated discussion, varied with the offering of suggestions and resolutions, and finally the whole matter was on motion, tabled until the next convention.

Mr. Alex Macadam, of Montgomery, offered the following suggestion:

The valuable and instructive paper read by Mr. Arnold this morning touches the point of the most vital importance to the cheese-makers of America, inasmuch as it distinctly proves that milk in many instances is sufficiently injured to produce badly tainted milk and floating curds before it is drawn from the cow, and I am of opinion that as much as nine-tenths of it is so produced, and that the most important points to which the attention of American cheese makers can be turned, is to the production of the best possible quality of cheese from milk so tainted, for as long as the thermometer is liable to raise over 90°, through the months of June, July and August, just so long will there be floating curds and tainted milk to contend with, no matter how well the milk is cooled or aerated, or what care has been taken with the utensils with which the milk has come in contact.

Mr. Hawley, of Onondaga, said a close-fitting wet jacket put on cans of milk will keep the milk cool while being transported to the factory.

ABORTION IN COWS.

On motion, Mr. Briggs, of Chenango, was requested to prepare a paper giving the facts concerning his claimed discovery of a preventative of abortion in cows, the paper to be published in the report of the Association.

ADJOURNMENT.

Just before four o'clock the Convention finally adjourned.

ABORTION IN COWS.

COMMUNICATION FROM L. M. BRIGGS, ESQ., OF CHENANGO CO.

GARDNER B. WEEKS, ESQ., *Secretary, &c.*,

Dear Sir:—Your communication of Jan. 13th, at hand. I am very much flattered by the vote of the Association you represent so worthily as Secretary, inviting me to prepare a paper on my "Theory of the Cause, and Remedy for Abortion in Cows," and pleased to have an opportunity to partially explain my ideas on the subject

After years of observation and research in this matter, I am convinced that the original cause of abortion in cows, exists in the exhaustion from the soil of the pastures and meadows of our dairying states, of certain substances elementarily necessary to the replacement in the blood of the animal, those organic compounds used in the vital processes of fœtal development, thereby causing a depraved condition of the blood. All are aware, that after a certain length of time our farms become devoid of *something* essentially requisite to ensure a proper degree of health and development. Some advocate plaster, some lime, some anchor their hopes in ordinary manuring, others have numerous remedies. None have succeeded in reaching the desired goal, until at present. In consequence of the depraved condition of the blood before mentioned, the growth of tissues necessary to the perfect development of the fœtus, is abnormal and imperfect, laying it open to the attacks of parasitic organisms, which by their action cause the premature expulsion of the fœtus, and the consequent train of evils. There are two methods of curing the evil: one immediate, in the animal—the other requiring a longer period, and of no immediate benefit, by supplying the soil with the lacking elements. The first method of curing, I accomplish by administering in the most convenient form such substances as I have found, after repeated trials and patient observations on the result, to be the cause of the impoverished condition of the blood, by their absence, with such others as are necessary under the circumstances.

The subject is of national importance, and I trust that sufficient interest will be felt in it to cause the authorities to place it before the people in the manner it deserves. Had I the leisure, and means sufficient, I would write a more extended and complete essay on the subject of Abortion in Cows—its causes, effects, &c., including recipes, with full directions for the cure of that great scourge to the dairying districts.

Respectfully, LEMUEL M. BRIGGS.

North Pitcher, N. Y., Jan. 27, 1872.

FACTORY REPORTS FOR 1871.

NEW YORK.

ONEIDA COUNTY.

Wight's Factory, Whitesboro.—Number of cows, 900; pounds of milk, 3,905,959; pounds of cheese, 302,745; pounds of milk to 1 pound of cheese, 9 93-100; average sales of cheese, per pound, 12 2-100; expenses of making and furnishing, 1 82-100, per pound; net sales of cheese, per pound, 10 20-100; amount of money distributed to patrons, $30,880; value of 1 pound of milk, net, .01027 cents. Season commenced March 21, and ended Nov. 23. The above fractions are not exact, but very nearly so.—L. L. Wight.

Weeks' Factory, Verona.—Season began April 3d; closed Nov. 3d; whole number of cows, 800; average number, perhaps, 725; pounds of milk received, 2,706, 791, which made in green cheese, 282,151 pounds, and of cured cheese, 271,347; shrinkage, 10,804 pounds, or nearly 4 per cent.; pounds of milk required for one of green cheese, 9 59-100; of cured cheese, 9 97-100 pounds. Twenty-seven sales of cheese were made, at prices ranging from 13 cents down to 10 1-4 cents, and then again rising to 13 5-8 cents per pound; the average price obtained being 11 93-100 per pound.—Net to patrons, per 100 pounds of milk, was $1.01 1-6.—G. Merry.

Willow Grove Factory, Trenton.—Season commenced April, and closed Nov. 1; and the night's milk was allowed to be skimmed in the morning during the month of October; whole number of pounds of milk received, 2,956,930; number of pounds of cured cheese made, 289,760; number of pounds of milk required to make one pound of cheese, 10 20-100; average price received for cheese, 11 706-1000; total sum received from sales was $33,920.99; paid to patrons, $29,056.05; paid to Alonzo Westcoat, maker, $1,883.41;

paid for use of factory, $1,159.04; paid for furnishing, $1,816.11; cash in hands of treasurer, $6.38. The furnishing fund was all paid to Henry Miller, who was principal salesman, and purchased all the materials. He paid for boxes, $715.84; paid for salt, $106.25; paid for bandage, $166.10; paid for rennets, $374.22; for wood, $245.74; for annatto, $82.20; the balance was paid for expenses of selling, service of salesmen, service of treasurer, stamps, &c.—Henry Broadwell, Treas.

Lee Centre Factory.—Commencing April 3, ending Nov. 4; number of cows from which milk was received, 931; whole number of pounds of milk received, 2,220,325; number of pounds of cured cheese made, 225,271; average number of pounds of milk required to make a pound of cured cheese, 9.85; number of cheese made, 3,149; average weight, about 71 1-2; number of sales, 12; total amount received from sales, $25,415.42; highest price per pound for cheese sold, 13 5-8c.; lowest, 10c.; average, 11.28c.; whole amount of expenses charged patrons for making 100 pounds of cheese, $1.70; amount paid Robert McAdam for making and furnishing, $3,829.55. I will say that in the season for making cheese, when it required the most milk to make a pound, the maker, Mr. McAdam, had the milk from some 931 cows, until the first or middle of September, then one-fourth of the milk was taken from the factory for making butter and other purposes, making a material difference in the average for the season. If it had not been taken from the factory until the 4th of November, at the time the factory closed, it would have required but a small fraction over nine pounds.—E. F. Wentworth, Salesman and Treasurer.

