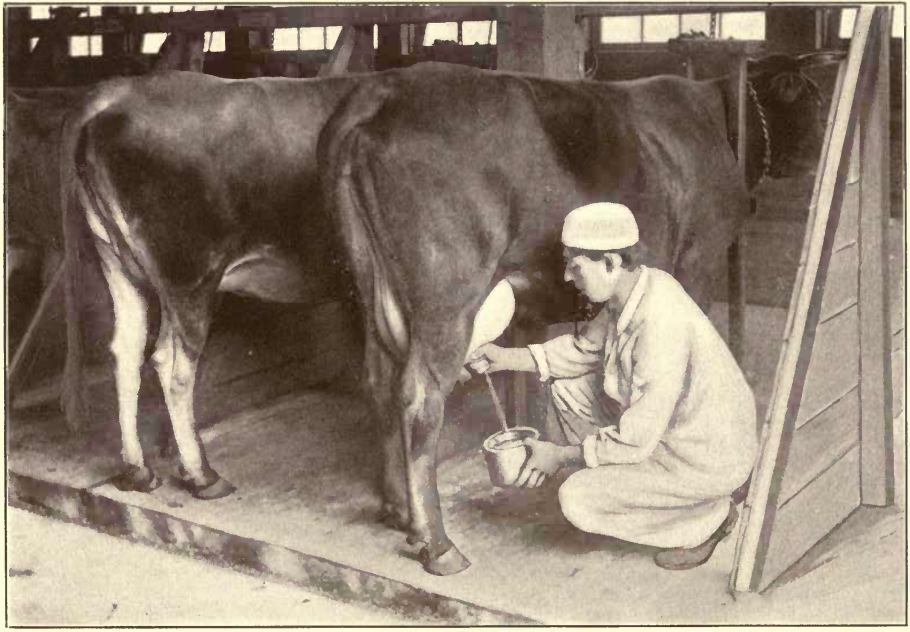
CLEAN MILK

S. D. BELCHER. M. D.



DRAWING THE FOREMILK.

CLEAN MILK

By

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With an Introduction by

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PREFACE

BECAUSE of the presence of dirt in milk, bacteriology becomes a necessary factor in the production of milk.

It has been the aim of the author to set forth practical methods for the exclusion of bacteria from milk. In the following pages, there is incorporated a system of operations which has been successful in materially reducing the bacterial contamination of milk, from the moment it is drawn from the cow until it is used by the consumer.

To the veterinarian, the dairyman, and the agriculturist it is stated that all intention of invading their spheres of work is disclaimed. The purpose is to render available the special knowledge of the bacteriologist on the ways of preventing contamination, and regarding this in the light of a common good it is hoped that these special workers will receive it in a spirit of co-operation.

The work in the field which supplied the data for the book was performed under a grant from the Rockefeller Institute for

Medical Research. This work was under the direction and supervision of Dr. Park and formed a part of the movement for the improvement of New York city's milk supply, conducted by Dr. Park, with the co-operation of the Rockefeller Institute for Medical Research, for the Department of Health of the City of New York.

In the performance of that work and in the making of this book, the author has been at all times indebted to Dr. Park for suggestions and criticism, and is glad of this opportunity of making public acknowledgment of the benefit derived from working under his personal direction.

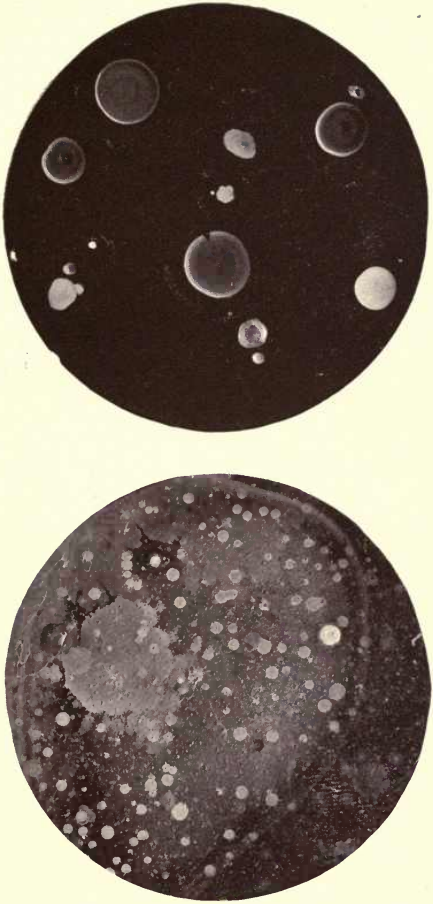
To the many gentlemen who courteously offered their establishments as experiment stations, acknowledgment is also due, and to Walter W. Law, Esq., the proprietor of Briarcliff Farms, and to Mr. Loton Horton, the President of the Sheffield Farms-Slawson-Decker Co. for their interest and encouragement during the progress of the work.

INTRODUCTION

A PURE milk supply has ever been a recognized desideratum, and the best efforts of sanitarians and public officials have for many years been devoted toward its attainment. The universal use of milk as a food, and the important place it holds in the diet of the world, have justified every effort toward rendering it available and wholesome for human consumption. Heretofore, the insistence on a proper nutritive value and the prohibition of the use of preservatives have been the principal objects sought, but with the development of the science of bacteria, there has arisen a new and a most important consideration concerning milk. Good milk can no longer be decided on the ground that it contains a required percentage of solids and is free from deleterious chemicals, but it must also be subject to the test of bacterial contamination. Since bacterial contamination may result in the conveyance of infectious diseases, such as typhoid, diphtheria, scarlet fever,

and tuberculosis, it will be admitted that it is a factor deserving attention.

By the ordinary observer impure milk is recognized by its containing coarse dirt, hair, etc., which settles at the bottom of the can or bottle, also by its sour taste or its curdling when heated, and by its emitting the odor of decomposition. But the absence of all of these by no means indicates that the milk is pure or safe. Milk may be entirely unfit for food when none of these conditions are present, since the chief dangers in milk are due to the bacteria which it contains, and bacteria are far too small to be seen by the unaided eye, being among the smallest and simplest of all living things. They much resemble the cells of which plants are composed, and require moisture, warmth, and food to grow. Milk is the only article of food in which nearly all bacteria grow rapidly, and in it they multiply at a favorable temperature, *i. e.*, about blood heat, in an almost incredible manner. From a single germ as many as 200 may be produced in three hours;



BACTERIOLOGICAL ANALYSES OF CLEAN AND UNCLEAN MILK.

10,000 in six hours; 10,000,000 in nine hours, and 2,000,000,000 in eighteen hours. As the bacteria grow and increase in numbers they impair the nutritive properties of the milk, and in this way injure it as a food, and, what is much more important, they produce many new substances, some of which are poisonous. It is the result of the activities of bacteria which causes milk to sour and produces in it bad taste and odors. But long before milk has become sour to the taste, it may contain enormous numbers of bacteria and has usually become unwholesome, and probably a source of great danger. The number of bacteria which may be found in milk is almost beyond belief. This is directly proportionate to the age of the milk, the amount of dirt and filth it contains, and the height of the temperature at which it has been kept. The number of bacteria is, therefore, the best means of determining whether the milk is clean and fresh and whether it has been properly handled, and it tells with certainty the story of mistakes or neglect.

Where do these bacteria come from? Do they do any good? Do they do any harm? These are the questions which are naturally asked. Most of the bacteria fortunately are not those which induce disease. They are the bacteria associated with dirt. They come from dirty cows, stables, hands, and pails, the dust of the stables, of the atmosphere of the milk house or creamery where milk is mixed and bottled. But these dirt bacteria are not the only ones which find their way into milk. The germs which cause various infectious diseases, such as typhoid fever, scarlet fever, tuberculosis, diphtheria, and mouth and foot disease, live and rapidly multiply in milk. Every year epidemics occur which have been traced to milk contaminated by ignorant or careless milkmen, who have infected their milk from their dirty hands or the dirty water, or in other careless ways. This, of course, is entirely unnecessary and can be prevented. The extent of this danger may be judged by the fact that two years ago there was published in one of

the medical journals a report upon three hundred and thirty outbreaks of epidemic diseases traced to milk; one hundred and ninety-five of these were epidemics of typhoid fever, in one hundred and forty-seven of which the disease prevailed at the dairy or farm; in sixty-seven, it was due to contamination of well-water; in twenty-four, employees at the farm were acting as nurses, and in ten, they were working while still sick. There were ninety-nine epidemics of scarlet fever, in sixty-eight of which the source of infection was traced to the illness of persons at the dairy; in seventeen, the employees were themselves suffering from scarlet fever, and in ten, they were acting as nurses to scarlet fever patients. In other cases the mode of infection was through the storage of milk near infected rooms, or the poison was brought by cans or bottles from patients' houses. There were thirty-six epidemics of diphtheria, in thirteen of which the disease existed at the farm or dairy. When it is remembered that

some of these epidemics have numbered hundreds of cases with many deaths, the great importance of this is apparent and the amount of mischief which is possible through the neglect of a single person seems appalling. Most of this harm results because the men who are handling the milk are entirely ignorant of the manner in which milk becomes infected, and consequently fail to take the simple precautions which would be quite sufficient to prevent such a calamity.

In the spring of 1901 it was determined to attempt, through the Department of Health and other agencies, to improve the milk of New York city by preventing the excessive and unnecessary bacterial contamination then occurring. At the same time, through funds supplied by the Rockefeller Institute for Medical Research, physicians were appointed to study carefully the influence upon the health of infants of the filth bacteria and the bacterial products existing in the milk ordinarily consumed in New York city. In

addition, Dr. Belcher, who had already become greatly interested in the bacterial side of the milk problem, was authorized to conduct an investigation at the sources of production. This meant practically the transporting of a laboratory to dairy farms and creamery buildings and the performance of scientific labor amid the actual conditions attending the production of milk. In the two years devoted to this task, thousands of experiments were made and every detail of milk production subjected to exhaustive and critical study and examination. The results of this research were placed at the service of farmers and milkmen, and it is gratifying to record that in many instances these business men hastened to adopt precautions against contamination. In a spirit of co-operation, the dairy farmer, the city dealer, and the bacteriologist joined forces in an effort to produce milk free from serious bacterial defilement. Dr. Belcher's method was the aseptic, as opposed to the antiseptic; the insistence upon cleanliness, barns free from

dust, cows without dirt upon their bodies, utensils sterilized, milkers washed and clad in clean garments; these requirements and effective cooling sufficing to produce, at moderate cost, a food article known to be safe and wholesome.

The practicability and the commercial value of such a system of milk production has not been without demonstration. The dealers and dairy farmers, who under the supervision of Dr. Belcher introduced the aseptic method and produced milk with reduced bacterial contamination, received certification from the Milk Commission of the County Medical Society and their product became known as "Certified Milk."

This superior milk found a ready sale, and the increasing demand for it is a hopeful indication that the public will make due acknowledgment of the efforts of progressive farmers and dealers. The public may rest assured that just as much clean, wholesome milk will be produced as can be sold, but a general appreciation of the difference be-

tween good and bad milk and a demand for improvement must come first.

In the general solution of the milk problem in large cities, some help may come through legislation. Certainly the Health Department of the State and city should be given the right to inspect farms and demand those things which are necessary in order to produce a wholesome milk and to exclude contagious disease. Sufficient improvements, however, are not to be brought about by compulsion of the dealers, but by educating them up to the point of voluntarily doing better work. It is to the co-operation of the dealers and farmers that we must look for an absolutely pure milk supply, and behind all this must be a public appreciation of good milk.

One of the most valuable results of Dr. Belcher's work has been to bring about in the dealers a new feeling of proper responsibility to the farmers and to the public. Many of them are convinced of their ability to aid in giving the public pure milk, and they have

co-operated in a most commendable manner. Some of the dealers have built ice houses and have supplied ice to farmers who could not afford it, and they have in every way encouraged the farmers to improve their barns and have furnished them with materials which made these things possible. Their co-operation is a very important factor in any movement to secure pure milk, because as the capitalists they are in a position to carry out improvements both at the farms, the creameries, during transportation, and in the local deliveries of milk. In order that farmers might not be tempted to mix the milk from cows which appear, in any way, to be sick, with the rest of their milk, some of the dealers paid the farmers full price for the milk from sick cows and had it thrown away. To avoid the danger of spreading contagious disease through their milk, they have encouraged the farmers to report any instance of such disease in their employees or families and have provided for the handling of milk by others during the period of illness.

Great improvements in transportation are possible and here the railroads should be made to feel their responsibility to the public. They should do all in their power to make it easy, not only for the large dealers but for the individual farmers, to ship milk under suitable conditions, and they should try to arrange their schedules so that milk can be delivered in New York in such a condition as not to be a menace to public health. The New York Health Department has already made a rule that no milk shall be delivered in the city the temperature of which stands over 50° F. If enforced, this will insure proper icing of milk on all cars, and the rule will be enforced if the people who consume milk will give the officials their moral support.

Milk certification at the present time promises a solution of some of the difficulties. It seems to be necessary to have a third party, composed of some body of persons who stands between the dealers and the public, and who are able to give an assur-

ance to the public that milk has been handled and produced under proper hygienic conditions. Such an assurance is now provided in certificates issued in several of the larger cities. In New York this certificate is given by the County Medical Society. This society has appointed a commission to pass upon the milk supplied by the different dealers. The commission is composed of professional men of the highest standing, who with the reports furnished by the inspector and the bacteriologist are qualified to judge.

The greatest force in the attainment of an improved milk supply, however, rests in public opinion. It is for the consumers in general and the leaders of the community in particular to decide this problem of pure food. The milk dealers are ready and eager to put on sale a better commodity, just as soon as there is a demand, and it remains for the physicians, the directors of hospitals and other institutions, the teachers of domestic economy, and philanthropic men and women to encourage the good work. There is

need for an educational movement advocating an additional payment in return for the observance of proper hygienic and esthetic precautions, and it should not be forgotten that the improvement of the milk used by those who live in comfort and luxury tends to the betterment of that served to the poor.

THE TRANSPORTATION OF MILK.

The great distance from which milk is now brought to New York is hardly appreciated by the public. On the north, farmers send milk almost from the Canadian border, and on the west from almost as far as Buffalo. When milk was consumed on the farm or delivered to a neighboring town, simple precautions sufficed to supply a fairly wholesome milk, but now that distances have become so great, much more care and thought must be given to its collection and transportation. The railroads bringing milk to New York designate two forms of milk trains—the long haul trains, transporting milk one hundred and fifty to three hundred miles,

and short haul trains transporting it only from fifty to one hundred and fifty miles. One would naturally expect that the railroads would endeavor to bring the milk to the city in the very best possible condition. While this is true of some of the railroads it is not true of others. Some seem to assume that all they need to do is to get the milk to New York in a salable condition. If the milk is transported very long distances great precautions are taken to preserve it, while if transported from adjacent counties hardly any attention at all is paid to it. Thus it comes about that some of the very worst milk delivered in New York is milk brought from the nearest places.

In the summer of 1901, the writer noticed that an ordinary freight car was left by the morning train on a siding about eighty miles from New York city, to receive the milk of a number of separate farms from the adjacent country. The day was the second of July, when the mercury ranged from 85° to 98°. At three o'clock in the afternoon, the far-

mers began to drive up with their cans of milk. They themselves had to drive from three to six miles in the hot sun, and so delivered the milk already warmed considerably above the point at which they had taken it from their springs. From three to five o'clock, the cans of milk were standing in the car without ice, the thermometer in the car registering 98°. At five o'clock the car was attached to the train drawn to New York, and the milk delivered on the platform, never having been cooled in any way during its transit.

The example cited is not an isolated one, for similar conditions were found at other stations on this road. From the observations made last summer, it appeared that fully 10 per cent. of the milk carried by this road during the hottest months was never iced at all during transportation, and much more was iced but very slightly. Milk handled in this way in hot weather is often so changed that it is unfit to be sold, and is refused by the dealers. When, however, the

changes have not gone far enough to render it unsalable it is delivered to the groceries and sold by them to their customers. The officials said that the individual farmers were responsible, as they should have iced their milk, while the farmers said as individuals it was impracticable for them to properly ice their milk, as they were only provided with an ordinary freight car which was allowed to stand out in the hot sun in the middle of the afternoon. On the same siding, in marked contrast to the car above described, was the milk car of one of the New York dealers, which was not an ordinary freight car, but one made for the purpose of transporting milk. This dealer, taking his milk directly from the creamery, placed it in the car with about three tons of ice. His milk was thus transported to New York in a thoroughly cooled condition.

