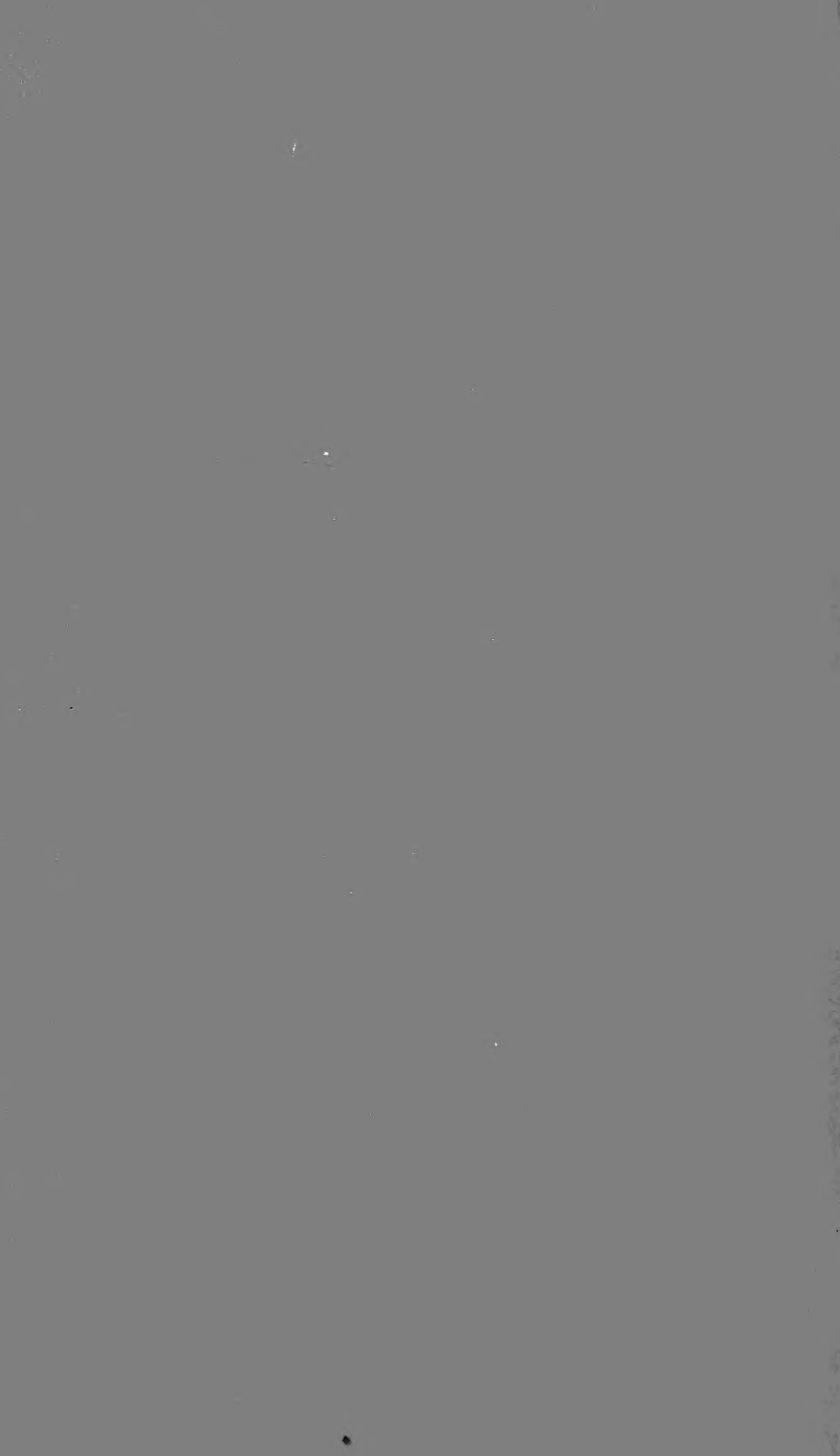


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U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF ANIMAL INDUSTRY.
DAIRY DIVISION.

EXPERIMENTAL EXPORTS OF BUTTER, 1897.

BY

HENRY E. ALVORD, C. E.,
CHIEF OF DAIRY DIVISION.

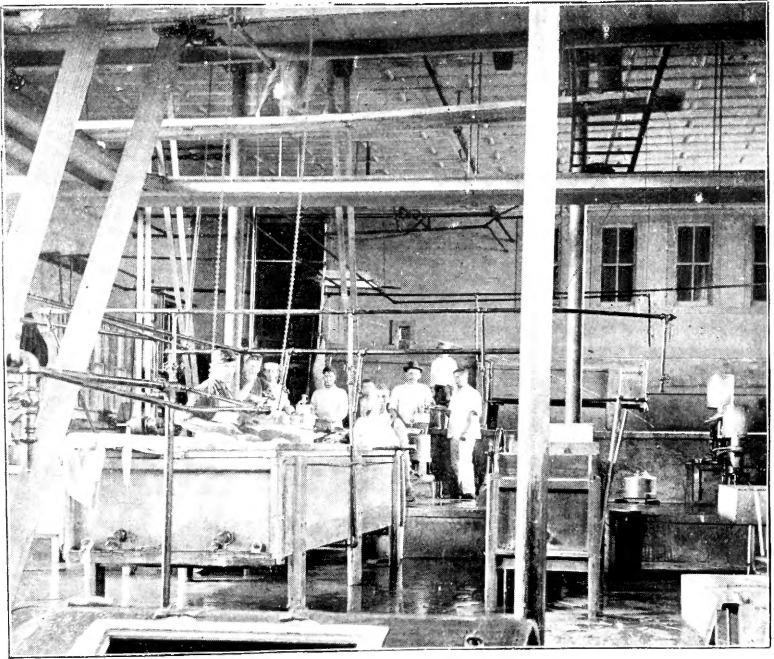
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Butter room: Dairy students at work.



Preparing first shipment of butter for export.

REPORT UPON EXPERIMENTAL EXPORTS OF BUTTER, 1897.

By HENRY E. ALVORD, C. E.,
Chief of Dairy Division, Bureau of Animal Industry.

Soon after entering upon office a year ago the Secretary of Agriculture directed that experimental exports of selected creamery butter be made to England, under the supervision of the Bureau of Animal Industry, for the purpose of gaining information beneficial to all persons desiring to sell in British markets a part of the fine butter produced in this country. The detailed execution of this work was assigned to the Dairy Division; shipments were made periodically during the greatest butter-producing months of the year 1897, and upon this subject I have now the honor to submit this report.

For more than a century the annual export of butter from the United States has exceeded 1,000,000 pounds, and at times this export has reached 35,000,000 and 40,000,000 pounds a year.¹ But this butter has been nearly all of inferior grade, and shipped without special care as ordinary ocean freight. The low average quality of the butter thus exported, together with the large exports of butter substitutes in recent years,² has given to foreign merchants, especially in Great Britain, the impression that good butter could not be obtained in the United States. And the great fluctuation in the quantity of yearly exports has indicated that no regular supply from this country could be depended upon.

The experimental exports by the Department during the past year were designed in part to correct these erroneous opinions entertained by foreign butter buyers.

The recent rapid extension of the creamery system in this country has raised the average quality of the butter product of the United States, and there have been indications for a year or two that the supply of high-grade butter would soon exceed the domestic demand. This condition has been appreciated by experienced merchants, who have lately exported considerable butter of high grade to Great Britain, using for a portion of it refrigerated transportation on ocean steamers. Knowledge of the conditions attending this business has been confined to a very few persons, and with the steadily increasing

¹ See table of butter exports appended, p. 107.

² See table of exports of oleo, etc., appended, p. 108.

desire to extend the market for creamery butter, especially from the large producing districts of the West and Northwest, it was deemed expedient for this Department to ascertain the facts experimentally and make them known to all concerned.

It was decided to make the trial shipments of the season to London. There was good reason for making the first effort to promote an increased demand for fine American butter in the markets of England. That country is the greatest of all buyers of foreign-made butter. Great Britain imported butter during the year 1897 to the value of \$77,000,000. This was 45 per cent in excess of like imports five years before, and the demand seems to be steadily increasing.¹

Creamery butter of the grade known commercially as "extras" was selected as the standard for trial exports, because this represents the great bulk of the product for a part of which it seems desirable to obtain a foreign demand, and because of the purpose to demonstrate the high quality of butter obtainable in this country. The butter was produced from creameries in eleven different States, in order to further demonstrate that this production is not confined to any particular and limited portion of the United States.

The butter exported was made in accordance with special instructions from this office at creameries in Connecticut, Iowa, Kansas, Massachusetts, Minnesota, New Hampshire, New York, Ohio, South Dakota, Vermont, and Wisconsin. Creameries were selected for the purpose which were known to have won high honors at public butter exhibits and contests, or which were designated, at the request of the Department, by State dairy officials or State dairy associations. The instructions given were based upon the available knowledge regarding the particular requirements of the London market, and in the preparation of the later lots the makers had the benefit of experience derived from the earlier shipments. The Department paid for the butter used the regular market price for the product of the creamery concerned, at its own shipping station, at the time of shipment. Whatever extra labor and special care was necessary, in the use of unusual packages, modification of usual methods to conform to instructions, promptness in making and shipping and rendering reports, was cheerfully contributed, without charge, by the managers and butter makers of the respective creameries. A list of the creameries which cooperated with the Department in this public-spirited manner is appended at page 108, together with the places and times of manufacture. Acknowledgment is hereby made for the material assistance thus rendered.

The butter was made in all cases from the regular factory supplies of milk or cream and in substantially the same way as prepared for home markets, so that the shipments as a whole fairly represented the best product of the active creamery districts of the country.

¹ See table of British imports of butter, appended, p. 108.

Detailed reports were rendered in every case, and a full history was obtained of every lot of butter experimentally exported.¹ To complete the record, sample packages were carefully examined and scored by commercial experts and analyzed by competent chemists, as later described.

Several interesting experiments were made incidentally to determine facts along certain lines connected with the subject. Important among these were trials of the relative merits, upon reaching the London market, and the comparative keeping quality of butter as usually made and that from pasteurized cream; also experiments in sending to such a distant market "sweet," or wholly unsalted butter. Although these trials were insufficient to furnish conclusive results, they were satisfactory in the main and fully justify repetition, with the same ends in view. Special reports upon these subjects are included in the Appendix. (See pages 110 and 125.)

It is already evident that pasteurization of milk or cream, in connection with butter making, deserves careful study and persistent trial, especially in connection with the export trade. The prevailing creamery methods result in a product which has general characteristics and shows a vast improvement in almost every particular over the great diversity in butter consequent upon the practice of farm dairies. But there is still altogether too much variation in creamery butter for the good of the trade, not only among different factories but in the product of the same creamery at different times. Natural methods of ripening cream are uncertain, even under expert management; when inexperience and carelessness are involved, the opportunities become almost infinite for variety in flavor and other qualities. Pasteurization, necessarily accompanied by "starters" in cream-ripening, being preferably of known and special ferments, or "cultures," certainly tends to much greater uniformity in butter, even from widely separated sources, and produces a flavor slow in development and well adapted to foreign trade, besides apparently improving keeping quality, which is an important factor in the same connection. At least 95 per cent of the export butter of Denmark is now made from milk or cream which has been pasteurized, and there can be no doubt that to this fact is largely due that remarkable uniformity in flavor and general character which gives Danish butter such a strong hold in the best English markets.

The butter which brings the highest price of all in London is entirely without salt and called "fresh" and "sweet." The supply is mainly from the north of France, although some is made in England and some obtained from Ireland and from Italy. The favorite form is a 2-pound roll, packed twelve in a box. The rolls are not separately wrapped, but the box usually has linings of both cloth and paper. When the best salted butter is selling in London at 25 cents

¹ For an example of these reports, see Appendix V, p. 109.

per pound, these Normandy and Brittany rolls sell at 30 cents per pound. The supply is quite constant, and this butter is delivered so as to be consumed within a week or ten days from the time it is made. It usually contains a small quantity of borax or other preservative to assist in keeping it sound. During the early autumn the Department sent over two lots of unsalted butter, made at Eastern creameries. This was packed like the French rolls and also in other ways. Parts of this butter molded badly on the way, but this could be avoided in future. These trials, the first of their kind ever made so far as known, met with several accidents and in several particulars gave unsatisfactory results, but enough was learned from them to show that it is entirely practicable to make butter of this class and place it in London just as fine in quality and condition as that which is above described as supplied from France.

The butter exported was sent in packages which varied much in size, form, material, and treatment. For general trade, a package holding from 50 to 60 pounds is wanted in Great Britain as well as in this country. Fifty-six pounds (or a half hundredweight) is an approved size in London, and "quarters" (of 28 pounds) are acceptable in limited quantity. Smaller or family-sized packages, to be sold unbroken, which are gaining in popularity in the best American markets, are not favored in London by either wholesale or retail merchants. Packages holding from 1 to 7 pounds were objected to as innovations; but, although retail merchants in London prefer to adhere to old methods and cut from a large lump for their customers, there were indications that consumers would soon learn to like the unbroken, convenient-sized packages, and by persistent offering these would come into demand, especially in connection with suburban trade.

There is great variety in form as well as size among the butter packages appearing in the London market. Firkins or small casks holding from 50 to 120 pounds are very common, and the cubical box, which originated in Australia and bears that name, is a prime favorite. This box holds just a cubic foot of butter, which usually weighs a little over 56 pounds. The cubical or other rectangular package unquestionably has intrinsic merits and decided commercial advantages. As an export package it is already generally advocated. But it would be highly objectionable to have one form of package demanded for export purposes and a different one for domestic use, and it will certainly be a long time before the "Welsh" tub, or more properly the American creamery tub, ceases to be the standard butter package of the United States. It is a great mistake to suppose that London or any British market yet demands its butter in Australian boxes. A small fraction of the butter sold in London is in this form. By far the greater portion is in "kiels" or casks in every respect inferior to the creamery tub. It has already been demonstrated that if the

quality is satisfactory London will pay as much for its (salted) butter in one form as in another. It will be an easy matter to compromise by cutting the capacity of the creamery tub from 60 pounds to 56, and thus making a package acceptable both at home and abroad.

The chief objection to the creamery tub at present in British markets is that poor butter from the United States has been so largely exported in that form that this package is closely associated in the minds of English buyers with a low grade of goods. This prejudice is so strong that it is hard to get an English merchant who is seeking good butter to even take time to examine the contents of a package recognized by him as a "States tub."

The materials approved for tubs are white ash and spruce, without marked preference in London. For boxes, spruce and poplar are used, and the latter seems to be preferred by the foreign buyers. More important than the kind of wood is its thorough seasoning, in order to be absolutely odorless and tasteless.

The packages alone are an insufficient protection to their contents against the exposure of the voyage and the incidental transfer. Hence all packages need good parchment-paper linings well put in place. Double linings are desirable. These are used by foreign countries as a rule and are much heavier and better in quality than those used in this country. Besides linings, different methods were tried of coating the inside of the boxes with suitable material, to insure against unseasoned wood and to render the packages as nearly air-tight as possible. Paraffin was used for this purpose, applied hot, so as to thoroughly coat the inner surfaces, including the cover, and fill all cracks and joints. A patent application, a sort of enamel, was also tried. These extra precautions to guard the butter from exterior injury were found to be worthy of general adoption. The parchment linings may be regarded as essential; otherwise, the interior box coatings may depend upon the quality and tightness of the package.

A package with a clean exterior is attractive at the place of ultimate sale. Boxes and tubs are exposed to much rough handling and soiling between a Western creamery and a British market. It has been found that a coarse burlap sack or cover fitted to the box or tub and drawn tightly over it helps materially in keeping the package clean, prevents changes of temperature, and facilitates handling. In the trial shipments butter from different places was sent abroad with parts of the same lot sacked and partly without. Reports showed that while packages of butter thus protected did not actually sell for more than those of like contents sent without this covering, the sacked packages were first chosen because cleaner, and English merchants advised that the burlap covers be used in all cases. Early in the season of 1897 these sacks cost in quantity only about 4 cents each; later, changes in tariff caused a rise in price to 10 cents, and still later the

price settled down to about 8 cents each. At this rate it seems to be true economy to use them on all packages of fine butter exported.

The Department trials included butter in prints (variously called blocks, tablets, lumps, rolls, and pats) of pound and half-pound weights, in separate paper wrappers, some packed in cases of different sizes and some with every print in a box of heavy paper. Also, butter in small boxes of tin and paper board, hermetically sealed and suited for ocean voyages and use in hot climates. With proper care, it will not be difficult to send print butter from this country to English markets in good condition and to make this form popular with retail merchants and their customers. For butter in sealed packages there is always a demand from the shipping trade, but as the contents of these packages can not be examined, the sales must depend upon an established reputation as to quality, and this is a matter of time and business effort. The whole question of exporting small packages and novelties in form and material, including print butter, requires much further attention.

With the exception of two lots, the butter selected for the export trials was carefully sampled and submitted to chemical analysis. These analyses were made in nearly all cases at the agricultural experiment stations in the States furnishing the butter, and acknowledgment is due to these stations for their prompt and gratuitous assistance. Additional analyses were made by the Chemical Division of this Department, and in order to have a still further check upon the work the butter was sampled in a number of cases while on the London market and examined by a public analyst in that city. The object of this chemical work was to determine as exactly as possible the important components of the butter in question, especially the proportions of fat, water, and salt.

In order that the butter exported might be closely compared with high-grade butter from other countries on sale at the same time in London, sample packages of the best butter to be found in that market, from various sources of supply, were purchased several times during the season and their contents were also analyzed. In two instances packages of these foreign-made butters were sent over from London to this country, being subjected to exactly the same conditions as to time, distance, and transportation as the States butter exported, except that the movement was in the opposite direction. The butters thus obtained for comparison were as follows: Best English Dorset, in keg; Irish creamery, in pyramidal box; "Royal" Danish, in "kiels" or casks; Dutch creamery, in firkin; Finnish, in keg; Brittany rolls, unsalted, in boxes; Normandy, in basket; New South Wales, in cubical box; New Zealand, in oblong box; Australian, in cubical box. Some of these were analyzed by a London chemist, but most of them at this Department and by the experiment stations in Connecticut and Iowa.

So far as practicable, the different lots of butter exported and those imported for examination were inspected by an expert and scored upon a scale of points. The butter inspector of the New York Mercantile Exchange was selected for this duty and performed it very acceptably. In this way a fair basis for comparison was established. For further information packages of butter from export lots were placed in cold storage in New York, held there and examined again about the time the same lots were on sale in London, and some of the export butter was sent back from London to be compared in New York, after its double journey, with packages of the same lot retained in New York. Several of the foreign butters were also scored in Chicago.

It was found impracticable to have the American butter included in the export trials scored in London and compared in that way with other butter on sale there, because this method of examination seems to be unknown in that market. Diligent inquiry failed to find anyone known to the trade in London who had ever scored butter upon a scale of points. Some attempts were made to use a score card sent over, but the inspectors were so unaccustomed to this method that, although doubtless good commercial judges of butter, the reports from them were of little value.

The records of the various analyses and scores referred to are appended in tabular form, with some explanatory notes. (See pages 128 to 134, inclusive.)

The distance and the danger of injury incident to the long journey by land and by sea being appreciated from the first, the matter of transportation received the closest attention throughout the trials made. Shipments were allowed to follow commercial lines and be subjected to commercial conditions as closely as possible, but they were watched at all points by agents of the Department, in order to ascertain the exact facts, as a basis for subsequent improvement in the existing conditions.

Railroad transportation facilities for perishable commodities are excellent in this country from all the principal producing regions to important points on the eastern seaboard. Similar facilities abroad are unusual and inferior. The various lines of refrigerator cars are well equipped and admirably managed here, so that little criticism of the present service is possible. The cleanliness of the cars, the temperature at which they are kept, the time schedules, and the freight tariffs, including these special facilities, were examined, tested, approved, and commended. All the large creamery districts of the West are well served by refrigerator lines, and butter is carried thence to markets 2,000 miles or more distant and delivered in as good condition as at the starting point.