Wilcox's Factory, Sauquoit.—The season commenced April 24, and extended to Nov. 2; number of pounds of milk received, 433,951; from which 42,607 3-4 pounds cured cheese were made; average weight of cheeses, 55 pounds; number of cheeses made, 770; April 24th to May 6th, 10-69 pounds milk made 1 pound of cheese; May 6th to May 20th, 10.72 pounds milk made 1 pound of cheese; May 20th to June 1st, 10.37 pounds milk made 1 pound of cheese; June 1st to June 17th, 10.03 pounds milk made 1 pound of cheese; June 17th to July 20th, 10.17 pounds milk made 1 pound of cheese; July 20th to Aug. 10th, 10.43 pounds milk made 1 pound of cheese; Aug. 10th to Aug. 31st, 10.34 pounds milk made 1 pound of cheese; Aug. 31st to Sept. 30th, 9.67 pounds milk made 1 pound of cheese; Sept. 30th to Nov. 2d, 10.02 pounds milk made 1 pound of cheese. Average number of pounds of milk for one of cheese, 10.185, being .315 less than the average of the previous year; patrons paid $1.85 per hundred for manufacturing, furnishing and delivering at factory, ready for market.—Geo. D. Dunham, Sec'y.

HERKIMER COUNTY.

Fairfield Dairy Association, Fairfield.—This factory has made cheese for the last four years, summer and winter, not stopping in the fall and commencing again in the spring; but I will report from the 1st of March to the 1st of November, 1871: Whole number of pounds of cheese sold (not including what was used by patrons,) 350,421 pounds; cash received for same, $39,235.35; whole number of sales average 11 19-100 cents per pound; number of pounds of milk for a pound of cured cheese, 9 95-100; net value of one pound of milk, 1 16-100 cents. I would say that we had the milk of about 960 cows, and at the present time we are making 18 cheeses per week; weight, 60 pounds, cured.—JOHN F. HARVEY, Secretary.

Feb. 12, 1871.

Report of Paine's Hollow Factory.—Opened on the 30th of March, closed on the 29th of November; whole number of pounds of milk received, 1,009,722; proceeds were 106,411 pounds; number of pounds of milk to one pound cheese, 9 48-100; the average price per pound of cheese was 11 79 100 cents; average price per 100 pounds of milk was $1.2426; amount of cash received was $12,547.07; number of boxes of cheese were 1,731; number of days in sales were 212; number of sales made were 18; the average weight of each cheese was 61 47-100 pounds; the average number of cheese made per day were 8 11-100; greatest number of cows were 351; average number of cows during the season, estimated 300; greatest price received for cheese, 14 1-2 cents per pound; lowest price received, 10 cents per pound.—CHARLES KLING, Proprietor.

MADISON COUNTY.

South Jordan Factory, Brookfield.—Greatest number of cows, 435; pounds of milk received, 1,320, 824; pounds of cured cheese sold, 137,374; amount of money received, $15,953.47; expense per 100 pounds, for making, &c., $1.91; pounds of milk to pound cured cheese, 9.61; net price to patrons for 100 pounds milk, $1.009; highest price received, 13 1-2 cents; lowest, 9 1-2c.; average, 11.61c.; number of cheeses made, 2,020; cheese sold at factory, to patrons and others, 8,000 pounds; commenced making April 3d, closed Nov. 17th. The expense includes insurance, drawing to railroad, about 8 miles, and all other items. Milk was skimmed from Oct. 1st till the close of the season. Factory under the management of Mr. E. C. Miller.—D. B. STILLMAN, Sec'y.

Excelsior Factory, Brookfield.—Commenced April 10th, and closed Nov. 4th; whole number of cows, 400; pounds of milk received, 1,149,386; pounds cured cheese made, 118,538; average

pounds of milk for one of cheese, 9.696; average weight of cheese, 70 pounds; amount of money received, $13,667.26; amount received by patrons, $11,567.26; entire expenses, $2,100.00; net cash to patrons for each 100 pounds of milk, $1,066.—F. Blanding, Manufacturer and Secretary. William Stanbro, Treas.

D. M. Brown's Factory, Brookfield.—Season commenced April 11, closed Nov. 25; whole number of cows, 260; number pounds of milk delivered, 792,936; pounds of cured cheese, 82,473; average number pounds of milk to one pound of cheese, 9-61; total cash receipts, $9,440.89; average price per pound of cheese, .11447; total expense of manufacture, including rent of factory, furnishing and marketing, $1,086.88; cost per 100 pounds cheese, $1.317; total net proceeds to patrons, $8,354.01; do. per 100 pounds cheese, $10-13; do. per one pound milk, 01-054.—E. Whitford, Sec'y. P. F. Babcock, Manufacturer.

MONTGOMERY COUNTY.

Canajoharie Factory, Canajoharie.—Factory opened March 21, closed November 28; number of cows, 312; number of cheeses made, 2,080; amount of milk received, 1,077,228 pounds; amount of cured cheese, 111,734 pounds; amount of milk taken for one pound of cured cheese, 9.64 pounds; money received, $13,218.91; average price of one pound of cured cheese, 11.83c.; average price of one pound of milk, 1.227c. Factory under the supervision of Alexander Macadam, and under the personal management of Miss Anna McDonald, who succeeded in giving general satisfaction to all the patrons.—Conrad Kilts, Treasurer.

Hallsville Factory, Minden.—Commenced March 13, and closed Nov. 16; whole number of cows, 412; pounds of milk received, 1,557,887; pounds of cured cheese, 156,925; average pounds of milk for one of cheese, 9 93-100; whole amount of money received by sale of cheese, $19,437.73; average price of one pound of milk, .01247; average price of one pound of cheese, .1238c.; factory under the direction of Alex Macadam.—Henry Walrath, Treasurer.