The manner of local delivery of milk is also important. Most of the railroads deposit their milk upon the station platforms between 11 and 12 P. M. Here much of it

remains until 4 or 5 A. M. before it is collected by the delivery wagons. Many of these wagons use no ice, and even milk which is properly cooled when it arrives, may become in this time so warm as to be greatly injured by active fermentation which such a temperature induces. Both the railroad transportation and local delivery can be accomplished with much less danger of contamination if the milk is placed in sealed bottles at the creamery. This is the best method if only the bottles themselves have been properly sterilized.

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THE COW YARD AND THE PASTURE

CHAPTER I.

THE visitor to a dairy farm, seeking a knowledge of the conditions there and the methods in operation, would naturally come upon them in a certain order of precedence. The first thing would be the pasture lands and the grounds immediate to the cow stables and the dairy house. An observation of these would be followed by a study of the buildings, their construction and equipment; then the herd, the workers, and the utensils. Once the milking began, the milk would be followed through all its various handlings. An order similar to this has been adopted in this book. Starting with the cow yard as the first factor in the contamination of milk, the other component parts of the establishment are taken in the order in which a visitor would usually meet them.

It is a common dream picture, that of a cow barn perched on a grassy knoll, and the

herd turned out to pasture in broad, open fields of greensward stretching away from the door of the building, but beautiful and visionary as this may appear in the books, it is not so uncommon a realization.

In the Delaware Valley, in the State of New York, the usual plan of a dairy farm locates the cow barn in one corner of a half-acre lot, into which, after milking, the herd is turned, thence to wend its way to the broader upland pastures. At modern progressive establishments the field surrounding or adjacent to the cow barn where the herd collects at milking time is always large and spacious, so that it may with justice be claimed that the cows pass directly from the pasture to their stalls.

Providing adequate pasture and an ample enclosure for the cows to collect in, an enclosure which will answer as an exercise ground in winter, means that the farmer has done much toward the cleanliness of his cows. It is a general observation that in summer, when the cows are outdoors day and night,

they are clean, and through no exertion of the herdsman.

The reason for this is simple, and must be evident to any one after a moment's thought. The cow, naturally a cleanly animal, avoids pollution if she can, and when at liberty in the fields not only does so, but carefully grooms her own body. It is only when the cow is treated like a pig or tied down like a prisoner in a loathsome dungeon that she becomes dirty. Nobody asks the farmer to clean his cows; they themselves will do that if given half a chance; but he should play fair with them, not lead them into a muddy, filthy yard, where each step splashes manure half way up their flanks, or pen them in a space only large enough for a sow and her litter.

The practise of enclosing cows in the space between two wings of a barn, or in a narrow yard formed by a fence around three sides of a building, is responsible for so much defilement of cows that for his own advantage, pecuniary and otherwise, a dairy far-

mer should abandon it and provide a large field connecting with the cow barn, and spacious enough, first, to be used as a gathering place at milking time, and in winter, as an exercise ground, and, secondly, to give the animals a fair chance to keep clean. This large field has so much to do with the cleanliness of the herd that it will surely be required, when dairy farmers are licensed by the State.

If a man will not dispense with the small enclosure, at least he should keep it in a sanitary condition, so that not only the herd, but also the members of his family, may cross it without suffering contamination. Such a place is usually a quagmire, boasting of sundry pools due to defective drainage or formed by the overflow from the water trough, with manure lying scattered about or gathered in a huge heap, all of which attract flies, which, besides a great irritation to cows, are, with milk and water, the chief carriers of typhoid. Across this strong-smelling area warm milk in uncovered pails will be

carried, and this exposure and the exposure to manure in the stalls is a source of the so-called "animal odor," supposed by dairy farmers to be a characteristic of fresh milk.

A soft and muddy surface should be drained, the pools filled in, and a new surface made with firm, hard material, such as a man uses to make the paths around his house. Some material is usually available, and at moderate cost—crushed stone, gravel, sand, or the ashes from the furnace or the stove. Some farmers cover the yard with a material which, being useful as a fertilizer, can be gathered up with the manure, when the cow yard is cleaned.

The evils of a bad cow yard will sometimes be reproduced in a pasture lot. Constant use has destroyed the turf, and the surface becomes so trampled and cut up that the field is little better than a muddy yard, resulting in a defilement of the cows, which could be avoided by changing the pasture frequently.

MANURE

CHAPTER II.

MANURE at a dairy farm is unavoidable, but the evil of its presence can be minimized. Admittedly the chief obstacle in the securing of clean milk, the objections to it need hardly be stated.

It is one of the causes of the "animal odor," to remove which farmers aerate so conscientiously; it pollutes the premises, attracts flies, offers a breeding place for germs, and is a serious inconvenience when women of the family do the milking. By its very nature it is the most offensive contamination, and the mere proximity, not to mention actual presence of it in milk, should render abhorent that fluid as an article of food. Although the dairy farmers to a man recognize this and each stoutly maintains that his milk is free from it, yet in how many cases are the precautions against it woefully inadequate? Its value as a fertilizer has complicated the problem of keeping it out of milk. In order to collect it, the farmer carefully

accumulates it in a manure "gutter" until the gutter and its contents are ready to overflow, when he pitches it out of the barn window, to form for months a small mountain of putrid matter, and not until the summer boarders are due to arrive is it carted away to the fields.

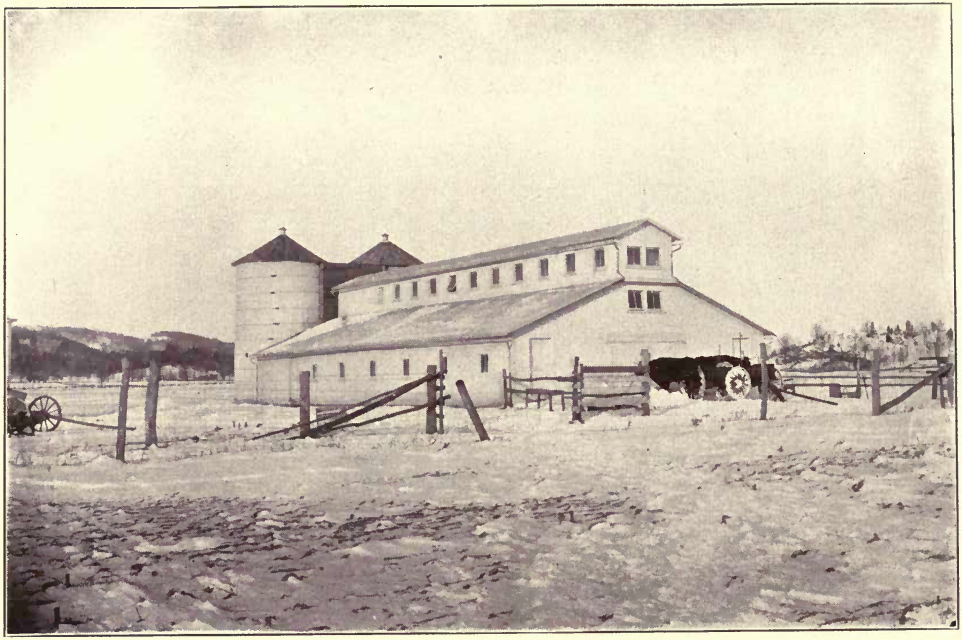
In the interests of public decency, for the betterment of the product he sells, and from a sense of pride in using cleanly methods, the farmer should guard against manure defiling his milk. It is not a difficult, costly, or complicated undertaking, and if he practises the maxim "An ounce of prevention is worth a pound of cure," he will find the manure problem solving itself.

Much can be done by providing an adequate cow yard and by the use of an effective stanchion in a suitable stall. These would insure the cleanliness of the cows. Then there is the removal of manure and its proper storage.

Manure ought to be removed from the stalls at least once a day, but preferably

THE DAILY REMOVAL OF MANURE.

watertight cart, such as is used by street cleaners, is suggested as a good vehicle, preventing dripping and also capable of being more easily cleaned than a wooden one.



A SHED BARN.

CHAPTER III.—IN GENERAL.

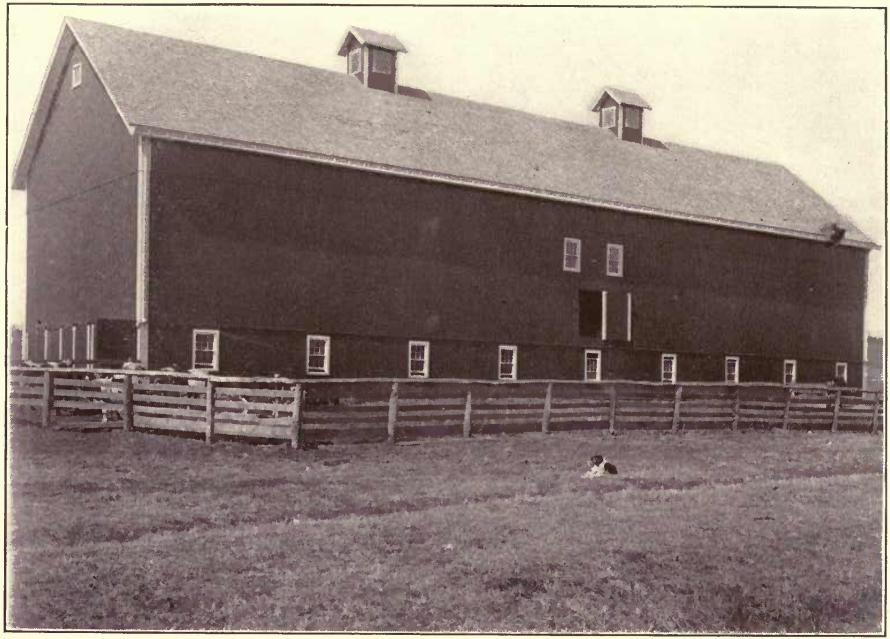
WHEN the farmer, on the approach of winter, puts his herd indoors to afford them shelter against the cold and stormy weather, he exposes them, in all too many cases, to dangers hardly less fatal. Even when there is a building which may be truthfully and accurately described as a cow barn, it is seldom designed and constructed to suit the peculiar needs of dairy cattle, while in the vast majority of instances the winter quarters of the herd are in a combination structure used for feed storage, horse stable, wagon barn, and general rubbish disposal. Furthermore, in such a building the herd will be allotted the worst place, usually the basement or ground floor, where, beneath a low ceiling and with scant window space, they must live for months, breathing poisonous air and subjected to the noise and disturbance made by the other occupants of the building. For animals whom nature intended to wander at will in the peace and

quiet of the open fields no more cruel treatment in the guise of intended kindness could be devised, nor could the dairy farmer's worst enemy concoct a scheme more injurious to his pocketbook. The dairy should be both his pride and profit; the animals represent a large investment, and are usually his most valuable possession; their yield of milk and butter and the calves they bear form his principal source of income. Whether a herd is profitable or not depends on the general well being of the animals, and yet in so important a factor as the cow stable are so many farmers wilfully negligent or indifferent. They well know that the cow is not a tough and rugged animal, but a tender and sensitive one, easily affected by surrounding conditions, and wonderfully responsive to good or bad treatment. Granted that cows should be housed during cold weather, it seems only reasonable to demand that during the period indoors they should not be deprived of the necessities of a healthy existence. When outdoors the cows have suffi-

cient light and air, an opportunity for needed exercise, and the liberty to keep clean, and these things must be provided during the stay indoors if the farmer would do justice to his herd and at the same time swell his pocketbook to its proper thickness.

The specifications for a cow barn must come from the experts in that branch of architecture, but in the interests of clean milk, which are identical with the interests of dairying in general, some ideas about the construction may be advanced. In the first place the building should be designed, constructed, and used solely and entirely as a stable for dairy cattle; it should not be used as a storage place for feed, vehicles, or utensils, nor as a stable for other animals. This singleness of purpose means that the needs of the cow will be the principal consideration, and these needs, important though they be, call for no grand or complicated structure. The cow barn should be practically a shed, with a continuous row of windows in the side walls and a Monitor skylight in the

roof, extending the entire length of the building. This form of structure insures an abundance of light and air, and means a reduced dirt surface and consequently less cleaning, while its small cost and ease of construction make it feasible for even the poorest farmer. It also encourages the practise of small herds in separate buildings, and is likely to secure more spacious stalls for individual cows. As against the tenement house style of barn, the shed means that a farmer's eggs are not all in one basket. In case of fire or wind storm all his possessions are not imperiled through being under one roof. Such a building practically solves the problems of light, air, and ventilation. The glass area insures a well-lighted interior, the Monitor skylight contributes light and also provides an outlet for the warm, stale air, while a supply of fresh air is pouring in through cracks and openings which are innumerable in a building constructed after the common style of a barn. Airtight construction is not needed in a cow barn, for it is a great mistake to keep



A LOFT BARN.

dairy cattle in a hothouse temperature. A herd of cows in a loosely built shed will thrive better in the coldest weather than if maintained in a tightly built, steam-heated barn, with an elaborate scheme for ventilation and the regulation of temperature.

The shed style of barn, from its simplicity, means small cost and a greater facility of construction, things which should induce farmers to break up the great herds stabled in one building and adopt instead the custom of small herds isolated in separate barns. Further, its skeleton interior construction and the absence of a ceiling mean a greatly diminished dust surface. There will be no dust sifting from the lofts above, which means a decrease in the amount of dirt in the cow barn, and this helps toward the general cleanliness of the place itself, the animals therein, and the milk there exposed.

A cow barn should be designed for a small herd, perhaps twenty, and it is preferable, whenever possible, that they be stalled in a single line. This arrangement of stalls has

advantages which should recommend it to dairy farmers who believe in having the very best, if it does cost a little more. It is patterned after the pavilion system which is followed in constructing modern hospitals, and what is beneficial in the matter of light and air for human beings in illness may safely and advantageously be provided for dairy cattle, especially the breeds whose tendency to disease and disablement is in direct ratio with their value. The single line barn provides a maximum of light and air of the purest kind for each animal, it makes possible a thorough sun exposure of the interior, and the hygienic value of these two factors in a dwelling, whether for humans or dairy cattle, cannot be overestimated. The double line of stalls, however, will appeal more favorably to most farmers, and in connection with this plan it is recommended that the cows be stalled tail to tail. This reduces the chance of infection by coughing across, and also places the heads to the windows, thereby affording a better supply of pure air.

All interior construction, such as the roof supports and the stalls, should be on the skeleton order, because of the advantage derived from a reduced dust surface, the greater ease in cleaning, and the absence of anything like partitions to stop the circulation of air.

THE FLOOR.

Cement is the best material for a floor.

It is more durable than wood, and does not offer cracks and crevices for the deposit of dust, is more readily and thoroughly cleaned, since it is adapted to flushing with a hose, and has the great advantage of adaptability to draining. For those who consider it too hard for the cows to stand or lie upon, the suggestion is made of providing wooden flooring for the stalls. This question of stall flooring is fully discussed later under the remarks on the stalls.

In laying the floor provision should be made for a slope away from the rear of the stalls and the construction of a urine gutter.

It is earnestly advised that there be no manure gutter, but, instead, a practical, useful urine gutter.

The manure gutter usually amounts to a dirty, ill-smelling hole in the floor, as it seldom accomplishes its intended purpose and is of service only to the man who removes the manure, when he must take a day off to do so. It does not deserve the name of gutter, for it fails to carry off the contents; neither does it facilitate the separation of the manure and urine and the collecting of the latter. Moreover it is a rare thing to find a cow and a stall fitting so exactly that the droppings fall directly into the gutter; usually they fall on either side of it, so the abolishment of the manure gutter would be only a slight change of actual conditions, while the substitution of a wheelbarrow in place of the gutter as a temporary storage place would be an improvement in the matter of cleanliness, and count toward the prevention of an offensive odor in the milk.

The urine gutter, on the contrary, is use-

ful and necessary, and can readily be made to accomplish its intended purpose, which is to facilitate the separation of urine and its collection, to become available as a fertilizer.

In building the urine gutter suggestion is made of laying the floor after the plan used for city streets, which slope from the center toward the sidewalks, where the curb forms a gutter, which is pitched lengthwise. As a result, the rain first flows toward the gutter and then follows it to the catch basin at the intersection of the two thoroughfares. In a similar way the urine could be carried off. With the floor sloping from the rear of the stalls, the urine will naturally flow toward the base of the slope, where it runs into the gutter and follows the pitch of this to a trap or catch basin connecting with a cistern.

THE SIDINGS—LIGHT IN A BARN AND TUBERCULOSIS.

