STRAINING MILK ON THE FARM

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A. C. DAHLBERG

ABSTRACT

Milk should be produced under careful sanitary conditions, but nevertheless it needs straining. Milk is strained to remove most of the visible sediment to improve its appearance. Filtration refers to the complete removal of all visible sediment. It is not essential and it is rather difficult to remove all visible sediment from milk on the farm. Straining is ample as milk must be filtered or clarified at the milk plant.

Single-service cotton or flannel discs or squares are generally employed. Cloth is more satisfactory due to greater capacity even tho cotton removes more sediment. Most strainers using cotton handle so little milk that their value is questionable. A suitable strainer using cotton, embodying most of the principles discussed in this bulletin, and which has reasonably good capacity is illustrated on page 9. Cotton is recommended for milk sold raw which cannot be filtered or clarified at the milk plant and for those dairies where exceptionally good sediments are desired and small capacity is not important.

The capacity of a strainer decreases with low temperatures and with high fat content of the milk.

Cloths or cotton discs or squares clog with small amounts of butterfat even when very clean milk is being strained.

Photographs with legends are given on pages 9, 10, and 13 showing strainers which illustrate certain desirable features when used with either cloth or cotton.

The features to be considered in selecting and using a single-service milk strainer are summarized on pages 20, 21, and 22.

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1The author is indebted to Dr. John Drew of the Dairymen's League Cooperative Association for helpful suggestions and cooperation during the course of this study. The author is also indebted to manufacturers of strainers and of cotton pads and cloths for their cooperation in furnishing samples and in constructing certain suggested features in their equipment for experimental studies.
INTRODUCTION

The amount of foreign material that finds its way into milk ought to be kept at a minimum even tho it is entirely feasible in the milk plant to remove almost completely all insoluble, visible material. Public health officials and milk sanitarians are correctly emphasizing that milk should be produced as pure as possible in its original condition even tho it is later subjected to certain treatments to insure its safe consumption.

The presence of foreign material in milk is particularly undesirable since it indicates that its production has not been surrounded with suitable sanitary conditions.

It is doubtless true that extraneous material which finds its way into milk may not usually be particularly injurious to health, but consumers want and ought to have clean milk. Sediment often introduces foreign flavors and odors, and it may slightly affect the bacterial content of milk even tho it usually does not contain disease-producing organisms. Numerous investigations have clearly demonstrated that sediment found in milk has usually not been an important factor in affecting the bacterial count of the milk.

So far as any experimental evidence is concerned, the removal of foreign sediment by suitable methods of straining or filtering has little effect upon the healthfulness of the milk. Contaminations produced by the extraneous material are effected to a considerable degree as soon as this material comes in contact with the milk so that the problem of straining is largely concerned with the marketability of milk. The whiteness of milk makes it an ideal medium in which extraneous material can be readily seen and the presence of visible sediment materially affects its market value.

Even tho milk is produced with the utmost of care, it is very desirable that it should be strained immediately after it is produced as an added precaution in its sanitary handling. This has been recognized for many years and most old literature on this subject makes mention of the desirability of straining milk.

Rham, in 1845, stated that milk should be strained immediately following production thru a fine metal or cloth sieve.

In his book on Dairy Farming published in 1856, Ruricola states

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³Ruricola. Dairy Farming. London: John Edward Taylor. 1856. (See page 141.)
that milk "ought to be passed thru a wooden bowl at the bottom of which there should be a hole of about two inches in diameter, covered with a fine wire gauze made of brass or silver; the latter is of course preferable as being equally durable and less likely to corrode."

Just 50 years ago Sheldon\(^4\) described a wire strainer with a hundred meshes per inch which would remove visible sediment from milk. It is interesting to observe that his conclusions have, in the main, been verified at this Station during the last year.

A large variety of materials, such as sponges, sand, pyrites, and charcoal, have been tried experimentally for milk straining purposes in milk plants. On dairy farms the straining devices have been wire gauze, cloth, and cotton pads. In many sections of the country the wire strainer is extensively used, while in other places, particularly in certain sections producing market milk, the use of the wire strainer has been barred thru rulings of public health officials and milk sanitarians. At the present time thru the northeastern United States single-service cloth or cotton pad strainers are almost universally recommended.