Root Factory, Root.—Whole number of cows, 537; average number, 490; number pounds of milk, 1,529,023; number pounds of cured cheese, 156,155; number pounds of milk to one pound cured cheese, 9.79; average price per pound, 11.93c.; sold at Little Falls; 18 sales; lowest, 10 1-4c.; highest, 14 1-2c.; last sale, Nov. 13th, 432 boxes cheese, bearing date Sept. 16, to Nov. 3, inclusive, 14c.; price for making and furnishing, 2c.; heating apparatus, O'Neil's

vats; factory opened April 17, closed Nov. 3; cheese manufactured by Seth Allen, after the Cheddar style, using Macadam's curd mill, and annattoine for coloring.—J. D. Snow, Secretary. Ira J. Carr, Treasurer.

LEWIS COUNTY.

Sulphur Spring Factory, Lowville.—Commenced May 2d, and closed Oct. 31st; received the milk of 650 cows; amount of milk, 1,500,707 pounds; amount of cheese, 154,113 pounds; sold, May 29th, 4,404 pounds, at 11 1-2c.; June 6th, 7,460 pounds, at 11 1-8c.; June 14th, 13,602 pounds, at 11 3-16c.; July 13th, 17,215 pounds, at 10 3-4c.; Aug. 10th, 22,569 pounds, at 9 5-8c.; Sept. 9th, 31,935 pounds, at 10c.; Nov. 14th, 56,928 pounds, at 13 1-2c.; made 1,610 pounds of whey butter, which sold for $310.51; entire receipts for cheese, $17,756.27; expenses out, for making, at 1c. per pound, $1,541.13; furnishing, at 1-2c. per pound, $770.56; average net value of 1,000 pounds of milk, $10.4232; average gross value of 1,000 pounds of milk, $12.03834; average gross value of 100 pounds of cheese, $11.72307; average net value of 100 pounds of cheese, $10.14982; average pounds of milk for one pound of cured cheese, 9.7377.

	Lbs. Milk.	Lbs. Green Cheese.	Lbs. Dry Cheese.	Lbs. Shkge	Pr Ct. Shkge	Av'rge da's old when sold.	Lbs. Milk for 1 lb. Grn Cheese.	Lbs. Mlk for 1 lb. Cured Cheese.
May...	245,790	26,468	25,466	1,002	3.78	21	9.286	9.651
June...	390,796	42,519	39,784	2,735	6.43	43	9.191	9.822
July...	328,994	34,667	31,935	2,732	7.88	54	9.49	10.301
Aug...	227,396	24,805	22,408	2,397	9.66	73	9.167	10.147
Sept...	175,590	20,099	19,954	1,045	5.19	53	8.736	9.215
Oct....	132,141	16,554	15,466	1,088	6.57	34	7.982	8.543
	1,500,707	165,112	154,113	10,999				

The weight of green cheese in the above table is estimated from weighing the cheese from the press on an average once in five days. The shrinkage seems to be in proportion to the age of the cheese when sold, excepting the cheese of October. The extra shrinkage in this month, I think due to the heat of the stove in curing. The September cheese were cured at a low temperature.—C. L. Sheldon.

JEFFERSON COUNTY.

Bettinger Factory, Mannsville.—Ira Bettinger, maker and proprietor. Factory opened April 3, closed December 25; milk delivered twice a day from May 7 to Sept. 1; balance of the season, skimmed; total amount of milk received, 2,069,557 pounds; total amount of cheese made, 209,755 pounds; taking 9.86 pounds milk for one pound of cured cheese; total amount of sales, $24,607.50 lowest sale, 9 1-4c.; highest sale, 14 1-8c.; average sale, 11.73; one pound of milk brought .01189.—A. M. Wardwell, Sec'y.

ST. LAWRENCE COUNTY.

Gouverneur Factory, Gouverneur.—This factory the past season has run a little over five months, and the latter part of the season we were, as last year, cut short very much of our usual flow of milk, by the extreme drouth. Average number of cows, 500; milk received, 1,388,065 pounds; number pounds cured cheese, 144,721; milk for one pound cured cheese, 9.59 pounds.—S. W. Crandall, Proprietor.

OSWEGO COUNTY.

Union Factory, Mexico.—Opened April 18th, and closed November 1st; the milk from 900 cows was manufactured into cheese, being an aggregate of 1,897,966 pounds of milk for the whole season, or 9,733 pounds daily; the number of pounds of cheese manufactured this season was 185,939; it required an average of 10 1-10 pounds milk for one of cheese; the size of the cheeses average about 78 pounds each, and during the best of the season 23 cheeses were made per day; the average price received for cheese was $11.44 per cwt., the highest being 14 cents per pound; the price paid for manufacturing was $2 per cwt., which includes all expenses and the delivery of the cheese to the railroad.

CLINTON COUNTY.

Rouse's Point Factory.—Commenced making cheese May 15th; amount of milk received, 499,213 pounds; amount of cheese, 52,835; number of pounds of milk for one pound of cured cheese, 9.45.

ALLEGANY COUNTY.

Simpson Factory, New Hudson.—Received 1,413,162 pounds of milk, from which was sold 2,482 boxes of cheese, weighing 148,442 pounds, at an average of a trifle over 11c.; highest, 13 3-8c.; pounds of milk to one pound cured cheese, 9.52; on account of the dry season, the flow of milk was much less than usual.—Wm. Simpson, Jr.

CHAUTAUQUA COUNTY.

Arkwright Union Factory, Canadawa.—Commenced making cheese the 1st day of May; closed Nov. 20; number of pounds of milk, 1,597,132; number of pounds of cheese, 156,629; amount of money received, $17,121.75; number of pounds of milk to one of cheese, 9 75-100; average sale per pound, 11c.—E. Crawford.

FRANKLIN COUNTY.

Keeler Butter Factory, Malone.—We commenced taking milk June 27th, and closed October 22d; received 152,829 pounds milk, and made 7,387 pounds butter, giving 1 pound butter for 20 5-7 pounds milk, which we sold on an average of 31 1-4c. per pound at the factory for the season. We use the revolving barrel churn, which is carried by water, brought in a pen-stock from a brook; the same power pumps the water for the pans, from a well under the factory; we use the Ashton ground salt, 1 ounce to a pound of butter; we set our milk 5 inches deep in the Jewett Patent Pan.—P. H. Shields, Treasurer.