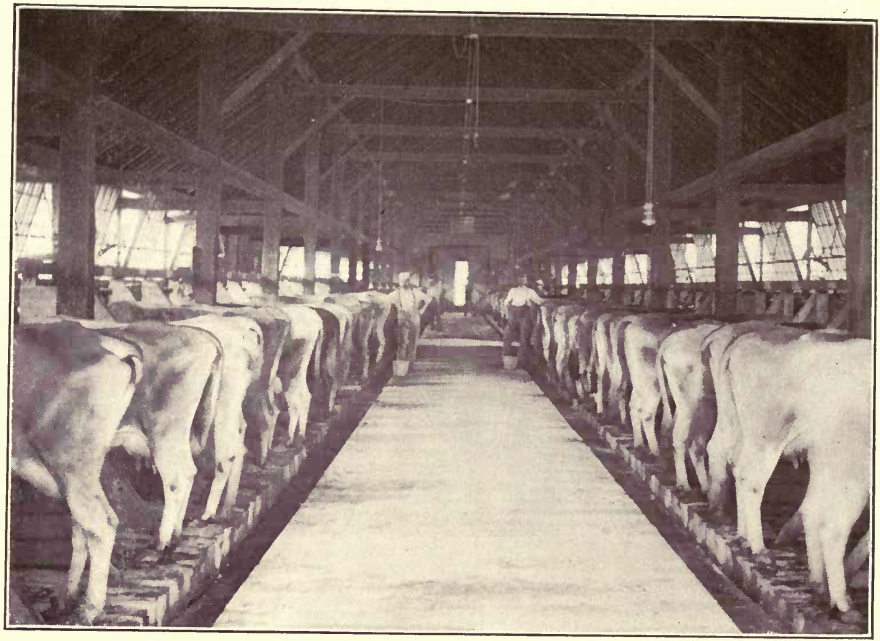
The interior surface of the side walls

should be smooth and of a material such as plaster, adaptable to a light color.

The smoothness is of value, as it offers a difficult lodgment for dust, and a diminution of dust deposit means not only less necessary cleaning, but a reduced chance of infection, inasmuch as dust in the air is the principal conveyor of dried sputum, which may contain the tubercle bacilli.

The light color is a way of increasing the light in a barn, and the need of light is so great that the owner of dairy cattle cannot afford to neglect any means of supplying it. Its value comes home to him if he remembers that there is a definite inverse ratio between the amount of light in the stable and the spread of tuberculosis among the cattle therein, and aside from the fact that the danger of infection by one tuberculous cow of the entire herd is lessened, there is the consideration of the general health of the animals, which is admittedly better maintained in a light stable.

The principal and often the only source of



INTERIOR OF A MODERN BARN.

light is the windows in the sidings, and it moves the beholder to pity that in so many barns they resemble the loop-holes in a revolutionary fortress. No one asks the farmer to build a cow barn of glass, as the gardener builds his hothouse, but he might with profit take a point or two from the methods of the gardener. In his conservatory the gardener tries to reproduce artificially the conditions of nature, and the more closely he attains them the better his plants thrive. The farmer's object is to conserve his cows during the winter months, and the more closely he reproduces natural conditions the greater will be his success. It he puts them in a building deficient in light they are deprived of one of the essentials of health, and thereby rendered more liable to be attacked by disease. A sick cow milks her owner's pocketbook; yet farmers have been known to maintain a tuberculous herd for years, while they would not keep a consumptive farmhand for a week. If they were unaware of the presence of the disease they paid a stag-

gering price for their ignorance. With the present diffusion of scientific knowledge there is small excuse for a dairy farmer to be ignorant of the prevalence of tuberculosis in dairy cattle, and if, when the most practical precautions against it are pointed out, he fails to do his share in combating the disease, he must be left to his own devices until such time as the State, in the interests of the community in general and the dairy industry in particular, shall compel him to maintain his establishment in a sanitary condition and conduct his business with ordinary hygienic safeguards.

Tuberculosis as a subject is to the farmer worse than the proverbial red rag to a bull, but his wrath is of small consequence when the problem is so grave. It is the mountain to which farmer Mahomet must some day come, and no one realizes this better than the officials, agricultural and scientific, who are charged with safeguarding the farmer's interests. The subject cannot be discussed adequately in a work of this character; all

that can be done is to remind the farmer of the extreme danger and suggest to him that if not because of the possible danger of communicating tuberculosis to the persons who drink his milk, then because of the welfare of his cows, he adopt the simple measures of prevention. Foremost among these is light, and one would like to see cow barns with a continuous row of windows in the side walls. Some men offer as a compromise a window to each cow, which is a vast improvement over ordinary conditions. The Monitor skylight advocated for a barn gives much light, and in some barns glass trapdoors have been laid in the slope of the roof.

VENTILATION.

After light, the next question concerning a barn is the air, which is furnished by Nature without stint and of unquestioned purity when the cows are in the fields. When the farmer takes his cows indoors he cannot ignore, unless to their detriment and the depletion of his income, the quality and

the quantity of the air he gives them to breathe.

A supply of good air is usually assured if there is an outlet overhead, because dead air and the exhalation of the cattle, being warmer than the fresh uninhaled air, will rise and pass out, provided there is an outlet.

The admission of fresh air is usually accomplished by the doors, the windows, and the loose construction of a barn, but when this fails, as it so often does in the tenement house style of barn, with its loft on loft, the owner is in the hands of his architect and must look to him for a system of ventilation.

Good ventilation will compensate for small air space, and the cubic dimensions of a building do not of themselves imply good or bad air. A small amount of air constantly renewed is far better than a great quantity of stale air.

THE STALLS AND THE STANCHION.

In building the stalls the same ideas apply which governed the interior construction of

the barn, namely, a skeleton framework and the absence of solid board partitions, in order to reduce the dust surface and not to impede the circulation of air and the diffusion of light.

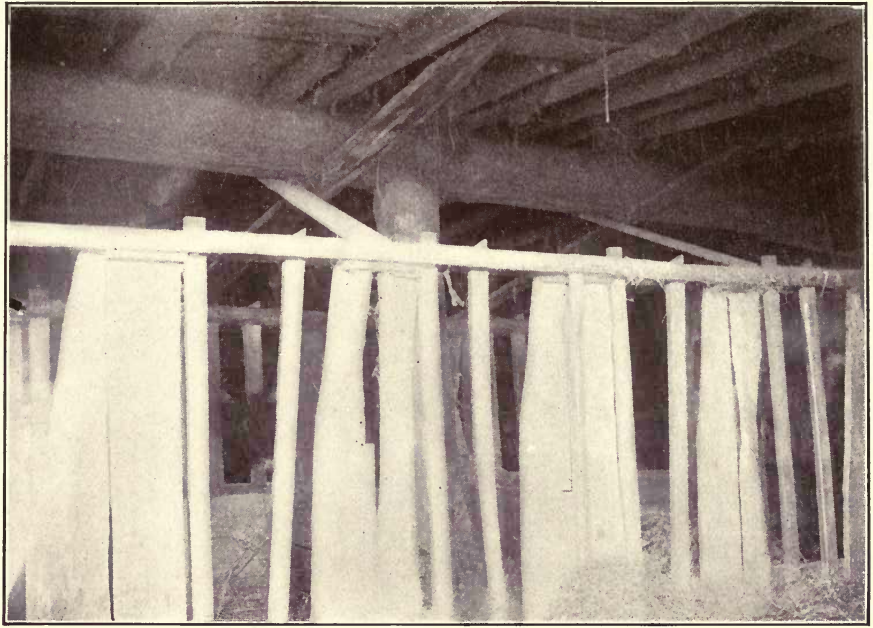
Smoothness and the adaptability to a light color might also be considered.

Regarding the stanchion framework, which usually consists of two horizontal timbers, into which is set the stanchion, it is recommended that the lower timber be sunk in the floor and leveled over flush with it. This removes the corners, which, besides collecting dust and particles of food, are difficult to clean, and is of further advantage in that the cow, as she lunges forward when about to lie down, will not strike her knees against the bar.

In an effort to provide separate stalls many farmers have built a diagonal partition, extending from the upper timber of the stanchion framework down toward the lower end of the stall floor. Such a separation is to be commended, but instead of the

solid partition it is advised that there be substituted a single detachable bar.

With the introduction of the manure gutter came the problem of accommodating cow and stall, and the problem is still vexatious. The gutter fixes the length of the stall, and if the cows fit, well and good; if they don't, there is no help for it. In probably 90 per cent. of the cases, and even when the stalls graduate from the size required for a Holstein down to the smaller accommodations for a Jersey, the cow and the stall are misfits. The manure gutter is then either useless or becomes a greater cause of defilement. When the stall is too long the gutter might better be away, as it then performs no useful purpose, since the droppings fall on the floor of the stall. It would be a great improvement to abolish the manure gutter, and for a device to assist in mechanically keeping cows free of manure study the possibilities of the stanchion. The tipping stanchion, used in combination with a floor beginning to slope at the rear of the stalls,



A TYPICAL BAD CEILING.

is earnestly recommended for the consideration of dairy farmers. This stanchion is set at an angle instead of vertically; its lower end is attached, as ordinarily, to the lower timber of the stanchion framework, but the upper end is fastened the necessary distance, say eight inches, back of the place of attachment for the upright stanchion. The result of this is that the cow, when prostrate, is advanced the distance of the tipping away from her droppings. When she stands the stanchion permits forward motion, and as it can be made flexible or revolvable side motion as well, but the backward motion is curtailed and reduced to a minimum, so it is reasonably certain that the animal will not be stepping in manure. Nature contributes toward accomplishing this, as the physiological act of defecation is performed in such a manner as to insure the animal's freedom from pollution by her own excretion. In general, manure drops outside the area covered by the animal's body when erect, and if when erect she is prevented

from stepping back any considerable distance, and, also, when about to lie down caused to prostrate herself some inches forward, she will, in all probability, remain practically clean of manure. The accomplishment of this means a great deal toward keeping manure out of milk, but it also means just as much in the reduction of labor devoted to keeping the herd in a cleanly condition.

MANGERS AND WATER BUCKETS.

If the observations of modern dairy establishments can be taken as a basis of judgment, feeding from the floor is preferable to the use of mangers. These would better be discarded, on account of the great amount of infectious matter they contain, dirt, dust, and particles of food, in immediate proximity to the mouth and nostrils of the animal. It is practically impossible to clean mangers thoroughly, and, like solid board partitions, they are objectionable on the score of an impediment to the circulation of air and the diffusion of light.

If water buckets are used they can be attached to the stanchion framework, but they require careful and regular cleaning in order to guard against the communication of infectious material.

EQUIPMENT.

Artificial light of some kind must be available, as during a great portion of the year the milking is performed in semi-darkness. It goes without saying that if the milker is expected to do his work in a cleanly manner he must at least be able to see what he is doing. Electric light is all that could be desired, but even the smallest farmer is able to have necessary light, since if nothing else is possible he can provide each milker with a lantern.

Water supply in the barn should include taps of hot and cold water, and with them be provided conveniences for cleaning of the hands.

Clean hands should be an absolute rule of milking, yet small as this important require-

ment is it will be neglected unless the opportunity of washing is right at hand.

Washing facilities should be placed in the barn, not only for convenience sake, but also because, as far as possible, all procedures connected with milking should be separated from the household, and, therefore, the milkers should not wash in the kitchen. Many barns boast a washing room, but every farmer can supply a tin basin, soap, and towels, and even when running water is not to be had pails of water can be provided. When washing facilities are thus ready it is very little trouble for the milkers to wash immediately before milking, and numerous farmers, of their own accord, wash the hands thoroughly several times during the milking period, a practise which one old farmer, who cared nothing for the manure thickened on the cows' hides, religiously observed.

STORAGE.

Storage in the cow barn is a practise which denotes things out of their proper place, and

is also condemned because of the unnecessary dirt and dust it occasions in the barn. If it be farm utensils they bring a great amount of dirt indoors, which the wind is liable to scatter about on the men and animals, the walls and ceilings, and thereby increase the work of cleaning and also add a chance of defiling the milk.

Food, in the shape of grain feed piled in a corner, means that dry dust from it will be carried in the air. The odor of silage in the milk is often caused by its presence in the barn rather than by the feeding of it to the cows. This holds equally true of brewers' grains.

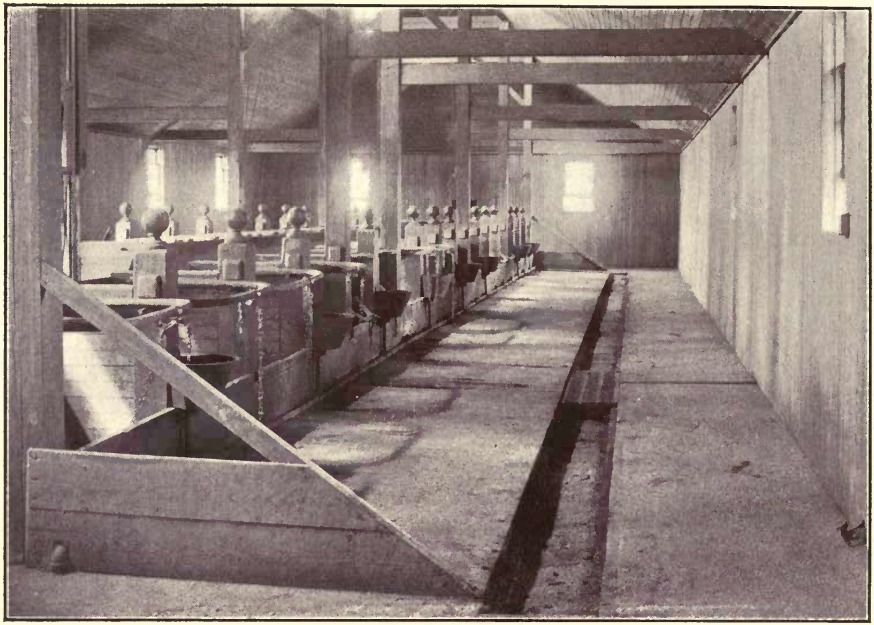
Milking utensils, including the forty-quart cans, should not be kept in the barn, which is not an appropriate place for such articles. They belong in the dairy house, the vat room, or the spring house.

CARE OF THE BARN.

The barn should be in such condition that cows, when brought clean from the fields or

after being groomed and washed, shall not become dirty again through their surroundings indoors. If it be considered that cows are stabled uninterruptedly for a period of six months, and that the condition of their quarters is a factor in their health, and, furthermore, that the milking is done in the barn, the cleanliness of the place will be admitted to be of prime importance. Keeping a barn in a sanitary condition is not a great problem, for there is hardly a dairy community which does not boast of a barn, accommodating a herd of from ten to fifty cows, which is clean and free from odors. The means required are very inexpensive, and the methods to be followed simple.

If a farmer starts with his barn in proper condition he has done much in his campaign against dirt and disease. A thorough overhauling and cleaning just before the cows are put in the barn for the winter period, and after they are turned out to pasture on the approach of summer, will do much toward preserving the building and reducing the



AFTER THE DAILY CLEANING.

labor of maintaining it throughout the year. In this semi-annual cleaning every part of the barn should receive attention, and considering that dust is the great enemy, every possible lurking place or lodgment for it should be removed or reduced as much as possible. A diminution of dust in the barn decreases the danger of rapid infection of a herd from a tuberculous cow, and this is best accomplished by reducing the footholds for dust, such as cracks, corners, rough surfaces, etc., and also by removing the dust by constant and thorough cleanings.

Whitewashing also should be a regular part of these general cleanings, and the entire interior receive a liberal coat. Besides the two general cleanings some whitewashing should be done all through the year. If a pail and brush are kept handy it can be done at odd hours and on rainy days. The advantages of whitewashing are such as recommend it to every farmer. It is an effective disinfectant, because of the lime contained in it; it absorbs odors, and unques-

tionably makes the interior lighter. As has previously been pointed out, light in a barn is so important that any means of increasing it should not be neglected.

As part of the daily cleaning the entire floor should be flushed and washed down with a hose, or, where this is not possible, then thoroughly swept, but the sweeping should be over at least one hour before milking, in order to allow time for the dust to settle. It is sometimes expedient to sprinkle the floor with a hose or sprinkling can. In this daily cleaning it is important that the alleys, the mangers, the feed troughs, and water buckets receive special attention, in order that remnants of food shall not be overlooked. Food particles not only produce an odor, but also provide a medium for bacterial growth. A part of the daily cleaning not to be neglected is a thorough airing and sunning of the barn.