A detailed review of the literature on the subject of milk straining would be too lengthy for this popular presentation.

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THE PROBLEM OF SINGLE-SERVICE STRainers

Lack of sanitary precautions on the part of dairy farmers in cleaning and sterilizing wire mesh and cloth strainers which would be used over and over again led to regulations requiring the use of single-service cloth or cotton strainers. The introduction of these strainers was very rapid and few manufacturers of strainers or straining materials had an opportunity to consider the problem sufficiently to give dairy farmers an entirely suitable product.

The problem was studied at this Station because of the necessity of securing some satisfactory straining device. In 1924,\(^5\) the first publication from this Station on the removal of sediment from milk dealt exclusively with the problem from a milk plant standpoint. Since that time a large number of straining devices have been collected for use in straining the Station's milk supply which consists of the product of a herd of 26 Jersey cows. For the past five years almost every straining device on the market has been collected and tried experimentally, not


because they were unsatisfactory from the standpoint of removing the sediment from milk, but because they failed to give satisfactory capacity. In most instances the cotton cloths and cotton pads supplied with the strainer would clog prior to straining one 10-gallon can of milk or thin spots would develop in the cotton.

The question immediately arose concerning what constituted satisfactory straining from the standpoint of the dairy farmer. How much milk should be poured thru a single cloth or cotton? How completely should the straining medium remove visible sediment?

At the present time there is much division of opinion concerning standards for judging a milk strainer. Some manufacturers of cloth and cotton for straining contend that only one 10-gallon can of milk should be passed thru one cotton pad or cloth. The most efficient results are said to be secured by the continual changing of the straining material. Thus it is evident that the cost of straining is materially increased. Quite aside from the question of removing the sediment from milk is the problem of sanitary conditions involved in this procedure. A dairy farmer milking cows seldom has the time or the conveniences to change cotton pads or cloths in a wet strainer without introducing contamination from the hands which may carry disease organisms. Contamination of this type, altho invisible, is far worse than the presence of visible sediment in milk.

It seems evident that a satisfactory strainer must permit the flow of milk with sufficient speed so that it will not interfere with the rate at which one man can milk cows by machine. The maximum capacity of the strainer ought to be sufficient to handle a complete milking on an average good sized dairy farm. This would mean that the cotton pad or cloth ought to strain not less than three 10-gallon cans of milk.

If the strainer has sufficient speed, then it may be considered from the viewpoint of the efficiency with which sediment is removed. Speed in straining is given first consideration because it is essential from the dairyman's standpoint that the straining of milk should not interfere with routine work. When a strainer has sufficient speed it cannot do the most perfect filtering, but it can do reasonably satisfactory straining.

There is need for a brief discussion of the two terms, straining and filtering, commonly used in the production of market milk. When milk is strained most of the visible sediment is removed from it. It may be possible to find traces of foreign material on the sediment disc or in the bottom of the milk bottle after it has stood undisturbed for 24 hours even tho milk, produced under good sanitary conditions, has been
satisfactorily strained. The word filtration has been applied to dairy farm practices in the past few years, but the accuracy of its usage is questionable. Most thorough filtration would remove all fat and proteins, much of the ash, and the filtered milk would be whey. The least that can be expected of filtration is the complete removal of all visible sediment from milk. It is doubtful that filtering can ever be done on the farm because dairy farm operations do not lend themselves to milk filtering. If milk is to be filtered it is essential that it must be maintained at a temperature of not less than 90°F and some pressure must be exerted upon the filtering medium by the milk. Colder milk can be filtered by greatly increased pressure. In the winter months milk is below this temperature and there is seldom sufficient head pressure in the strainer to force the milk thru a fine filtering device.

Irrespective of the thoroughness with which milk is strained on the farm, it is essential that it must be filtered or clarified in the milk plant. Such being the case there is no necessity of filtering milk on the farm. Furthermore, if milk is well filtered on the farm it is impossible for the milk inspector to examine a given lot of milk to determine the sanitary conditions surrounding its production. The presence of a portion of the sediment that has found its way into milk serves as a guide to the milk inspector in locating unsanitary conditions.