Union Butter Factory, Bangor.—Commenced taking milk May 29th; it was a new thing for us all, as butter factories using the Jewett's patent pans are yet in their infancy. It was not strange, therefore, if every thing was not as it should be. We had no serious trouble, however, except that the supply of water was not sufficient in the warmest days; this we shall remedy, and we expect every thing will work entirely satisfactory next year.

We received milk 96 days, closing the factory Sept. 2d; had the milk of 125 cows for the first 30 days, and of 141 cows the remainder of the time; received in all, 233,161 pounds of milk; had at the time of selling, which was about the 1st of October, 9,522 pounds of butter, which was about 1 pound of butter to 24 1.2 pounds of milk; owing to a lack of spring water, the yield of butter was not as great as it would otherwise have been; we trust, from what we have learned the past season, that with everything in proper shape 22 pounds of milk, on an average, will make 1 pound of butter; some days we made a pound of butter from 21 1 2 pounds of milk; the total expense of making the butter, including tubs, salt, &c., was $265.28; used ground rock salt, one ounce to the pound; sold the butter for 30c. per pound, delivered at the depot.—Rinaldo Roys, Managing Director.

Barley Spring Butter Factory, Chateaugay.—The long continued drought of the past summer and fall, has been a great drawback to dairymen; nevertheless, our success has been sufficient to assure us that a butter factory, when properly conducted and properly sustained by its patrons, will greatly diminish the labor and largely increase the wealth of those who avail themselves thereof.

This factory commenced work May 29th, and closed Oct. 20th, a season of 145 days, and had the milk of 135 cows; the supply of milk received, was in May, 5,921 pounds; in June, 82,488 pounds; in July, 72,804 pounds; in August, 55,795 pounds; in September, 35,625 pounds; in October, 18,176 pounds; total, 270,811 pounds; and it gave us, good butter, 12,012 pounds, or 1 pound of butter to nearly 22.55 pounds of milk; we used 1 oz. salt to 1 pound butter;

depth milk in pans (Jewett's patent pans), 4 1-2 inches; temperature of milk, 63 deg.; temperature of room, 70 deg.; our churn, square box, no dash; average receipt for butter, 29 1-5c. at home; price ranging at Boston, 29c. to 35 1-3c.; transportation to Boston, about 1c.

We have learned that too much care cannot be taken in keeping the milk and cans clean, and that the animal heat should be entirely out of the milk before it is put in the cans for transportation to the factory; unless the patrons do their part properly, the manufacturer cannot achieve perfect success; he cannot overcome the evils arising from their neglect. We note, too, that great care must be taken in setting the milk, to have it all of equal temperature; and furthermore, it is absolutely requisite that all things that can affect the flavor of the butter should be excluded from the milk and butter rooms. Vegetables and fruit we deem objectionable, having had two tubs of butter damaged by apples, which, having prematurely dropped from the trees, had been placed in the milk room to ripen. —A. M. Bennett.

Cold Spring Butter Factory, Malone.—Amount of milk received, 441,267 pounds; amount of butter produced, 19,776; average amount of milk required to make one pound of butter, 22 31-100 pounds; average price of sales to Aug. 1st, 29 2-3c. per pound; average price of sales after Aug. 1st, 34 1-8c. per pound. We use the Jewett patent milk pans, and a barrel dash churn; Ashton ground salt—one oz. to the pound.—William Lytle, Proprietor.

Berry Butter Factory, Malone.—Commenced receiving milk 24th of May, and closed Oct. 28th; pounds of milk received, 425,988; pounds of butter made, 16,931; taking a fraction over 25 pounds of milk for a pound of butter; the factory uses Jewett's patent milk pans, and allows the milk to stand thirty-six hours before skimming, when it does not sour before; after skimming, the cream was allowed to stand until the next morning, before churning; we use the barrel churn; butter is salted with factory-filled salt, at the rate of one ounce of salt to the pound; the factory building is 47 x 30 feet on the ground, under one-half of which is a cellar for storing butter, and the other half contains water wheel, churns and pump. During the warmest weather in the summer, the water from the water wheel ran into the well, making it impossible to keep the milk cool, so that it often changed within twelve hours; to this cause may be traced the fact of its taking so many pounds of milk for a pound of butter. The butter was sold from 28 to 35c., averaging a little over 31c.—L. B. Sperry, Sec'y.

Moira Factory, Moira.—The factory started May 23d, closed Sept. 16th; started with 145 cows, and increased to 197; pounds

milk, 348,263; number of pounds of butter, 15,056; pounds of milk to one pound of butter, 23 1-8; we used the "Honey Bee" salt, made in Boston, and one oz. to one pound of butter; the churn was a dash churn; milk set, when we had the most, about 6 inches, and less, according to the quantity received; we tried to keep the temperature of milk about 60 deg. to 62 deg., but in the hottest weather it run higher—average about 65 deg.; we contracted our butter up to Sept. 1st, at 30c., and made but little after that, and jobbed it out; the pans were Jewett's pans.—S. N. Dickinson.

CATTARAUGUS COUNTY.

Brooks' Creamery, Little Valley, N. Y.—May, pounds of milk, 106,431; pounds of butter, 3,396; pounds of cheese, 7,728; June pounds of milk, 298,263; pounds of butter, 9,840; pounds of cheese, 22,559; July, pounds of milk, 264,652; pounds of butter, 9,230; pounds of cheese, 18,337; August, pounds of milk, 168,948; pounds of butter, 5,723; pounds of cheese, 11,861; total, pounds of milk, 838,294; pounds of butter, 28,189; pounds of cheese, 60,485; thus it required 8.46 pounds of milk to make a pound of butter and cheese; temperature of water, 50 to 54 deg.; milk set 12 and 24 hours in deep cooler pails; in August a batch of milk having passed the point for making good cheese, was churned, and the result was a pound of butter from less than 23 pounds of milk.—*Stock Journal.*

MASSACHUSETTS.