The sidings and the windows should be cleaned at least once a month, and dust not permitted to collect in corners and cracks

in the woodwork. Cobwebs especially gather dust, and these should be removed quite frequently, as it requires only a few minutes' work with a broom to brush them away.

The stalls and stanchion framework need frequent cleaning, and good farmers clean them once a week.

The manure gutter, where there is one, needs above all things the greatest attention, and the necessity for the proper cleaning of it cannot be emphasized strongly enough. Manure is the principle cause of the contamination of milk; it defiles the animals, the buildings, and the workers, and by excluding it from the milk, a great step in the production of clean milk has been taken. As has been shown, manure gutters should not be allowed, but a well-constructed gutter can be kept in a sanitary condition. It must be thoroughly cleaned out at least once a day and land plaster and lime strewn in it. These are both absorbents and disinfectants. A point should be made of this daily

cleaning, and the practise of waiting until the gutter is full or overflowing condemned. The soiled bedding may be drawn into the gutter and used as an absorbent for the urine. Many farmers are accustomed to put the horse manure and refuse from the horse stable into the gutter, but this practise is not advisable. Where a grating is placed over the gutter care should be taken that it is kept clean. This grating, as a rule, is better dispensed with, because it is difficult to keep clean, and only the rich man can afford the extra labor necessary for complicated devices. In carrying away manure from the barn it may be suggested that this be done with care, in order not to contaminate the barn and the cow yard. Frequently the ground around farm buildings will be seriously polluted from careless handling of the manure. A metal wheelbarrow or the watertight cart in use by street cleaners is suggested as well suited for this purpose.

BEDDING.

Bedding or no bedding is a question with

farmers. Many, even with a cement floor to the stalls, believe it to be unnecessary.

When the stalls have a wooden floor, or a wooden platform is placed upon a cement floor, less bedding is required, and this is an advantage, for bedding means dust in close proximity to the udder and teats and consequently greater exposure for the milk.

The farmer should see that not too much bedding is laid, and that it is clean and free as possible from dust. Bedding a cow up to the belly is an unwise practise, for it increases the difficulty of producing pure milk.

The best bedding is planed shavings, and the worst is hay. Hay not only carries much dust, but is also the source of special spore-bearing organisms whose presence in milk are to be guarded against. Other material may be used, such as sawdust, dried leaves, and straw, which are good absorbents and reasonably free from dust. When straw is used it must be cut up small, so that it will not reach up to the body of the cow.

All bedding should be removed daily, to permit cleaning of the entire floor of the barn, but if this is not done at least the soiled bedding should be drawn into the manure gutter and some fresh bedding added. The removal of bedding should be part of the morning chores, and the placing of fresh bedding is best done after the evening milking. This practise not only leaves more room for the milker and his utensils, but the resulting dust is raised at a time when the milk will not be exposed to it.

FEEDING.

It is better that no rations be given just preceding or during the milking, because of the dust which will be raised, but if a farmer insists on feeding at this time the least harm is done by giving a scant ration of moist grain.

After the milking is over any food may be given. In general all foods likely to produce a foreign odor and taste in the milk should be fed some hours before milking. It is much

wiser to feed silage or any strong smelling or fermentable food immediately after the morning milking, because the daily cleaning and airing taking place then, fragments of these foods are removed and there is time for the odor to pass off before the next milking.

In order to abbreviate the evening chores many farmers have the practise of pulling down hay before milking. This is to be condemned, because it fills the air with dust.

The practise of bringing silage in trucks and cars to stand for hours in the barn is equally bad, because it means the presence of an odor in the barn likely to be absorbed by the warm milk.

ISOLATION QUARTERS

CHAPTER IV.

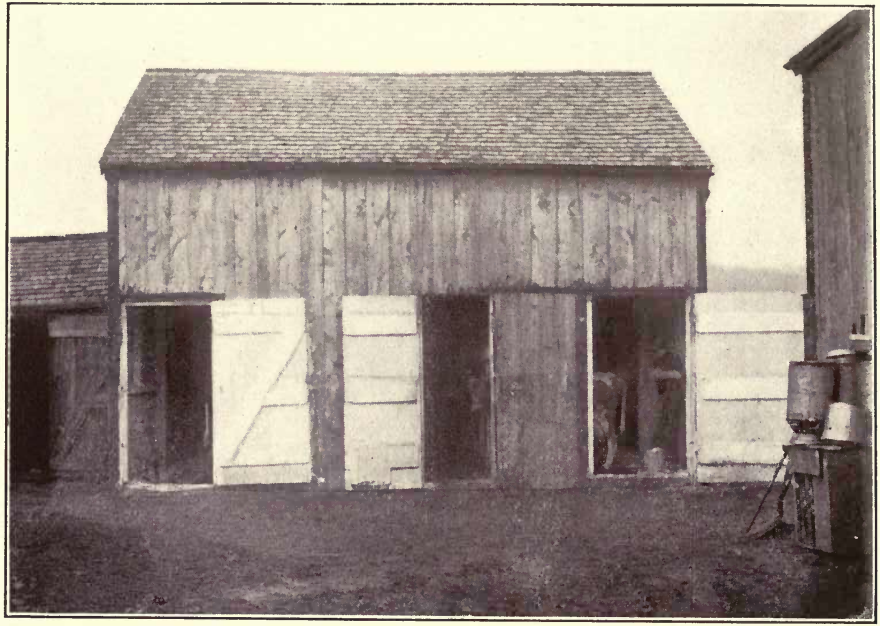
THE question of caring for a sick cow brings out, perhaps more decisively than in any other way, how inseparably united are sentiment and profit in dairying. That a tender, sensitive animal burdened with her unborn offspring should be gently handled and protected from hardship and abuse, receives the assent of every humane person; but when this animal is, at the same time, daily producing an article convertible into dollars and cents, and the amount of this money-making article is increased by kindness and diminished by brutality, it is then that sentiment is reinforced by profit and the two unite and say "Be kind to the cow."

Assuming that farmers realize the relation between the health of the animal and her profit to him, it seems reasonable to assert that no dairy establishment is complete without some provision for isolating a cow.

Once she shows any disorder or comes under suspicion in any way, it is necessary that she be separated from the herd. No farmer is justified, nor can he afford to be responsible for a sick animal, not only on account of the particular animal, but because of the danger to his entire herd and to the milk as well. A veterinarian, as a qualified person on whose judgment and decision the farmer can rely, should be summoned, and in the meantime, no risk incurred but the animal in question promptly isolated. Some place apart from the cow barn should be provided, where the animal can be watched, and receive the necessary treatment and attention. The isolation quarters should insure to a sick animal an abundant supply of light and air, ease and comfort, and a freedom from noise and disturbance. The quarters also should be capable of thorough disinfection after use.

The isolation quarters could also be of great service in the treatment of tuberculosis. An animal could be quarantined there,

until the diagnosis be made. If it be conclusive that the animal has tuberculosis and is valuable enough to be worth the trouble, she could receive attention and treatment which might result in curing her.



THE BARN OF A SMALL FARMER, WHO MADE CERTIFIED MILK.

IMPROVEMENT OF A DAIRY

CHAPTER V.

THE statement is made advisedly that there is hardly a dairy in the land whose efficiency in producing clean milk cannot be raised to a standard as high as any which, with reasonableness, is applied to the production of any other commercial product. Some places are beyond redemption short of a new establishment, but in the main dairy farms, whether those of the home farmer class, with a herd of a dozen or a score of cows, or those of an aggregation of farms under one manager, boasting of a thousand cattle, are capable of great improvement, and this improvement with simple and rather inexpensive means. A typical case of what has been accomplished is here set forth. The dairy, consisting of twenty cows, was owned by the farmer, and all the work done by himself and his wife. It was a very small establishment, but it represented a type of dairy that is probably more numerous than any other, is too frequently and

mistakenly classed as hopeless, and for these reasons it seemed desirable to devote efforts toward its improvement and demonstrate what could be done under unfavorable conditions.

The bacteriologist made a visit and found conditions that represented millions of bacteria to a cubic centimetre of milk. The barn floor was in bad condition and the gutter contained much manure; overhead was a ceiling of poles with the hay in wisps and bunches sticking down. The place looked as if it had not been cleaned for years, the sidings were thickly bespattered with urine and manure spots, cobwebs spanned every corner and angle, dust lay piled in the crevices and crannies, and there did not seem to be a square inch of clean wood in the whole interior. Dirty clothing hung on hooks, plows and other farm machinery were scattered about, and in a corner was stored a pile of feed. Though it was summer, even the cows were not clean, many of them having manure on the flanks. When the herd was brought

indoors for milking they stood restlessly in their stalls, stamping and swishing their tails. It was a hot, sultry day in August, but indoors was more uncomfortable than in the open air. The sun streamed through the western windows, the strong odor in the place attracted great numbers of flies, and the stuffy, heated atmosphere was trying to both cows and humans. The straining of the milk was done in the barn; the strainer had partly rusted, while the cheesecloth used, being loosely fastened, would slip into the strainer and be lifted out by the fingers of the milker.

To remedy such conditions required co-operation, but the farmer had a willing spirit and was convinced of the advantages to be derived from the knowledge and scientific training of the visitor. In company with the bacteriologist the farmer went through his establishment and its defects were pointed out to him, the loss they caused him, and the injury resulting to his milk. The weak points in his system of operations were

explained to him, the necessary changes indicated, and where asked the ways and means to improvement suggested.

On a return visit the place was found transformed. The barn interior was cool, light, and presented an orderly appearance. The use of whitewash had done wonders in brightening the barn. Sheathing paper had been tacked upon the poles, and it made a tight ceiling. Green window shades on the western windows tempered the afternoon sun, and the barn was cooler. The odor was greatly diminished, and fewer flies were about, and, though it was just as hot as on the previous visit, the cows were standing quietly and at ease. Adjoining the barn the farmer had built a plain board lean-to just the size of a vat room, and here the milk was carried in covered pails and strained through a metal wire mesh strainer without any cloth. A wash-boiler had been called into use, and the milking pail and the strainer boiled daily. Under the new conditions the farmer's milk registered a count of less than

30,000 bacteria per c.c., and aside from the satisfaction he felt in such a good record, the farmer was free to admit that under his new system the milking went more expeditiously.

It is to be noted in connection with the improvement of this dairy that the changes required a very small expenditure, and these changes once made would be effective for a long period of time. The whitewash, sheathing paper for the ceiling, the green shades, the new utensils, and the building of a milk room did not cost much for the material, while the work was done by the farmer himself. In return for it the farmer had transformed his dairy so that it became a show place in the community, he had improved the stabling accommodations for the herd, he had a new system of operations which was more convenient and more rapid than his former one, and he had equipped himself to produce a superior grade of milk.

THE COWS

CHAPTER VI.

THE owner of or the person responsible for dairy cattle has laid upon himself certain definite responsibilities and duties from the mere fact of taking charge of living animals of that character. One of these, and not the least important, is their maintenance in a state of health. He owes it to himself, to the animals, and to his fellow men in the community that neither the animals nor their product shall be obnoxious. Some of the things calculated to accomplish this much desired result have been set forth in the recommendation for a clean, light, and airy barn, and also the isolation quarters. What is here offered for the consideration of dairy farmers is the important matter of the external cleanliness of the cows.

Whether a cow's hide be clean, as in Nature, or plastered with manure accumulations, as in the dairy state, is no small matter. Not only has it a bearing on the welfare

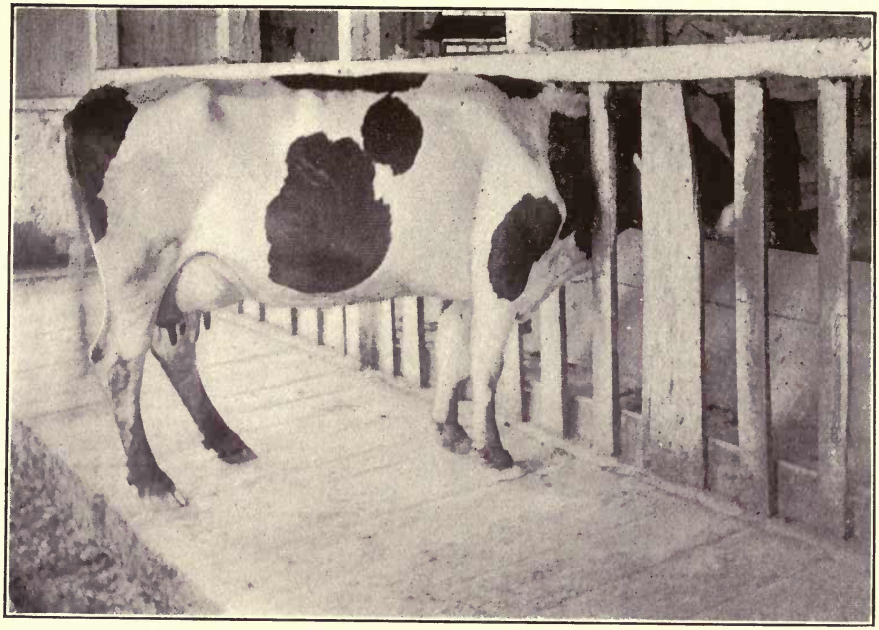
of the animal, but it affects in all too great a degree the quality of her product.

It is generally accepted that if the cow be dirty it is her keeper, not the animal, who is to blame. In summer, when she is pastured and at liberty to follow her own devices, she can select her own bed, and it is a clean one; she uses the comb, brush, and water provided by Nature, and, aided by a long handle, her very supple neck, she washes and grooms her own body. She asks and needs no attention from the keeper, and in winter it would be the same if she were given half a chance to keep clean. In place of the open field, with pure air unstinted, she may be boxed beneath a two-foot ceiling, which showers down hay, dust, cobwebs, and the settling refuse of a three-story building, her head is pilloried between slats, she must lie in a bed made for her of her own filth, and her acquaintance with outdoors amounts to trampling a narrow, dirty yard. It can be laid down as a safe guide that when the cow requires cleaning there is something funda-

mentally wrong in the method of keeping her. When she is bound hard and fast by the neck the person doing this must make up for the cow's inability to groom herself; when she is compelled to lie down in a bed of manure the farmer cannot shirk his duty, and that is, clean the cow of manure.

The sight of a cow with manure flanks is so common that it has come to be accepted as the distinctive badge of a dairy animal. It denotes wanton neglect and shameful laziness on the part of the animal's keeper, and the man who stands by and calmly watches the noxious stuff thicken and thicken day by day is unfit to associate with a dairy cow. If his own sense of decency is stopped up like his nose, and the public sentiment of his home community does not prod him, he will revel in his filth until the State, under a license system, quarantines the milk produced by such filthy dairies.

If the prevention of this blot on the dairy industry called for a considerable expenditure of money and labor the farmer might



A COMMON FORM OF STANCHION.

have some excuse. In the case of the poor man who can afford only a primitive arrangement for a stanchion and stall, and in the case of him who can afford but will not pay for adequate stabling accommodation, there can be used an old broom, which with a few minutes' work each day will brush off the greatest part of the manure and keep the cow's hide decently clean. If the cow receives no other cleaning, at least the brushing of the flanks with the broom can be done each day, and the cheapness and efficiency of this simple act puts it beyond the power of even the poorest dairy farmer in the land to offer a good excuse for his cows carrying a load of manure.

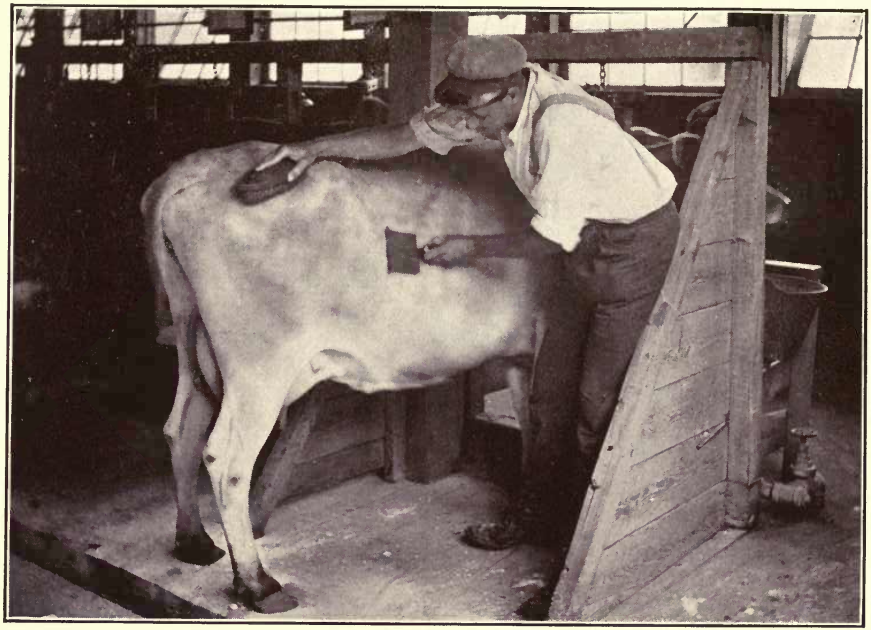
For the dairy farmer with a pride in his dairy, who wishes to produce an especially clean milk and a milk that is a luxury indeed, there is a special cleaning which supplements the daily grooming. The currycombing and brushing is an ordinary daily attention which the cow, as a valuable animal and a profitable member of the establishment, is

as much entitled to as she is to her daily ration. An extra cleaning with a view to making absolutely clean milk should include the use of soap and water.