METAL EQUIPMENT FOR STRAINERS

The number of straining funnels now on the market is too large for any individual dairyman to ever hope to try more than a small part of them. This fact is illustrated in Fig. 1 which shows all of the metal straining equipment used in the last series of tests. There are 22 different funnels illustrated, and they represent but part of those used during the course of the experiments.

Well reinforced and heavily tinned iron is generally used in constructing strainers. Some strainers have been made of aluminum, but this metal in thin sheets is somewhat soft and tends to dent very badly according to experiences in straining the Station's milk supply. Some strainers are too lightly constructed. The funnel need not be of excessive capacity if the milk passes thru it with sufficient rapidity. The usual capacity of 12 to 16 quarts is ample. It is desirable that the strainer should be seamless and free from indentations or irregularities of any sort on the inside, illustrated in Fig. 2. A number of the straining devices are so constructed that they are rather difficult to wash. This applies particularly to funnels with irregular internal surfaces,
with seams, with close woven wire grids, and discs that have openings that are rather difficult to wash, particularly when the disc is soldered into the bottom or is an integral part of the funnel. The most simply constructed funnel and equipment that operates well is the best.

Every straining funnel ought to be so equipped that the dairyman can use it with cotton or with cloth because there is a marked difference in preference for cloth or cotton in various sections of the country.

Strainers ought to be constructed to give a maximum straining surface for the can in which the strainer is used. Thruout the Middle West the predominating 10-gallon can has a neck 6½ inches in diameter. For a can with a neck of this size a strainer with an outlet or foot that is 5¾ inches overall represents the maximum size that can be satisfactorily employed. Thru the North Atlantic states the predominating 10-gallon can has a neck that is 7¾ inches in diameter.
FIG. 2.—A STRAINER THAT ILLUSTRATES CERTAIN PRINCIPLES IN DESIGN.

The funnel B (inside view) is absolutely smooth inside and has no seam. The clamp A is used only when cloth is attached to the outside of the funnel. The wire grid D is the under support to hold cotton from breaking or washing and to hold cloth from stretching. The wires in the grid are not interwoven but one row lays on the other and are electrically welded and tinned. The conical perforated disc C fits so tightly into the foot of the funnel B that it will hold a cloth in place without the use of the wire grid D and it prevents leakage of milk around the disc. The disc is convex so that there is a clearance of from $\frac{3}{8}$ to $\frac{3}{4}$ inch between the disc and wire grid to give room for expansion of the cotton when wet.

For a can of this type it is possible to use a strainer that is about 6$\frac{3}{4}$ inches in diameter. This extra size of the foot greatly increases the capacity of the strainer.

The equipment which goes with the straining funnels is exceedingly numerous and varied. It is fortunate that certain principles can be stated that hold for all types of straining equipment.

Cotton pads must be placed upon some support and the stream of milk cannot be poured directly upon the cotton or the pad will become irregular in thickness. It is also essential that the cotton must not be packed so that a conical or raised upper disc must be employed. The equipment must fit together well to prevent milk from flowing around the cotton. These points are illustrated in Figs. 2 and 3.

Calculations showing the influence of the diameter of the foot and
various devices for supporting the cotton are shown in Table 1. The first three strainers fit the small-necked can and the last three fit the large-necked can. These calculations were made to explain the marked variations which were experimentally encountered in the capacity of various strainers. A study of the table will show that a disc for supporting the cotton perforated with large holes gives the smallest capacity. A perforated disc with a large number of small holes gives approximately double the capacity that is present in the large-holed
<table>
<thead>
<tr>
<th>Strainer No.</th>
<th>Foot diameter in inches</th>
<th>Type of cotton support</th>
<th>Holes</th>
<th>Area in square inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inside</td>
<td>Outside</td>
<td>Size in inches</td>
<td>Number</td>
</tr>
<tr>
<td>1</td>
<td>4(3/4)</td>
<td>5</td>
<td>Bottom perforated</td>
<td>5/4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>5(3/4)</td>
<td>Perforated disc</td>
<td>5/8</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>5(3/4)</td>
<td>Wire grid</td>
<td>5(1/8)*</td>
</tr>
<tr>
<td>4</td>
<td>5(1/2)</td>
<td>6(1/8)</td>
<td>Bottom perforated</td>
<td>5/4</td>
</tr>
<tr>
<td>5</td>
<td>5(1/8)</td>
<td>6(1/8)</td>
<td>Perforated disc</td>
<td>5/8</td>
</tr>
<tr>
<td>6</td>
<td>5(1/8)</td>
<td>6(1/8)</td>
<td>Wire grid</td>
<td>6(1/4)+</td>
</tr>
</tbody>
</table>