These Reports are taken from the columns of the Massachusetts *Ploughman:*

Worcester County Factory, Warren.—Capital invested, $5,200; began making April 3, closed Oct. 28; 808,859 pounds milk used; 9.77 pounds milk to one of cured cheese; cheese kept from 30 to 60 days before marketed; weigh 60 to 70 pounds each, 18 inch hoops; help, two men and one woman three months, costing, including board, $828.30; 250 rennets, cost $50; boxes 30 cents each; 1097 yards cloth used, costing $78.69; steam heated; fuel used, 18 cords wood, costing $72, and coal, costing $15; F. F. Syracuse dairy salt used; cheese cost 2 1-4c. per pound to get ready for market; salt used, 2.6 pounds per 100 pounds milk; cheese cured, 82,765 pounds; net income, $10.31 per 100 pounds; average number cows for season, 300; 275 pounds cheese per cow.

Barre Central Factory, Barre.—Capital invested, $8,000; began to make cheese, April 10; closed Nov. 12; 1,551,915 pounds of milk used; 9.892 pounds to one pound of cured cheese; cheese kept 4 to 6 weeks before being marketed; 2267 cheeses, 40 to 75 pounds each, in 18 inch hoops; 34 smaller, 10 to 20 pounds each; help,

one man and one woman, and one woman extra about 3 months, at cost, including board, of $1,007.33; 404 rennets, cost $101; 1634 boxes, cost $457.52; 1255 yards cloth bandage, cost $106.60; Ralph vat used; 25 1-2 cords wood, cost $131.56; 16 bbls. and 1 sack, Syracuse F. F. dairy salt, cost $61.16; total expense per pound getting cheese ready to send from factory, including boxes, 1 cent and 92 hundredths; expense of freight and marketing, $520.78; 156,800 pounds cheese cured; net income per 100 pounds, $10.73; value of 1-5 of whey left at factory, $455.23.

Hardwick Union Factory, Gilbertville.—Capital invested, $3,100; began making cheese April 20; closed Oct. 15; 598,721 pounds milk used; 10.29 pounds milk to one of cured cheese; cheese kept from 6 to 8 weeks before being marketed; 1163 cheeses; each 50 pounds, and 18 inches diameter; help, one person, at a cost, including board, of $638.64; 257 rennets, cost $64.25; 938 boxes, cost $281.40; 847 1-2 yards cloth, cost $76.27, nearly half remaining; steam heated; 12 cords wood burnt, costing $73.50, and one ton coal, $11; 6 sacks dairy salt, costing $19.50; all other expenses, including interest on invested capital, $241.60; freightage and marketing cost $93.43; salt used, 2.8 per 1000 pounds milk; 58,129 pounds cheese cured; net income per 100 pounds, $9.09.

Warren Factory, Warren.—Two-story building 26 x 60, with L for boiler; cost $3,000; began May 1, closed Sept. 18; 307,747 pounds milk produced; 9.76 pounds milk to one of cured cheese; kept 40 to 60 days before marketing; 470 cheese, each 68 pounds, and 18 inch diameter; help, one man, cost one cent per pound of cheese made; 130 rennets; 200 boxes, cost $60; $21 worth cloth used; steam heated; fuel, cost 11c. per 100 pounds cheese; 5 bbls. Syracuse F. F. salt used, costing $20; total expense per pound in getting cheese ready to send from factory, 1 1-4c.; expense of freight and marketing, 30c. per 100 pounds; 31,536 pounds cured cheese; net income, $10.54. Process of manufacturing cheese—milk set at 82 deg., milk to coagulate in 25 minutes; stand before cutting, 30 minutes; cut the curd lengthwise of the vat and cross it; stand 30 minutes before heating, then apply the heat and work with the agitator; heat slowly until the temperature is 96 or 98 deg., as the weather may require; remove the curd before the whey changes; salt. 2.7 to 1,000 pounds of milk; curd cooled to 86 deg. before putting in the hoops; stand 30 minutes before pressing; bandage after pressing lightly 30 minutes; press two days, and then remove the cheese to the dry room.

Hardwick Centre Factory.—Capital invested, $4,280.50; began to make cheese March 6th, closed Nov. 9th; 1,578,299 pounds milk used; 9 4-5 pounds of milk used to one pound of cured cheese;

cheese kept six weeks before being marketed; 2413 cheeses made: help, two men and one woman, costing $1,275.75, including board; 753 rennets, cost $130; 2,351 boxes, cost $705.60; 1,152 yards cloth used; Ralph vat used; fuel cost $114; F. F. dairy salt, New York mills, 19 bbls., costing $58.50; expense per pound getting cheese ready to send from factory, 1 4-5c.; expense of freight and marketing, 4-5c. per pound; 160,752 pounds cheese cured; net income per 100 pounds, $10.52.

Coys' Hill Factory, Warren.—Capital invested, $6,000; began making cheese March 20, closed Sept. 27; 955,777 pounds milk used; 9.75 pounds milk to one of cured cheese; cheese kept before marketing, 40 to 60 days; average weight about 50 pounds each, 15 inch hoops; help, one man through the season, and one man and girl three months, costing, including board, 85c. per 100 pounds of cheese, including rennets and wood; 1,931 boxes, cost $499.11; 1,017 yards cloth, cost 8 1-2c. per yard; Millar's circulating coil cheese vat used; 13 sacks Worthington salt used, costing $2.75 per sack; total expense per pound getting cheese ready to send from factory, including freight and marketing, 2 1-4c. per pound; 98,067 pounds cheese cured; net income per 100 pounds, $9.92 1-2.

New Braintree Factory.—Capital invested, $9,000; began making cheese April 3, closed Nov. 11; 1,679,351 pounds milk used, being 10.1 to 1 pound cheese cured; cheese kept from 30 to 70 days before marketing; made two sizes, 30 to 40 pounds each, and 60 to 70 pounds each; help equal to one man and two women all the time, and a second man 3 months, at a cost, including board, of $1,440.04; used 830 rennets, costing $159.55; 2,261 boxes, cost $644.38; 1,255 yards of cloth used, costing $139.43; steam heated; 4,300 pounds coal and 30 cords wood, cost $201.97; 4,500 pounds Marshall's salt used, costing $65; total expense per 100 pounds getting cheese ready to send from factory, $2.13; 2.6 pounds salt used per 1,000 pounds milk; 165,552 pounds cheese cured; net income per 100 pounds, $10.71.