Thirty minutes before each milking the flanks should be scrubbed, the tail from the base to end, the udder and the folds between the udder and flanks thoroughly washed, and then the tail combed out. This washing immediately before milking leaves a damp surface from which dust will not fly.

The washing may at first affect the flow of milk, but this is only temporary and ceases once the cow becomes accustomed to it.

Once the cows are cleaned in preparation for the milking they should be kept standing until the milking is completed. This action not only assists in reducing the chances of dirt getting into the milk but is of great value in saving time, in some dairies as much as thirty minutes being gained on the time required for milking. It can be accomplished in various ways, but one of the most simple and effective is the use of a throat latch.



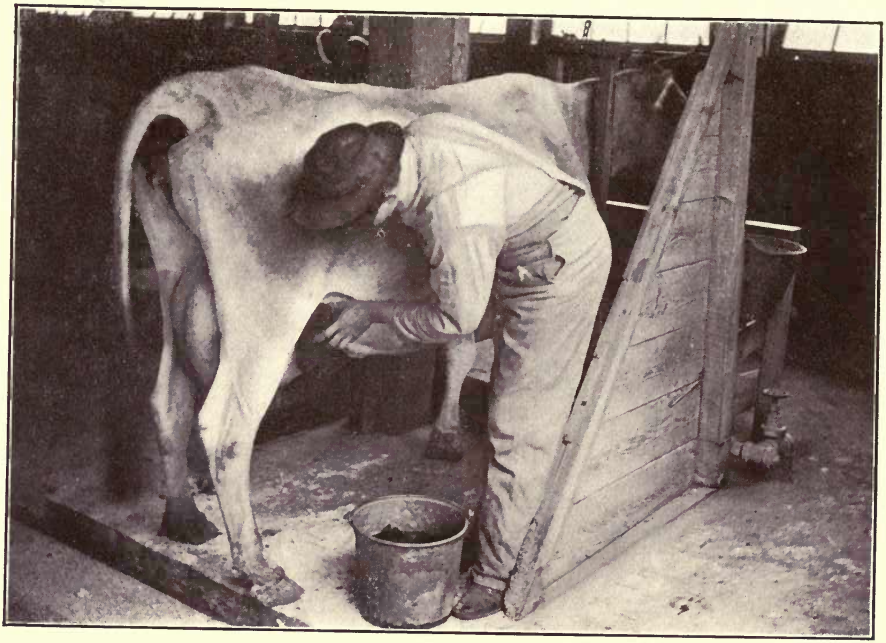
PART OF THE DAILY ROUTINE.

This is simply a long rope or chain drawn under the necks of a line of cows and attached to the stanchion framework; it can as well be a short chain fastened to one bar of a stanchion and hooking, under the neck of the cow, to the other bar. It is also feasible where the cow has a collar, to hook this to the stanchion. Many stanchions can also be made to keep the cows upright for the short time required for milking.

It may seem superfluous, but experience justifies the remark that this compulsory standing of the animal is intended to last only during the milking period, and once the milking is over the throat latch or stanchion should be cast loose.

What to do with a cow's tail during milking has given many a farmer considerable concern. In order to prevent it being whisked about, and depositing dirt in the milk, it has been bandaged and attached by a loop to the ceiling, but the simple and adequate method of making it harmless by clipping and washing is rarely practised by the farmer.

Clipping long hairs is also advisable. This clipping should proceed from the flanks backward, include the base and length of the tail, down the legs, and around the abdomen and udder. Long hair or clumps of hair in the region of the udder especially should be removed. The tail, or at least the long straggling hairs, should be trimmed to within five inches of the ground.



WASHING THE FLANKS AND UDDER.

THE MILKER

CHAPTER VII.

THE fact that milk is a food will suggest to every person that the rules of cleanliness observed in the kitchen and dining room may be well applied to its production. It is not too much to say that the milker should make a toilet for the dairy as punctilious as that of the maid who waits on the table.

The need of cleanly precautions is increased because milk has a peculiarly active capacity for absorbing all manner of odors, it is a favorable medium for the propagation of disease bacteria, and its color and taste are no indications of its power for good or evil. It is especially dangerous, since unlike many foods it does not, in a majority of the uses it is put to, undergo the sterilization produced by cooking. In view of this, it is not unreasonable to demand that the persons handling milk, while it is exposed, be free from disease, and be clean in person and clothing.

The milker should be selected with great care, as the task is one requiring an understanding of cows and a sympathy with them, a skill in working quickly and neatly, and a willingness to take pains in protecting milk against pollution.

As scrupulous cleanliness is required of the milker, bathing facilities should be convenient and laundry service be free and unstinted, that the milking suit and other clothing be frequently changed.

The simplest health precaution would bar out a milker who has or is convalescing from an infectious or contagious disease, or who is nursing a patient with a communicable malady. Similarly, if a milker has contracted influenza or any inflammation causing pus discharges, he should be relieved from milking duty.

Odors are absorbed so readily and retained for so long a time by milk that establishments producing a superior article should not neglect this matter. For this reason, it would be preferable to employ

A BARN SUPERINTENDENT'S OFFICE.

milkers who did not use tobacco in any form, while it should be superfluous to forbid the use of intoxicating liquors. The odors communicated to milk from the hands of milkers are too numerous to be cited, and the employees of milk companies charged with testing milk for odor can recite numerous instances of obnoxious odors introduced by defilement of the hands of milkers. There is also the ever-present danger of typhoid germs being communicated to milk from milkers' fingers, which have been contaminated by infected feces.

The preparation for milking should consist of washing the hands and arms as far as the elbows with warm water and soap, and the use of a finger brush and nail file. After this washing the milker should not touch the beard, face, ears, eyes, the handkerchief, or brush the cow's hide with the naked hand.

The milking clothes, usually consisting of cap, jacket, and trousers, should be reserved for this purpose, and might with advantage be sterilized daily.

All milking should be done with dry hands, and the fore-milk never used to moisten the fingers. If the fingers are hard or chapped or dandruff is on the cow's teats a little vaseline should be applied. In case of coughing, milkers should be careful to avert the head from the milking pail, a precaution also to be observed in case of sneezing.

The dairy farmer who does not receive a premium for cleanliness is hardly expected to adopt the foregoing requirements, but so long as he offers for public sale and consumption a food article like milk, with its possibilities of disease conveying and its tendencies to deterioration and absolute loss, he may be expected, out of deference to the public, to do something.

A minimum requirement, such as a State license system should enact, is the washing of hands and the wearing of a garment to protect the milk from defilement by the ordinary working clothes. Some farmers have no idea that washing the hands is a necessary preparation for milking. They will

milk with visible dirt upon the hands, which, becoming mingled with milk, trickles down between the fingers into the milk pail, while others will milk even with open sores upon the hands. In contrast to such men many farmers not only wash the hands just before taking the milking pail, but also wash after milking every four or five cows.

The wearing of dirty working clothes while milking is inexcusable. If they cannot be discarded, at least, some garment such as a jacket, overalls, or apron should be worn over them. The heavy cap or broad brimmed hat, especially, should be put off during milking, lest dirt fall from it into the milking pail.

MILK AND ITS PRESERVATION

CHAPTER VIII.

WHEN Nature instituted milk as a food she also provided the manner of supplying it in such a way that it should not be exposed; the teat of the mother entered the mouth of the offspring and the food passed from one to the other without suffering external contamination, except what might be caused by extraneous matter attached to the outside of the teat. Human ingenuity has imitated the method, and when the scientist wants to secure milk in its natural state he inserts a sterilized glass tube into the teat and draws milk into a sterilized bottle. The point of interest to the dairy farmer is this: Milk taken from a cow by the scientist in this manner will usually keep fresh and sweet at room temperature for years when protected from later contamination. From this fact the farmer can lay down all the necessary rules for the handling of his product, and all these

rules can be summed up in one: Do not expose milk more than is absolutely necessary. Manifestly some exposure will take place; the farmer not only cannot do as the scientist does, but his object is not to produce sterile milk, but a marketable article that will retain its original properties for a limited period of time. In order to do this let him imitate so far as he can the method of the scientist, and the closer he attains this the better will be his product. But even when the milk has been exposed there remains a simple and powerful corrective. Keep milk at a low temperature. The secret of milk preservation lies in these two rules: First, expose milk as little as possible; second, keep milk at a low temperature; and it must be classed as a piece of good fortune that a food product of such value and widespread use can be maintained by the observance of so few and so simple precautions. If the producer of milk will conduct his business with the knowledge and understanding that the cause of the physical and chemical

change in milk, and consequently a depreciation of its value, is the result of exposure to bacterial dirt, he will be forewarned and forearmed and much better qualified to work intelligently.

Exposure to bacterial dirt is occasioned by putting milk into unclean vessels, by keeping it uncovered near unclean persons and animals, and leaving it uncovered in unclean places. Some exposure must occur in the ordinary routine. So much is granted. But this exposure can be made as slight and as harmless and as short as possible. That is, milk in its passage from cow to consumer should enter a small number of vessels, the fewer the better; the surface it touches in these vessels should be reduced as much as can be, and the openings in these vessels should be as small as the purpose allows, and provided with covers. Necessary exposure is limited to drawing milk from a clean cow with clean fingers into a clean pail in a clean barn; it means straining in a clean room through a clean strainer into a clean

receiving can. Short exposure means milking quickly, straining quickly, filling vessels quickly, and covering them immediately.

The exposure which has resulted can be offset by cooling the milk and maintaining it at a low temperature. A better method than the use of ice for preserving milk has not been devised; it is the natural one to be employed in connection with a food product like milk threatened with bacterial operations; its efficiency is beyond question, and its cheapness seems like a provision of Nature to aid mankind in its food supply. What icing milk accomplishes is the delaying of those changes in the milk which would otherwise take place rapidly. When milk is maintained at a temperature of 40° Fah. the bacteria in it do not increase rapidly in numbers, and are not active in performing those functions which result in changes in milk, such as souring, and in the formation of deleterious products, which are responsible for the so-called milk and ice-cream poisoning.

The cooling of milk should be done within one hour, and, if possible, immediately after milking. Making all due allowance for the action of the bacterial substance in milk, this is the safest procedure. If the farmer does not provide for the cooling it may not be done when it is imperatively needed, and even when milk is delivered to the consumer within a short time it may still be kept for as long as a day before being consumed. This quick and continued cooling is absolutely essential for milk destined for the cities, which will be twenty-four and forty-eight hours old when delivered.

MILKING

CHAPTER IX.

As a preparation for milking the barn has been cleaned of manure, land plaster or lime laid, the cows have been groomed, and the udder, the folds near it, and the tail washed, and the throat latch or stanchion fastened to keep the animals standing.

The person about to milk has washed his hands and put on milking clothes and taken the milking pail, which has a small opening and is provided with a cover.

Before beginning to milk the milker should wipe off the teats with a towel, which should be kept in the pocket of the jacket of the milking suit. The milker should be careful not to handle a dirty milking stool, wipe the udder or teats, or brush the side of the cow with the naked hand. At the best dairy farms the foremilk is discarded.

The practise of leaning the head against the cow's body should be abandoned. While milking, the pail should be held at an angle

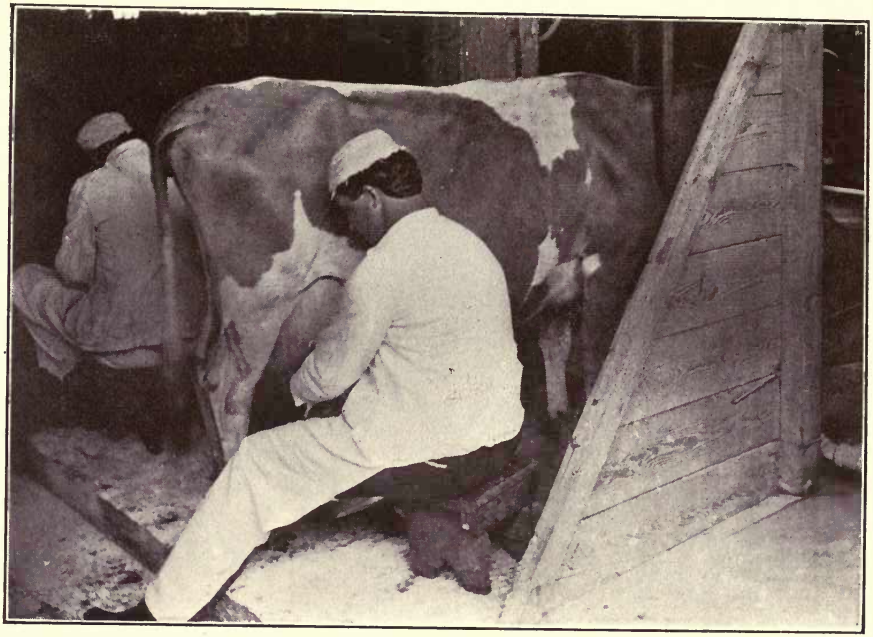
of 45 degrees, that the surface of milk presented to falling dirt may be reduced.

In case of any pollution by the cow during milking the milker should be careful that no drops of urine, bits of feces, or dust raised by the droppings get into the milk, and if a pail of milk is contaminated in this way, or by another accident, such as a cow putting a hoof into the pail, the milk should be kept from the general supply.

As the milking must be done expeditiously it is necessary and also a wise provision that all unnecessary persons be excluded from the cow barn. They not only disturb the herd, and, therefore, affect the flow of milk, but they also represent an unknown danger of infection.

Children under fourteen years of age especially should be excluded, as they may be carriers of diphtheria or scarlet fever, to which they are more susceptible than adults.

Small animals, such as dogs and cats, should not be permitted in barns and dairy rooms.



MILKING AT A MODERN DAIRY FARM.

As soon as a cow has been milked the milking pail must be covered and so carried to the place where the straining is to be done.

The straining should not be done in the barn, the barn yard, or any place in proximity to dirt, or where flies will gather; a proper place is the dairy room, the spring house, or vat room, where milk can be protected against extreme contamination.

When the milk has been poured from the milking pail the latter should immediately be re-covered and kept so until the milker begins to milk another cow.

As soon as a forty-quart can is filled it should be placed in a cooling vat whose temperature is less than 45°. So few springs have so low a temperature that the addition of ice is usually necessary. The covers should be tightly fastened on the cans, to keep out dust, frogs, and mice.

If the farmer persists in tipping the covers he should protect the can with a wire or cloth covering.

The cans of milk when in transit to the

country receiving station should have wrapped about them a wet blanket, upon which has been placed another dry one. Jackets for the cans, of course, are better, since they are more effective in preventing the rise of temperature.

Every farmer should use a dairy thermometer, that he may definitely know at what temperature the milk leaves his place, the temperature of the spring, and the cooling vat.

HAULING ICE TO THE DAIRY.

THE DAIRY ROOM AND THE ICE HOUSE

CHAPTER X.

THE dairy room should be reserved for its set purpose because of the necessity of its being always kept scrupulously clean.

No storage should be permitted, such as apples, vegetables, and other products.

Small animals should be excluded.

It should be built like a good barn with smooth walls and ceilings and a cement floor. Whitewash should be applied on the side walls and ceiling. The daily cleaning should be a thorough one, special attention being given to removing coagulated milk from the floor, which if left will draw flies and collect dirt. The windows should be screened, and precaution taken against a draft of wind laden with dust. A direct entrance from the barn should be avoided, or at least an alley or ante room constructed.

ICE HOUSE.

A supply of ice is scarcely to be dispensed

with, if pure milk is to receive proper care. A good spring should be considered an auxiliary in cooling rather than a main reliance, for seldom is spring water, without the addition of some ice, cold enough to reduce the temperature sufficiently.