*Inside dimensions of ring holding wires. Total area 20.63 square inches. Total length of wires 50\(1/2\) inches, diameter of each wire 1/20 inch. Wires placed 8 strands to 3 inches to make 5/16 inch square openings to support cotton. Area of wire 2.52 square inches.

1Inside dimensions of ring holding wires. Total area 30.68 square inches. Total length of wires 84 inches, diameter of each wire 1/20 inch. Wires placed 8 strands to 3 inches to make 5/16 inch square openings to support cotton. Area of wire 4.2 square inches.

disc. When the perforated disc is eliminated and a wire grid is used to support the cotton, then the capacity of the strainer is approximately double that which is given by the small-holed perforated disc. These calculations agree very closely with those experimentally obtained in straining milk. It is interesting to note that the perforated disc in the strainer with the large foot does not give as much capacity as the small strainer with the wire grid. The maximum capacity is of course given by the strainer which has the foot of largest diameter and in which the cotton is supported by a wire grid.

Some objection may be raised against the wire grid, Figs. 2 and 3, on the basis that it is difficult to wash. It is true that it is more difficult to wash than a flat surface, but it can be readily cleaned. No piece of dairy equipment will remain in a sanitary condition without proper washing and sterilizing. It is difficult to wash the metal around the openings in a perforated disc, yet few milk inspectors have objected to this equipment. The Drew wire grid does not have interwoven wire so that the ease of washing is aided. Experience at this Station indicates that this wire grid is as easily washed as the perforated disc.

The conical disc which is placed on top of the cotton should be bent sufficiently so that it will never press upon the cotton even after it becomes soaked with milk. A flat perforated disc can be used if it is held about 5/8 to 1/4 inch above the wire grid. Experiments have shown that there is little merit in the various methods of perforating the upper conical disc to force milk to flow upon the cotton from different angles.
When the disc was perforated with 100 to 125 holes which were 3/16 of an inch in diameter, the speed of the strainer was just as rapid as with any other method of perforating the disc. Holes of this type permit the use of a disc which is strong and easily washed.

Irrespective of the type of equipment employed, cotton without reinforcing, which is so universally used, will wash badly. It is essential to the securing of uniformly good results that a thin gauze should protect the cotton on the top where milk strikes it. Single or double cloth faced cotton should be used. It is true that plain cotton does give more capacity than gauze-faced pads and that it is less expensive. However, the formation of thin areas in the cotton by the washing of the milk gives uncertain straining efficiency so that the best results are not always secured. It is to be hoped that a strainer will eventually be devised in which plain cotton can be used with uniform results.

The equipment which gives best satisfaction for supporting the cotton pad, Fig. 3, also gives the maximum capacity with the cloth when placed inside the strainer funnel and it can be satisfactorily used when more milk needs to be strained than will pass thru cotton. A smaller cloth is satisfactory with the inside equipment, thus slightly reducing the cost of cloths as compared with the outside attachment, if one cloth is sufficient to strain the milk.