Carload lots which can be moved unbroken from the creamery or creamery town to destination have great advantages, especially in

hot weather. Small lots necessitate opening the cars, causing more or less fluctuation in the temperature of the butter, and involve transfers from car to car at interior points, sometimes including an open-air haul across a city or town. These transfers receive in many cases the attention of special agents, if they are duly notified by shippers, but still afford opportunity for improvement. It is practicable to lessen the exposure of butter at these transfers by reducing distances, avoiding midday hauls and handling, and protecting the packages while on wagons and drays.

Terminal facilities at the principal markets, including deliveries to consignees, have been greatly improved, but are yet far from perfect. Butter arriving unexpectedly, perhaps a day ahead of time, may remain at the terminal shed for several hours in a constantly rising temperature; it is not uncommon for notices of such arrivals in the early morning to reach consignees after 1 o'clock p. m. By efficient cooperation between railroads and merchants, it seems possible to materially lessen the average time which now elapses between the discharges of butter from refrigerator cars and its storing in cellars and cold rooms.

The Department trials included nineteen shipments over five refrigerator lines west of Chicago and four others reaching New York City. These shipments being all intended for export upon steamers with latest receiving hours named well in advance, estimates were made for as close connections as possible between railroad and vessel. Of the nineteen shipments mentioned, fifteen arrived at New York on time, and four were so late as to miss the sailing day desired. Three of these were from west of Chicago and one from central Ohio; they were delayed upon three different transportation lines. These delays were not due to railroad accidents or detentions of trains, but to avoidable circumstances in connection with transfers, showing points for improvement in the service.

It is not usually a matter of consequence to the merchant at an Eastern market if a consignment of butter arrives late by some hours, or even a day or two. But with butter intended for direct export, economy in handling and protection of quality render close connection between railroad and steamer quite important. Time, tide, and ocean steamers wait not for railroads. This kind of special service by the latter must be made as nearly perfect as possible. Some detentions by rail are unavoidable; and, to provide against these, the terminal facilities of the transportation lines should include cold-storage accommodations, well located and ample in capacity, so that butter for export may arrive two or three days in advance of sailing time and (where the refrigerator car can not be held) be stored without charge until the proper hour for delivery to the vessel. There have been a few attempts to make such provisions in a small way, but nothing commensurate with the requirements of enlarged traffic.

Six trial shipments had to be brought to New York City by express from creameries in the States of New Hampshire, Massachusetts, Connecticut, and New York because refrigerator car service could not be obtained. Local traffic is still lacking such accommodations in the East. It cost more per pound in every instance to bring butter to the port of export from creameries 100 to 300 miles distant than to bring it from points ten times as far distant, and the butter coming 2,000 miles arrived in better order. Such conditions require no comment.

In accordance with special instructions from the Secretary of Agriculture, much attention was given to ascertaining the present and prospective facilities for the transportation of perishable farm products by sea, including ports from which few exports of this character have yet been made.

During a great part of the year accommodations for first-class ocean freight are good and sufficient. But there are several months in which butter for export is most abundant, when the quality of a high-grade article can only be safely preserved by cold storage during the voyage. The same provisions are needed for the preservation of other perishable products. A good many ocean steamers now have large commercial refrigerators fitted to be maintained at any desired temperature above the zero of Fahrenheit. Up to the present time, however, the demand for such accommodations has been so small and infrequent for commodities other than fresh meat that the expense of keeping these refrigerators ready for general purposes has not been justified. Nearly all of the commercial refrigerators upon vessels sailing regularly from ports of the United States consequently have been, and still are, contracted for by the large exporters of beef and other fresh meats and used by them exclusively throughout the season. During the summer of 1897 one commercial refrigerator was open to the general public on the steamers of the American Line from the port of New York weekly for three weeks out of every four. This was the extent of the accommodations of this kind which could be depended upon as available. Other lines from New York opened a refrigerator for general use occasionally. Inquiries at Portland, Me., Boston, Philadelphia, Baltimore, Charleston, New Orleans, Galveston, San Francisco, and Portland, Oreg., failed to find like facilities offered to shippers. From a few of these ports fresh meat was exported in refrigerators under exclusive contracts. Occasionally a vessel fitted with a refrigerator would clear from one of them, but these occasions were so rare and irregular as to be of no practical benefit to shippers. Earnest efforts to arrange for experimental exports of dairy products, fresh fruits, and other perishables over new lines, under the auspices of this Department, failed because suitable refrigerated ocean transportation could not be obtained. The same state of affairs seems probable for the season of 1898, although there are partial promises of a line of steamers with

refrigerators available to the public from Boston to Bristol, and an occasional additional refrigerator on a Liverpool steamer from New York.

While this unfortunate lack of refrigerated space available to all exporters exists in this country, the butter makers and merchants of Canada, who are competing with those of the United States for position in the markets of Great Britain, have export facilities which can hardly be excelled. Under the fostering care of the Dominion government, which has borne a large part of the expense of initial equipment, seventeen steamers sailing from Montreal during the past season have been fitted with refrigerators, and the use of these has been secured to shippers in general at extremely low rates. There has thus been weekly refrigerated service from Montreal to London, Liverpool, and Bristol, and fortnightly service to Glasgow. There has also been fortnightly service from Halifax and St. Johns to London, and monthly service from Prince Edward Island. The system of refrigeration on all these vessels is mechanical, securing the best insulated compartments, and duplex machinery makes accidents next to impossible. Under the contracts between the Canadian government and the steamship lines these extra facilities are offered to shippers of butter made in the Dominion at a charge not exceeding 10 English shillings per ton, or about 1 mill per pound, above the prevailing rates for first-class freight. During the season of 1897 the rate on butter in refrigerators from Montreal to London averaged about 50 shillings per ton of 2,240 pounds, or half a cent a pound. Of course, these rates were secured only for Canadian produce, and, indeed, refrigerated accommodations could be obtained upon the steamers from Montreal for other produce only in case the Canadian offerings did not fill the compartments.

The combined railway and ocean rates from the Northwestern States to Great Britain were so much more favorable by way of Montreal than by way of New York that considerable States butter was sent by that route during the past season. The quantity of butter which crossed into Canada from the United States at Detroit, Mich., and Champlain, N. Y., during the year 1896-97 was three times as great as during the year next preceding.

The trial shipments for this Department were made from New York to London via Southampton. The commercial refrigerators were used as much as possible, and at other times, through the courtesy of the International Navigation Company, the butter was carried in the ships' own cold rooms at current rates. The temperature preferred during the voyage was 30° to 32°, and this was easily obtained and evenly held. There is no reason to believe that there was any deterioration of quality in the butter of the several lots exported consequent upon the voyage itself and the detention on shipboard for seven to nine days. Entirely satisfactory transportation facilities can be

provided on vessels, as now on land, whenever the demand is such as to secure the supply.

Terminal facilities and the conditions pertaining to the necessary transfers at both ends of the voyage are far from what is needed. The steamers while loading are ready to receive certain classes of freight only at certain hours. These hours seldom agree with those of arrival by rail and delivery at the docks. Hence there is detention and exposure at the wharves, there being no provisions there for temporary cold storage or special protection until taken on board. Butter is subjected to similar exposure on arrival at Southampton and while awaiting the forward movement to London. There is one large refrigerator on the wharf at Southampton, owned by the steamship company, but this is without subdivisions, is used indiscriminately for all kinds of perishable products detained, meats especially, and is not a suitable place for holding butter. The Southwestern Railway Company have large masonry vaults under their tracks at Southampton, and these are kept clean and sweet and ventilated with electric fans. They would do for temporary storage of butter even without refrigeration, except in such extremely hot weather as rarely occurs at that place. Refrigerator cars on the line to London are furnished only for carload lots and shippers must provide their own ice. The railroad ordinarily offers no special accommodations, but the journey to London is short. The train carrying perishables makes the trip by night in about four hours, and the merchandise is very promptly delivered in the city during the early morning hours. The transfer from railway terminal to the warehouses of merchants is attended with less delay, and this service is better otherwise, than in New York. Early in the season there was complaint of much carelessness in the way butter was handled and exposed when taken from the steamer and while held at Southampton, and the packages arrived in London soiled and sometimes showing very hard usage. Department agents gave this matter attention, and before the season closed the conditions at Southampton were reported as greatly improved. Better cold storage at British ports and the more general use of refrigerator cars on British railways are improvements required for commerce of this kind.

If the transportation facilities were as good all the way from the American creamery to the European market as those afforded by the railroad lines in the United States and the trans-Atlantic steamers (when their refrigerators are available), the journey might be even longer and slower without injury to butter exported over this route. The chief danger of damage, as already stated, arises from the delays, exposure, and changes of temperature incident to the transfers on railways and those from land to water and water to land again. For perfecting this service attention should be directed to reducing the number of these transfers and improving the conditions pertaining to those which are unavoidable.

With the accommodations which were available during 1897, by the New York City route, and without material variation from usual commercial practice, this Department was able to transport butter from the creameries where made in the several States and deliver it to merchants in London in the number of days indicated as follows: Vermont, New Hampshire, Massachusetts, and Connecticut, ten or eleven days; New York, ten; Ohio, thirteen; Wisconsin, fourteen; Iowa, twelve to fifteen; Minnesota, sixteen to eighteen; Kansas and South Dakota, seventeen or eighteen. It is doubtful whether this time can be materially reduced, and fortunately a few days more or less seems to make no difference, if the butter is in a good refrigerator, on land or sea. The cost of the transportation service described, from the creameries to London, ranges from $1\frac{3}{4}$ cents to $3\frac{1}{2}$ cents per pound of butter, net weight. The least was from Ohio and the greatest from Vermont. The average from Iowa was rather less than $2\frac{1}{2}$ cents and from Kansas about $2\frac{3}{4}$ cents. These rates included transfer, cartage in New York, and the drayage on delivery in London, and were for single ton lots. The cost from the time the butter left the refrigerator car on arrival in New York until delivered to the London merchant averaged for the season almost 1 cent per pound. The extra expenses in cases of late arrival in New York and detention there in cold storage are not included. Butter shipped in carload lots secured much better rates, the difference being mainly in the tariff west of the Mississippi River. From different points in Kansas, rates of \$1.20 to \$1.40 per 100 pounds were obtained; allowing for packages this made about $1\frac{1}{2}$ cents per pound on the net weight of butter.

The butter sent to London by this Department was handled in that city in various ways. Some went to large wholesale houses and from them reached consumers through the regular course of trade, some was first taken by jobbers who placed it in varying quantities in the hands of others to sell again, and in a few cases shipments were delivered directly to retail dealers who sold the butter at once to consumers. One of the main objects of the trials was to have merchants of different classes make critical examinations of this States butter, compare it with the best butters in the market, and give opinions as to its merits. This was found to be a difficult matter, especially during the early part of the season. The wholesale merchants all had their favorite sources of supply and were unwilling to admit that any butter from this side of the Atlantic was at all equal to the English, Irish, Scandinavian, French, and colonial products. The prejudice shown against States butter was truly remarkable. All sorts of trivial faults were found with it, some of which were proved to be absolutely groundless, and the conclusion was forced that the object was to justify grading the American butter low and paying prices for it much below its actual comparative merit. These first buyers persistently refused to tell the prices at which they sold the butter, although several of

them accepted it upon a definite promise to give this information. There is reason to believe that in several instances the butter was sold to retailers at prices much above the grade first assigned to it and at which the wholesalers made settlement. As the season advanced and the true quality of the butter bearing the Department brand became known in certain trade circles, it was accorded more justice and paid for at relatively better rates. The opinions of merchants were given in very general terms, yet, on the whole, they were favorable to the butter. And it was noticeable that the nearer the butter got to the consumers, the better satisfied the people were who handled it. Although paid for at second-grade rates, or lower, retailers generally placed it on sale as first-class goods and got the highest market prices for it from their customers. The opinions obtained from consumers were nearly all highly commendatory, although in most cases they believed it to be "Best Dorset" (English) or Danish butter—the favorite brands in the high-class retail trade for cured, or salted, butter in London. The prejudice against butter from the United States extends to the consumers, and hence the action of retailers in general in concealing the identity of American butter when they sold it. In a few instances, by special effort, dealers were induced to advertise and placard what was sent by the Department, as "Selected creamery butter from the United States." To sell it readily, as such, they were obliged to place the price rather lower than that of butter of greater reputation, but (by them) admitted to be no better, on sale at the same place. Twenty-four cents was a usual price for the former and 26 for the latter. In one case the States butter sold rather slowly at this comparative rate, so the merchant removed the sign and sold it unidentified at the higher price, apparently to the entire satisfaction of the consumers. One merchant who followed the wishes of the Department throughout the season closer than any other retailed the butter under its true name, and reported that he was constantly receiving inquiries from customers whom he had urged to try it for the first time, asking specifically for more of the United States butter.

Evidence was not lacking that, in contradiction of adverse opinions, some merchants really recognized the merits of the States butter. All exported by the Department had the same marking (quoted above), but no indication of the creamery or even the State from which it came. All was represented alike as "Produce of the United States." But several merchants who had received sample lots or packages from these experimental exports inquired privately of the Department agents for the addresses of the creameries at which the butter was made, with a view to corresponding with them in regard to future supplies. At least two creameries have since made direct shipments of butter to England upon orders thus received.

As already indicated, there were certain features of the trade nota-

ble throughout these London trials. The prejudice against anything new or from a new source was such that merchants would buy the new article, even after becoming convinced of its actual merits, only when obtained at a price materially lower than that willingly paid for one of established reputation and usually handled, yet no better in quality. When the United States butter was sent to a wholesaler, its identity was lost completely before reaching the consumer. The dealers knew just what they were selling, but they took good care that the consumers did not know. The custom of London retailers in exposing their butter "stripped"—or turned out from casks, tubs, and boxes and held in mass, with no package or marking in sight, to be cut from in quantity to suit buyers—contributes to this concealment of the true origin of the butter. Dorsetshire has the reputation in London of producing the best butter to be found. It occupies the place there which "Goshen" and "Orange County" formerly held in New York, and which "Elgin Creamery" now holds in this country—although the latter term, as used, is actually very general, indefinite, and deceptive. Therefore even the best Danish butter is largely retailed in London as "Best Dorset." The retail merchant is evidently willing to deceive his customers so far as he can in this way if his margin of profit is thereby increased. As an example, one London merchant who favored the representative of the Department by showing his books was found to be purchasing during the same week Danish butter at 118 shillings per hundredweight ($25\frac{1}{2}$ cents per pound), Normandy butter at 106 shillings (23 cents), and United States butter at 100 to 96 shillings (22 or 21 cents), and was retailing all of them at the same rate of 1 shilling 2 pence (or about 28 cents) per pound. And nearly all of it was sold as Dorset butter.

The usual commission for wholesaling butter in London is 4 per cent besides the incidental expenses, and retailers depend upon getting an average of 3 or 4 cents a pound for cutting out butter in pounds and half pounds to serve to customers. Some make a better profit, as above indicated, by using a well-selected, good article, from a source lacking special reputation and hence bought at an advantage. Others sell butter incident to other business at little or no profit to attract trade, as many grocers sell sugar. Although the London wholesale butter market is subject to great fluctuations in the course of the year, retailers endeavor to vary the price to consumers very little. During 1897 the best salt butter sold in London at 24 to 28 cents per pound, seldom going outside these limits in the hands of the largest retailers. There was a temporary drop to 22 cents in May and June, but choice lots remained at this minimum only a few days.

The London wholesale market for the year presented features familiar in this country, but less extreme, and the extremes reached did not accord in time with those of New York. The highest London prices realized for choicest Danish butter were 25 and 26 cents in Jan-

uary, September, November, and December, and the lowest was 20½ cents in May and June. The average for the year on this grade was between 23 and 24 cents. In New York creamery extras were highest in February and March, temporarily, and in October, November, and December, and lowest in May, the range being from 14 to 24 cents, and the average 19 cents per pound. For three months during the summer Danish butter stood from 5 to 6 cents higher in London than creamery extras in New York; this was the favorable time for export, although States butter was quoted for some weeks in London at about 18 cents. During certain weeks in the spring creamery extras brought nearly as much in New York as best Danish did in London, and in October the one actually sold at a higher price in New York than the other did in London. The export season was therefore short, and was delayed at the outset and checked at the close by home conditions. The rise began simultaneously in the two great markets early in August, with a mutual reaction in September, but after that the advance was steadier and longer continued in this country. The public quotations of States butter in London were 5 to 7 cents below those for Danish all through the earlier months of the year and until fresh arrivals from Australian and New Zealand creameries ceased in April. Then the gap began to close and in August and September it had been reduced more than one-half. Before the end of September, however, American creamery butter was worth as much in New York as it would bring in London, and exports ceased. These conditions were plainly detrimental to establishing a continuous foreign trade. Some of these facts and relations are shown graphically in the accompanying diagram of butter prices in London and New York during 1897. (See Appendix XII, p. 135.)

The question of profit was not regarded as of special importance in connection with these experimental exports. Information was the prime consideration. Yet the financial results were not disregarded. Commercial conditions were adhered to as closely as practicable and profit was sought so far as compatible with the more important object. But circumstances incident to the trials were unfavorable to gains from the purely business standpoint. The quantities of butter handled were so small as to be unattractive to buyers, and at the same time the incidental expense per pound was unduly large. The shipments were irregular and successive sales made through different channels, so that the advantages of a regular supply and demand were lost. In order to accomplish the main purpose of the work, expenses were incurred which would not occur in the usual course of trade.

The purchases for these exports were made during the seven months from April to October, inclusive, at prices ranging from 13 cents per pound, paid in Kansas in July, to 25 cents, paid in Connecticut in October. The sales in London ranged from 15¼ cents in May, to 21¼ cents in October. Butter sent in rather more than half of the several

shipments was sold at more or less profit, and this was the result with almost half of the different lots of butter. Notwithstanding the unfavorable conditions mentioned, butter from Minnesota and Ohio sold at a net profit of $2\frac{1}{4}$ cents per pound, from Kansas at 2 cents profit, and from Wisconsin at about 1 cent. The average cost of these lots at the creameries where made, at current market rates, was $14\frac{1}{4}$ cents, and the average selling price of the same in London was $18\frac{1}{2}$ cents. (The fractions stated are not exact, but approximately correct.)

Every lot of butter obtained in New England, as well as one lot from New York, was sold in London at a decided loss. This was due partly to the disproportionate cost of transportation to New York, already noted, but more particularly to the higher prices which the creameries of this region are able to maintain because of the local markets for their product. It was plain enough, in advance, that butter which during the summer was in active demand at 20, 22, and 25 cents a pound at the creamery door could not be exported at a profit.

On the other hand, all the butter bought at creameries in Ohio or States farther west, at the current wholesale rates for "extras," was sold at a net profit in England, with the exception of a few lots at the two ends of the export season, when the market relations were known to be unfavorable to such transactions.

All considered, the operations of the year may be regarded as reasonably satisfactory in a business way, as well as otherwise, while at the same time a number of points were developed where greater economy could be practiced another season.

Following are a number of extracts from written and verbal statements made by merchants, retail dealers, consumers, and agents of the Department regarding the butter sent to London in the experiments of 1897, and these include some comparisons with other butters found in that market during the same season:

STATEMENTS FROM WHOLESALE MERCHANTS.

We have examined the packages of butter ex *S. S. St. Paul* and are favorably impressed with the quality of all. The boxes and tubs of 56 pounds net weight or more are the style of packing most likely to command the attention of buyers here, and we should recommend strict adherence thereto in fair proportions of each.

The American trade has been spoiled hitherto by inferior butter. United States butter must now make a good name by degrees; the quality must be high and uniform, the supply regular.

This last lot I think a perfect salt butter and very suitable for the English market. I have no doubt it would find a ready sale if it could be sold (wholesale) delivered to the tradesman during the spring and summer months at 88s. to 102s. per hundredweight [19 to 22 cents per pound] and in the autumn and winter months from 108s. to 124s. per hundredweight [$23\frac{1}{2}$ to 27 cents per pound].

We have carefully inspected your American butter and find the quality and condition better than any of the kind we have yet seen, but it contains too much liquor, which runs when defrosted.

We have carefully and repeatedly examined the American butter, assisted by expert buyers, and all are of the opinion that the boxes and pails are suitable for the London trade. The butter is well packed, but contains too much water. This causes rapid deterioration directly the frost is gone, and in a normal temperature the water runs from the butter.