One ton and one half for each cow is a good average amount for a year, and this can generally be procured in the country at a moderate cost of labor and money. If a small pond is not already available, it is easy to flood a meadow or dam a brook in winter time and cut the quantity of ice needed.

Building the ice house may form the principal expense, but this expense is incurred but once in many years and is justified by the improved quality of the milk. The ice house need not be a fine structure of double walls filled with sawdust, for almost any kind of building can be made to serve the purpose.

UTENSILS

CHAPTER XI.

THE utensils present an important consideration in the production of clean milk. They will frequently be the one defect in a good dairy and in many cases are responsible, more than any other one thing, for an increased bacterial count.

In their manufacture, cleaning, and storage, the dairyman can accomplish much in the way of improving his product.

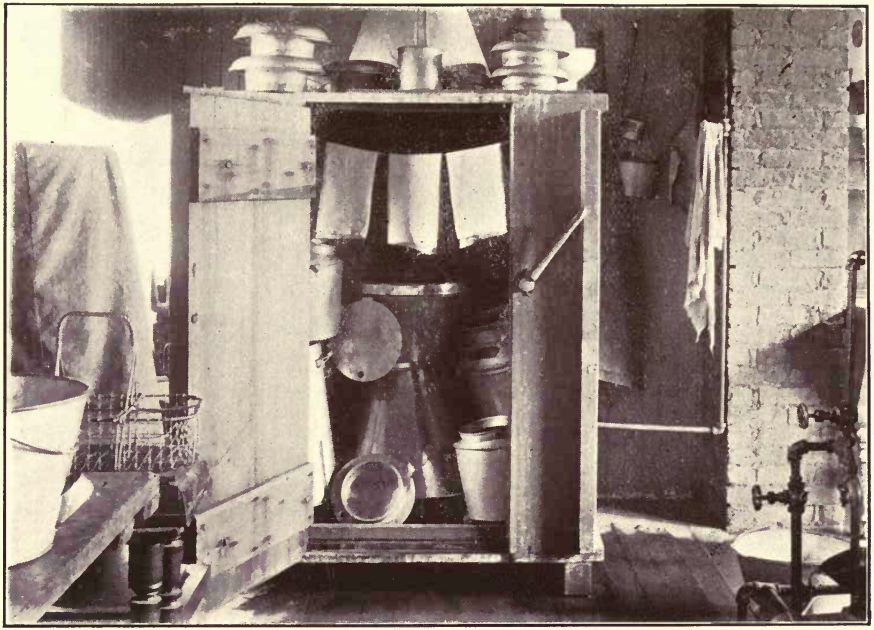
In general, few articles should be used in the ordinary dairy routine, and these of simple construction. Every surface which milk touches is an additional chance for contamination, so in the passage from the cow to the consumer the fewer the vessels it enters the better.

Utensils should be constructed with the view of accomplishing three things: A reduction of the exposure of the milk contained in them, a reduction of the surface it is to come in contact with, and a facilitation of their proper cleaning.

In the case of utensils made of metal, such as milking pails, strainers, and cans, close scrutiny of the seams and joints is necessary to insure that they are well soldered and closed. Open joints or cracks in the seams offer a hold for coagulated milk, which is a medium for bacterial growth and is responsible for the odor in cans and has a share in causing milk to sour. Tubs and vats made of slate or metal are preferable to wood because they are more easily kept in a sanitary condition.

The cleaning of milk utensils should be done with much care, and a point made of washing them immediately after use. This prompt washing is very important and the practise of delaying it for several hours must be severely condemned. The milk thickens on the sides and bottom of the vessel, while the bacteria are increasing at a tremendous rate, and when the cleaning is performed it is extra difficult and rarely accomplished thoroughly.

The odor of milk vessels is due to careless



A BOX STERILIZER.

and improper methods of cleaning. Utensils after use should be immediately rinsed in cold water, in order to prevent coagulation of the milk still in the vessel and also to remove as much of this milk as possible. Then they should be scrubbed with warm water, to which has been added some solvent such as soap or a washing soda, to act upon the fatty substance, and finally rinsed clean.

The cleaning of milk utensils is not complete nor adequate without sterilization. This is accomplished much more easily than farmers imagine, as an ordinary wash boiler can be utilized. These are usually large enough to contain the pails and the strainer at once or in not more than two or three batches.

Boiling for thirty minutes and drying in the oven or on the stove will generally accomplish sterilization, and the farmer has the satisfaction of knowing that so far as the cleanliness of his utensils is concerned he is beyond reproach.

The water used for washing purposes

must be uncontaminated, and this precaution no dairy farmer can afford to neglect, as the lesson of typhoid epidemics ascribed to milk plainly teaches. In most of the cases the infection was traced back and definitely fixed on the wash water. In the event of typhoid in his own household, the farmer should send no milk to market.

The storage of utensils is very often done haphazardly and without any thought toward keeping them clean. They should not be kept in the barn or cow yard, where dirt is being blown about, and where they are knocked around or offer a chance for small animals to get in. A proper place is the dairy, the spring house, or the vat room, where they can be shielded from dust.

The custom of sun exposure practically amounts to a snare and a delusion as it is rarely performed in a proper manner. Usually only the exterior receives the benefit of the exposure, as the utensils are placed bottom upward and the sun's rays cannot reach the interior.

When so placed that the sun does affect the interior, dirt and flies enter, and furthermore the residue of the washing water, instead of draining off, collects in the bottom of the can. An enclosed glass box is an effective method, as it permits of the sun exposure as well as guarding against dirt reaching the inside of the utensils.

The wide topped, coverless milking pail, at present so much in use, should be abandoned for a pail with a narrower opening, about eight inches in diameter, and accompanied by a cover. This cover should always be upon the pail to protect the interior, once it is cleaned, and to protect the milk while being carried from place to place. When a man is milking, this cover should not be laid carelessly on the floor, but hung, top upward, on a convenient hook. After milking, the cover should immediately be placed on the pail and not removed until the milk is about to be poured through the strainer. Many excellent dairies are deficient in this particular. The milk is carried in wide, uncovered

pails from the cow to the straining room, a distance of anywhere from twenty-five to one hundred feet, across a cow yard, under a hay loft, or past a manure pile, with a large surface of warm milk exposed to falling dirt and prevalent odors.

The strainer is a utensil that theoretically should not be used. If milk were produced in a clean manner, the dirt that the strainer is expected to remove would not get into the milk, so straining would be unnecessary.

No reliance can be placed on the strainer's ability to make up for previous careless handling of milk. Bacterial dirt once in milk has done its harm, and the strainer will certainly not reduce, and most probably does increase, the bacteria already present.

For this reason it cannot be kept too scrupulously clean, and should be boiled for an hour and dried in the oven at least once, and preferably twice, a day.

The best strainer for the average dairyman is a metal vessel with a 100-wire mesh, set in the sides rather than the bottom of

the vessel. This wire should be replaced once it becomes broken or rusted, and in cleaning should be scrubbed with a small, stiff bristle brush.

When milk is strained through a cloth, such as canton flannel, cheesecloth, Turkish towelling, or thick linen, the cloth must be kept scrupulously clean. After being washed in the manner prescribed for washing milk utensils, they should be sterilized by baking in the oven for thirty minutes, wrapped in paper or cloth, and kept wrapped until required for use.

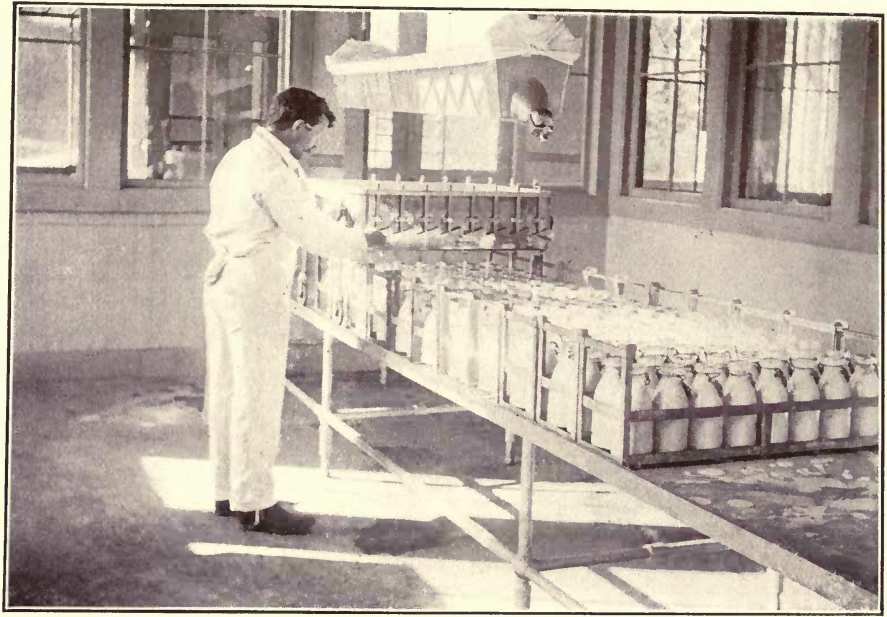
Absorbent cotton, when used for straining, should be used only once and then destroyed.

The receiving can, usually the typical forty-quart can familiar to every one, is the responsibility of the dealer. He should not only furnish cans which are constructed properly as to material, tight seams, etc., but he should deliver these cans to the farmer daily, in such condition that the latter need only remove the cover to pour in the milk

and then replace it, not to be removed again until the milk is delivered out of the farmer's charge. This can be accomplished by cleaning the cans at the country receiving station, sterilizing them, and delivering them to the farmer, who may take them away covered and keep them so until ready to fill them with milk.

It should be an invariable rule that milk cans are to be used for no other purpose than to contain milk on its way from the dairy to the receiving station.

The milking stool deserves a word. As this is handled by the milker at least twice for every cow milked, it follows that it should be clean, and not in a condition to defile the hands. Some farmers have recognized this and regularly boil them.



FILLING BOTTLES.

THE BOTTLING OF MILK

CHAPTER XII.

THE advantages of bottled milk over the old style "dipped" milk are so generally recognized that it is hardly necessary to make a recommendation.

The exposure of dipped milk to contaminating sources is endless. The forty-quart can will be opened a hundred times on a dirty, ill-smelling wagon, standing in numerous streets and avenues, whose atmospheres register a tremendous bacterial count, or in a retailer's shop, with its dirt and odors and the long procession of customers of every degree of contamination or infection.

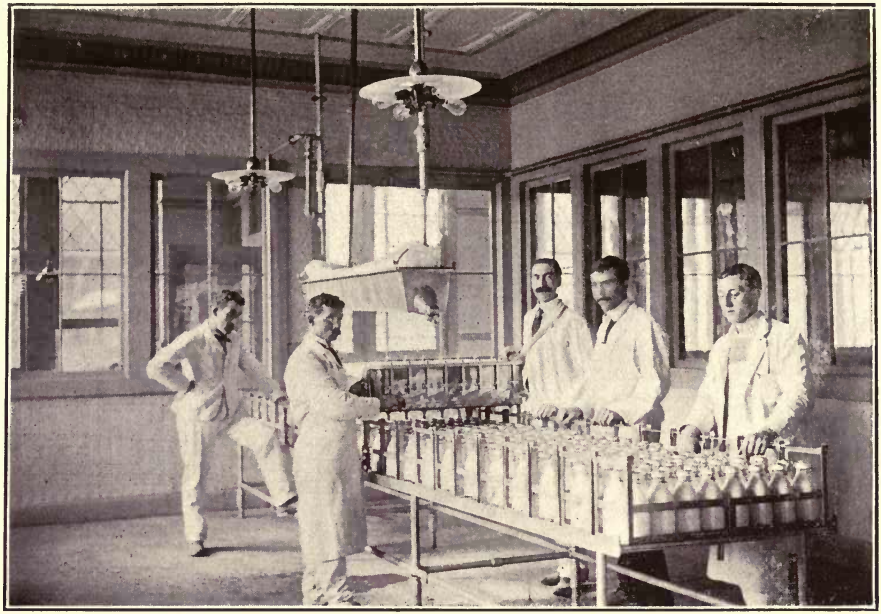
When hawked about from house to house and family to family the exposure is even worse. Bottled milk, on the contrary, means a small quantity, and frequently the exact and entire supply of a family, protected from the moment it is bottled and covered until delivered for use.

In the process of bottling this milk also undergoes an inspection, and the consequent

expulsion of sundry strange inhabitants which have entered at the farm, and in the case of dipped milk would have continued their journey for forty-eight hours longer.

While bottled milk is in general to be preferred to dipped milk, it must not, however, be permitted to masquerade as a superior article merely because it is a small quantity contained in glass, instead of a large quantity contained in tin.

If bottled milk is to deserve its superiority over dipped milk the bottling must be done in a proper manner. The question to be asked is not "Is it bottled milk?" but "How is it bottled?" The good work done by the milker in protecting milk against exposure must be continued by the bottler, and the rules which guide the milker can also be laid down for the bottler. The exposure of milk must be as small, as harmless, and as short as possible. The bottling room, whether at the dairy or the large bottling establishment, must be cut off from the other rooms and form a separate, isolated room.



A MODERN BOTTLING ROOM.

It should be constructed with the same idea in mind that the great surgeon follows when he plans his operating room. Contamination must be reduced to a minimum. The place is to be kept immaculately clean, and the construction of it should further the accomplishment of this. The walls and ceiling should be smooth, and with the floor and the fixtures be cleaned daily by flushing and steaming.

Provision by means of screens and shades should be made against the blowing in of dust and the entrance of flies, as well as the sun's rays heating the room.

Adjoining the bottling room, or set into one of the walls, should be the sterilizer, which is an indispensable part of every bottling establishment. The sterilizer, to facilitate the work and assist in reducing the exposure of milk, should connect the bottling and the cleaning rooms. Once the bottles have been cleaned they are to be put in the sterilizer at the wash room end, and after sterilization taken out from the

bottling room end. At many establishments it has been found practicable to make the sterilizer large enough to contain all the bottles, and thereby use it as storage place until they are needed. This is far more advantageous than the custom of standing them in open racks, exposed to all the contamination of a large factory room.

The persons engaged in the bottling should be selected for their fitness, with as much and even more care than the milkers. In bottling milk is subjected to its greatest exposure, and the process brings the workers in closer contact with it. Their health, personal habits, and manner of working should be considered, and, like the milkers, they should make a careful toilet before work and wear clean working suits while engaged near unprotected milk. They should be the only persons allowed to enter the bottling room while milk is exposed, and for this reason arrangements should be made by which milk is brought into the bottling room, and the filled bottles passed

out, without the milker or those engaged in the packing and shipping entering.

Bottling should be done quickly and neatly, and the capping and covering keep pace with the filling. The practise of delaying the covering until a large number of bottles is filled is a bad one, as it means a longer exposure of the bottled milk than is necessary. The pasteboard caps, which must also be sterilized, should be handled in a cleanly manner, and not laid around in dirty places.

The overflow from the bottling table is unfit to be bottled, and this milk should not be offered for human consumption.

As soon as milk is bottled the bottle should be packed in ice ready for shipment. The boxes should have covers and be deep enough to hold sufficient ice to cover the tops of the bottles, as the cream, rising to the top, contains more bacteria than the rest of the milk, and needs thorough icing.

All utensils and vessels used in bottling milk are subject to the same requirements as other milk vessels. They should be con-

structed with a view to reducing the surfaces coming in contact with milk, and thought should be given to avoiding corners and other lodgments for coagulated milk. Whenever possible, covers should be provided for openings or open vessels, such as receiving vats, carriers, and fillers. All utensils must be cleaned in the manner prescribed for milk vessels, and also sterilized. The vents of the bottle filler require boiling to clean them properly.

Bottles need thorough cleaning with cold and hot water, a soda solvent, and a brush, and must also be sterilized. Sterilization of milk bottles in their routine passage from bottling room to consumer and back again is very necessary. The dealer who does not provide for this is criminally neglectful of the sanitary requirements of his business. The bottles are his property, are furnished by him for the use of his customers, and the responsibility for any infection due to them may be laid to him. The vicissitudes of a milk bottle are beyond any one's control,

BOTTLING AT A HOME DAIRY.

and the uses to which it is put, the thousand and one exposures it undergoes, and the varying customers it serves require that it shall be subjected to the simple and adequate precaution of sterilization.

Bottling for the small farmer is subject to the same requirements. The bottling room should be clean and kept in a sanitary condition; it should not be directly connected with the house or the cow barn, and precautions taken against the entrance of flies and dirt.