The cloth is more rigid than the cotton and can stand pouring of milk directly upon it and it needs no support underneath. Numerous tests have been made on cloths with and without supports. These tests have invariably shown that the capacity of the cloth is almost doubled when there is no supporting grid. This means that the average thin outling flannel generally employed for straining milk will handle about three cans of milk in the winter months when it is used inside the straining funnel with a supporting wire grid, but it will strain about five cans of milk if it is attached to the outside of the strainer, as shown in Fig. 4. The increased capacity is much greater than the increase in the cost of the cloth due to the extra size required to make the outside attachment. It is also interesting to note that this same flannel when supported on the inside of the strainer with a perforated disc, instead of the wire grid, will strain only one, or occasionally two, cans of milk without clogging. These figures were secured experimentally, but the quantities will vary tremendously depending primarily upon the temperature of the milk at the time of straining.

Perhaps the most satisfactory outside clamp for holding the cloth is a plain band drawn tight to the funnel by an eccentric clamp, Fig. 4,
FIG. 4.—THE USE OF FLANNEL ATTACHED TO THE OUTSIDE.

The band is pushed down over the cloth and the clamp is then turned snugly against the strainer to tighten the band. The reinforcing on the extreme outer edge of strainer, shown in Fig. 3, holds the cloth and band from slipping off. This clamp comes in contact with milk only if the cans are overfilled.

the cloth and clamp being held in place by the reinforcing at the foot of the strainer. If reasonable care is used in placing the cloth and clamp on the strainer there is no danger that they will ever slide off. The eccentric clamp shown in Fig. 4 is not very sanitary, due to difficulty in washing the holes in which the crooked wire is held, but it comes in contact with milk only when the can is overfilled. Cloths can be held
satisfactorily by inside tight fitting equipment, but for the greatest capacity there should be no under support.

SINGLE-SERVICE CLOTH AND COTTON

Most dairy farmers in the sections using single-service straining media employ cotton pads. This is probably due to the fear of milk inspectors and milk plant operators that cloth may be used several times before being discarded and to sales pressure by cotton manufacturers rather than to the choice of dairymen. Repeated use of cloth can be avoided by milk plants selling cloths to dairymen in regular amounts, thereby avoiding any reason for not discarding the cloth after each milking. Difficulty with capacity of cotton pads is almost universal since most strainers using cotton seldom strain more than one can of milk and often clog before 40 or 50 pounds of milk have been strained. Observations on dairy farms support the belief that when ample capacity is secured with cotton it is due either to thin areas being formed by washing the cotton with the milk or the milk flows around the cotton due to poor adjustment of the cotton to the straining funnel. In other words, capacity is generally secured by failure of all of the milk to pass uniformly thru the cotton.

During the course of these experiments scores of cotton pads of various types have been tried and in no instance up to 1930 has any cotton pad ever been secured which, when placed in the usual strainer, would strain one 10-gallon can of Jersey milk during the winter months. Under these conditions it is practically impossible to state other than that the use of cotton pads has generally been very unsatisfactory due to lack of capacity.

In recent months the capacity of cotton pads has been increased by improved manufacturing methods. These newer cotton pads can be used in the new large foot strainer described in this bulletin to strain one or two cans of milk in the winter months and about three cans of milk in the summer. Since cotton is most efficient in removing sediment, it can be satisfactorily used on small dairies without changing the cotton during milking. The larger dairies ought to use two or three funnels to make it unnecessary to change the cotton during milking. Cotton has a special place in grade A dairies, particularly those selling grade A raw milk which is not filtered or clarified at a milk plant.

The simplest and easiest manner of increasing the capacity of cotton pads would be to decrease their thickness. They are now much thicker than necessary for satisfactory straining. Most cotton pads of 6½-inch
diameter weigh from 170 to 220 grams (about 6 to 8 ounces) per 100. If the amount of cotton was reduced to 120 to 150 grams per 100 a much more satisfactory and serviceable straining medium would be secured. Manufacturers of cotton discs or squares have experienced difficulty in spreading cotton so thinly without leaving very thin areas. Due to methods of manufacture, there may be differences in the capacity of cotton pads of uniform weight.