I have inspected samples of butter and consider the quality to be very fine. There is but one fault that I can find, and that is that the firkins contain too great a percentage of water. I am sure that this class of butter would be taken up very largely by the consumers in London and the suburbs if it could be shipped in large quantities regularly throughout the season and the quality kept equal to this lot. I should like to take up 2,000 to 3,000 packages per month for my customers.

My opinion of the States butter sent to me in June is in every way satisfactory for our London trade, both in quality and color. I do not hesitate in saying that if the manufacture of it can be kept to this standard it will make a very successful departure in the supply for this market. I shall be glad to receive further consignments.

I am very pleased with the general turnout of these American butters which I have had from you. With more attention to details heretofore referred to, there would be no difficulty in creating a good demand for butter of this description, and prices obtainable would be equal to finest Australian, New Zealand, and Canadian butter.

STATEMENTS FROM RETAIL DEALERS.

The package of American butter which I got from the lot you indicated to me was found in every way satisfactory. By this I mean that the butter was well made, carefully packed, and seemed possessed of the very best keeping quality. The flavor was most agreeable, and the amount of salt just about right to suit the general English taste. I truly believe that a standard of butter as good as this would bring the very highest prices on the London market.

There was a brightness of flavor, a certain bouquet, about that American butter which assured me that it had been churned—may I say the milk set and churned?—in an atmosphere pure and wholesome, and imparting to it a dewy freshness not always found in the very highest priced butters. Great credit is due to somebody for preparing such an excellent article, and it affords me great pleasure to say so.

The quality is only a good second. It does not compare favorably with the French, Danish, and colonial butter, the flavor being much poorer and the texture weaker. It also contains too much water and salt. Tested after being exposed out of the packages for two days, the quality has been found to have become impaired, and this shows that the quantity of liquor contained in the butter causes it to deteriorate rapidly upon exposure to the normal atmosphere.

For the London trade it savors too much of the Irish "twang," is a little too salt, and the color too high. The best standard of butter for you to imitate, if I may say so, is the finest Danish, which gives satisfaction nearly the whole year round.

The sample of butter I consider remarkably good, grass flavor, and equal to the "Best Dorset" in style and make, and if put on our market would undoubtedly meet with a ready sale.

This is, indeed, the best States butter I have tasted in England, but still there is room for improvement. A little less water and a trifle more salt would be in the right direction.

The lot of butter received from you I was very much pleased with, being just the class of butter which is appreciated by my customers. As you have asked my individual opinion, I beg to say that I consider the texture, coloring, and

salting can not be improved upon and the flavor is A1; in fact, I regret not being certain of obtaining further supplies of this butter.

You promised me the first parcel of States butter you had in like the last; I should have some. I hope you have not forgotten, as my customers still continue to ask for it. If you have any now, please let me have three boxes tomorrow. If you have not same quality as before, do not send any. United States butter, as a rule, comes very inferior and all goes wrong after being exposed in the air a few hours.

Messrs. H. Brothers purchased box No. VI, Lot I, at 90s. per hundredweight [19½ cents per pound] and retailed the same at 1 shilling a pound (24 or 25 cents). They considered this butter to be fair in quality, though lacking in body. At the same time they purchased other United States butter at 88s. and Irish butter at 104s. The United States butter they regarded as rather better than the Irish. All three of these butters they retailed at the same price—1 shilling—being the highest price at which butter was then sold to their line of trade.

STATEMENTS FROM CONSUMERS.

The sample of United States butter was excellent. It came, saw, and conquered. It was such a decided success that if you can furnish me with the address of a place where it can be regularly procured, the dealer can be sure of one customer.

Referring to the small package of American butter lately procured on your suggestion, both Mrs. C. and I thought the butter very good, although a little more salt than we are accustomed to using. It arrived in splendid condition and was beautifully packed. As regards the packing, however, you are doubtless aware that in small households it is the custom to buy butter in small quantities, probably in pound pats, as by this means it can be obtained more frequently and consequently fresher. I should think this 5-pound package would be suitable for hotels, clubs, and large establishments.

In regard to the United States butter, of which you put me in the way of getting a small package lately, won't you please tell me where I can purchase more of it?

I purchased a small quantity of American butter from Messrs. H. Brothers. It is very good, similar to Irish creamery butter I have used, but I think the quality superior. It is rather light in color, otherwise, in my opinion, it is excellent.

STATEMENTS FROM REPRESENTATIVES OF THE DEPARTMENT OF AGRICULTURE.

Butter from the United States has not a good reputation at the present time in the London market. Consequently the same class of butter as the Danish, or even if better in quality, will not bring so high a price on account of the excellent reputation of the latter. Of course, this applies mainly to the wholesale trade, as the butter entirely loses its identity when sold to the retailer. Salt butter is, as a rule, retailed in London as "Best Dorset," irrespective of its actual place of manufacture.

So much inferior butter from the United States has been sent to England that some of the dealers laugh at us as soon as we mention United States butter to them. Consequently we have had much difficulty in getting some dealers to handle the butter at all. Had we been trying to sell the butter outright to them they would have had nothing to do with us.

Some dealers have objected to handling our butter, fearing, on the one hand, it might not suit their customers, and, on the other, thinking it might please them so well that they, the dealers, would be embarrassed by being unable to procure a further supply of the same, or other equally good.

These people dislike very much to acknowledge that the United States butter is better than that which has a good reputation, because, while not so admitted, they are able to buy it at a low rate wholesale and then get full price for it when sold to the consumer. Yet I have repeatedly compared the United States butter with the Danish and "Best Dorset" with friends who are in the butter trade and have invariably found the butter of the trial shipments superior in quality, flavor, and body.

The butter trade of London is a very queer one. Even the largest consumers have only a daily supply left at their doors. This is done to save the cost of private refrigerators and ice, and is one reason why large dealers object to the family-sized packages. Many people only purchase a half pound at a time. The hotels and restaurants have contracts with retail houses to supply them with a certain quantity of prints ready to put on the table every day. Still, I think the oblong and square boxes, holding from 3 to 7 pounds, would be very useful in a suburban trade where it was not convenient to have butter brought to the door every day.

The butter in the cases of carriers, in half-pound prints, was of a very good quality, the only objection being the fact of being in such prints. Retailers customarily buy the half firkin, or 56-pound box, and divide the butter up into pound or half-pound rolls, wrapping each roll with parchment paper bearing the dealer's name and address. I firmly believe, however, that with a little time and work spent upon the introduction of the print package, it could be made to sell largely in the London and suburban market, provided, of course, that the package is not too expensive.

The butter now coming in the trial shipments is undoubtedly better in quality than most of the Danish and Dorset—just as good in flavor and much better in body.

The fact of the ——— stores, as well as ——— & Son, selling this butter at 1s. and 1s. 1d. [about 26 cents] a pound, which are the very highest current retail prices, proves beyond doubt that the butter was of excellent quality when made, was well packed, and arrived in London in fine condition.

Messrs. ——— and ———, as well as the two houses already named, told me that this United States butter compared favorably with the "Best Dorset." The latter is the best salt butter on the London market, some of it being made in Dorsetshire, but most of it coming from Denmark.

Wherever possible, we have ascertained from the retailers the prices obtained for the butter sold from our different lots, and find that they realized the full price for the best butter, 1s. and 1s. 1d. a pound, according to the locality of the store. This proves conclusively that if the creameries of the United States will put up the same grade of salt butter, and are able to guarantee the weight and quality, it will not be long before such butter will bring the highest price in the London wholesale market. But it must be sold squarely, in the right way, and the returns not eaten up by excessive charges.

In my opinion, if the United States butter is honestly made, properly packed, carefully transported, and then fairly handled in this country (Great Britain), it will soon be able to compete with the best Danish or any other first-class butter that is sent to British markets.

Many butter dealers in London are very anxious, owing to our efforts here this year, to handle United States butter; but in order to do so successfully and build up a remunerative trade they must be guaranteed a regular supply of butter of uniform good quality. Those who had handled butter from the States previous to these Government consignments complain that it has not been uniform, and that

no reliability could be placed on the comparative merits of successive consignments. This has injured the trade much, and fear of this prevents building it up. These difficulties could be overcome by the Department supervising the butter and cheese export trade in a way similar to that done for live cattle, dressed beef, and packed meats. If all butter exported could be examined by an expert inspector and given a Government certificate of purity and quality, it would give such butter a standing in the markets of Great Britain and enhance its value to a great extent.

Box No. 7—E I retained for trial at my house. This box was opened November 13, 1897, and I supplied a family of six persons until February 16, 1898, or about three months. During this time it was kept in a larder without ice, and remained sweet, firm, and good throughout. If we had been using butter purchased at the retail stores, such butter being either Danish, Dorset, or Australian—the best salt butter on the London market—I know from my previous accounts that we would have consumed $67\frac{1}{2}$ pounds. There was but $57\frac{1}{2}$ pounds in the States box. I consider this another strong argument in favor of our United States butter, and also proof that such butter does not contain too much water, but is actually firmer, more solid, than most other salt butter sold in London.

Comments are necessary upon these expressions of opinion, else they might be misleading.

English dealers generally seemed to consider it necessary to find some fault with butter from the United States, and as most of them were already convinced that butter from this country was, as a rule, soft and briny, their criticism was very apt to include these points. Several of them referred to other butters as having the desirable "body" which ours lacked. But the facts, determined with an exactness far beyond the power of human judgment, did not sustain these complaints.

The following is a tabular comparison of the water and fat found in the butters embraced in the Department trial exports as the result of chemical analyses made in this country and in London, with the same facts as to the composition of selected lots of the best butter to be found in London from nine foreign sources. The highest and lowest results are given in each case, as well as the averages obtained:

Comparative composition of butter, United States and foreign.

Butter: Where made and where analyzed.	Water.			Butter fat.		
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
United States:	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
American analyses	8.12	12.87	10.85	84.21	89.49	86.84
London analyses.....	8.08	11.73	10.13	86.71	90.09	88.06
Foreign, United States analyses.....	8.62	15.50	12.40	78.50	89.27	84.57

These figures show at a glance the much greater dryness of the butter from the United States, especially when determined by the London official analyst, and the superior richness of the States in pure butter fat. Only one lot of the export butter showed less than

85 per cent fat and none reached 13 per cent water by home analyses. The English analyst reported only three cases above 11 per cent of water, and made an average of over 88 per cent fat. Among the foreign butters, half were above 13 per cent water and only four reached 88 per cent of fat. The produce sent over by the Department, therefore, gave its buyers (according to English tests) three and a half pounds more of actual butter in every hundredweight than was found in the best foreign articles. The English Dorset, regarded as a standard, was found carrying almost 14 per cent water (which is not excessive) and only $84\frac{1}{3}$ per cent fat. The Danish, constantly referred to as a pattern, was found by the Department to average much better—10.45 per cent water and 86.79 per cent fat; but this is better than given by Danish authorities, who claim the water content of their export butter ranges from 12 to 16 per cent and averages about $14\frac{1}{2}$ per cent. There are other points for judging butter on a chemical basis. The foreign matter in butter is represented by the casein, or curd; of this, the less the better. The foreign samples examined contained from 0.48 to 2.40 per cent of casein (with sugar, albumen, etc.) and averaged 1.03 per cent. The States butter exported contained 0.33 to 1.30 per cent and averaged 0.81 per cent. Besides this, none of the United States butter contained preservatives of any kind, while all of the foreign butters, excepting the English, Danish, Finnish, and New Zealand, were "borated" more or less, some quite heavily. Yet some of the foreign butter was exceptionally well made; and the Danish and French particularly, even although in some cases testing pretty high in water, appeared to be dry and had a texture or body superior to most of that included in the experimental exports.

As to the degree of color preferred for butter, the opinions of merchants and consumers in London differ materially. It is evident that the London market does not want its winter butter colored much, but in summer it accepts the "natural June color" of grass butter without complaint. On the whole, the conditions in this respect seem to be about the same as in New York. It was noticeable that in the lots of foreign butter brought from London as representative of the preference of that market several were decidedly deeper in tint than the average of the best in New York at the same time. The Danish packages were included among those having the most color. Where complaints are made in London of too much color in American butter, it may be generally attributed to sheer prejudice and not true market judgment.

Opinions as to salt differ still more and naturally vary with individual taste. Three or four English merchants examining the same lot of States butter separately gave as many different judgments as to the salting. And the same critic declared one lot of butter too salt and another too fresh, when the records of the making, sustained by

chemical analysis, proved the former actually to contain less salt than the latter. The facts as to the London market judgment in this particular seem to be that the very best butter should have no salt, and that the more salt butter contains the lower the grade to which it is assigned. Yet if butter is to have any salt, from one-fourth to two-thirds of an ounce per pound will be accepted, as tastes vary, and the average preference seems to be for half an ounce, or from $2\frac{1}{2}$ to 3 per cent of salt remaining in the butter as placed in market.

Grading butter closely, or scoring it upon a scale of points, is a matter of individual judgment, but to secure figures which have any value for purposes of comparison, the work must be done by an expert. Such a comparison of the different lots sent to London by the Department, with the best from other countries found in that market, was much to be desired, made from the British standpoint of perfection. As already explained, the expert necessary for the purpose was not to be found in London. In place of such a comparison we only have the general expressions of merchants; those which have been quoted are in most cases very indefinite and contain no satisfactory comparisons. The few cases given and others in which comparisons were made, upon being merged in a "composite" form, seem to place the best States butter as second to the Danish, Swedish, and best French, and no more than equal to the best Irish, Australian, and Canadian. Yet a good many persons were entirely satisfied with our butter, and the evidence is conclusive that it was retailed to consumers in nearly all cases at the very highest prices for butter containing any salt.

The definite lessons from these transactions are not numerous, but the following conclusions and recommendations may be deduced, including some repetitions from the foregoing report upon the work:

The demand for butter of good quality in Great Britain and the steady increase in this demand offers a market for large quantities of the best creamery product of the United States.

The relative rates have been such for a number of years in the two countries that during the greater portion of every year it is probable that first-class butter can be profitably exported from America to England.

For a time, butter from the United States will be most acceptable in British markets to take the place of the large arrivals of fresh "Colonial" or Australian butter, which begin to fall off in April and do not recur until October. But this is a secondary position commercially and should not satisfy American ambition. There is no reason why butter from this country should not compete successfully with Canadian and Australian butter in the markets of the United Kingdom at all seasons of the year. Moreover, if the supply be made regular and the quality brought to a standard which may be easily attained and maintained, States butter is certain soon to take place,

in British estimation, as the equal of Danish and other supplies now ranking first.

The disadvantage of distance and the difficulties of transportation can be overcome. At present the facilities are better for delivering butter in Great Britain from Canada than from the United States. Effort will be necessary to improve the conditions in this respect, as already explained.

The local requirements of markets in different parts of England and Scotland will have to be further studied and care taken to prepare butter especially to meet these varied tastes, in order to insure success. As a rule, the British demand a butter freer from brine, more waxy in texture, firmer, or "better in body" than the average "extras" of the American creamery. For export butter, more time and care in making and packing are essential; less attention to securing a "quick" high flavor and more attention to good body. The flavor may be mild, rather slow in development, but should be "clean" and uniform month after month.

It seems probable that pasteurizing cream and the use of pure cultures for ripening will be well adapted to making successful export butter, and probably necessary where special skill in cream-ripening is lacking. The color in British markets is permitted to vary somewhat with the season, but very little artificial coloring is desirable at any time, and natural grass yellow is generally regarded as too deep. Some English markets prefer butter very pale, or a light shade of straw color. In salt there is almost as much difference in taste as in our domestic markets, with a tendency there, as here, to use butter with less and less salt.

For packages, nothing is now so acceptable as the rectangular or block form, modified by a slight taper to the four sides. The top is thus a little larger and the contents can be easily turned out ("stripped") in good shape. This pyramidal form has been adopted by the best Irish creameries. Next in favor stands the cubical box, used for two or three years in Australia, Canada, and the United States. Then follows the oblong box from New Zealand. All these packages should contain, when sold, 56 pounds, or a full half hundredweight of butter, but should not run to 57 pounds or over. The Danish kiel, or cask, is in special favor in Great Britain, simply because it is recognized as meaning good Danish butter. The chief objection to the American creamery tub has been already stated; also the fact that British buyers will not quarrel over shape and style of package, or even its size, if once convinced that the butter in it suits them.

Packages for export should be strong enough to stand a long journey and some hard usage; lumber five-eighths of an inch thick is none too heavy for cubical 56-pound boxes, or others similar. All packages should be well finished, with tight joints and well-fitted covers. Merchants prefer covers fastened with screws, but these

must not exceed six in number, as customs officers are impatient, and where covers can not be easily removed they break open the packages to be inspected. A better fitting cover for boxes than heretofore used, and some simple but efficient fastener, like the tub clip or fastener, are needed package improvements. Linings, sufficient and strong for protection, are essential. Burlap bags to cover packages, whether boxes or tubs, are advised, especially for exports made in hot weather.

Shrinkage must be provided for. The usual loss is about one-half of one per cent on the net weight; the range of loss one-fourth to three-fourths of one per cent. The Department investigations were not conclusive on this point, but if 57 pounds of weighed butter of suitable texture are packed into an export box, the net weight in any market of Great Britain, within a month's time, will be pretty certain to exceed 56 pounds and avoid allowance being claimed for short weight.

Success will doubtless reward the enterprise of anyone who will export fine butter in pound prints or convenient small packages for delivery unbroken to consumers, and press it persistently in London and other good English markets, but the desired end will be slow to reach. In such a venture it will be necessary to allow for shrinkage of weight on every small package, roll or print, as the market laws require full weight in all commodities at retail and are strictly enforced.

Export butter, if it is to have suitable transportation facilities and to be retailed when two to three weeks old, should be well chilled, but not frozen, before shipped from the creamery, and then carried to destination at a temperature held between 31° and 45° F. Care should be taken to avoid a rise above 50° at any time before exposure for retail.

For all lots less than a carload, special arrangements should be made in advance for proper attention by agents of transportation companies, to avoid delay and exposure of butter at transfer points; and unless the dispatch companies will perform like service efficiently at the place of export, and foreign consignees are of proved reliability, prudence demands the assistance of experienced export agents or brokers at the seaboard terminals. Experienced exporters must continue to conduct the bulk of our export trade for a long time to come.

It is evident that successfully to introduce fine creamery butter from the United States and establish a demand for it in British markets, with full recognition of its merits, there must be a considerable period of persistent effort, during which there will be some unsatisfactory results. English merchants of standing and in control of a reliable high-class trade must be interested in the effort and induced to act as agents for States butter. These agents must then be regularly supplied with butter uniform in quality and quantity and suited

to the markets they represent for seven or eight months in the year. The desired end will be sooner attained if the supply is continued throughout the year, whether or not the returns are satisfactory for all the months. No regular demand can be built up unless retail merchants of a desirable class can be continuously supplied, so as to secure and hold customers for the new line of goods; and the conditions must be constantly insisted upon that the butter shall be always marked, known, and sold as produce of the United States. In short, States butter will have to be introduced to Great Britain by enterprising, persistent, long-continued effort, supplying only the best, and always as States butter, just as a place for American beef was made in those same markets.

The Department can not establish this foreign trade in high-class butter or even commence it; but it may do something toward ascertaining the conditions which control such trade, present and prospective, and assist in making them known to many interested parties.

The results of the trials made during the year 1897 appear to justify a repetition of the experimental shipments in 1898 upon an enlarged scale and in a broader field, to include, besides butter, other perishable farm products which this country has to sell.

APPENDIX I.

EXPORTS OF BUTTER FROM THE UNITED STATES.

[Selected and representative fiscal years, ending June 30.]