Greenfield Factory.—Capital invested, $2,700; began making April 22, closed Sept. 20; milk produced, 215,492 pounds; pounds of milk to one of cured cheese, 9.74; 535 cheeses, each weighing 40 pounds, 15 inches in diameter; help, one man, at a cost, including board, of $510; 196 rennets, cost 39.89; boxes 28c. each; 275 yds. cloth, cost $26.10; Charles Millar & Sons' heater; fuel burned, 6 cords and 98 feet wood, costing $27.66; 3 bags Marshall's salt used, 43 ounces per 1,000 pounds milk; 22,079 pounds cured cheese, sold at an average of $13.63 per 100 pounds.

Lenox Factory.—Capital invested, $3,000; began to make May 1, closed Oct. 14; 228,403 pounds milk used; 10.4 pounds to 1 of cheese cured; cheese mostly sold in September; average weight, 55 pounds each; help, one man, costing, with board, $478; rennets cost $10; 310 boxes cost $62; Ralph vat used; fuel, 6 cords of alder wood, costing $18; Ashton's salt used; total expense per pound getting cheese ready to send from factory, 2 1-2c.; 21.767 pounds cured cheese; net income per 100 pounds, $10.05.

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Green Mountain Factory, Peru, Berkshire County.—Building 36 by 64 feet; attachment for press room, 14 by 20; complete cost of building, with apparatus, $2,500; began operations May 15th, closed Sept. 29th; length of time in operation (not open on Sundays), 94 days; 496,230 pounds of milk used; 50,124 pounds cured cheese; 57,141 pounds green cheese; 9.9 pounds milk to 1 pound of cured cheese; 8.68 1-2 pounds milk to one of green cheese; number of cows, 260; greatest yield of milk, June 22d, 5,417 pounds; smallest yield, May 17, 2,756 pounds; average per cow for season, 1,908.58 pounds; average per day to each cow, 30.303-1000 pounds; cost of getting cheese ready for market, $2.50 per 100 pounds; average price sold for per pound, 12 1-2c.; weight, 60 pounds each, 15 inch diameter; boxes cost $30; A. G. Bagg's patent heater used; 2 1 2 pounds salt to 1,000 pounds milk.

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VIRGINIA.

Old Dominion Factory, Hamilton.—Amount of milk received from May 6th to Sept. 8th, 1871, 378,138 pounds; amount of cheese manufactured, 36,625 pounds; 10.3 pounds of milk required for one pound of cheese; average net price of cheese, 12 7-8c. per pound, after deducting cost of boxes, freight, and all other expenses, except manufacturing; value of 36,625 pounds at 12 7-8c. per pound, $4,715.47; average number of cows, 125; 2 1-2c. per pound charged for manufacturing, curing, boxing, furnishing all materials, except boxes, selling at the factory, collecting the money and dividing same among the patrons in proportion to milk furnished.

I submit the following report of the profits of my dairy for the past season, commencing 5 month 7th, and closing 12 month 1st, 1871:

Average number of cows, 3; total amount of cheese made from 5 month 6th to 9 month 8th, 2,640 pounds; 2,640 pounds cheese, at 10 1-2c. net price per pound, after deducting all expenses, including manufacturing, $272; milk and butter from 9 month 8th to 12 month 1st, 329 gallons milk, at 11c., $36.19; 120 pounds butter, at 25c., (deducting for making,) $30; 7 calves, $49; total, $387.19; average, $48.39 per cow; averaging 80 pounds of cheese per cow each month. A thorough-bred calf valued at $100, not included in above statement.

Report of the profits of Thomas R. Smith's dairy of 10 cows, near Lincoln, Va., for the past season :—Cheese, 2640 pounds, $273.81; butter, 970 pounds, 297.14; ten calves, $61.40; total, $632.25; deduct, three tons of mill feed, $60; balance, $572.35; average per cow, $57.23. (No deduction made in above for manufacturing butter).

Report of profits of B. W. Welsh's dairy of 8 cows, near Circleville, Loudoun county, Va., for the past year :—Cheese, butter and calves, $344; average is $43 per cow.

Report of the profits of E. J. Smith's dairy, averaging 10 1-2 cows, for the past season, near Lincoln, Va. :—2,790 pounds cheese, net, $288.30; 765 pounds butter, at 30 6-7c., $236.05; calves, $33.50; total, $557.85; average per cow, $46.03. (No deduction made in above for manufacturing butter).—J. K. Taylor.

CONDENSED REPORTS.

The following Table gives the number of cows, amount of cured cheese, average price, average pounds of milk to one of cured cheese, and average weight, for the several Factories from which full Reports have been received:

Name of Factory.	Location.	Whole number of Cows.	Amount of Cheese made.	Average price per 100 lbs.	Av. Wt.	Av. lbs. Mlk. for 1 lb. Ch.
Wight's	Whitesboro, Oneida Co.	900	302,745	$12.02	..	9.93
Weeks'	Verona, " "	800	271,347	11.93	..	9.97
Willow Grove	Trenton, " "	850	289,760	11.71	..	10.20
Lee Centre	Lee Centre, " "	931	225,271	11.28	71	9.85
Wilcox's	Sauquoit, " "	200	42,608	.....	55	10.18
Fairfield Association	Fairfield, Herkimer Co.	960	350,421	11.19	60	9.95
Paine's Hollow	Paine's Hollow, " "	351	106,411	11.79	61	9.48
So. Jordan	Brookfield, Madison Co.	435	137,374	11.61	..	9.61
Excelsior	" " "	400	118,538	11.53	70	9.69
Brown's	" " "	260	82,473	11.45	..	9.61
Canajoharie	Canajoharie, Mont. Co.	312	111,734	11.83	..	9.64
Hallsville	Minden, " "	412	156,925	12.38	..	9.93
Root	Root, " "	537	156,155	11.93	..	9.79
Sulphur Spring	Lowville, Lewis Co.	650	154,113	11 72	..	9.74
Bettinger	Mannsville, Jefferson Co.	700	209,755	11.73	..	9.86
Gouverneur	Gouverneur, St. Law. Co.	500	144,721	.....	..	9.59
Union	Mexico, Oswego Co.	900	185,939	11.44	78	10.10
Rouses Point	Rouses Point, Clinton Co.	250	52,835	.....	..	9.45
Simpson	New Hudson, Alle. Co.	500	148,442	11.03	..	9 52
Arkwright Union	Canadawa, Chaut. Co.	500	156,629	11.00	..	9.75
Worcester County	Warren, Mass.	300	82,765	.....	65	9.77
Barre Central	Barre, "	500	156,800	.....	..	9.89
Hardwick Union	Gilbertville, "	200	58,129	.....	50	10.29
Warren	Warren, "	150	31,536	.....	..	9.76
Hardwick Centre	Hard. Cen., "	550	160,752	.....	..	9.80
Coy's Hill	Warren, "	300	98,067	.....	50	9.75
New Braintree	New Braintree, "	550	165,552	.....	..	10.10
Greenfield	Greenfield, "	100	22,079	.....	..	9.74
Lenox	Lenox, "	100	21,767	.....	55	10.40
Green Mountain	Peru, "	260	50,124	12.50	..	9.90
Old Dominion	Hamilton, Virginia	150	36,625	12.88	..	10 30
		14,508	4,288,392	11.73	62	9.85
Butter Factories.			Butter.	Butter.	—	But. yld
Keeler	Malone, Franklin Co.	.....	7,387	31.25	..	20.70
Union	Bangor, " "	141	9,522	30.00	..	24.50
Barley Spring	Chateaugay, " "	135	12,012	29.20	..	22.55
Cold Spring	Malone, " "	.....	19,776	.....	..	22.31
Berry	" " "	.....	16,931	31.00	..	25.10
Moira	Moira, " "	.....	15,056	30.00	..	23.12
Brooks' Creamery	Little Valley, Catt. Co.	.....	28,189	.....	..	.....
			108,873	30.29	..	23 05