The sterilization can be accomplished by the use of a wash boiler if no other means are available.

The packing and shipping should be done apart, and the milker excluded from the bottling room. The milk pails could be passed through a window or door, or the milk poured through an opening in the wall into a receiving vat. From this receiving vat the milk can be directly bottled, warm as it is, and cooled later by the ice covering the bottle in the shipping box.

Dairy farmers who use a cooler should keep this utensil scrupulously clean, sterilize it, and, until it is to be used, covered with an enveloping cloth or a bag with drawing strings. The ice must be put in before the cloth is removed, that dirt from the ice may not fall on the surface over which the milk is to flow. The use of this additional utensil and the extra handling of milk may be advantageous for the clean dairyman, who really wants to cool the milk thereby, but the man who will not take sufficient care in this process would better not do it at all, as his milk is probably better before passing over the cooler than after.

Dairymen would do well to consider what they expect to accomplish by using the cooler. If they want to cool milk in that way, and find it a saving of ice, well and good. But if they seek to remove odors from milk, they are working along wrong lines. The so-called cow odor is removed in the best and quickest way by keeping manure out of milk. Food odors can be practically kept

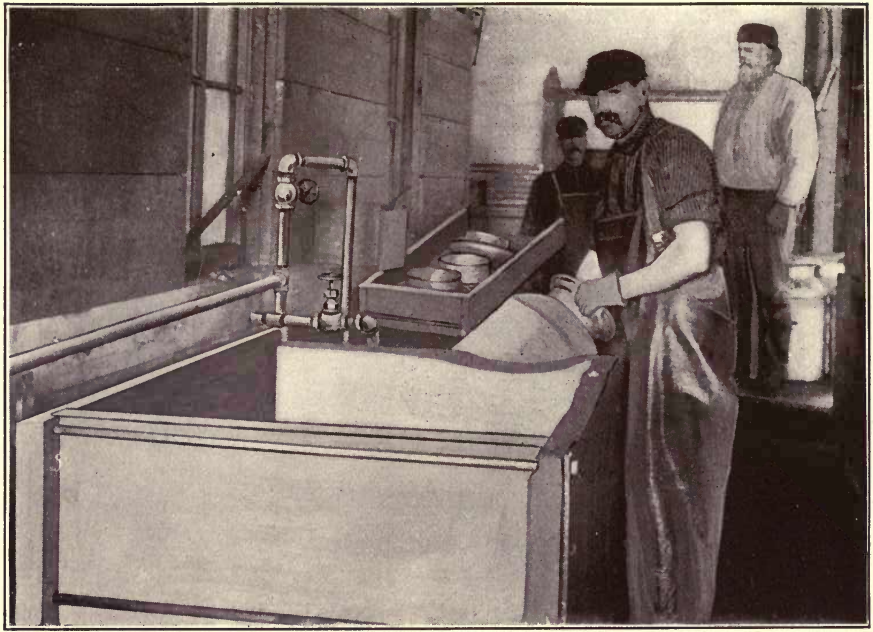
out by keeping the food and the odor away from warm milk, and by feeding such foods several hours before or just after milking. Odors will be removed by aeration, but the milk must be aerated warm. And in performing aeration the dairyman should assure himself that the removal of odors by such exposure does not become a greater evil through the introduction of countless bacteria and the absorption of the prevalent odor of the place where the aeration takes place.

THE OPPORTUNITY OF THE DEALER

CHAPTER XIII.

IT will hardly be disputed that the person with most at stake in the milk business is the dealer, the man who buys the milk from the dairy farmer and sells it, by retail or wholesale, to the consumer. His city depots and country factories, with the equipment of a widespread delivery system and a manifold paraphernalia of bottles, cans, and boxes, form a very large financial investment, and with this is also pledged his personal reputation.

In addition to the cares and troubles inseparable from any commercial enterprise, the milk dealer is constantly engaged in maintaining a delicate equilibrium between his farmer and his customer, the main props to his business. The exactions and requirements of the one must be fulfilled by the other; the cause and the remedy for complaints are usually sought at the farm, and the conditions there are reflected in the



CLEANING CANS AT A COUNTRY RECEIVING STATION.

operations in the city. Inasmuch as the dealer is thus intimately concerned in the status of his farmers, it may not be too much to suggest that the dealer should know his farmer as man to man; that with the business relations should go hand in hand a personal one, from which could result a better knowledge and understanding of each other's difficulties and through this a cordial co-operation for the betterment of their mutual interests. Certainly the dealer can work great improvement at the dairy farms, and he is the man to do it.

His moral influence in a dairy community can count for much, and in one way at least, if in no other, can this be exerted. This is in the matter of handling and protecting milk once the farmer delivers it into his charge. In other words, the dealer's country establishment, be it creamery, shipping station, or what not, should be an object lesson in the care of milk.

Further, he could erect a model cow barn and maintain a dairy that would be a school

of instruction and an experiment station. It should be conducted on strictly business principles, with practical dairy methods and a system of operations in vogue that any farmer could duplicate. The plans of the buildings, the cost of erecting and maintaining them, the cost of the herd and the profit from it, indeed, every item connected with the establishment, should be freely offered for the inspection of the dealer's farmers and available for their use. It should be a practical demonstration of what a dairy farmer can do in the matter of profit, in the matter of producing good milk, and in the matter of keeping it clean.

An opportunity for the dealer to exercise profitable philanthropy is in the institution of hospital barns and quarantine quarters for his dairy communities. It is not supposed that these should be conducted on a charitable basis, but rather be self-supporting. Where dairy farmers in the vicinity of such an institution number from fifty to one hundred, and their herds approach in round

CLEANING BOTTLES AT A LARGE DAIRY.

numbers five hundred to a thousand animals, the provision for efficient veterinary service and proper treatment of sick animals would seem welcome and likely to be repaid.

When milk is once delivered on the dealer's premises it should be beyond any further risk of contamination or deterioration. The dealer owes it to the farmer on the one hand, and to his customer on the other, that henceforth the care and protection of this milk should be beyond cavil or reproach. The farmer stands for a large number of individuals working under certain difficulties, and allowance is made thereby for some shortcomings at the dairy. But at the dealer's establishment conditions are different. It is one place subtending fifty or a hundred dairies, its requirements are comparatively few and simple, definitely known, and can be readily provided for.

The milk is to be received from the farmers, at once thoroughly iced, and kept iced until delivered for use. If it is to be bottled, the bottling room and the process of bottling

can be arranged to insure perfect care of the milk. The bottling of milk at the country establishment is the most important part of its routine, and usually its most glaring weakness. If this were accomplished properly the whole tone of the establishment would tend to improve.

In the receiving of milk from the farmers there is usually to be found some objectionable features. One is pumping milk to a gallery or upper floor and another is admitting the farmers in close proximity to the exposed milk in vats or in process of bottling.

The pumping of milk is most reprehensible, as the extent of pipe surface it touches is considerable and the piping is difficult to clean thoroughly. Furthermore, the desired result, namely, the securing of sufficient "fall" for the flow of milk, can be accomplished in a much more satisfactory way. It should be planned that the wagons drive up to a sufficient elevation to deliver on the upper floor, or gallery. When the building sets

against a hillside this is readily accomplished, and even when on level ground a bridge driveway six to eight feet high can be built at a cost that is more than justified by the improvement in handing the milk.

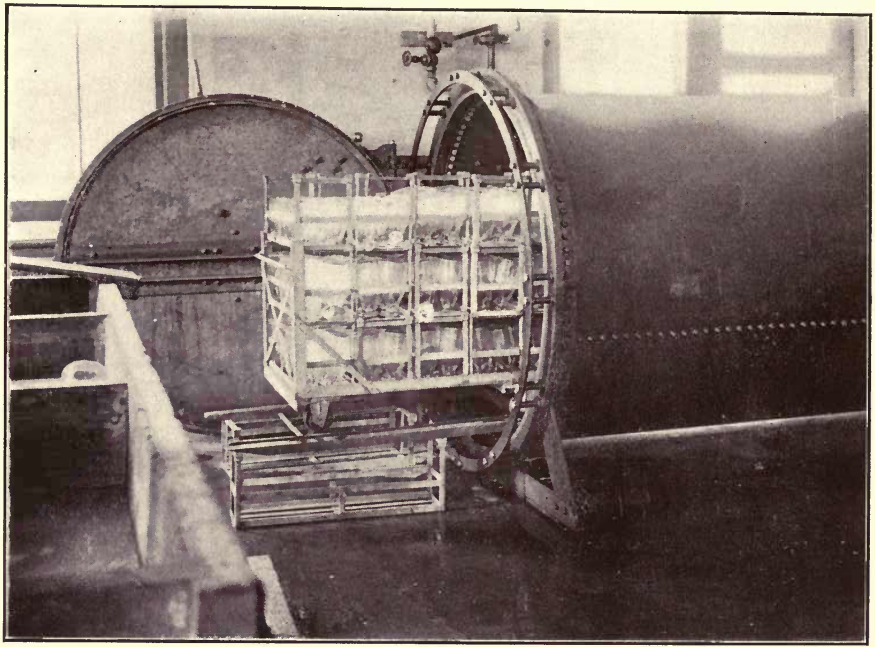
The receiving room should be enclosed and cut off from the bottling room. It is not unusual to find one large room in which milk is flowing over an immense uncovered cooler into uncovered vats, and thence through the various stages of bottling, while at a wide doorway farmers are driving up, depositing their cans, and standing by while the contents are weighed or measured.

It follows as a matter of course that the bottling room should adjoin the receiving room, that the passage of the milk from one to the other may be as short and accomplished in as simple a manner as possible. In cases where the bottling cannot keep pace with the delivery it is necessary that the milk be received in vats, but there is no reason why these vats should not be covered.

At some stage in the routine of passing

from the receiving to the bottling room the milk should receive its last necessary straining, but preferably should not be strained into the bottle filler. Where this is done properly by the use of a good wire mesh strainer little objection can be made, but the usual method of using loose cheesecloth, which is constantly slipping into the milk, is far worse than no straining at all.

The requirements for bottling and the need of an isolated room for the purpose have previously been indicated in the chapter on Bottling Milk. Once milk is bottled and kept tightly covered the danger of external contamination is practically eliminated. There remains only one thing to do henceforth, and that is, pile on ice. Not only at the country establishment and on the railroad train, but also, and more particularly, when on the delivery wagons in the city, should bottled milk be kept iced. Careful dealers have come to recognize this, and now provide stations where their delivery men re-ice in the course of the morning's



STERILIZER IN USE AT LARGE ESTABLISHMENTS.

delivery. Too much labor and watchfulness has been expended in protecting milk at its danger period to be turned to naught through the lack of sufficient icing during delivery.

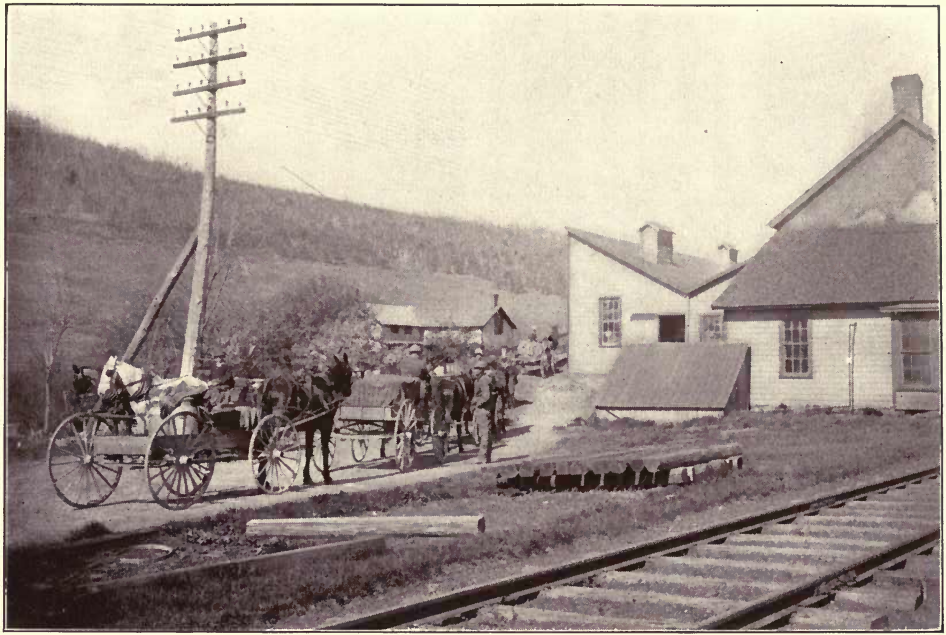
The cleanliness of cans has a far more important bearing on the production of clean milk than many dealers suppose. If a farmer be given a can actually clean and sterilized he is relieved of one labor which, with his limited facilities, he can hardly do properly. He may keep the can covered, and so protected against contamination, until just before he fills it with milk; when filled he may recover it promptly, ignoring the exploded "animal odor" idea, and let the animal heat subside in the usual process of cooling.

The reduction in harmful exposure accomplished by furnishing to the farmer cans in proper condition is so great that it would repay any dealer to provide for it. It only means doing thoroughly what is now done carelessly, that is, the washing of the cans,

and, in addition, the installation of a sterilizer, which at most is not a heavy expenditure, and in a pinch could be built by the dealer's employees.

It is hardly expected that cans will be thoroughly cleaned while the farmer waits for them. A double set is required, but this provision is frequently of itself an economy, and numerous dealers have already adopted it.

Once the cans are emptied of milk they should be rinsed in cold water to prevent coagulation of the milk remaining in the can and also to remove as much as possible of this milk. Then they should be scrubbed in hot water, to which has been added a solvent, and finally rinsed in clean hot water. They are then ready to be put upside down in the sterilizer, and, after sterilization and drying, covered, and the cans stored in racks ready for the farmers to secure them on the following morning.



FARMERS DELIVERING MILK TO THE SHIPPING STATION.

MARKET MILK

CHAPTER XIV.

AFTER all has been said and done in the movement for clean milk, the great question is still: "What of the market milk?" the millions of quarts consumed daily by the public institutions, the hotels and eating places, and by the great mass of the population, who seem to know little and care less about the food they eat. Cheapness is the one consideration, and low-priced milk is accepted, regardless of the condition of the dairies, the health and treatment of the cows, and the unclean persons handling the milk. It seems like trying to help people who will not help themselves, but in the progress of the movement for clean milk this phase of it must sooner or later receive attention. It is so great and affects so large a proportion of the population that eventually the State will have to grapple with it. Until then, what can be done? The dealers engaged in purveying this immense quantity are either

indifferent or benumbed with helplessness. They see no advantage in improving the methods at their dairies, while their customers, not yet alive to the truly remarkable value of this almost indispensable food, will not contribute the additional fraction necessary for an improved article. Whatever plan is devised, then, must appeal to the dealer and the farmer as accruing to their advantage; it should call for very little additional expense to either party, and the less it changes the present routine the more favorable is likely to be its reception. Such a plan is here advanced. It requires of the dealer only that he shall thoroughly wash and sterilize the forty-quart cans furnished to the farmer. The latter is asked in turn to do these things:

Keep the cows' flanks clear of manure by using an old broom daily.

Use only pure water in the barn and the dairy.

Avoid contact with contagious diseases.

Wash his hands before milking.

Boil his milking pail and strainer.

Cover the forty-quart can as soon as filled, and keep it covered.

Cool the milk, either by icing or putting the cans in vats.

Milk produced according to these directions is not likely to be a vehicle for the transmission of the germs of the cummunicable diseases, and should show a bacterial count of not more than 100,000 per c.c. What this means in the way of improvement is evident if it be considered that much of the daily supply in New York city shows a count of millions of bacteria per c.c.

It should be evident that the dealer, as a return for some extra care in cleaning cans and the installation of a sterilizer, which, it must be remembered, is not an expensive machine, not only obtains an improvement in the general keeping qualities of his commodity, but, furthermore, has a definite assurance of cleanliness.