Years.	Pounds.	Years.	Pounds.	Years.	Pounds.
1790.....	470,440	1870.....	2,019,288	1888.....	10,455,651
1800.....	1,822,341	1873.....	4,518,844	1890.....	29,748,042
1810.....	1,620,538	1875.....	6,360,827	1891.....	15,187,114
1820.....	1,069,024	1877.....	21,527,242	1892.....	15,047,246
1830.....	1,728,212	1878.....	21,837,117	1893.....	8,920,107
1840.....	3,785,993	1879.....	38,248,016	1894.....	11,812,092
1850.....	3,876,175	1880.....	39,236,658	1895.....	5,598,812
1860.....	7,640,914	1882.....	14,794,305	1896.....	19,373,913
1865.....	21,559,892	1885.....	21,683,148	1897.....	31,345,224

	Pounds.
For the twelve months ending December 31, 1896.....	27,220,218
For the twelve months ending December 31, 1897.....	30,914,783

APPENDIX II.

ANNUAL EXPORTS OF IMITATION BUTTER AND OLEO OIL FROM THE UNITED STATES.

Years.	Imitation butter.	Oleo oil.	Years.	Imitation butter.	Oleo oil.
	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
1884	1,537,682	37,785,159	1891.....	1,986,743	80,231,035
1885	761,938	37,120,217	1892.....	1,610,837	91,581,703
1886	928,053	27,729,885	1893.....	3,479,322	113,939,363
1887	834,574	45,712,985	1894.....	3,898,950	123,295,895
1888	1,729,327	30,146,595	1895.....	10,100,897	78,098,878
1889	2,192,047	28,102,534	1896.....	6,063,699	103,276,756
1890	2,535,926	68,218,098	1897.....	4,864,351	113,506,152

APPENDIX III.

IMPORTS OF BUTTER INTO THE UNITED KINGDOM.

[For the countries named and for the stated calendar year.]

Countries.	1886.	1890.	1894.	1895.	1896.	1897.
	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>
United States.....	42,390	84,553	29,996	66,932	141,553	154,196
Canada	31,522	24,318	20,887	38,949	88,357	109,402
Denmark.....	400,556	824,749	1,102,493	1,162,770	1,228,784	1,334,728
Other countries.....	1,069,098	1,094,097	1,421,459	1,557,011	1,579,253	1,619,475
Total	1,543,566	2,027,717	2,574,835	2,825,662	3,037,947	3,217,801

APPENDIX IV.

LIST OF SHIPMENTS, WITH DATES OF EXPORT AND NAMES OF CREAMERIES AT WHICH BUTTER WAS MADE EXPRESSLY FOR THESE TRIALS.

Ex- port.	Date.	Creameries.
I.	May 5	College Creamery, State Agricultural College, Ames, Iowa. Diamond Creameries, Monticello, Iowa. Hillside Creamery, Cornish, N. H.
II.	May 26	College Creamery, Ames, Iowa. Jersey Hill Creamery, Ryegate, Vt.
III.	June 16	Star Lake Creamery, Strout, Minn. Conway Creamery, Conway, Mass.
IV.	July 7	Hesston Creamery, Newton, Kans.
V.	July 28	Mount Pleasant Cooperative Creamery, Mount Pleasant, Ohio. Bentley & Son's Creamery, Circleville, Ohio. Jensen Creamery Company, Beloit, Kans.
VI.	Aug. 25	Sennett Creamery, Sennett, N. Y. Edmunds Creamery, Sherman, N. Y. Hilton & Nimmo's Creamery, Knapps, N. Y.
VII.	Sept. 15	Hoards's Creameries, Fort Atkinson, Wis.
VIII.	Oct. 6	College Creamery, Ames, Iowa. Vernon Creamery, Rockville, Conn.
IX.	Oct. 27	Big Stone Creamery, Big Stone City, S. Dak. Star Lake Creamery, Strout, Minn.

APPENDIX V.

EXAMPLE OF REPORT MADE UPON EVERY LOT OF BUTTER PREPARED FOR AND EXPORTED BY THE DEPARTMENT OF AGRICULTURE.

From College Creamery, Ames, Iowa. Lot A, of Export VIII, October:

1. The cows supplying milk to creamery are mostly grades. Shorthorn blood predominates.
2. During the time milk was produced from which this butter was made the cows were at pasture and without additional feed.
3. The whole milk is hauled daily to the creamery by the producers, the average distance hauled by the patrons being about five miles.
4. The cream is obtained by passing the milk through a De Laval separator immediately after reaching the creamery, at a temperature of 85° F.
5. The average per cent of fat in the milk received is 4, and in the cream, as separated, 23.
6. The cream is cooled to 75° F. and held from twelve to eighteen hours for ripening; the temperature meantime varies from 69° to 75°.
7. A portion of the cream was pasteurized, and to that, after cooling down, a homemade skim-milk "starter" was added.
8. Mann's test was applied to determine acidity of the cream, and the degrees noted as shown in churning record below.
9. No coloring matter was used. One-half ounce of salt used per pound of butter.
10. Working: The butter was worked two minutes, incorporating the salt, then allowed to stand in cool room for eighteen hours, worked a second time four minutes, and packed at once.
11. The skim-milk from separator was tested and showed barely a trace of fat. The buttermilk was tested and showed one-tenth of 1 per cent of fat.
12. Very warm weather prevailed during the days this butter was made—about 70° F. in the morning, and from 85° to 90° during the midday hours.

Churning report on butter made for Export VIII.

Information required.	Number and date of churning.		
	First, Sept. 27.	Second, Sept. 29.	Third, Sept. 30.
Milk separated at degrees F.....	85	85	85
Per cent of fat in cream.....	25	20	23
Cream ripened at degrees F.....	75	75	73
Acidity of cream at churning.....	37	37.2	38
Cream churned at degrees F.....	52	52	52
Buttermilk, temperature when drawn, degrees F.....	54	55	54
Length of time in churning, minutes.....	35	25	70
Butter washed, number of times.....	1	1	1
Wash water, temperature, degrees F.....	46	46	47
Butter worked, times.....	2	2	2

Description of packages as filled:

First churning: Tubs, A 1, A 2; spruce boxes, A 7, A 8; poplar boxes, A 13, A 14.

Second churning: Tubs, A 3, A 4; spruce boxes, A 9, A 10; poplar boxes, A 15, A 16.

Third churning: Tubs, A 5, A 6; spruce boxes, A 11, A 12, poplar boxes, A 17, A 18.

All packages of third churning, butter made from pasteurized cream.

Packages parchment lined: A 1, A 2, A 9, A 10, A 17, and A 18.

Packages lined with paraffine coating: A 3, A 4, A 11, A 12, A 13, A 14.

Packages covered with burlap sacks: Tubs, 1, 3, 5; boxes, 7, 9, 11, 13, 15, 17.

Weights, gross and net, of several packages as per list attached.

Butter well chilled in packages until October 1. Delivered to refrigerator car on Chicago and Northwestern Railroad at Ames, 7 a. m.; waybill 15; Pennsylvania Railroad car 41241; train No. 38; weather, cloudy; temperature, 69° F.

G. L. MCKAY, *Superintendent Creamery.*

AMES, IOWA, *October 2, 1897.*

APPENDIX VI.

PASTEURIZING CREAM FOR BUTTER.

INTRODUCTION.

In connection with preparing butter especially suited to export, the question arose as to the efficacy of pasteurizing cream for the purpose of improving the keeping quality of the butter and also of producing an article more uniform in texture and flavor. Upon inquiry it was learned that, although several creameries in different States had made some experiments in pasteurization both of the whole milk and the cream, none had fully adopted the system or acquired experience which gave definite results.

In the course of correspondence on the subject with different parties, the late J. L. Hoffman, president of the Hesston Creamery Company, of Newton, Kans. (also at that time president of the Kansas State Dairy Association), offered the use of his creamery, with its supplies and working force, for any experiments in pasteurizing which this Department might wish to conduct. This location, in a new creamery district, far distant from large markets either at home or abroad, and subject to extremely hot weather during its active butter-producing season, presented conditions particularly favorable for such experiments.

Accordingly, Mr. J. H. Monrad, of Winnetka, Ill., special field agent for the Dairy Division, was detailed to proceed to Newton, Kans., and supervise during the month of June a series of experiments in making butter for export from cream pasteurized for the purpose. Mr. Monrad approved the selection of the Hesston Creamery because it seemed desirable to make the experiments under normal conditions at a creamery of average character. If pasteurization proved desirable under such circumstances, it would emphasize the usefulness of the practice more than if much better results were obtained from experiments at a carefully managed dairy school or at some new and perfectly equipped creamery.

Considering season, place, and general conditions, it was not expected to make butter of the highest quality, but a good article was sought, suitable for export, and opportunity to make fair comparisons in the quality when fresh, and in the keeping properties, of considerable quantities of butter made from the same lot of cream, under good control, partly treated by usual factory methods and partly pasteurized.

Recognizing the difficulty of obtaining cold water in Kansas for cooling cream at separating stations and keeping it at a proper temperature during the haul to the central factory, Mr. Monrad had made the original suggestion at the State dairy convention at Abilene (1896) that it might be expedient to heat cream at stations immediately after separating, or to separate at a high temperature and haul the cream hot to the main factory, where pasteurization might be completed. Mr. Monrad was authorized, in connection with the other work proposed, to make a practical test of this suggestion.

The full report of this work follows. Although the bulk of butter made in these experiments passed at once out of his possession, was shipped to New York, and thence exported to London, the data regarding it was preserved and furnished to Mr. Monrad to embody in his report.

It is not felt that the results of these experiments in Kansas are at all conclusive, but they constitute an instructive contribution to experience in pasteurizing for making butter during the early stages of this practice in America.

H. E. A.

**Record of Experiments in Pasteurization made at the Hesston Creamery,
Newton, Kans., June, 1897.**

By J. H. MONRAD,

Special Agent of Dairy Division, Bureau of Animal Industry.

Pasteurizing cream for butter-making can not in itself be properly called an experiment, as the practical benefit of this system was long ago proved in Denmark and elsewhere. But the work to be here reported was truly experimental under the conditions which existed and bore upon it.

My first duty was to select the apparatus needed and set it up at the creamery. From previous study of the subject, I at once discarded all tank heaters and sought "continuous" appliances as being the only ones practical for creamery use. Of these but two were found on the market, being made and sold by A. H. Barber & Co. and by the De Laval Separator Company. Each firm generously placed an outfit at my service, free of charge. These were forwarded to Newton, and I followed, reaching that place the 8th of June. Before reporting the experiment I give herewith a short description of the creamery and its regular system of butter-making.

THE NEWTON CREAMERY.

The milk is taken from an elevated driveway and dumped into the weigh can, which is on a small platform, high enough to run it into the milk vat. The latter is on a lower and larger platform in the separator room; on the same platform is also the cream vat for receiving the cream from the ten skimming stations connected with this factory.

From the receiving vat a 1½-inch pipe 8 feet long conducts the milk to the milk heater and thence to the separators. There are two separators of the Alpha No. 1 pattern, which are on the same level as the cream room. The door to the latter is near the separators and the cream is carried in 10-gallon cans to the ripening vats in that room.

In the separator room is the wash tank, the 15-horsepower engine, and a No. 3 Barber refrigerator compressor. The boiler room, with a 20-horsepower boiler, is on a lower level, and still lower is the cellar. Here is the churn room with two combined churns and workers (a Disbrow and a Fargo) and also a Mason worker. Also in this basement and under the cream room is the printing room, 14 by 12 feet; an ante-storage room, 14 by 8 feet; and the refrigerator, 14 by 15 feet—all cooled with direct expansion coils.

In the churn room the floor is of fine flagstones, but not being laid in cement some of the smell in the room may have been caused by seepage into the sand on which the stones rest. In one corner is a sink hole from which the buttermilk, as well as washings, etc., are pumped into two large elevated tanks outside; from these the washings are hauled and scattered over a field, the city authorities having prohibited the use of an adjacent sluggish creek as means of drainage. This is not only a very unlucky situation, but an expensive arrangement, and the owners have a very difficult problem to solve. Indeed, the solution may lose the

town of Newton the creamery, with its appendix of a large cash trade from the patrons, as it would be cheaper to build anew elsewhere than to provide a private sewer for a long distance.

Above the churn room and just opposite and on the same level as the separators is a storage room and in it the pump which raises the drainage to the outside tanks. This room was the only space available for the pasteurizing apparatus, and the smell from the pump was kept down by repeated rinsings with limewater. The creamery company kindly allowed me to pull down the partition between this and the separating room, giving better access and more fresh air.

The cream room, 15 by 35 feet, is newly built, well insulated, and has a brine tank, 6 by 11 feet and 30 inches deep, suspended close under the ceiling. The temperature of this room was from 52° to 55°¹ during the week, running up to 60° or 62° Sunday evening when the compressor had not run after 12 o'clock Saturday night. In this room are ten vats U-formed, made of tinned copper; they are 10½ feet long and 2 feet wide and hold about 1,500 pounds. There are no cooling jackets to the vats, and, cooling by air being too slow, ice is put directly into the cream. The vats are placed one a little higher than the other, so that enough slant may be given to the conductor which leads the cream to the churns below. A rotary pump circulates the brine (when desired) through a Bair copper cooler, and over this the cream flows between the receiving tank and the vats in the cream room.

In one test, the cream, flowing at the rate of about 1,200 pounds per hour, was cooled 10°, but the company has secured two more coolers of same size and will thus have better control of cream received from outlying stations.

The system of working is as follows: At 6 a. m. the day force arrives. W. S. Andis takes charge of the boiler, engine, compressor, and the separators. S. W. Hank receives the milk, which comes in slowly at first, and so much so, indeed, that it is often half past 8 before separating can begin. In the cellar the chief butter maker, D. S. Brandt, prepares for work in the printing room, while his son makes shipping boxes, and in the churn room J. R. Lewellen and N. P. Reed take turns at churning and helping in the printing room. As a rule, the churns are full of cream in the morning and often one has been already churned by the night man, C. S. Stouffer.

Let us first follow the work of Mr. Andis. He starts the deep-well pump, which gives an alkaline, salty water, and runs this over the Bair cream cooler, filling one of the cream vats with water at 52° or 54°, ready to be used for washing the butter by running it into the churns by the cream conductor. He starts the separators and carries the cream into the vat, where it is allowed to cool, ripening without a "starter." About 11 o'clock the separating is finished and then he cleans his separators. In the afternoon he helps Mr. Hank in cleaning the cream cans as they come in.

The first load of cream arrives at 1.30 or 2 p. m. and is dumped through a large fine wire strainer into the receiving vat and run over the cooler, being, as a rule, reduced to 66° or 70°. This is also allowed to ripen without a starter, and is indeed often half ripe before it arrives; acidity in one case was 21.5 cc. When there is any half-churned lumpy cream left on the strainer it is melted in a water bath and stirred into the cream.

The rest of the afternoon is occupied by the two men named in receiving cream, cleaning cans, and cleaning upstairs. Mr. Andis also has his boiler and engine, etc., to attend to.

The night man keeps the compressor running and receives cream, which comes in as late as midnight, washes the cans, and cools the cream by putting crushed ice in it and stirring. This cream, as a rule, stands at 55° or 56° in the morning,

¹ Fahrenheit thermometer in all cases in this report.

at which temperature it is run into the churns. The acidity of the cream churned the first day of my visit was 20 to 23 cc. by the test. The buttermilk was 60° to 61°, showed an acidity of 31 to 33 cc., and was quite salt from the previous churning.

After drawing the buttermilk, the granules are washed with the water cooled as described above, salted with one ounce salt, and worked in the churn from two and a half to three minutes. It is then left thirty to sixty minutes and given a second working, this time six to eight revolutions on the Mason worker, and then either packed in tubs or boxes or taken to the other room to be made into prints or rolls. The refrigerator is kept at about 42°.

I at once set about ascertaining the acidity of the milk as delivered at the creamery and the general conditions there under which the work must be done. To my great regret both were found less satisfactory than expected. The acidity of the milk as determined by the Mann test (one-tenth normal to 50 cc.) varied from 9 cc. to 20 cc., the average of the last in the vat being 16 cc. But the cream as it came from the separator showed 8.5 cc. at 10 a. m., 9.6 cc. at 11.15 a. m., and 10.6 cc. at noon, when the separating was finished; consequently I had no fear of being unable to pasteurize it.

The creamery possesses an ice machine and has a very fine cream room, but part of the building is old and the churn room is located in the basement, where the air is musty. I saw no way of giving pasteurization a perfect test unless a complete annex was newly built and equipped, but undertook to improve existing conditions.

On the 14th we unpacked and commenced placing the apparatus, and I also tested the milk and cream for acidity. The temperature in the shade was 95° and the acidity of the first can of cream was 9 cc., the second 10 cc., the fourth 12 cc., and the last 14 cc. The smell in the churn room was somewhat improved by the use of lime and an improved ventilating fan in one window, but anyone conversant with pasteurization will acknowledge I had a right to be discouraged.

Indeed, I wrote to Jensen Bros., of Beloit, Kans., asking them to let me know the acidity of their cream, whether the conditions were right at their creamery, and whether I would be welcome if I decided to move there. This was done pending the effect of the following circular letter which I sent to the patrons of the Hesston Creamery Company:

NEWTON, KANS., June 15, 1897.

To the patrons of Hesston Creamery:

DEAR SIR: The Agricultural Department at Washington is about making an experimental shipment of butter from this creamery.

In order to give it keeping quality the cream is to be pasteurized (heated to 160° and cooled).

I regret to say that I find nearly all the milk delivered too sour for this purpose, and hence I ask the favor of your help for two weeks by taking a little extra care.

First, in cleanliness in milk; next, in the care of the cans. They should be emptied at once and rinsed with cold or lukewarm water, then scrubbed with soda or lye water, rinsed again, and finally rinsed with boiling water and placed without wiping in a slanting position (bottom up) where the air is pure.

Same care should be taken in cleaning milk pails, strainers, etc.

When milking, place the shipping can in cold water and leave the cover off, stirring often, until the milk is as cold as the air, then cover.

The morning's milk should also be cooled, even if only for twenty minutes. If stirred or dipped, that will be a great help.

When hauling the milk cover the cans with a wet blanket and keep it wet until delivered.

By doing this you will serve your own interest and not compel me to give up the experiment and report that the Kansas farmers can not deliver milk sweet enough for this purpose.

Hoping you will help me all you can for a couple of weeks, I remain,

Yours, truly,

J. H. MONRAD,

Field Agent, Dairy Division, U. S. Department of Agriculture.

Meanwhile I tried to pasteurize the cream as it was and made some preliminary churnings, the details of which will be given later.

From Jensen Bros. I received by wire a hearty invitation; but the following letter showed me that the average condition of the milk received at Beloit was no better than at Newton :

. THE JENSEN CREAMERY COMPANY (ESTABLISHED 1894),
Beloit, Kans., June 17, 1897.

Mr. J. H. MONRAD, *Newton, Kans.*

DEAR SIR: Your letter of June 16 received, and note all you say. I wired you this morning: "Come here sure; will do everything to make the experiment a success; have a pasteurizer." Of course, we will have some difficulties, but we will arrange it all right. We don't take milk on Sundays generally, but should think we could for this purpose and have the whole creamery to our disposal during the experiment. We will have plenty of milk, as we receive 40,000 pounds per day here, and I could notify our best customers to fetch that day. I have Mann's acid test. I tested the cream from the separator this morning and it took 12 cc. to give it the red color. This sample cream was taken at about 10 a. m. Yesterday and last night we had thunder and cyclone weather, it being over 100° and a warm wind blowing. Under ordinary conditions we can get the cream all right. We are pasteurizing 50 gallons every day for a starter, and sterilizing all our skim milk. Ought to be able to pasteurize the cream. We have not got a small cream vat, but can get one. We have got a regular cream cooler. Will help you myself and supply whatever you need. Have got pipe-fitting tools and fittings. Hope that you will decide to come here, as I am very much interested.

Yours, very truly,

THE JENSEN CREAMERY COMPANY,
By W. F. JENSEN.

While we might have selected the best milk, it would not fill the demand for a practical test if we did so. Hence the only choice was to give up the experiment or try it under the existing conditions. Although it was evident that the best results could not be obtained under these circumstances, the condition of the cream (testing as high as 13 cc.) after being pasteurized, encouraged me in the belief that some practical value might be extracted for the benefit of the creamery men, even if the butter made under my direction did not score high enough to be creditable. I was also encouraged by having read the claims made by some experimenters in this country that improvement resulted from pasteurizing cream gathered twice a week, and completely sour.