GEO. F. COMSTOCK, President. THOS. MOLLOY, Treasurer.
J. W. BARKER, Secretary.

THE SALT COMPANY

OF ONONDAGA,

(INCORPORATED 1860.)

Gen'l Office, No. 1 Clinton Block,

SYRACUSE, N. Y.

MANUFACTURERS OF

COARSE, FINE, DAIRY AND TABLE SALT,

Address, J. W. BARKER, Sec'y, Syracuse, N. Y.

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Milwaukee,	WILLIAM BUTLER, "

This salt is kept on hand and for sale by all the prominent gro-

cers in the country, and the Dairy and Table Salt particularly in those localities where Butter and Cheese are made for exportation. In this connection we refer with a great deal of pleasure to Gardner B. Weeks, Esq., late of Verona, now of Syracuse, the Secretary of the American Dairymen's Association.

We would refer to the Report of the Committee of the State Fair at Buffalo, in 1867, published in our advertisement in the Report of the American Dairymen's Association for 1867, from which we make the following extracts:

"We pronounced in twenty-five cases the Butter cured with Factory Filled Salt, made at the New York Mills, Syracuse, to be the best, as compared with its alternate package, cured in the same dairy, with Ashton."

And again, "We come now to an article of Salt, manufactured by the Salt Company of Onondaga, which more nearly and intimately interests the farmers and the people generally, that is the Dairy or Butter and Cheese Salt." Also, "We unhesitatingly pronounce that the same is the EQUAL OF ASHTON for the preservation of Butter and Cheese."

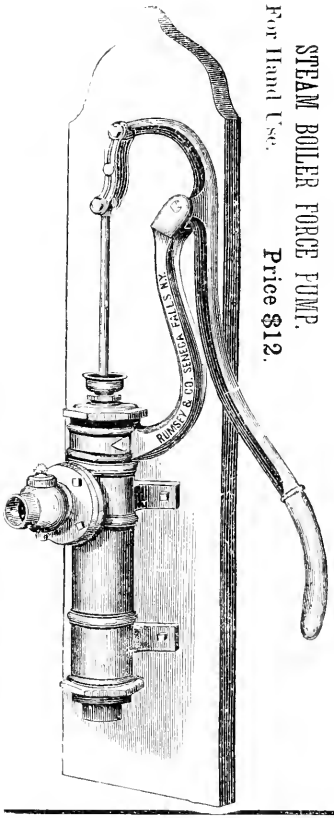
Extract from the Report of the Butter and Cheese Committee at the State Fair at Rochester, 1868: "Your committee find as they have examined the Cheese Reports, the Cheese has been invariably salted with the best quality of Onondaga Salt." And again, "A competitor salted several packages of Butter with each kind of salt, (Onondaga Factory Filled and Ashton), and requested the committee to closely examine each package and see if they could determine from the quality of the Butter which kind of Salt was preferable; the result of the examination was, your committee could see no difference in the Butter, and the maker, (who is an expert in butter,) stated to your committee *that he was not able to detect any difference*, and *only knew* which was Ashton or Onondaga by the *mark* he put upon the packages. The committee wish to add to the above report the fact that all of the butter to which were awarded premiums was salted with Ashton, *excepting* the butter made by Miss Clara Clark, which was salted with Onondaga Salt; this Butter was *superior to any other Butter on exhibition*, and is recommended to the Executive Committee as entitled to a special premium."

Extract from Professor S. W. Johnson's (of Sheffield Scientific School, Yale College,) article in the American Agricultural Annual for 1868, on "Milk and Butter."

"Much of the fine table Salt commonly sold in New England, in Connecticut at least, is also impure and unfit for use. The purest Salt made in this or any other country that the writer is acquainted with, came some years ago from Syracuse, N. Y., where the ingenious processes of Dr. Goessman were then employed. If, as we suppose, the same processes are in use now, (they are) the Onondaga Factory Filled Salt must take rank *second to none* as regards purity and freedom from deleterious ingredients, especially the chloride of calcium and magnesium. This rank it has assumed, we believe, in the estimation of all who have given it a fair trial. The brand Onondaga Factory Filled Dairy Salt corresponds closely with Dr. Muller's description of the best Salt for removing buttermilk."

The Salt Company of Onondaga guaranty that their Factory Filled Dairy Salt is as pure and as good as any in the world, and that all kinds of Salt manufactured by them will bear favorable comparison with the best brands of any other manufacture of a similar kind of Salt, fine or coarse.

SYRACUSE, March, 1872.