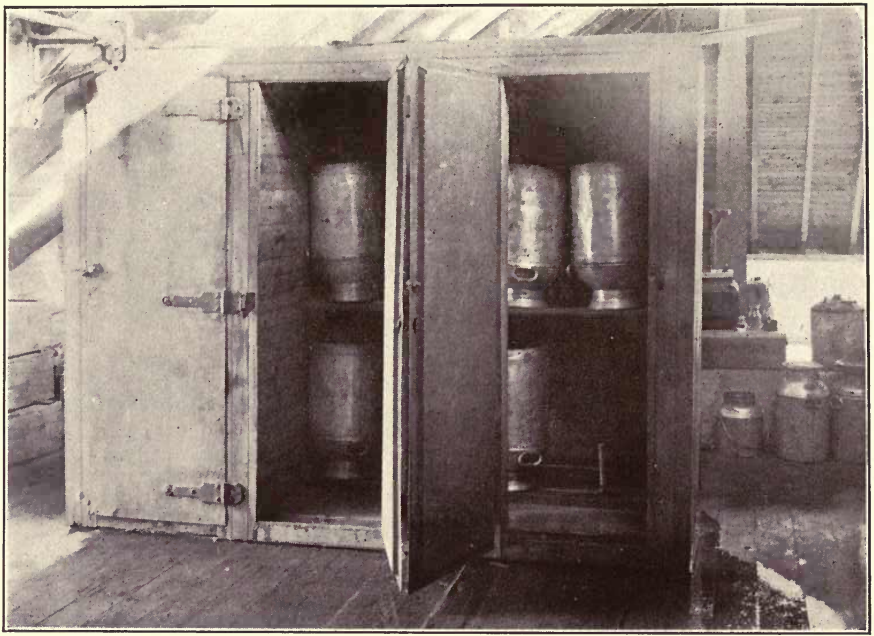
The farmer, also, can assure himself that he is producing a better article, and doing it

with hardly appreciable additional labor and expense. If keeping the cows free of manure and boiling his utensils be an added labor, they are practically offset by the simplification of his routine, as the covering of the can immediately relieves him of much other care and trouble.

It is expected that objections will be made to this plan on the score of "animal odor" and animal heat. The animal odor bugaboo should have been banished long ago, and it is high time that dairy farmers learn that the so-called "cowy odor" is due to manure, a statement which is capable of being easily demonstrated.

Animal heat is the heat natural in milk when at body temperature, and differs in no way from other heat. Reduce the temperature and you reduce the animal heat. Animal heat is only harmful because it allows the bacteria, which entered with the dirt, to grow and ferment the milk.

Recurring to the scientist who draws milk from the teat of the cow through a glass



STEAM BOX FOR STERILIZING CANS.

tube into a glass bottle. He surely imprisons animal heat in his bottle of milk, yet because no bacteria entered it will keep sweet for years at room temperature.

Full cognizance is taken of the conditions likely to prevail at dairies. It is even expected that this plan shall be put in force at establishments where the cow stables shall be in an extremely filthy state, and it is devised to meet just such conditions. Until adequate measures are taken to improve unsanitary establishments the present evils should be mitigated as much as possible. No matter how defective and unclean a dairy may be, it is believed that the simple rules laid down will be effective in producing a reasonably clean milk. They have been tested at a hundred isolated establishments under the most varying circumstances, and the results have always been satisfactory. In one dairy community in New York State the system has been in successful operation for months, the daily production amounting to three thousand quarts.

THE DUTY OF THE CONSUMER

CHAPTER XV.

IT would be strange indeed if no responsibility rested on the person for whom the dairy farmer and the milk dealer have been roused to better efforts in their activities. The custom has long been to attack the milk problem at the producer's end, and while the wisdom of this course is unquestionable it should be apparent that, once the production of milk is raised to a satisfactory standard, the attention of the consumer of milk should be directed to what this improvement entails. After all, it is the consumer who is the cause of solicitude, whose protection enlists the interest of scientific societies and prompts the watchfulness of health officials.

This precious individual has heretofore been guarded against deception in the matter of the chemical properties of milk. Now and henceforth there is the assurance of esthetic and hygienic safeguards. Not even the most exquisite palate need hesitate to

drink milk, as it is doubtful if any other article of food is now produced with the same attendant cleanliness through all its various handlings. Immunity against the communication of disease has been amply provided by the utilization of modern scientific knowledge. What is beyond the power of the householder, namely, a knowledge and a supervision of the source of the family food supply, has been accomplished for him, by the co-operation of health officials, physicians, milk dealers, and dairy farmers. Under an inspected system of milk production there is assured to the consumer a scrutiny of the methods and the equipment of the dairy farm whence comes the family supply.

The fact that so important a food as milk is placed beyond suspicion as to the manner of its production should be cause for public rejoicing. It should inspire in the consumer of milk a confidence regarding it, and induce him to use more of it, as milk, in food value, is unsurpassed by any other one article utilized for the sustenance of life.

This notable advance in hygienic food production calls for public acknowledgment and deserves proper appreciation by all persons interested in the purity of the food they eat. In domestic economy, the improved methods at present in vogue in the kitchen and dining room indicate the progress of modern civilization, and if the producer of food in the field of his activity has accomplished an advance comparable to that which has taken place in the preparation and in the service of food, his achievement is certainly noteworthy and deserving of compensation. The best type of milk dealer has put on public sale a food commodity whose production challenges comparison with anything done in the cleanest kitchen in the land. The consumer should consider the milk dealer's regard for cleanliness as a personal service, and as he is a merchant, not an altruist, the acknowledgment should be made in a very practical way, namely, by paying him a fair price for the article.

What a bottle of clean milk, produced in

accordance with the new requirements of dairying, represents should be brought to the attention of every householder. Few can have any knowledge or supervision of their food supply, but the consciousness that milk, at least, may be placed above suspicion marks a most important advance in hygienic food production. The consumer of milk may, for a slight additional cost, obtain the assurance that the milk brought into the house has been produced with attendant cleanliness and hygienic safeguards far in advance of the methods pursued in the average kitchen. This assurance stands for healthy animals receiving humane treatment, the milking performed amid cleanly surroundings, by workers who have carefully prepared for their task; the milk received into vessels cleaned far better than most kitchen utensils, and, once in these vessels, henceforth protected against contamination, preserved in a proper manner, and delivered to the consumer with its entire history accompanying it.

To point out to the consumer a duty in connection with this superior milk should be unnecessary. It is usually the women of the family who are charged with the purchasing of food, and it is for them to decide whether the labors of scientific workers and the enterprise of dealers and farmers shall be fruitless or not. No better field for civic labor and the advancement of the public good is offered than the seconding of these efforts for the improvement of the milk supply. A woman should consider her family milk supply as of the first importance; it should not be left to servants or the janitor to decide what dealer shall supply the milk. She herself should take an interest in it and make inquiries as to the source of supply and the manner of producing it. When she bestows her patronage on the dealer who has expended money and labor to secure a good milk she has the satisfaction of knowing that her discrimination in his favor, against the dealer who does not care, counts for widespread benefit. It stands for the

encouragement of the conscientious dealer, a more adequate payment of the dairy farmer, and the improvement of the milk supply of the poor who cannot afford to pay for a special milk.

The family physician, as part of his duty to his patients, should be in a position to recommend milk produced with proper sanitary precautions; and if he be deficient the consumer has recourse to the health officials, who regard it as a pleasure to supply information as to what is good food, and where one may go for information concerning its production.

A proper knowledge of milk should be considered an indispensable part of the equipment of a housekeeper. No person charged with the responsibility of furnishing food can afford to be ignorant of what milk represents in the regimen of human diet. Its value is becoming appreciated throughout the entire world, and the consumption greatly increased. It is recognized as a complete food, containing, as it

does, a proportion of the elements found in the nitrogenous food, the carbohydrates, and the fats, and, in addition, many of the minerals required by the human body. As the result of the labors of scientific men improved methods have been devised for its production and preservation, and apprehension on esthetic or hygienic grounds has been almost entirely removed.

The advance made by the dairy farmer and the milk dealer require that the consumer shall also organize the methods in order that the improvement accomplished by them may be maintained and extended. The treatment of milk in the average household is woefully careless, and done without knowledge of the why and wherefore. The prevailing belief that a thunderstorm is the cause of milk souring is one instance of misunderstanding. The fact that it is easy to purchase milk which will not sour during a thunderstorm should suggest to the consumer that there must be some other reason. And the reason is the presence of lactic acid

forming bacteria in the milk. Secure milk which does not contain these bacteria and it will not sour. It is not disputed that milk sours during a thunderstorm, but the cause is not the thunderstorm itself, but certain conditions accompanying it, which are favorable to the action of lactic acid bacteria.

The consumer should further brush up his knowledge of bacteria and be primed on the difference between clean earth and bacterial dirt. The former is harmless, while the latter is an enemy to be ceaselessly and vigilantly guarded against. The milkman who proudly holds up to view a bottle of milk, clear of visible soil, should be compelled to give something more reliable than this spectacular exhibition. He should be asked to demonstrate as well the absence of bacterial contamination, and compelled to give proof that in his process of extracting soil, which may be perfectly harmless, he has not added to the milk numbers of lactic acid and other harmful bacteria.

Milk in the household is governed by the

very same rules which are in force at the dairy farm. It is a manifest injustice to the farmer and the dealer that, after their conscientious efforts to deliver milk in a wholesome condition, it should be spoiled through carelessness or ignorance on the part of the householder. There is even a greater need for proper care, as, by the time milk reaches the consumer, Nature's provision for preserving milk has been exhausted.

The care of milk may be briefly stated: Expose it as little as possible and keep it iced.

Once the dealer delivers it his responsibility is ended and that of the consumer begins. It should never be permitted to stand for hours before being placed in the ice box. Where it is delivered before people are awake provision for icing it in warm weather should be made. As one of the "modern conveniences," so much vaunted in city apartments, there should be an ice box for containing milk until the tenants are ready to care for it. Such a receptacle would pay

for itself many times over by the milk it would save from spoiling.

Once milk is received in the family it should go immediately into the ice box and be kept in a compartment separate from strong-smelling foods. The bottle, if not covered by a sealed cap, should be cleaned before being opened, and always kept covered when milk is not being poured out.

It must be recognized that milk shall go into none but clean vessels, and these vessels shall always have a cover.

For the dining table, milk should be served after the manner of coffee, in a pot, accompanied by a small cup or glass for drinking. The milk pot should be made after the style of a syrup pitcher, with a tight-fitting cover.

In hotels, restaurants, and other public eating places, whose cuisine and service is otherwise faultless, the manner of serving milk is antiquated. Whereas in families and households, bottled milk has long been in use, there still remains in hotels and restaurants, the unclean practise of dipping milk

from large receptacles. All the thought and attention lavished on other foods is denied to milk, which in fact requires the most careful protection. Just as the wine and finer grades of beer and ale are brought to the table in sealed bottles, so also should milk, and brands of milk of known reputation for cleanliness. The hotel keeper has no excuse for not furnishing milk in this manner, as many dealers are able to supply him with pint or quart jars, which have been sealed at the dairy, and the question of cost is not to be considered. At most it is only a fraction more than the present objectionable method calls for and the advance in cleanliness is imperatively needed. Certainly the patrons of expensive hotels are entitled to every refinement in the service of their food, and a bottle of milk, known to have been produced and delivered with a regard for cleanliness, is no longer a luxury.

Flies must be ever and constantly guarded against. A fly in milk should be considered an offense and, when sickness exists in the

house, sufficient cause to discard the portion of milk it has touched. A good rule to follow is that only the amount needed for immediate use should be taken from the main supply in the ice box.

The exact value of pasteurization and sterilization of milk should be clearly understood and the effect of these processes not exaggerated. They are effective for the time being and are a protection against the contamination which has already taken place. They do not, however, operate to control future contamination, and it is folly to suppose that milk once heated to 174° F., or even to the boiling point, has been made proof against the action of bacteria, which enter after the milk has undergone either of these processes. Pasteurized milk and sterilized milk cannot be exposed with impunity, nor can they be preserved without proper icing. The same care and treatment accorded raw milk must be given to them if the good effects of the heating processes are to be retained.

Milk vessels should be selected primarily with a view to their adaptability to thorough cleaning, which means also their adaptability to keeping milk sweet. Much of the souring of milk, not only in the household but also at the dairy farms and in the milk dealers' stores, may be ascribed to improper cleaning of utensils used to contain milk. Coagulated milk contains great numbers of lactic acid forming bacteria, which effect the souring of milk, and in milk vessels this coagulated milk lodges in seams, rims, crevices, and corners.

It follows, therefore, that milk vessels should not be fancy in shape with narrow necks and ornamented with flutings and indentations. The interior, at least, should be designed to resemble a hollow sphere, bowl shaped, with smooth, even sides forming with the bottom a rounded corner.

The use of tin vessels is in general to be avoided, because of their tendency to rust and the liability of open seams.

The cleaning of vessels cannot be done too

carefully. A vessel once used to contain milk should, unless it be used again immediately, be considered unfit for use again until it has been cleaned. Proper cleaning consists in first rinsing the vessel in cold water, secondly, washing it in hot water, to which has been added a solvent, such as soap or washing powder, thirdly, rinsing it in clean, hot water, and, lastly, draining it.

The milk bottle has great possibilities as the object of a campaign of education. A diffusion of knowledge concerning the proper use of this article would be no slight contribution to the improvement of the milk supply, and would, at the same time, count as a useful and necessary addition to hygienic practise. Needless to say, the milk dealer would rejoice exceedingly if this came to pass. The misuse of the milk bottle is for him a burning topic of discussion and an incitement to denunciation, for it amounts to such an imposition that the consumer should hasten to give the dealer his due: return his bottles, and return them clean.

The pecuniary loss inflicted upon the dealer through the destruction and misappropriation of milk bottles by his customers is out of all proportion to the extent of the business transaction involved. It is an instance of downright injustice, and no one cognizant of the magnitude of the abuse can fail to sympathize with the dealer. The truth of his grievance is obvious to every observer, and the facts point to a most reprehensible thoughtlessness among many people who purchase bottled milk.

In the existing conditions of things the dealer must provide a bottle, and present the use of it as a gift pure and simple to his customer. The invention of the familiar quart bottle was itself a boon to the consumer of milk, and when there is added the free use of it, even though it be an act of compulsory generosity, one would expect, from the usual faith in one's fellow beings, some acknowledgment of the indebtedness. What actually happens has changed many a decent, wholesouled milkman into a cynical pessi-

mist of the worst stripe. His bottles disappear at a rate that makes him think that his customers are consuming the bottles as well as the milk contained in them. Too often they go up the dumb waiter and that is the end of them, as far as the dealer is concerned. A good share of his profits, or it may be his working capital, goes for new bottles, while his lost ones, or rather those which have escaped the garbage barrel, reappear in various capacities in the customer's household.

The dealer is deprived of the use of his property, and this property will be even destroyed with never a thought of compensation therefor. This is manifest injustice, and the sufferer thereby feels it keenly. The business of retailing bottled milk at the best does not boast any such profit that the destruction of bottles can be calmly charged up to profit and loss, and if the milkman's pecuniary reward be almost wiped out by the loss in bottles, what in the world has he left for the hardships and exacting labor

of his calling? The consciousness that he has performed a service to society may appeal to an altruist, but it is extremely poor satisfaction for a merchant such as the milkman.

The restitution of the milk bottle may be a matter of ethical conduct for the meditation of the consumer, but the use and misuse of the article concerns the entire community. For a vessel designed and intended only to contain a fluid food destined to pass between human lips, the vicissitudes of the milk bottle are beyond comprehension. It ekes out many a meagre crockery closet, and in numerous households is put to divers reprehensible uses. The various purposes fulfilled by this food receptacle would make a catalogue of astonishing length and variety, and the abuse has grown to such proportions that prompt and vigorous action should be taken. A campaign of education on milk and milk vessels would do much to remedy the evil, and local boards of health, by incorporating in their regulations a pro-

vision limiting the use of milk bottles, could impress people with the necessity for reserving this article for its purpose.

The fact that epidemics of contagious diseases have been traced to milk bottles which came from houses where the disease existed indicates a plain duty of the consumer. In case of any communicable disease in the family no milk bottle should leave the premises unless it has been boiled for ten minutes.

The cleaning of milk bottles before they are returned to the dealer is incumbent upon every person who uses bottled milk. The simplest rule of good housekeeping calls for this, and proper methods in the kitchen would accomplish it as a matter of course. It is one of the small things whose moral effect may be considerable. The difference between returning to the milkman a clean bottle and an unclean or filthy one is not lost upon him, or upon the other individuals who handle it in the course of its journey to and from the consumer.

After the bottles are cleaned they should not be placed in basements or areaways, but kept in the household until the milkman calls for them. This practise is necessary because of the protection required by the bottles. In the interval between leaving the consumer's hands and coming into the care of the milkman they may be subjected to many undesirable uses, and are liable to be seriously contaminated, a result to the prevention of which the consumer should lend his assistance.