As will be seen, the work done here under my direction is nothing more than can be easily done at any creamery having plenty of ice or a refrigerating machine; indeed, it was more difficult here than it would be if the creamery was pasteurizing regularly from day to day.

SETTING UP THE APPARATUS.

It was hoped to arrange the pasteurizers so as to catch the cream from the separators and run it directly over the coolers, but this could only be done by using a dark corner in the churn cellar, where the air was not good enough to expose the cream on the coolers, and where the heat from the heaters would be objectionable. I also suspected, what was proved later on, that both machines were of too great capacity for the heat to be kept down between 155° and 165°. Consequently the storage room was selected, just opposite the separators, and we removed the partition.

The Barber apparatus was placed as shown in fig. 4, the only difference being that there were four Bair coolers instead of three.

The heater, a cross section of which is shown in fig. 5, consists of a cast-iron base *I*, in which a turbine flyer (*ff*) is inserted and driven by steam from the pipe *fs*. It also has a pipe *T* for the exhaust, but this is, as a rule, closed by the damper *K*, when not less than 1,000 pounds of milk per hour is treated.

G is a galvanized cylinder riveted to the base and provided with an annular tin gutter *H*. *D* is a slightly conical tinned copper drum soldered to a tinned brass

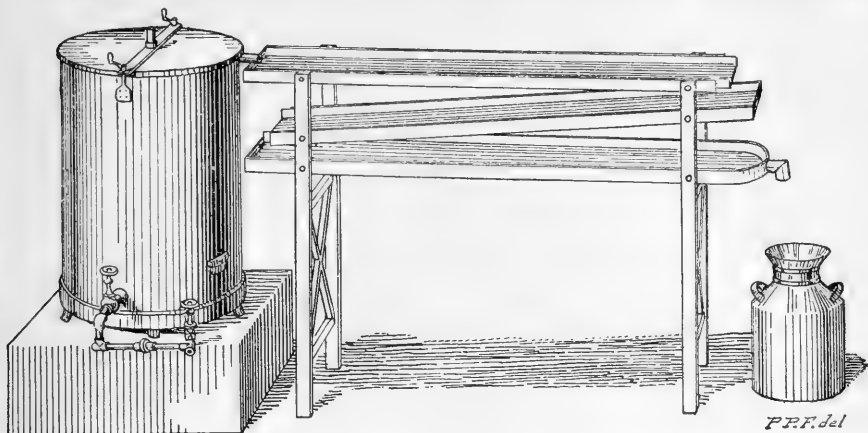


FIG. 4.—Barber pasteurizing and cooling apparatus.

bottom with a spindle which fits in the cup *C*, revolved by the turbine flyer *ff*, running on ball bearings. Drum *D* is strengthened by a hoop at the top, into which

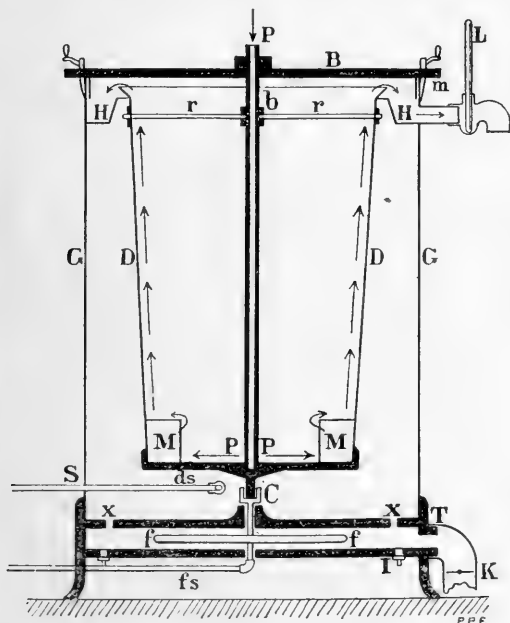


FIG. 5.—Cross section of heater for Barber apparatus.

is riveted a cross (*r*) of four rods, which again brace the 1-inch pipe *P* that acts as spindle for the drum. The cylinder *G* has a flat cover with a crossbar *B*, which is held in position by two thumbscrews *m*. In the center of this bar is the upper bearing. The cream enters at *P* (the hollow shaft) and is distributed from four holes at the bottom, but the chamber *M* (which was

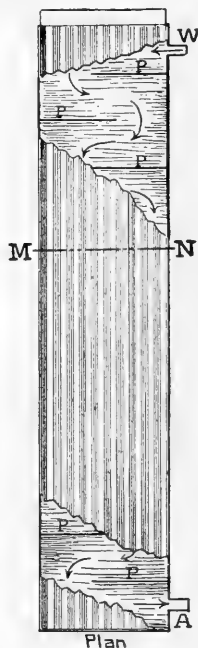


FIG. 6.—Bair cooler.

ing back any possible dirt when heating new milk) is not used in the cream heater. The cream flows in a thin film all the way, as shown by the arrows, and is thrown into the gutter *H*, leaving through the spout arranged with a thermometer at *l*. The exhaust steam from the flyer *ff* passes up through six holes *ax* into the cylinder and is the usual medium for heating the drum *D*. The pipe *S* supplies direct steam for this purpose, in addition, if needed.

I had no regulating cup, and simply placed a tin can holding about 16 gallons on a shelf above the heater and ran the milk from that through a faucet with a

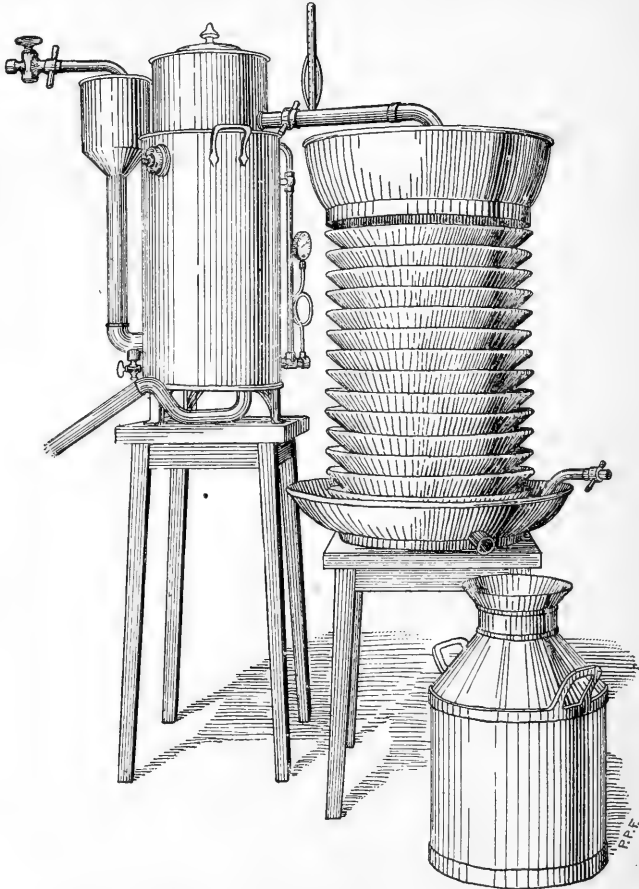


FIG. 7.—The De Laval pasteurizing and cooling apparatus.

pointed nozzle which fitted into the hollow spindle. Into this can we had to dump the cream, and the uneven pressure thus created made constant watching a necessity, in order to keep an even temperature. The apparatus should not be used without a regulating cup of some kind like those used for separators.

The Bair cooler (fig. 6) is in this case 8 feet long and 18 inches wide, like a wide, shallow gutter with a corrugated bottom, shown in the cross section *NM*, and a double bottom where the cooling water circulates in an alternating current, caused by the partitions *PP*. The water flows as shown by the arrows on the sketch, entering at *W* and escaping at *A*. The milk or cream flows over the top and, of course, in the opposite direction.

These coolers were given a drop of only about 2 inches, having a total drop from heater spout to the cooler spout of 18 inches. The two upper coolers were made of tin and connected with the overflow from the condensing tank of the refrigerator, the water showing from 80° to 85°, and the two lower (made of copper) were connected with the Bair cooler in the cream room and the rotary pump, so that brine could be turned on at will. The brine was, as a rule, at a temperature between 30° and 32°.

The De Laval apparatus.—This neat and well-made apparatus, imported from Sweden, was placed next to the Barber in a similar manner, as shown in fig. 7. Soon after it became necessary to remove it to a skimming station.

The heater, a cross section of which is shown in fig. 8, is explained by the following key:

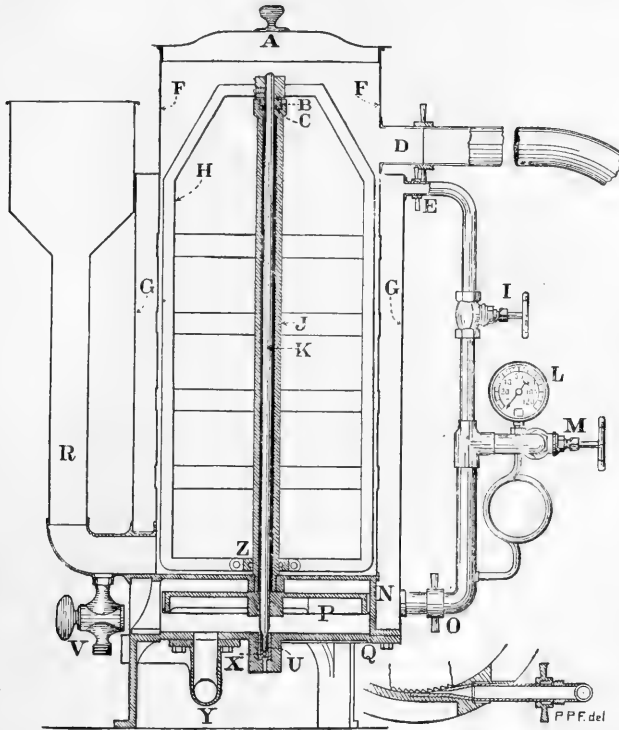


FIG. 8.—Cross section of heater for De Laval pasteurizing apparatus, with connecting pipes.

- | | | |
|----------------------------|-------------------------------|---------------------------|
| A—Cover. | I—Three-eighths-inch valve. | Q—Bottom plate. |
| B—Nut for balls. | J—Tubular shaft. | R—Feed pipe for milk. |
| C—Steel balls. | K—Shaft. | U—Footstep bearing. |
| D—Discharge pipe for milk. | L—Manometer (pressure gauge). | V—Milk-outlet faucet. |
| E—Pipe union. | M—Three-fourths-inch valve. | X—Steel ball for bearing. |
| F—Milk can. | N—Turbine housing. | Y—Outlet tube. |
| G—Mantle. | O—Pipe union. | Z—Center for stirrer. |
| H—Stirrer. | P—Turbine. | |

In operating this apparatus the cream and the steam are turned on at the same time, and when a pressure of 45 pounds is maintained the right speed of the dasher (stirrer) H is obtained. When finished, the remaining cream (about 5 or 6 gallons) is drawn out by the faucet (outlet tube) Y. No oiling is required, as the bearing runs in water from the condensed steam, which is held back by a water lock. Direct steam may be applied by the valve I.

The disk cooler, which is shown in fig. 7 as accompanying the De Laval pasteur-

izer, has a distributing cup considerably smaller than the one shown in fig. 7, and it is at the same time to some extent a regulating cup, as it may be adjusted to distributing various quantities of cream. The cooler is really more like the one shown in fig. 9, and consists of a series of disks over which the cream flows in

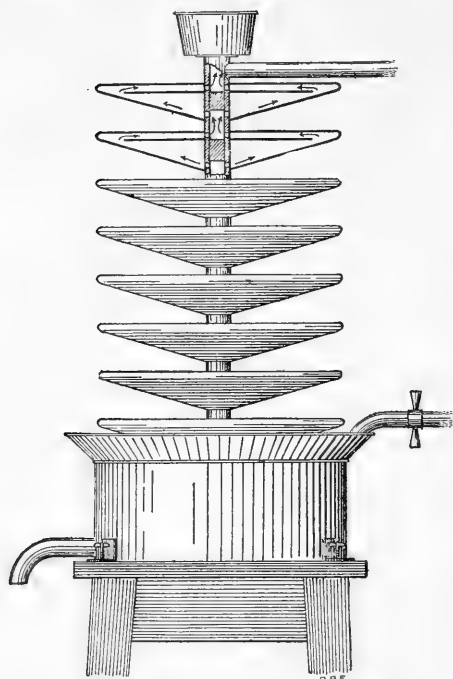


FIG. 9.—Elevation of disk cooler, with section through the two upper disks.

thin sheets, the cooling water (in this case brine) flowing inside the hollow disks from the bottom to the top.

When the under vessel is placed fairly level, the cooling cylinder may be leveled perfectly by the three set screws in its supports.

This cooler was also connected with the brine tank and pump, and, small as it is (only $14\frac{1}{2}$ inches in diameter and 14 inches high, with eight disks and a total drop of 24 inches), its cooling capacity astonished all who saw its work.

PRELIMINARY CHURNINGS.

As it seemed unlikely, at the first attempt, to do justice to either the system or the apparatus used, under these conditions, novel and far from perfect, I arranged for a few preliminary churnings, and Messrs. A. H. Barber & Co. kindly consented to take the butter from these churnings and keep it for tests as to keeping quality, I agreeing to stand half of whatever loss might result.

First churning.—June 17 the first four 10-gallon cans of cream separated at the factory were pasteurized on the Barber outfit, the temperature being kept between 155° and 165° and cooled to 62° . The acidity of the first can was 9 cc. and of the fourth 14 cc. At 11 a. m. the pasteurized cream was dumped in a small cream vat (with cover) placed in the cream room and 10 per cent of a starter made (according to directions) from Hansen's lactic ferment. The acidity of this starter was 54 cc., and the flavor did not suit me perfectly (having been developed at too high a temperature), but I had to use it.

At 6 p. m. the pasteurized cream tested 17 cc. acid at 62° , and next morning 20 cc. Having cooled it to 55° with crushed ice in the cream, it was churned in 48 minutes, the buttermilk being 59 , with an acidity of 30 cc. It was washed once with the deep-well water, cooled at 54° , and salted and worked in the manner usual at the creamery. The only precaution taken was to rinse the churn and butter worker with iced limewater, of which I had two barrels prepared.

It may be in order here to put in a strong plea for a more common use of limewater. Get a barrel or hogshead and fill with clean water; stir into this unslaked lime enough to make an inch or two of sediment form after settling; stir up two or three times, then let it settle, and use when clear as crystal. Rinse everything used with this, after the usual cleaning and before using; and never mind what adheres to the churn after draining, as it will not hurt the butter.¹

¹The cleansing properties of lime and limewater can not be doubted. But this advice to add more or less limewater to cream in the churn ought to be further explained and qualified.—H. E. A.

This butter was salted with one ounce of salt per pound and packed in 60-pound tubs. It was scored by Messrs. Barber and Mittelstadt on the 28th of June on this scale: Flavor 50, grain 30, color 10, salt 10 = 100 points. Marked: Flavor 44, grain 29, color 10, salt 10 = 93 points.

Second churning.—June 18, the best milk I found for pasteurizing for starter tested 12 cc. This time I took every other can of cream from the separator, and my fourth can had 14 cc. acid; the pasteurized cream, before adding the starter, was 12 cc., and 63° in temperature. The starter used had an acidity of 49 cc. and showed a little better flavor than on the day previous.

At 5.30 p.m. the temperature of the cream was 62° with 17 cc. acidity, and the next morning (5 o'clock) the same temperature with an acidity of 26 cc. Cooled with ice in the cream to 48°, but the churn heated it up to 53° by the time gas was let out, and it churned in twenty-five minutes, buttermilk being 56° with acidity of only 29 cc. It was worked and salted the usual way, and scored, June 28, flavor 45, grain 29, color 9½, salt 10 = 93½ points.

I believe that the higher acidity produced a gain of one point in flavor.

A tub made from the unpasteurized cream of same day's separating (every other can) scored 44, 28½, 9, 10 = 91½ points.

July 1, Mr. Sleighton, of Manchester, and Mr. Barton, of Chicago, looked at these two tubs, and while Mr. Sleighton thought there was not much difference, Mr. Barton declared the pasteurized to be considerably better than the other.

July 2, Mr. W. D. Collyer, of Chicago, scored them 97 and 97½, giving one-half point in favor of the unpasteurized on flavor.

Third churning.—On the 19th there was a little improvement in the milk, some of the patrons having evidently taken notice of my circular letter. The milk used for starter tested only 10 cc. The cream from 9 to 13 cc., and this was heated to 160° in the De Laval heater and cooled to 68°, this being the lowest the cooler could bring it at the flow (1,200 pounds per hour) needed to keep the temperature down to 160°.

As no work is done at this factory on Sundays, I ran the cream over the cooler twice, getting it down to 51°. The pasteurized cream showed 11.5 cc. acidity at 2 p.m., and Sunday at 10 a.m. 12 cc., temperature 56°. At 5.30 p.m. the cream room was 59°, the pasteurized cream 56°, with 18.5 cc. acid, while the regular corresponding cream was 51°, with 26.5 acid.

Monday morning the acidity was 26 cc.; the cream was cooled but not churned till 2 p.m. (when the acidity was 27 cc.) at a temperature of 55°. It took one hour and seven minutes to churn, and the buttermilk was 58°, with 33 cc. acidity.

A tub was selected by the butter maker, Mr. Brandt, from his regular product of the day, to compete with this churning, and the comparative scoring of these two, June 28, was as follows:

Pasteurized—flavor 45½, grain 29, color 9½, salt 10 = 94 points; regular—flavor 42½, grain 28, color 9½, salt 10 = 90 points. On July 2 Mr. Collyer scored them with this result: Pasteurized—flavor 41, grain 30, color 9, salt 10 = 90 points; regular—flavor 40, grain 30, color 9, salt 10 = 89 points.

Fourth churning.—The milk delivered Monday, June 21, was somewhat improved, the last can of cream being 11.5 cc., the milk used for starter 11 cc., and the worst milk accepted 23 cc., whereas on a previous day 30 cc. had been taken in. The cream was taken alternately from the two separators, one to the regular vat and one set aside for pasteurizing. When four cans of each were secured the half for pasteurizing was heated to 160° and then cooled to 65°.

The starter was added, and at 6.30 p.m. the cream was 64°, with 13 cc. acidity. Next morning at 6.30 it had the same temperature and 23 cc. acidity. It was drawn into 8-gallon cans, set in ice water at 11.30 a.m., with an acidity of 26 cc. and cooled to 54°, but owing to one of the combined churns breaking down it was not churned till 5 p.m., being then at a temperature of 54° and acidity 27.5

cc.; time of churning, forty-five minutes; buttermilk being 61° , with 31 cc. acidity. The temperature in churn room was 79° . This churning was salted with only three-fourths of an ounce of Genesee salt and packed in export boxes.

A control tub of 20 pounds was scored by Messrs. Barber and Mittelstadt on July 1: Flavor $46\frac{1}{2}$, grain 29, color $9\frac{3}{4}$, and salt $10 = 95\frac{1}{2}$ points. Mr. Collyer scored it on the 2d, flavor 44, grain 30, color $9\frac{1}{2}$, salt $10 = 93\frac{1}{2}$ points.

The unpasteurized cream had been treated the usual way, dumped in the cream vat as it came from the separator at 85° , and allowed to cool gradually to 62° , when plenty of ice was put in. On the morning of the 22d it had a temperature of 54° and acidity of 26 cc.; was churned at 53° in one hour and ten minutes, the finishing temperature being 57° . This was also salted with three-fourths of an ounce of Genesee salt. The scoring box of this "regular" churning was examined by Messrs. Barber and Mittelstadt and marked—flavor 42, grain $28\frac{3}{4}$, color $9\frac{1}{2}$, and salt $10 = 90\frac{1}{2}$ points; and by W. D. Collyer—flavor 33, grain 30, color 9, and salt $10 = 87$ points.

EXPORT CHURNINGS.