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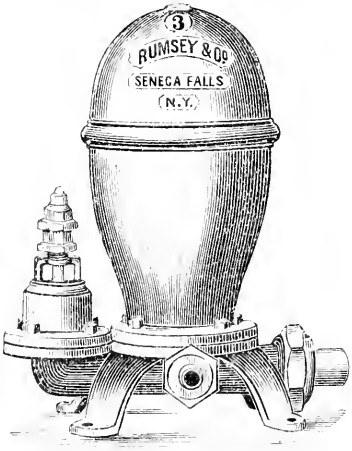

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Lift and Force Pumps,

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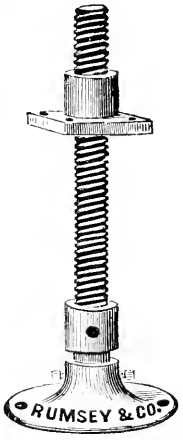
RUMSEY & CO.,
SENECA FALLS, N. Y.

Cheese Press Screw,



With and without Ratchet. This Cut represents our

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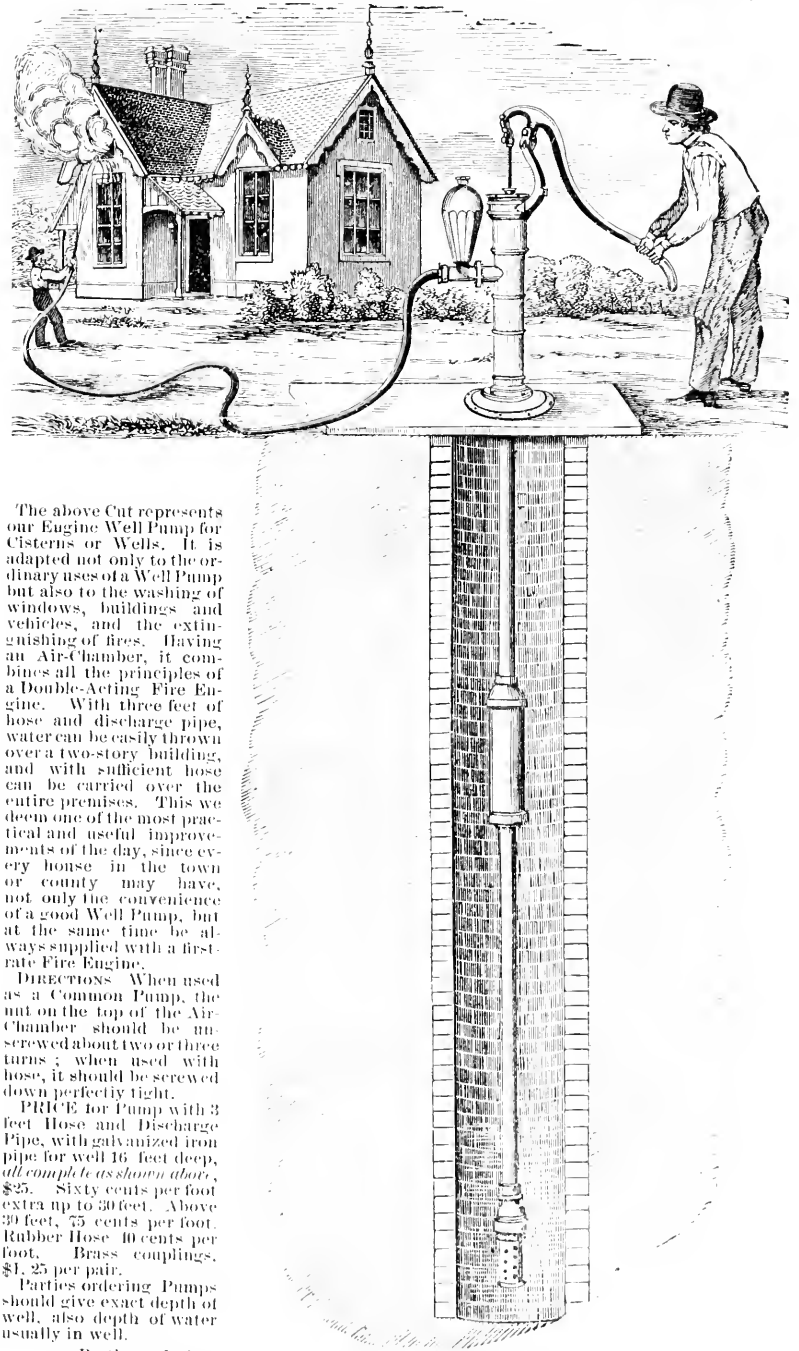
We make them from the very best Refined Iron, and Polished.

NO. 8, ENGINE WELL PUMP,

FOR WELLS FROM 10 TO 100 FEET DEEP,



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DIRECTIONS When used as a Common Pump, the nut on the top of the Air-Chamber should be unscrewed about two or three turns; when used with hose, it should be screwed down perfectly tight.

PRICE for Pump with 3 feet Hose and Discharge Pipe, with galvanized iron pipe for well 16 feet deep, *all complete as shown above*, $25. Sixty cents per foot extra up to 30 feet. Above 30 feet, 75 cents per foot. Rubber Hose 40 cents per foot. Brass couplings, $1. 25 per pair.

Parties ordering Pumps should give exact depth of well, also depth of water usually in well.

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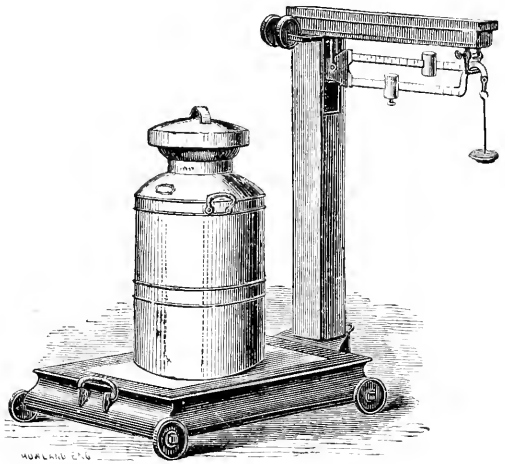
WITH DOUBLE BEAM AND SLIDING POISE.



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Easily fitted to any sized Can. Simple, Cheap, and Very Effective. Very little trouble to use—simply the putting of two to five pails of water into a tub, and turning the faucet. The water used gives it the necessary motion—stirring the milk constantly while running. Four or five pails of cold water (no ice) will reduce forty gallons of milk 20 to 25 degrees in forty minutes. Will send sample for half price. Send depth and diameter of can (*inside measure*) in which it is to be used. PRICE $4,00. A liberal discount to dealers.

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