Whenever farmers encounter difficulty with the capacity of cotton pads they are generally advised that the failure of the cotton pad to strain the milk is due to the dirt in their milk. There is little justification for this statement except in very extreme cases. Cotton pads generally clog due to the retention of the large clusters of fat globules which are present in the milk under most circumstances, particularly when cold. The cotton pads used for straining Jersey milk during the winter months usually contain a milk-cream mixture which tests from 8.0 to 12.0 per cent of fat. The fat content of the fluid remaining in the strainer cotton is easily secured by placing the cotton in a closed glass container, heating to 130 or 140°F and squeezing out the liquid by hand. It can then be tested for fat in the usual way. When Holstein milk is strained the fat content of the milk remaining in the cotton varies from 4.0 to 8.0 per cent, depending primarily upon the temperature and amount of milk strained. Ordinarily, the colder the temperature the richer the fat content of the milk remaining in the cotton. In some experiments the fat content of the fluid remaining in the cotton after straining skimmilk testing 0.01 per cent by the Babcock method was found to be between 2.0 and 3.0 per cent. These results clearly indicate that cotton pads clog and fail to give ample capacity due to the retention of butter fat.

Further evidence supports this contention. If a cotton pad clogged with fat is cleaned by pouring hot water thru it, the capacity of the cotton will be restored to approximately one-half of that which it originally had. These results can be secured even when precautions are taken to avoid jarring the cotton or washing thin spots in it with water.

The total weight of fat lost in each cotton pad is small because of the small amount of liquid which it holds. The fat in each cotton after clogging is about 3 grams or 0.1 of an ounce. When the cotton pads are discarded before they become clogged or when cloths are used, the fat losses are only one-fourth or one-third those just given. These facts emphasize the importance of ample capacity to save butterfat as well as the cost of extra cottons or cloths.
The rapidity with which a cotton clogs with fat is illustrated by Fig. 5. Jersey milk free from visible sediment was poured continuously thru the cotton at 90°. The amount of milk strained each minute was recorded. The cotton strained the first 10-gallon can of milk in less than 2 minutes, but it could not finish another 10 gallons of milk.

Flannel cloths attached to the outside of the funnel have been found to be so satisfactory that they have been employed regularly at this institution for nearly three years. There are a considerable number of thin bleached outing flannel cloths that are quite satisfactory for milk straining purposes. Dairy farmers should not purchase cloths at stores and cut them to a proper size because straining material must be uniform in thickness and of known sanitary quality. These cloths should be a thin grade of outing flannel with a noticeable nap. Tests have

![Graph]

**Fig. 5.—The rate at which the capacity of a cotton pad decreases with use.**

This is shown by the records of the total weight of milk which passed thru a cotton pad at one-minute intervals. Jersey milk, free from sediment, at 90° was used.
shown that three to five cans of Jersey milk can be strained thru one cloth flannel of the type mentioned. Such capacity makes it possible for the average large dairy farmer to use one cloth per milking, thereby eliminating the necessity of changing the cloth during the milking process.

Some question is always raised concerning the relative merits of cloth and cotton for straining purposes from the standpoint of the removal of sediment. It is generally true that the slower the rate of straining the more completely the sediment will be removed. When cotton is used which will strain only one can of milk in 5 minutes when the funnel is kept filled, nearly all of the visible sediment is removed. Similarly, if a dense filter cloth with long nap is used that has a capacity equal to that of the cotton, then practically all visible sediment will be removed. On the other hand, when a thin flannel cloth is used the capacity is markedly increased and the efficiency of removing sediment is decreased. The reason for such results is self-evident.

When milk is produced in a reasonably sanitary manner, straining thru flannel will remove most of the sediment and will yield milk which is sufficiently clean to be placed in the highest class by most milk inspectors. The milk may show a few specks on the sediment test disc and will show a few specks in the bottom of a milk bottle after 24 hours' standing, but the amount of this material is not sufficient to classify the milk as unclean. Straining with this degree of thoroness ought to be generally satisfactory. It is considerably more thor the than straining milk thru a brass screen of 100 mesh, but it is not thor enough to remove sediment from very dirty milk so completely that it will be classed as clean. It is debatable whether a strainer should be used on the farm that will produce an apparently clean milk from one that is actually dirty. Furthermore, since all milk must be filtered or clarified in the milk plant, there is no necessity for the complete removal of sediment from milk on the farm.