First churning, June 23.—Milk delivered on June 22 was decidedly better; the milk haulers nearly all had blankets over the cans, and milk used for starter showed 11 cc. acidity; the first can of cream 8.5 cc. and the last only 10.5 cc. Pasteurizing was done at 11.30 a. m., but the cream was not started till 2 p. m., as there was only one cream vat. At 6 p. m. it had 17 cc. acidity at 64° , and next morning at 6 o'clock 22 cc. at 63° , and at 11.30 a. m. 25 cc. at 62° . It was cooled in cans, as before described, and churned at 5 p. m. in fifty minutes at a temperature of 51° . The buttermilk was 59° , with an acidity of 31 cc.

The butter from this churning was packed in export boxes and was scored in New York by Mr. W. H. Healy, scale and results as follows: Scale: Flavor 40, grain 30, color 15, salt 10, package 5 = 100. Marked: Flavor 33, grain 30, color 14, salt 10, package 5 = 92.

NOTES.—Lacks flavor, but clean to taste; body good; color mottled.

The unpasteurized cream, handled the usual way, churned at 51° , buttermilk 61° , with 29 cc. acidity, made butter which was scored in New York by Mr. Healy, with the following comparative record: Marked: Flavor 31, grain 29, color 13, salt 10, package $4\frac{1}{2} = 87\frac{1}{2}$.

NOTES.—Flavor not clean, bitter. Body short; grain little salvy; color badly mottled; salt good; packing "slack."

Second churning, June 24.—Having found it impossible to get enough butter for three export boxes of each kind, apart from desired control boxes, I consulted with Messrs. Hoffman and Lewelling; and as they, as well as Mr. Brandt, declared that cream sent in early by express from a skinning station would be fully as good as the home cream, it was decided to have this done in order to eke out the unpasteurized cream and to pasteurize enough.

Milk received on the 23d was even better than that of the previous day, the first can showing only 7.5 cc. acidity and the third one 8 cc. The pasteurized cream was started in the usual manner, with about 8 per cent starter of an acidity of 49.5 cc., and next morning, at 5 o'clock, it was 63° , with 27 cc. acidity, increasing to 28 cc. at 9 a. m. Then it was set to cool, and churned at 3 p. m. at 49° in one hour and fifteen minutes, the buttermilk being 56° , with 34 cc. acidity. This butter was packed in boxes and scored in Chicago by three inspectors, and averaged—flavor $42\frac{3}{4}$, grain 29, color $9\frac{3}{4}$, and salt $10 = 91\frac{5}{2}$ points.

The corresponding unpasteurized cream was churned at 52° in thirty-three minutes, buttermilk being 60° , with 26 cc. acidity. The boxes of butter made from this were scored—flavor, $40\frac{1}{2}$, grain $28\frac{5}{8}$, color $9\frac{3}{4}$, and salt $10 = 88\frac{5}{8}$ points.

Third churning, June 25.—Acidity of the cream pasteurized was: First can, 8.8 cc.; the fourth, 10 cc., and the last, 12 cc. The cream next morning (25th), 6 o'clock, was 63° , with 29 cc. acidity, increasing to 30 cc., when it was cooled and

churned at 47° in fifty-seven minutes; buttermilk, 54°, with 38.5 cc. acidity. This butter scored—flavor 44 $\frac{1}{2}$, grain 29 $\frac{3}{8}$, color 9 $\frac{3}{8}$, and salt 10 = 93 $\frac{3}{8}$. The unpasteurized butter, which was churned at 52° in fifty minutes, with buttermilk 57°, and acidity 24.1 cc., scored—flavor 40 $\frac{3}{8}$, grain 28 $\frac{3}{8}$, color 9 $\frac{3}{8}$, and salt 10 = 88 $\frac{3}{8}$ points.

Fourth churning, June 26.—Friday, the 25th, I pasteurized the whole run of cream, dumping it into one of the regular vats and starting it with fully 10 per cent of starter. Mr. Brandt took charge of it, and it was cooled the next day by direct ice, acidity 28 cc., and churned at 49° in one hour, the buttermilk being 56° and 30 cc. acid. Of this a box was scored by three persons in Chicago, the average results being—flavor 44, grain 29 $\frac{1}{8}$, color 10, salt 10 = 93 $\frac{1}{8}$ points. For comparison, Mr. Brandt selected a tub from the regular make of the day, and this was similarly scored, its record being—flavor 42 $\frac{5}{8}$, grain 28 $\frac{5}{8}$, color 9 $\frac{5}{8}$, and salt 10 = 91 points.

SHIPPING HOT CREAM.

Fifth churning, June 28.—Having tried the De Laval heater once at the creamery, I then had it taken to the Halstead skimming station and prepared for heating cream there. On the 26th we drove over at 4 a. m. and set it in place. Knowing it would take care of more cream, I had requested Mr. Lewellen, in charge of the separators, to change them so as to give me more and thinner cream, and the heater was placed so as to catch the cream as it came from the two Alpha separators, there being just drop enough to place a cream-carrying can under the heater. We decided to divide the cream so that the first carrier was left unheated; the next three were heated and the last two not heated. This was fair enough, so far as the acidity was concerned, as the first can was 10 cc. and the last one only 11 cc.

It turned out that the temperature could not be kept below 170°, but I did not object to this, because it became a severer test as regards the "cooked" flavor, which I feared would result from not immediately cooling the cream after pasteurizing.

By 10.30 o'clock we had finished skimming and the cream hauler was ready to start. The three heated cans then showed 150°, 155°, and 158° temperature, the cans having cooled the cream that much. The unheated cream was 82°, also in three cans.

The cream arrived at Newton at 1.05 p. m. in good condition, the three heated cans at 138°, 140°, and 142°; this cream was immediately run over the Bair coolers and reduced to 64°.

The unheated cream was 85°, 84°, and 88°, the last being the carrier next to those containing the hot cream. This cream was somewhat churned and was treated the usual way, being run over the factory Bair cooler, reduced to 66°, and tested 21.5 cc. acidity at 3 p. m.; at this time the pasteurized cream tested only 8.5 cc. Starter was then added (8 per cent) to the latter, and next morning (Sunday), 7 o'clock, it had a temperature of 63° and 26 cc. acidity. At 11 a. m. it was 62° with 29 cc. acidity, and it was chilled to 52° in 8-gallon cans placed in ice water; but I also put in a couple of pounds of ice in each can. At 4 p. m. it was 46°, and Monday morning the acidity had only advanced to 31 cc. The churning was started at 50° and finished in one hour, with buttermilk at 59° and acidity 34.5 cc.

It must be observed that this cream hauled hot had, when cooled, considerably more "cooked" taste than the cream heated in Newton and cooled at once, but it is uncertain whether this was due to the higher heat or to keeping it hot for about three hours. As the ripening process went on the cooked flavor seemed to diminish, but both Mr. Lewellen and myself imagined we could detect it, even in the butter. Yet three days later, when asked about any peculiar flavor, none of the judges could find this cooked taste. This butter scored—flavor 43 $\frac{1}{8}$, grain 29 $\frac{3}{8}$, color 9 $\frac{3}{8}$, salt 10 = 91 $\frac{5}{8}$ points. The unpasteurized cream was churned at 53° in thirty-five minutes, buttermilk being 59°, with acidity of 28.5 cc. The butter scored—flavor 43 $\frac{1}{8}$, grain 29 $\frac{1}{8}$, color 9 $\frac{3}{8}$, salt 9 $\frac{5}{8}$ = 91 $\frac{3}{8}$ points.

THE PACKAGES.

It was the plan to have the boxes prepared in sets of three—one with paraffin, one with Dowdell's enamel, and one unprepared. I had ordered spruce boxes, these being in my estimation the best looking, but through a misunderstanding I received poplar boxes, uncrated and unburlapped, dirty, and short count, and had to do as well as possible with these. In applying the paraffin it was found essential to have the boxes perfectly dry and warm; with these conditions it gave a satisfactory coating. The Dowdell enamel was contributed for trial by its inventor, Mrs. F. D. Shaw, through the agency of F. A. Tripp. It seems to give a very nice coating, but is too complicated in its application to be practical in a creamery. It is not unlikely, however, that this difficulty can be overcome later.

The first six boxes being thrown out, some spruce boxes from the home supply of the factory were substituted, and thus I to VI, IX, and XII were untreated spruce; VII, X, XIII, XVI, XIX, and XXII were untreated poplar; VIII, XI, XIV, XVII, XX, and XXIII were paraffined poplar; and XV, XVIII, XXI, and XXIV were treated with Dowdell enamel.

GENERAL REMARKS.

These experiments, made under many difficulties, are not claimed to have been exhaustive enough to have scientific value, but they at least indicate what may be done in this line, and may encourage creamery men to follow up the matter. The results of pasteurization in these trials is best shown by comparing the scoring records of the different lots of butter, pasteurized and not pasteurized, as given in the table following:

Table of comparative scorings of butter, pasteurized and unpasteurized, made as per report.

Dates of churning.	First scoring, June 28 and July 1.					Second scoring, July 23.					
	P. a	Scale and points.					Scale and points.				
		Flavor, 50.	Grain, 30.	Color, 10.	Salt, 10.	Total score, 100.	Flavor, 50.	Grain, 30.	Color, 10.	Salt, 10.	Total score, 100.
1897.											
June 18.....	P.	44	29	10	10	93	39½	29½	9½	10	88½
19.....		41	29	9	10	89	36	29½	9½	10	84½
19.....	P.	42½	29½	9½	10	90½	38½	29½	9½	10	87½
20.....		41½	28½	9½	10	89½	35½	29½	9½	10	83½
20.....	P.	44	29½	9½	10	92½	40	29½	9½	10	89
22.....		40½	29½	9½	10	89½	37½	29½	9½	10	86½
22.....	P.	45½	29½	9½	10	94½	41	29½	9½	10	90
24.....		40½	28½	9½	10	88½	35½	29	9½	10	83½
24.....	P.	42½	29	9½	10	91½	38½	29½	9½	10	87½
25.....		40½	28½	9½	10	88½	36	28½	9½	10	84½
25.....	P.	44½	29½	9½	10	93	38½	29½	9½	10	86½
26.....		42½	28½	9½	10	91	37½	29	9½	10	85½
26.....	P.	44	29½	10	10	93½	38	29½	9½	10	86½
28.....		43½	29½	9½	9½	91½	38½	29½	9½	10	86½
28.....	P.	43	29½	9½	10	91½	37½	29½	9½	10	86½
Average for pasteurized					92½	.....					87½
Average for not pasteurized					90	.....					85
Points in favor of pasteurized					2½	.....					2½

a P equals "pasteurized."

NOTE.—All the figures are averages from marks of the three judges, acting separately.

The sample or control packages were taken from the several churnings. These were kept in the cold room of the Hesston creamery until all were ready and then sent together to Chicago. There the butter was kept by Mr. A. H. Barber in his sales room, which, although refrigerated, had a variable temperature of 42° to 45°. The judges had no knowledge whatever of the history or differences in the contents of the different packages while the scoring was being done.

As an additional contribution to the same subject, I procured sample packages of butter from Messrs. Jensen Bros., of Beloit, Kans., who were pasteurizing a part of the product of their creamery at the same time I was at Newton. The two packages were from the same lot of cream, the butter of one being pasteurized while the other was made up "raw." The packages were sent together to Chicago, scored on the 23d of July by the same judges, and their averages follow:

Score.	Flavor.	Grain.	Color.	Salt.	Total.
Scale	50	30	10	10	100
Pasteurized butter	45½	29½	10	10	94½
Regular make	44½	29½	9½	10	93½

The difference in favor of pasteurization, 1½ points.

A portion of the samples described were kept undisturbed at Chicago until August 13, when they were examined and scored by Mr. D. C. Wolverton, an excellent judge, with the following result. This gentleman was also in entire ignorance as to the butter in the various packages until his judgment had been recorded:

Place and date of making.	Hesston creamery, Newton, Kans.								Jensen creamery, Beloit, Kans., July, 1897.		
	June 22.		June 24.		June 25.		June 26.		P.	R.	
	Scale.	P. a	R. b	P.	R.	P.	R.	P.	R.	P.	R.
Flavor	50	44	40	38½	38	38	39	42	40	45	44
Grain	30	29	29	29½	29	29	28	29	29	29	29
Color	10	10	10	10	10	9½	9½	10	9½	10	10
Salt	10	10	10	10	10	10	10	10	10	10	10
Total	100	93	89	88	87	86½	86½	91	88½	94	93

a P=Pasteurized.

b R=Raw cream.

Averages: Flavor, P=41½; R=40½. Total: P=90½; R=88½.

The butter made at the Hesston creamery, as described, was duly exported to London and there subjected to criticism. An attempt was made to have it scored there upon the same scale of points as used in Chicago, and score cards were sent over for the purpose. This duty was assigned to the most competent person who could be found in London, but when the report was received (the middle of August) it was found to be useless for purposes of comparison. The examiner was evidently unaccustomed to the score card or to recording his judgment of butter by numerals, and the variations and inconsistencies in the report render it worthless. In general, this examiner reported that he failed to find any appreciable difference between butter made from cream which had been pasteurized and that from raw cream. As a matter of personal preference, he was rather inclined to favor the butter from raw cream at the time of his comparative examination in London.

Theoretically, the pasteurizing should have operated to preserve the flavor and

increase keeping quality, and should have appeared in the later scorings. The tables above show that although all the American judges somewhat favored the butter which had been pasteurized, this butter did not appear to increase its advantage with age.

In the matter of flavor alone I find that the average of the pasteurized samples in June was $43\frac{3}{4}$ against $41\frac{3}{4}$ for the other, or a superiority of 2 points. In July the comparative averages on flavor were 39 and $36\frac{3}{4}$, difference $2\frac{1}{2}$, or practically the same as in June. Mr. Wolverton gave the pasteurized lots an average in August of $1\frac{1}{4}$ points in flavor over the others.

CONCLUSIONS.

As the result of this Kansas work, and some experience in confirmation of it, my conclusions are as follows:

(1) That even for the home market, pasteurization will make some improvement in the butter of at least 75 creameries in every 100.

(2) That fully as good "body" can be obtained in butter made from pasteurized cream as from raw cream.

(3) That heating cream even to 170° and hauling it 12 miles while hot is perfectly practicable, although the butter thus made did not show any higher scoring at the first trial as a result of this treatment.

(4) That with the proper arrangements the pasteurization of cream need not be much extra work aside from the cleaning of apparatus; but an extra man is needed if the preparing of starter and the care of the cream, as well as the extra cleaning, is to be given the proper attention.

(5) That a large supply of ice or a refrigerating machine is necessary in order to chill the cream sufficiently to get a good "body."

(6) That in ripening cream a lower acid seems better adapted to a very rich cream, and there are indications that a better flavor can be obtained from thin cream.

(Professor McKay, of Ames, Iowa, was the first to draw attention to the vagueness of the acid test unless the richness of the cream is known. This is an important subject and needs more investigation. The cream at Newton I calculated to have about 37 per cent of fat and the Halstead cream 29 per cent, but as the testing there is done by perambulating tester, the means were not available for verifying these estimates. The correlation of acidity in cream and in the buttermilk is also worth investigating.)

I can not conclude this report without expressing my appreciation of the kind treatment given me by Messrs. Hoffman and Lewellen, and the good-natured way in which all the employees humored my demands for cleaning, including the use of limewater, and performed all the extra labor caused by my work.

I must also thank Messrs. A. H. Barber and John Mittelstadt, of Chicago (who acted as judges at the Exposition of 1893), and Mr. W. D. Collyer (of C. F. Love & Co.) for the cheerfulness with which they scored the butter under conditions prescribed by me. There was greater difference in the scoring than usual, because each judge worked by himself, in my presence, and had no chance to consult the others or afterwards modify his decision. A different "key" was therefore very likely to be used. Consequently it has been thought best to give the average marks of these three judges instead of the figures reported by each. Creamery men can not too highly appreciate this volunteer work, taking up valuable time, a service which I did not find all butter experts willing to render.

THE FUTURE.

As a rather curious coincidence I will mention that upon my return home I received a letter from Mr. J. D. Frederiksen, dated Denmark, June 24, in which he wrote: "It has been interesting to observe the progress made, especially in

the cooperative creameries and bacon factories, as well as in the sugar factories. It is the small farmers rather than the large 'estates' who have made this progress. Ninety-nine per cent of the creameries have pasteurizing outfits and 90 per cent pasteurize the cream, whether it is good or bad. There is no question but what the American creameries must follow suit. The Americans will adopt the English demand for mild-flavored butter, and ten years hence all cream in America, or at least the cream in all good creameries, will be pasteurized."

The introduction of this system will promote a higher standard of cleanliness in our creameries and compel the owners to give the needed extra help. If the Department desires to assist its introduction, it would be well to offer the aid of experts to creameries willing to pay their expenses while giving factory employees the necessary instruction in this new line of work.

I estimated the cost of an extra man, interest on apparatus, cost of cooling, and loss in yield of butter by the reduction in water content to meet export requirements to be about 1 cent per pound. It remains to be determined whether the above-mentioned advantages are worth this cost.

But it seems to me that uniformity, with a mild, clean flavor, is the only basis for building up an export trade, as well as for general improvement in the quality of the home market.

APPENDIX VII.

THE EXPORT OF FRESH (UNSALTED) BUTTER FROM THE UNITED STATES.

In the foregoing report the fact has been noted that butter without salt sells at a higher price in London than any other, and some description has been given of this butter as usually supplied from France for the London market. (See pp. 85 and 86.)

The custom of using unsalted butter has been slowly increasing in the United States for several years, and a considerable quantity of it, called "fresh" and "sweet" butter, now finds a market weekly in New York, as well as in other cities to a less extent.

It was therefore decided to try, in connection with the other experimental exports of the Department, the shipment of fresh butter from New York to London. So far as known, this form of butter had never before been exported from this country, at least upon a commercial basis.

Several hundred pounds of unsalted butter were engaged, to be made in August by two factories which have won a high reputation for this special product. They were the Sennett Creamery, of Sennett, Cayuga County, N. Y., and the Edmunds Creamery, of Sherman, Chautauqua County, N. Y. The officers of both these establishments did everything in their power to conform to the suggestions and instructions from this Department and to make this trial a success.

The butter was packed, at both factories, in bulk and in rolls. The former was put in cubical boxes, holding between 56 and 57 pounds net, to be sold as a half hundredweight. The boxes were coated inside with paraffin, besides being lined well with parchment paper. The rolls were made up (or intended to be) of 2 pounds weight each, in imitation of the Brittany fresh rolls, and a part of these were packed in a similar way, 1 dozen rolls in a box. The boxes were made exactly the size of those bought in the London market and imported (with the French butter they contained) as patterns. These were also paraffin coated inside and lined with parchment. Besides these extra precautions, each roll was wrapped in parchment paper, which is not the custom with the French rolls sold in London. From each factory a part of the rolls were wrapped in parchment, packed and shipped in a "portable refrigerator" or metallic chest with ice box.

The thorough making and density of the butter of this character as made in Brittany were developed in an interesting way in connection with these trials. The imported Brittany rolls were weighed on a standard scale and found to average 2 pounds each, "down weight." The rolls were then measured and molds made which would produce rolls of exactly the same size. The 12-roll packing boxes were also accurately duplicated, as already stated. But when the butter was made and molded, the rolls at one factory averaged 1 pound 14 ounces in weight and at the other factory only 1 pound 13 ounces. The sizes were right, and twelve of these rolls just filled the packing boxes made for them. When rolls of 2 pounds full weight and of the same shape were made up by hand, it was found impossible to get a dozen of them into one of the boxes provided. (This error in the rolls was discovered too late to have new molds and boxes made; so the short-weight rolls were shipped, and this defect had a very unfavorable bearing upon their sale in London.) Thus the pound of fresh butter as prepared in this country by very careful and skillful makers had a bulk materially greater than the similar butter made in Brittany, France. A natural conclusion was that the American butter was insufficiently worked and too porous. London critics said that it contained too much water. But the results of several analyses, by different analysts, shows that the American butter averaged 12.16 per cent water and 88.02 per cent fat, while the French butter averaged 13.10 per cent water and 85.93 fat. The other components averaged 0.82 of 1 per cent in the former and 0.97 of 1 per cent in the latter; this difference is accounted for, however, by the borax found in the Brittany butter, of which there was none in that from the United States. Chemically the American butter was the better, but the French butter excelled in its mechanical condition; it was uncommonly firm, fine grained, and dense, without being at all overworked. And while the French butter, as stated, carried a higher percentage of water, the latter was so thoroughly incorporated that this butter appeared to be very dry. These points are interesting and deserve attention from some of our experimenters in butter making.

Care was taken to have the butter made as late as possible to catch the export steamer, and transported with every precaution to avoid delay and exposure. The two lots of butter were made August 21 and 22, held in chilled rooms till evening of 23d, then sent by night express, reaching New York City at 6.30 a. m. of 24th. They were delivered at the vessel's side at 10.30 a. m., and an hour later were in its commercial refrigerator, at a temperature of 30° F. The atmospheric temperature at New York that day was 68° at 9 a. m. and 72° at noon. The steamer sailed from New York August 25, arrived at Southampton September 1, and the butter was delivered to merchants in London on the 2d of September, or the twelfth day after it was made.

Upon arrival in London some of the small boxes of rolls, made of light lumber, had been crushed and their contents spoiled. It was found also that the entire lot of butter, with the exception of some of the rolls in the two iron trunks, was damaged with mold. This trouble and the light weight of the rolls, already explained, caused the roll boxes to sell at a low rate. The bulk butter was slightly moldy on the outer portions of the cubes as removed from the packages. Upon cutting these parts away the greater portion of the butter was found in excellent condition. But as fresh butter is not sold in bulk in London this had to be worked up into rolls before being retailed, and this was a disadvantage. These several causes prevented realizing a satisfactory average on the sale of this butter in London, and it is fairer to the trial to name the prices of portions of the shipment, representative of the whole when starting, but which reached the foreign market free from accident and in the best of condition. These parts sold at a little less than 22 cents per pound wholesale and retailed at 24 to 27½ cents. The best fresh Brittany rolls were then selling at 28 to 30 cents per pound. The Normandy Pro-

duce Company took a good deal of the short-weight roll butter, including some from the iron trunks, and retailed it all as "Normandy fresh butter" at a shilling a pound. The butter cost 20 cents per pound when placed on the export steamer at New York and about 21 cents when delivered to merchants in London.

The two lots of butter constituting this shipment were examined and scored in New York by the inspector of the Mercantile Exchange, with the following result:

Scoring of unsalted butter in New York City.

	Flavor.	Grain.	Color.	Salt. <i>a</i>	Style.	Total.
Scale for perfection	40	30	15	10	5	100
Sennett Creamery	33	30	15	10	5	93
Edmunds Creamery	35	30	15	10	5	95

a To follow scale, all marked perfect on salt, although having none.

In London all the packages, except those injured and rejected, were examined and scored on the same scale, with the average result following. Comparisons were made by the same examiner—a novice in scoring—with French fresh butter and Danish salt butter judged at the same time:

Scoring of United States and French unsalted butter and Danish salted butter in London.

	Flavor.	Grain.	Color.	Salt.	Style.	Total.
Sennett	33	28	12	10	3	86
Edmunds	35	28	12	10	3	88
Edmunds in trunk	37	28	15	10	<i>a</i> 1	91
French	38	29	14	10	5	96
Danish	37	28	14	9	4	92

a Package unsuitable because too heavy. But for this deduction on "style," or package, this butter would have scored within one point of the French, which stood at the top of the market.

From various opinions given by the dealers and other critics who examined this butter in London the following are culled: Graded as second to best Brittany fresh rolls. The butter arrived bright, sweet, and in excellent condition except for the moldy spots inside the wrappers already described; texture not sufficiently hard when thawed from hard state in which it arrived, showing too many water globules; rather too much color [the butter was not colored] to compare favorably with the standard French supply. Some of the boxes had cloth at the bottom and top inside the parchment lining; the ends of the rolls touched this cloth and all received a distinct odor and taste from it. "Cotton cloth should never touch butter in packing for market." [Yet the boxes from France as found in London market ordinarily have two pieces of cotton cloth inside the paper lining, one at the bottom and the other at the top, in direct contact with both ends of all the rolls.] The butter which was not moldy sold readily at a price next to the best of its general class in the market. The short-weight rolls were objected to and had to be sold at a rather lower rate.

Special mention should be made of the patented carriers in which some of this butter was sent. They were made of galvanized iron and had within them boxes for holding ice free from contact with the butter. Each carrier or trunk was intended for four dozen 2-pound rolls, but the short weight of the rolls reduced the total contents from 96 to 90 pounds. Fifty pounds of ice was placed in each

carrier on leaving the creamery (August 23) and examined at New York the next day when put in steamer's refrigerator, when each was found to contain 15 to 20 pounds of ice. On reaching London there was still (September 2) a little ice in one trunk. In the other the ice had all melted and the water had reached the butter and injured its appearance. The butter in these trunks when opened in London was found to be hard, firm, and excellent in quality except for a few spots of mold. As the trunks were practically airtight, it is evident that the germs of this mold started with the butter from the creameries where made or at least from New York. The mold developed most in the 2-pound rolls in small boxes and least in the "portable refrigerators." While the latter carried the butter well, the weight of package and ice exceeded that of the butter contained, and it seems to be impracticable on that account alone, although efficient in its service.

Careful investigation satisfies the writer that the mold was preventable and not necessarily incident to the export of butter of this class. Salt butters sent before and after were exported free from mold, but some sent at the same time with these fresh lots was slightly affected. Fresh butter can undoubtedly be sent to London without being injured in this way. But for the mold and the short-weight rolls, the returns from the shipment would have been much better.

Although this trial can not be regarded as conclusive, its results justify repetition, and indicate that, with proper measures to secure the desired texture or "body" for the butter and further experience in packing and shipping, it will be possible for fresh roll butter made in the United States to be placed in the London market of such quality and in such condition as to equal the present favored product of the north of France. Whether the latter can be competed with commercially at a satisfactory profit will remain to be determined.

H. E. A.

APPENDIX VIII.

RECORD OF SCORING OF BUTTER EXPORTED.

No.	Sample.		Scored.		Points and scale.						Notes.
	Mark.	Where made.	Where.	When.	Flavor, 40.	Body, 30.	Color, 10.	Salt, 10.	Package, 10.	Total, 100.	
1	P.	Connecticut	New York	Oct. 5	37	30	10	10	10	97	
2	P.	do	London	Oct. 16	36	28	8	8	10	90	Same as No. 1.
3	A.	Iowa	Chicago	May 1	37	29	10	9.5	10	95.5	
4	A.	do	do	May 22	34	28	9.5	9.5	10	91	Same as No. 3.
5	A.	do	do	June 4	35	28	9	10	10	92	Do.
6	A.	do	London	May 15	35	25	10	6	10	86	Do.
7	A.	do	Chicago	May 22	38.5	28.5	10	10	10	97	
8	A.	do	do	June 4	36.5	28.5	9.5	10	10	94.5	Same as No. 7.
9	A.	do	New York	Oct. 7	38	29	9.5	9.5	10	96	
10	A.	do	do	Nov. 12	36.5	28	10	10	10	94.5	Same as No. 9.
11	H.	Kansas	Chicago	July 2	33.5	29	9.5	10	10	92	Pasteurized.
12	H.	do	do	July 2	32.5	28	9.5	10	10	90	Raw cream.
13	H.	do	New York	July 7	33	30	9	10	10	92	Pasteurized same as No. 11.
14	H.	do	do	Aug. 26	32	30	9	10	10	91	Do.
15	H.	do	do	July 7	31	29	8	10	10	88	Same as No. 12.
16	H.	do	do	Aug. 26	30	29	8	10	10	87	Do.
17	H.	do	London	July 19	38	27	10	9	9	93	Do.
18	J.	do	Chicago	July 27	36	29	10	10	10	95	Pasteurized.
19	J.	do	do	July 27	35.5	28.5	10	10	10	94	Raw cream.

Record of scoring of butter exported—Continued.

No.	Sample.		Scored.		Points and scale.						Notes.
	Mark.	Where made.	Where.	When.	Flavor, 40.	Body, 30.	Color, 10.	Salt, 10.	Package, 10.	Total, 100.	
20	J.	Kansas.....	New York	July 29	36	29.5	10	10	10	95.5	Same as No. 18.
21	J.	.....do.....	do	Aug. 26	35	29.5	10	10	10	94.5	Do.
22	J.	.....do.....	do	Aug. 26	31	30	10	10	10	91	Pasteurized. Box sent to London and back to New York.
23	J.	.....do.....	do	July 29	35	30	10	10	10	95	
24	J.	.....do.....	do	Aug. 26	34	30	10	10	10	94	Same as No. 23.
25	J.	.....do.....	do	Aug. 26	31	30	10	10	10	91	Box exported to London and sent back to New York.
26	J.	.....do.....	London	Aug. 7	33	27	8	8	10	86	Pasteurized.
27	J.	.....do.....	do	Aug. 7	31	27	8	6	10	82	Raw cream.
28	F.	Massachusetts...	Boston	June 18	35	30	10	10	10	95	
29	F.	.....do.....	New York	June 28	35	29	10	10	10	94	Same as No. 28.
30	F.	.....do.....	do	July 21	33	30	10	10	10	93	Do.
31	F.	.....do.....	London	July 25	36	30	10	9	10	95	Do.
32	E.	Minnesota.....	Minnesota	June 17	38	29	9.5	9.5	10	96	
33	E.	.....do.....	New York	June 28	36.5	30	10	10	10	96.5	Same as No. 32.
34	E.	.....do.....	London	July 14	35	30	10	9	10	94	Do.
35	E.	.....do.....	Minnesota	Oct. 25	39	30	9.5	10	10	98.5	
36	E.	.....do.....	New York	Nov. 1	36	30	10	10	10	96	Same as No. 35.
37	E.	.....do.....	do	Nov. 12	35	30	10	10	10	95	Do.
38	E.	.....do.....	London	Nov. 14	35	28	10	9	10	92	Do.
39	C.	New Hampshire.....	do	May 15	35	27	10	7	10	89	
40	K.	New York.....	New York	Aug. 26	33	30	10	10	10	93	
41	K.	.....do.....	London	Sept. 10	33	28	8	10	10	89	Same as No. 40.
42	L.	.....do.....	New York	Aug. 26	35	30	10	10	10	95	
43	L.	.....do.....	London	Sept. 10	37	28	10	10	10	95	Same as No. 42.
44	G.	Ohio.....	Ohio	Aug. 6	38	26	10	10	10	94	
45	G.	.....do.....	New York	July 29	34	29	10	10	10	93	Same as No. 44.
46	G.	.....do.....	do	Aug. 26	33	29	10	10	10	92	Do.
47	G.	.....do.....	do	Aug. 26	30	29	10	10	10	89	Same lot. Re- turned from London.
48	G.	.....do.....	London	Aug. 7	32	24	8	8	10	82	Same as No. 47.
49	I.	.....do.....	Ohio	Aug. 6	35	28	9	10	10	92	
50	I.	.....do.....	New York	Aug. 2	32	29.5	10	10	10	91.5	
51	I.	.....do.....	do	Aug. 26	28	29.5	10	10	10	87.5	Same as No. 50.
52	I.	.....do.....	do	Aug. 26	31	29.5	10	10	10	90.5	Same lot, back from London.
53	I.	.....do.....	London	Aug. 9	26	18	8	7	10	69	Same as No. 52.
54	O.	South Dakota.....	Madison	Nov. 1	30	30	9.5	8	10	96.5	
55	O.	.....do.....	New York	Nov. 3	36	30	10	10	10	96	Same as No. 54.
56	O.	.....do.....	London	Nov. 14	27	20	10	6	10	73	Do.
57	D.	Vermont.....	Boston	June 1	37	30	10	10	10	97	
58	N.	Wisconsin.....	Madison	Sept. 12	37	28	10	8	10	93	
59	N.	.....do.....	New York	Sept. 16	35	30	10	10	10	95	Same as No. 58.
60	N.	.....do.....	London	Sept. 25	35	27	9	6	10	87	Do.
Average of all, 60 records.....					34½	28½	9½	9½	10	91½	
Average of 45 records in United States.....					34½	29	9½	9½	10	93½	London omit- ted.

NOTES UPON APPENDIX VIII.

The scoring in London was much lower than elsewhere, and upon omitting this, as may fairly be done, the general average is seen to be much better. Chicago scoring averaged flavor a point higher than New York, and body a point lower. The packages appear to have been uniformly satisfactory. Salt and color were generally marked as perfect by American scorers, while in London both were "discounted" as being too high or strong. In body, the average of all is $28\frac{1}{2}$ out of a possible 30, which shows generally well-made butter; yet in this particular local differences in opinion are shown in the averages, being $29\frac{1}{2}$ in New York, $28\frac{1}{2}$ in Chicago, and $26\frac{1}{2}$ in London. In the right-hand column, "notes" indicates certain packages which are recorded as scored two or three times at different dates and places. For example, Nos. 3, 4, and 5 represent the same box of butter, held in Chicago, out of a lot of Iowa butter exported and scored May 1, then three weeks later, and two weeks later still; while No. 6, marked "same as No. 3," means a box of the same lot of butter, the same churning, scored after reaching London. A similar instance occurs with Nos. 28, 29, 30, and 31. No. 27 is the score of a package exported to London and brought back to New York; it was rated seven points better when it reached New York than when in London (No. 48) and but four points less than when it left New York (No. 45); and this deterioration is shown to be wholly in the flavor. Another instance is the score No. 52, as compared with No. 53 and No. 50; No. 53 shows the poor work done in London, and indicates the effect of such figures on the general average; it may be noted in this case that the butter lost but one point (on flavor) by its journey to and from London, while another box of the same lot which remained in New York dropped off four points in the same time, August 2 to 26.

In three cases—Nos. 11 and 12, 18 and 19, 26 and 27—there are opportunities for comparing butter from pasteurized cream and from raw cream, otherwise the same; in these cases the former scored higher than the latter. Nos. 11 and 13, the same butter, scored alike in Chicago and New York and lost but one point by being held from July 2 until August 26; Nos. 12 and 15, the same (raw cream) butter, which scored two points lower in New York than in Chicago, lost only one point by being held the same period. In all there are eight scores of pasteurized butter, and these give an average total of 92 points, which is just above the total average. The only butters which scored above 95 points when examined in New York prior to exportation were the following: No. 1, Connecticut, in October; No. 33, Minnesota, in June; No. 9, Iowa, in October; No. 36, Minnesota, in November; and No. 55, South Dakota, also November. In other respects these figures, which at first appear to have little significance, are susceptible of interesting comparisons.

APPENDIX IX.

RECORD OF SCORING OF FOREIGN-MADE BUTTERS.

No.	Sample of butter.		Scored.		Points and scale.						Notes.	
	Where made.	Form.	Where..	When.	Flavor, 40.	Body, 30.	Color, 10.	Salt, 10.	Package, 10.	Total, 100.		
1	Brittany, France..	Fresh rolls; no salt.	New York	June 28	36.5	30	10	10	10	96.5		
2	do		do	do	Nov. 3	35	30	10	10	10	95	
3	do		Chicago..	Nov. 10	26	30	10	10	10	86	Same as No. 2	
4	do		London ..	Sept. 29	38	29	9	10	10	96		
5	Normandy, France	Firkin ..	New York	June 28	31	29	10	10	10	90		
6	do	do	do	Aug. 26	29	29	10	10	10	88	Same as No. 5	
7	do	Basket ..	do	Nov. 3	33	30	10	10	10	93		
8	do	do	Chicago..	Nov. 10	27	30	9.5	10	10	86.5	Same as No. 7	
9	Denmark	Cask	New York	June 28	35	30	10	10	10	95		
10	do	do	do	Nov. 3	35.5	30	9.5	10	10	95		
11	do	do	Chicago..	Nov. 10	28	30	9.5	10	10	87.5	Same as No. 10	
12	do	Sealed tin	New York	July 21	33	30	10	10	10	93		
13	do	Cask	London ..	July 25	37	30	10	10	10	97		
14	do	do	do	Sept. 29	37	28	9	9	10	93		
15	Dorset, England..	Keg	New York	June 28	30.5	29	10	9.5	10	89		
16	do	do	do	Aug. 26	28	29	10	9.5	10	86.5	Same as No. 15	
17	Ireland (creamery)	Box	do	June 28	26	28.5	9.5	10	10	84		
18	do	Sealed tin	do	July 21	27	29	10	10	10	86		
19	do	Box	do	Nov. 3	34	29.5	10	10	10	93.5		
20	do	do	Chicago..	Nov. 10	26	29	10	10	10	85	Same as No. 19	
21	Holland	Keg	New York	Nov. 3	32.5	29.5	9.5	10	10	91.5		
22	do	do	Chicago..	Nov. 10	24	30	8	10	10	82	Same as No. 21	
23	Finland	do	New York	Nov. 3	33	30	9.5	10	10	92.5		
24	do	do	Chicago..	Nov. 10	24	28	8	10	10	80	Same as No. 23	
25	New South Wales.	Cub'l box	New York	June 28	29	29	10	10	10	88		
26	New Zealand	do	do	Nov. 3	33	30	10	10	10	93		
27	do	do	Chicago..	Nov. 10	24	30	10	10	10	84	Same as No. 26	

NOTES UPON APPENDIX IX.

These are scores upon foreign butter, made in this country by American judges, upon an American basis. The general average of the 27 records is as follows: Flavor 30½, body 29½, color 9½, salt 10, package 10; total 90. This indicates that the imported butter was found in good condition upon examination in New York and Chicago, with the exception of flavor, which had deteriorated nearly 25 per cent. "Notes" indicate records of the same butter examined at different times and places. Seven lots of butter which averaged 93½ points in New York on November 3 averaged 84½ points in Chicago a week later; the main disparity was that the New York scores averaged 8 points higher on flavor. This was manifestly due to difference in judgment rather than actual change in the butter; the same judges varied but half a point (average) on the "body" of the same samples.

The only lots of these foreign butters which scored above 94 points in New York were the two Danish casks brought over in June and November and the fresh Brittany rolls imported at the same time.

APPENDIX X.

RECORD OF CHEMICAL ANALYSES OF BUTTER EXPORTED.

The butter sampled.		Analyzed.		Report of analysis.					Notes.	
No.	Mark.	Where made.	Where.	When.	Water.	Fat.	Curd.	Natural ash.		Salt.
1	P	Connecticut	Connecticut	October	10.90	85.68	1.00	(a)	2.42	
2	P	do	London	do	9.30	87.30	1.00	(a)	2.40	Same as No. 1.
3	A	Iowa	Iowa	July	8.12	88.59	1.06	0.40	1.83	
4	A	do	do	do	12.87	84.21	1.23	0.70	0.99	
5	A	do	do	October	11.52	85.95	1.10	0.30	1.13	
6	A	do	London	November	8.08	90.09	0.59	(a)	1.24	Same as No. 5.
7	H	Kansas	Iowa	August	8.54	89.49	0.94	0.25	0.78	Raw cream.
8	H	do	do	do	10.73	86.37	1.19	0.94	0.77	Pasteurized.
9	H	do	London	July	10.12	88.08	1.10	(a)	0.70	Raw.
10	H	do	do	August	8.33	89.43	0.93	(a)	1.21	Same as No. 8.
11	J	do	do	do	9.35	88.86	0.67	(a)	1.12	
12	F	Massachusetts	Mass	June	9.78	87.71	0.85	(a)	1.66	
13	F	do	U. S. D. A. b.	August	9.41	87.84	0.89	0.04	1.82	Same as No. 12.
14	F	do	do	do	9.63	87.24	1.04	0.03	2.06	Do.
15	F	do	London	July	8.64	88.82	0.75	(a)	1.79	Do.
16	E	Minnesota	Minnesota	June	11.41	86.81	0.52	(a)	1.26	
17	E	do	U. S. D. A.	August	12.39	85.06	0.91	0.03	1.61	Same as No. 16.
18	E	do	London	July	10.80	86.96	0.96	(a)	1.28	Do.
19	E	do	Minnesota	November	10.83	86.86	0.65	(a)	1.68	
20	E	do	London	do	11.20	86.98	0.68	(a)	1.14	Same as No. 19.
21	K	New York	New York	September	12.54	86.28	0.83	0.48	0.00	
22	K	do	London	do	11.72	87.73	0.49	0.05	0.00	Same as No. 21.
23	L	do	New York	do	12.63	86.30	0.33	0.04	0.00	
24	L	do	London	do	11.73	87.79	0.43	0.05	0.00	Same as No. 23.
25	M	do	New York	do	10.50	87.53	0.33	(a)	1.25	
26	M	do	London	do	9.82	88.54	0.52	(a)	1.12	Same as No. 25.
27	G	Ohio	Ohio	August	10.64	87.16	0.80	0.53	0.87	
28	G	do	London	do	10.17	88.21	1.07	(a)	0.55	Same as No. 27.
29	I	do	Ohio	do	9.42	87.33	0.73	0.78	1.64	
30	I	do	London	do	11.10	86.71	0.82	(a)	1.37	Same as No. 29.
31	O	South Dakota	Wisconsin	November	9.38	87.96	1.30	(a)	1.36	
32	O	do	London	do	8.77	88.89	0.92	(a)	1.42	Same as No. 31.
33	D	Vermont	Vermont	June	11.37	86.25	0.53	(a)	1.85	
34	N	Wisconsin	Wisconsin	September	10.66	87.35	0.98	(a)	1.01	
35	N	do	London	October	9.52	88.86	0.76	(a)	0.86	Same as No. 34.
Average of the 35					10.30	87.20	0.81	0.33	1.36	

a The "natural ash" or mineral constituents included in the "salt" in these cases.

b U. S. D. A. = United States Department of Agriculture.