Exception should be made to these statements where raw milk for special trade is produced which will not be subjected to subsequent filtration or clarification. Under such circumstances, a dense flannel or special filter cloth or a cotton pad ought to be used to remove as much visible sediment as possible. The straining material will clog after straining from one to three cans of milk and there is no danger of washing sediment thru the cloth or cotton by continued use as long as it is free from tears, holes, etc.
TEMPERATURE AND FAT CONTENT OF MILK AFFECT STRAINING

The condition of milk at the time of straining influences the capacity of a strainer to a great extent. The factor of most importance is temperature. In the summer months milk is generally poured into the strainer at a temperature varying from 90° to 95°F, but during the winter the temperature ranges from 75° to 85°F.

A series of tests have been made on Jersey and Holstein milk to show the influence of temperature on capacity of straining. The results secured with Jersey milk are shown in Fig. 6. Strainer No. 6 as shown in Table 1 and in Figs. 2, 3, and 4, was used in the tests. It was used both with cotton and with flannel. It will be observed from the graph

![Diagram showing the length of time required to strain milk at various temperatures and the amount of milk that passed through the cotton pads or cloths before clogging.]

The tests were made with a strainer having a 6½-inch foot. The cloth was fastened outside the funnel, while the cotton was supported on a wire grid.
that this strainer, using cotton, handled only one can of milk when the temperature was 80° and less than one can at 75°. At 90° it was possible to strain four cans of milk satisfactorily. These results agree well with experiences in straining milk at the dairy barn at this Station during the winter and summer months and clearly illustrate that a strainer may handle several cans of milk during the summer months but might be entirely too slow during the winter.

One test is also shown on the graph illustrating results secured with a flannel cloth straining milk at 80°. This cloth strained six to 10 cans of milk without clogging, an amount which included the entire supply available at the beginning of the test. It is evident that this straining funnel when used with flannel which is not supported underneath will strain any reasonable quantities of milk during either the winter or summer months.

Altho it is hardly feasible to recommend the process for general practice, it is interesting to note that the capacity of a strainer can be greatly increased by a slight shaking after it has become clogged. It is true that such shaking does not seem to affect the efficiency of straining nor does it break the cotton when the cotton is properly supported with good equipment in the straining funnel. The shaking consisted of raising the strainer about 3 inches from the can and dropping it down upon the can for three consecutive times. If the cotton should break as a result of this treatment or the cloth should be torn loose, it would be necessary to re-strain the entire can of milk into which the milk had flowed after the accident occurred. It is for this reason that shaking should not be practiced.

Cold milk strains much slower than warm milk due to the solidification of the fat and to the formation of large clusters of fat globules. It is these clusters of fat globules which form in cold milk that rapidly clog the strainer.

Other things being equal, it would be expected that rich milk would be strained with much more difficulty than thin milk. The capacity of the strainer for handling milk is not decreased proportionately to the increase in the fat content. For example, an increase in the fat content of milk produced by average Holstein cattle to that produced by Jerseys will result in a decrease of approximately one-third in the total capacity of the strainer.

WIRE GAUZE STRAINER

Wire gauze strainers have been extensively employed in former years
for straining market milk and are still used in some places. They have come into disrepute largely because of the difficulties which have been encountered by dairymen in properly washing and sterilizing them. Aside from this point, they have considerable merit because they have great capacity and the effectiveness of removing sediment can be controlled by the mesh of the gauze. The finest gauze that ordinarily can be purchased is 125 mesh and this size does not remove sediment as satisfactorily as flannel cloth. On account of the serious objection to wire gauze by inspectors and plant operators, it is very doubtful whether it will ever again become popular on the dairy farm in market milk areas.

It is but fair to state that brass wire gauze of 125 mesh was used at the Station for about four months with entire satisfaction from a sanitary standpoint. The wire can be washed and sterilized, but it requires extra precautions to keep the wire in good sanitary condition.

SUMMARY

The essential factors involved in milk straining on the farm may be summarized as follows:

1. Milk ought to be produced under satisfactory sanitary conditions irrespective of subsequent efficient straining. Straining has little value in improving the sanitary qualities of milk.