NOTES UPON APPENDIX X.

The average of these 35 analyses shows the lots of butter to which they apply to have been exceptionally well made. The average of 10.3 per cent of moisture and 87.2 per cent of fat is much above commercial standards, while less than 1 per cent of curdy contents is correspondingly low and creditable. The range is not near as great as usual in the same number of samples from creamery butter as ordinarily made. Excepting two unsalted lots (Nos. 21 and 23), the water content

exceeds 12.5 per cent in only one case (No. 4, July butter), and the same lot is the only one in which the fat fell below 85 per cent. The latter was the minimum standard which it was intended to maintain. The figures for ash and salt show variation which indicates the difficulty of getting reliable results in these particulars from small butter samples as ordinarily taken. All of these butters were intentionally light salted, but the aim was to make them carry from 2 to 2½ per cent, and the uniformity of judgment in scoring these same lots, as per Appendix VIII, showed that they satisfied the taste of experts in this regard better than appears from this chemical record.

The butter exported appears even better from the records of the London analyst than from those made in this country. Thirteen lots were analyzed on both sides of the sea, and the results are compared below :

Analysis of United States butter in United States and in London.

	Water.	Fat.	Curd.	Ash.	Salt.
Averages:	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
In United States	10.77	86.56	0.81	0.51	1.35
In London	9.87	88.02	.76	-----	1.35

This comparison indicates that, despite all precautions, the butter dried out somewhat in transit, thus decreasing the water content and increasing the percentage of fat. The results on curd were very close, but, curiously, the London analyst, although he did not separate natural ash and salt, found less mineral matter in his drier butter than was found by American chemists. This is probably another example of the uneven distribution of salt in butter and the difficulty of getting duplicate samples in this respect.

APPENDIX XI.

RECORD OF ANALYSES OF FOREIGN-MADE BUTTERS.

[Representative selections imported by the Department of Agriculture.]

The butter sampled.			Analyzed.		Report of analysis.				
No.	Form.	Where made.	Where.	When.	Water.	Fat.	Curd.	Natural ash.	Salt.
1	Cask	Dorset, England...	London	July	15.00	83.39	0.50	(a)	1.11
2	do	do	U. S. D. A. c	do	13.89	84.33	.48	0.03	1.27
3	do	do	Connecticut	do	12.51	85.65	.08	(a)	1.16
4	Box	Ireland (creamery)	U. S. D. A.	do	14.63	79.54	1.67	.62	3.54 (b)
5	do	do	Connecticut	do	15.02	79.21	1.53	(a)	4.24 (b)
6	do	do	U. S. D. A.	November	15.31	82.17	1.13	.14	1.25 (b)
7	do	do	Iowa	do	13.28	84.93	.88	.06	.85 (b)
8	Tin	Ireland (Cork).....	U. S. D. A.	August ..	15.31	78.50	2.40	.44	3.35 (b)
9	Keg	Denmark	London	July	12.08	86.29	.71	(a)	.92
10	do	do	U. S. D. A.	do	9.71	88.11	1.06	.03	1.09
11	do	do	Connecticut	do	8.93	89.05	1.03	(a)	.99
12	do	do	U. S. D. A.	November	13.02	84.46	1.15	.05	1.32
13	do	do	Iowa	do	11.57	86.10	1.33	.15	.85
14	Tin	do	U. S. D. A.	August ..	8.62	87.80	1.29	.06	2.23
15	Cask	France, Normandy	do	July	12.22	83.12	1.18	.26	3.22 (b)
16	do	do	Connecticut	do	10.17	85.95	1.09	(a)	2.79 (b)

a The "natural ash" or mineral constituents included in the "salt" in these cases.

b Samples were found to contain preservative, generally borax.

c U. S. D. A. = United States Department of Agriculture.

Record of analyses of foreign-made butters—Continued.

[Representative selections imported by the Department of Agriculture.]

The butter sampled.			Analyzed.		Report of analysis.					
No.	Form.	Where made.	Where.	When.	Water.	Fat.	Curd.	Natural ash.	Salt.	
17	Basket.	France, Normandy	London	October...	10.63	85.50	1.06	(a)	2.81	(b)
18	do	do	U. S. D. A. c	November	11.91	85.55	1.13	.11	1.30	
19	do	do	Iowa	do	8.88	89.23	.79	.20	.90	
20	Rolls.	France, Brittany	U. S. D. A.	July	15.36	83.70	.75	.19	.....	(b)
21	do	do	Connecticut	do	15.52	83.80	.57	.11	.....	(b)
22	do	do	London	September	13.56	85.36	.78	.30	.....	(b)
23	do	do	U. S. D. A.	November	14.59	84.10	1.03	.28	.....	(b)
24	do	do	Iowa	do	10.37	88.72	.81	.08	.....	(b)
25	Cask	Finland	U. S. D. A.	do	12.57	83.71	1.30	.04	2.38	
26	do	do	Iowa	do	11.29	85.47	1.43	.35	1.46	
27	Keg	Holland	U. S. D. A.	do	12.86	83.75	1.16	.24	1.99	(b)
28	do	do	Iowa	do	10.56	87.17	1.01	.13	1.13	(b)
29	Box	Australia	London	August	10.40	87.51	.77	(a)	1.32	(b)
30	do	New South Wales.	U. S. D. A.	July	15.50	81.17	.98	.05	2.29	(b)
31	do	do	Connecticut	do	14.94	81.88	.96	(a)	2.22	(b)
32	do	New Zealand	U. S. D. A.	November	10.89	86.62	.60	.03	1.86	
33	do	do	Iowa	do	8.65	89.27	.70	.06	1.32	
		Average of 33...	.....	.....	12.40	84.57	1.03	.17	1.83	

a The "natural ash" or mineral constituents included in the "salt" in these cases.

b Samples were found to contain preservative, generally borax.

c U. S. D. A. = United States Department of Agriculture.

NOTES UPON APPENDIX XI.

The first comparison suggested by this table is the general average composition of this foreign-made butter, with the analyses of an almost equal number, in Appendix X. The water is seen to be 2.1 per cent more and the fat 2.6 per cent less. There is also more curdy matter in this butter and more salt. The chemical preservatives used are included in the "salt," and, although the quantities were not determined, these may account for the rise in the salt results. The range is also noted as much greater than in the American butters. The water rises above 12 per cent in 19 instances and to 15 per cent and over in 7. The fat falls below 85 per cent in 16 cases and below 82 per cent in 5 cases. The European butter without salt resembles that made similarly in this country in carrying a relatively high per cent of water and low per cent of fat, a greater difference in these respects than is accounted for simply by the absence of 2 per cent or less of salt. It is notable that all this foreign butter was "borated," or treated with preservatives other than common salt, excepting the lots from England, Denmark, Finland, and New Zealand.

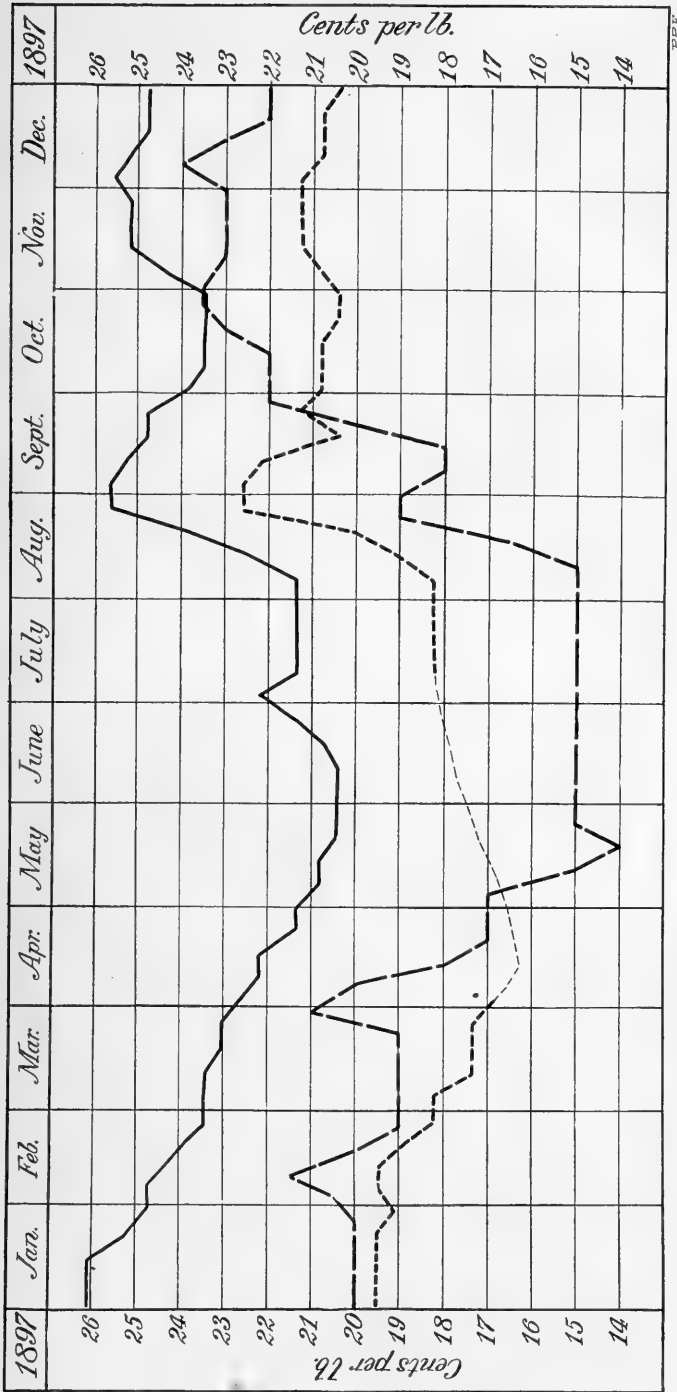


Diagram of butter price (wholesale) in London and New York for the year 1897

Best Danish in London ——— Extra Creamery in New York ······
 "States" Creamery in London - - - - - (estimated) - - - - -

FIG. 10.

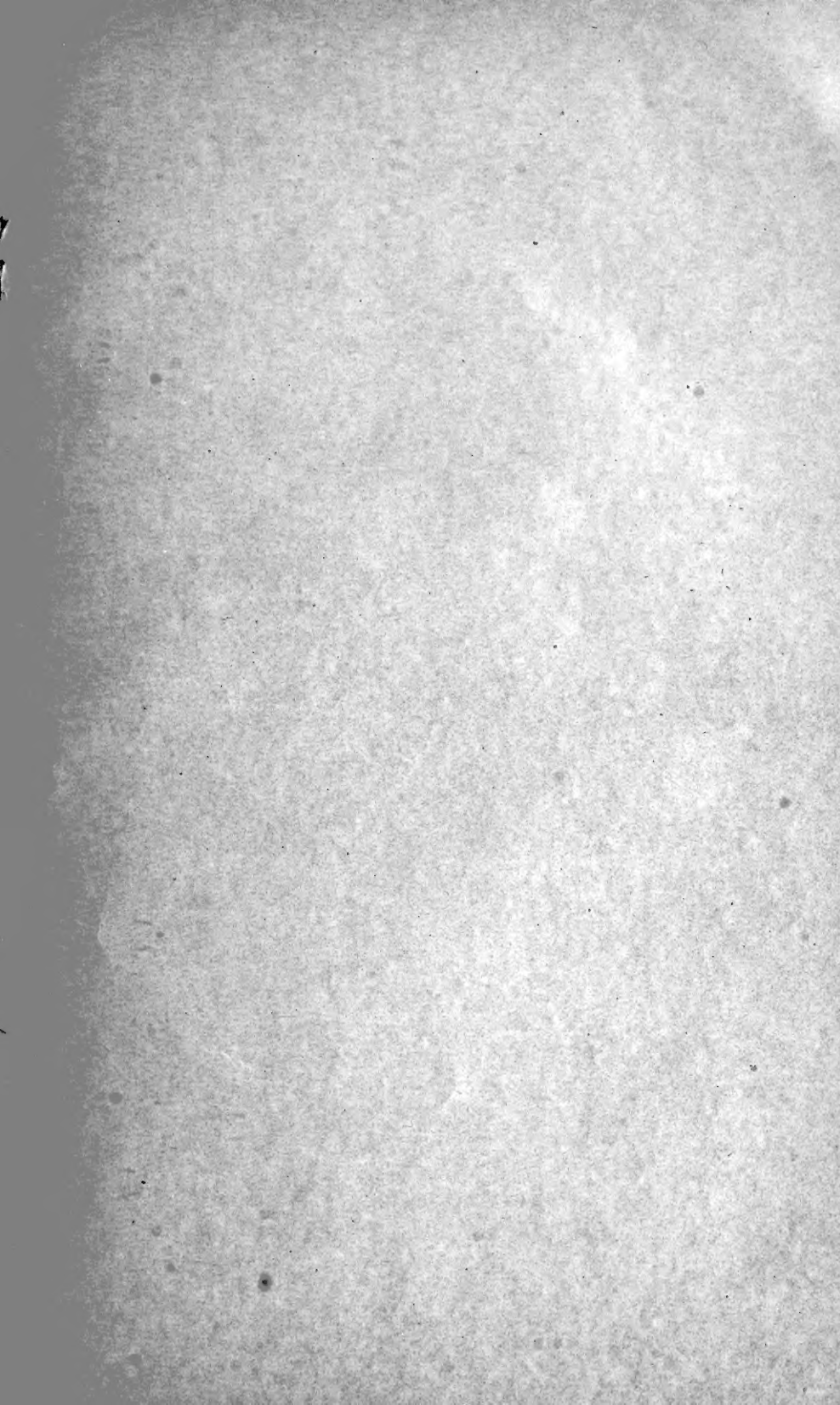
NOTES UPON APPENDIX XII (DIAGRAM).

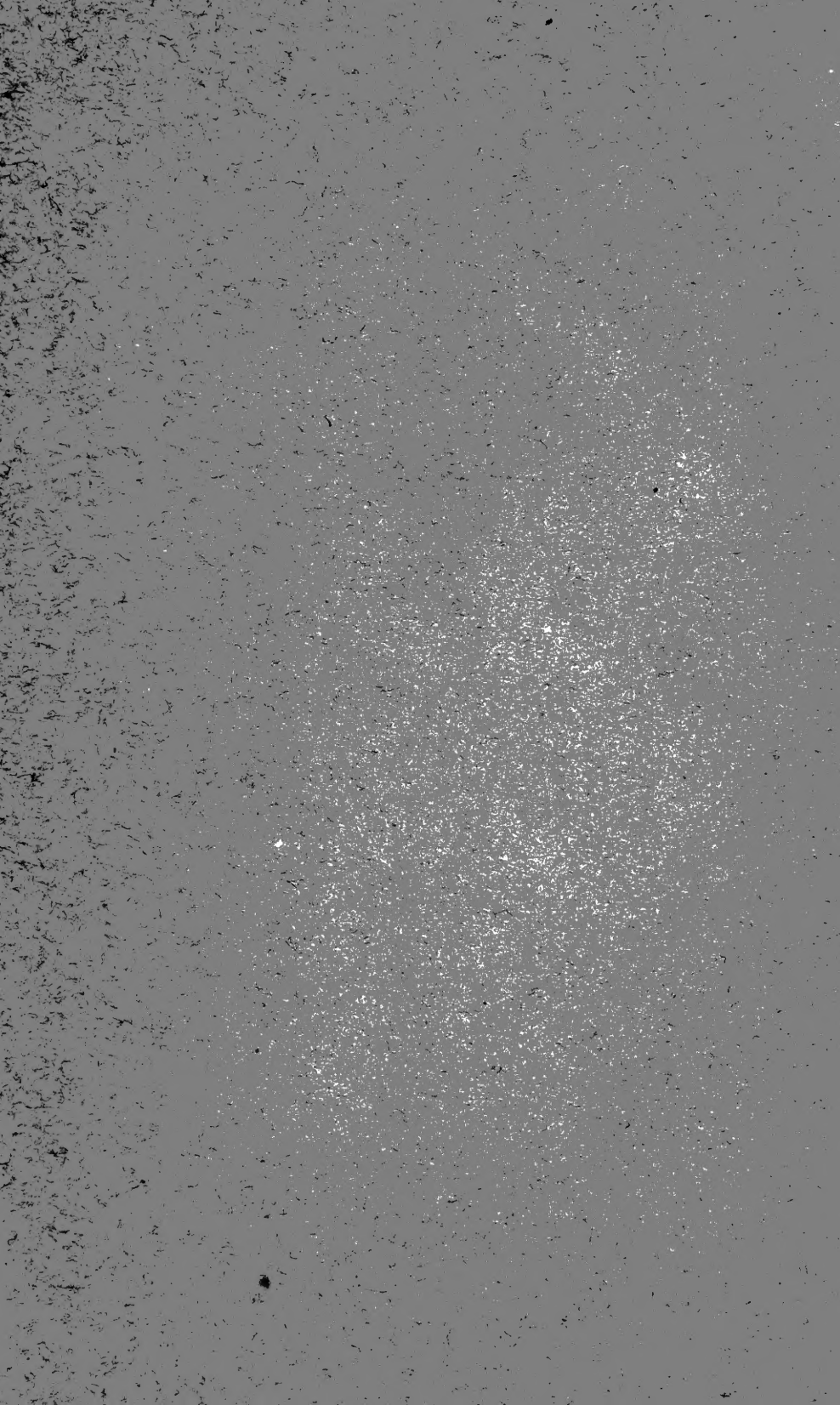
Upon the accompanying diagram the lines indicating the fluctuations in prices of butter in London and New York are based upon weekly quotations of the best grades of Danish and States, or "creamery extras," published by old and reliable merchants in the respective cities. The only exception is a period from early April to early July, when the London house failed to quote States butter. For this period the prices have been estimated from other data.

The most striking feature of the diagram is the difference between the prices of best butter in London and in New York during the greater part of the year. It is generally understood that American markets are so good in winter as to remove all inducement to export. The diagram does not support this view, except as to the last three months of 1897. The difference varies from nothing late in October to over 7 cents per pound less than two months earlier. With the exception of a few weeks near the close of the year, the difference was at all times greater than the cost of moving butter from New York to London. The explanation seems to be that during the winter months, when the margin in price might have encouraged export from New York, the supply of good "Colonial" (Australian and New Zealand) butter in England was such as to prevent any successful competition from this country.

The diagram also indicates the grade of butter exported. During seven months of the year States butter in London was quoted lower than "creamery extras" in New York. If the grade of exported butter had been "extras" it surely would have been kept at home and sold at the higher rate. In May, June, July, and August extras were very low in New York, and this appears to have started the shipment of that grade, which continued until New York prices rose again.

The notes upon the diagram are confirmed by the Treasury Department returns of the quantity and value of butter exported from the United States to the United Kingdom during the successive months of the year in question.





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