2. Milk is strained primarily to improve its appearance and marketability. Complete removal of all visible sediment from milk on the farm may discourage proper sanitary precautions and make it difficult for inspectors to recognize dirty milk.

3. There is need for strainers of ample capacity to avoid the necessity of changing cloths or cotton pads for each can of milk. Contamination from hands in a wet strainer is very undesirable. It is better to have an extra strainer than to change the cloth or cotton during milking.

4. It is difficult to filter milk on the farm. Good straining is satisfactory for ordinary milk because all milk must be filtered or clarified in the milk plant where excellent facilities are available for doing the work. Grade A raw milk or other milk sold raw without clarification or filtration in a milk plant ought to be strained thru cotton or heavy filter cloth to remove all sediment possible.
5. A good milk strainer should embody the following factors:
   a. Single-service cloths or cotton pads manufactured explicitly for straining milk.
   b. Easy washing and freedom from inside seams or outside crevices, etc.
   c. A capacity of at least two 10-gallon cans of milk without clogging in the winter. This requires an outlet of maximum size to fit the neck of the milk can for use with cotton.
   d. Removal of most of the visible sediment.
   e. Economical as to original cost, durability, and cloth or cotton requirement.

6. Single-service cloths, according to the opinion of the author, are more satisfactory for general use than cotton pads.

   The advantages of cloths are as follows:
   a. Greater capacity.
   b. More easily fastened in or on the outside of the funnel.
   c. Greater uniformity in results.
   d. Less costly due to more milk strained per cloth.
   e. Do not remove all of the very fine sediment, thus making it easier for the milk inspector to detect dirty milk.
   f. Hold less butterfat than cotton when clogged.

   The disadvantages of cloths are as follows:
   a. Less efficient removal of sediment than with cotton.
   b. Greater cost per unit.
   c. Possibility of re-using.

7. The cloth should be attached in or to the funnel, to give maximum capacity and efficiency, as follows:
   a. No milk should pass around the cloth.
   b. There should be no support underneath when maximum capacity is required.
   c. Where less capacity is required the cloth can be used by supporting it in the funnel like a cotton pad.
   d. For outside attachment the cloth should be about 3 inches larger in diameter than the outside diameter of the foot of the funnel. Thus the 5½-inch strainer requires an 8-inch cloth, while the 6¾-inch size requires a 10-inch cloth. If the inside attachment is used, the size of the cloth should be 6½ or 8 inches, respectively. In some funnels the cloth should just fit the opening.

8. The cotton requires extra precautions for best results as follows:
   a. No milk should pass around the cotton.
b. The cotton needs protection on the upper surface against washing by the milk by both a cloth facing on the cotton and a perforated conical or flat raised disc. If uniformly good straining is not essential, the plain cotton will prove satisfactory and cheaper than cloth faced cotton.

c. The cotton needs to rest upon a coarse wire grid. There is also a possibility of using a double cloth faced cotton pad without support underneath, but the straining is less uniform due to washing of the cotton.

d. Cotton is generally used with inside equipment, so for a 5½-inch strainer the cotton should be 6½ inches, but the capacity of this size is usually too small. The 8-inch cotton ought to be used in the 6¾-inch strainer. One type of strainer requires a small cotton that just fits into the straining funnel, while another type requires an outside fastening with larger discs or squares of cotton.

9. The capacity of a milk strainer becomes less as the milk cools and with increased percentages of fat. Cotton or cloth eventually clogs with butter fat. This fact makes it very important to strain milk as soon as each cow is milked.

10. The strainer shown in Figs. 2, 3, and 4, illustrates certain desirable features in milk straining. This strainer may be used with cloth or cotton discs or squares on the inside of the funnel or with cloth on the outside to give extra capacity for large dairies.

11. Strainers need to be thoroly washed and sterilized after each milking. They should be rinsed with cold water, then scrubbed with a brush, using warm water and a mineral washing powder, rinsed with or immersed in boiling hot water until thoroly heated and inverted to dry. When steam is available they should be sterilized with it in the usual way. A neglected strainer will become a source of bacterial contamination no matter how well it is constructed from a sanitary viewpoint.