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## Important Factors Affecting Machine Milking

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South Dakota State College  
OF  
Agriculture and Mechanic Arts

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**DAIRY HUSBANDRY DEPARTMENT**

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**IMPORTANT FACTORS  
AFFECTING MACHINE MILKING**

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## **IMPORTANT FACTORS AFFECTING MACHINE MILKING.**

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(By C. Larsen.)

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### **INTRODUCTION.**

In the field of progressive dairy farming, there are few lines of endeavor that mean so much as successful mechanical milkers. Further, there are few things in the dairy field that have advanced so rapidly, created so much interest, and attracted the attention of the public and practical dairy farmer as has the successful milking machine.

This interest is partially manifested by the many questions that are asked about mechanical milkers. The following are taken from letters to this department:

Do milking machines injure the cow's udder and teats? Do the milking machines tend to dry up the cows? Is it necessary to strip the cows after the milking machine? Are the cows difficult to accustom to machine milking? Will the milking machine save enough time so that it will pay to invest in a mechanical milker? How many cows should a person own before milking machines will pay? Is it costly to keep up the repairs of the milking machine? How much and what kind of power are required to operate a milking machine? Is it difficult to keep the milking machine clean and sanitary? What is the cost of installing a milking machine? Can the milking machines be installed and operated successfully in an ordinary farm barn? Is milk drawn by milking machines cleaner than milk drawn by hand? What kind of a milking machine is the best?

Some of these questions require long continuous



usage of milking machines and careful observation of their work under different conditions before they can be rightly answered.

In order to be able to answer at least some of these questions, seven leading makes of milking machines were installed and put into daily operation in the college dairy barn.

### Milking Machines in Operation.

Name of Machine:	Date When Installed	Length of time used:
Calfway .....	February, 1911 .....	5 years, 3 months
Sharples .....	November, 1913....	3 years, 5 months
Hinman .....	December, 1913....	3 years, 5 months
Burrill-Lawrence-Kennedy (B. L. K.).....	May, 1914.....	2 years, 1 month
Perfection .....	September, 1914...	1 year, 8 months
Empire .....	November, 1914....	1 year, 6 months
Waterloo Boy.....	October, 1915.....	0 years 7 months



View of all of the milking machines in the experiment. From left to right they are: Hinman, Waterloo Boy, Perfection, Empire, Calfway, B. L. K., and Sharples.

In this bulletin, it is not the intention to report on the comparative merits and demerits of the different kinds of milking machines, but to report on the importance of additional factors that must be considered to make mechanical milking a success.

## **OPERATOR OF MILKING MACHINE IMPORTANT.**

The operator of a milking machine acts in a similar capacity as does the governor of an engine. He co-ordinates the machine to the work that is being done.

In order to do this, he should thoroughly understand the milking machine and each cow. Does she milk easily or with difficulty? Does she give down her milk soon after, or before the milking machine is attached? Does she give down her milk slowly, or quickly? Does she milk out well, or is there much stripping to be done? These are some of the things the operator must understand. He should have a mental picture, or a complete conception of the manner in which the milk comes from the cow.

### **Principles and Manner of Milk Elaboration.**

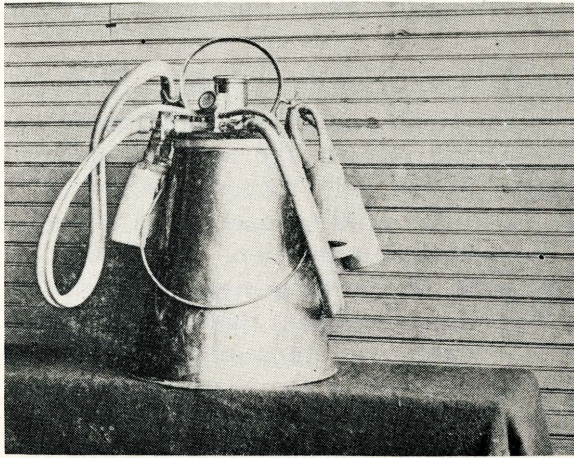
When a cow is being milked, three processes must function together harmoniously.

First, the secretion of the milk. This occurs within the mammary gland. It is in progress all of the time. It is a natural function, and an involuntary act, and cannot be controlled by the cow or by the milking machine operator. However, this secretion of milk is closely connected with the nervous system of the cow. Through the nervous system both the cow and the milking machine operator may affect, though not control, the secretion of the milk.

If the cow is frightened or made uneasy by the ma-

chine, or is made nervous in any way, the secretion of the milk does not proceed normally. Probably an occasional or temporary abnormal secretion of the milk will not seriously affect the cow and the work of the machine, but should this provocation continue, the production of the cow and the success of the mechanical milker would without doubt be hindered.

Second, the release of the milk. This is a very important part for the user of the milking machine to understand. The flow of the milk from the upper part of



**The "Calfway" Milking Machine.**

the udder to the lower part is controlled by the cow. The manufacture or secretion of the milk occurs in the mammary gland, chiefly in the upper part of the cow's udder. The cistern, or the milk reservoir is in the lower part of the cow's udder, or just above each teat. These extreme upper and lower parts of the cow's udder are connected by means of a complex system of tubes



and vacuoles. These serve to conduct and store the milk within the cow's udder. These milk ducts branch and re-branch. The opening and closing of these tubes or ducts are controlled by most cows.

If the milking machine in any way produces discomfort to the cow, she is likely to hold up her milk. A cow having a very distended udder or giving a large flow of milk is not likely to do this; but if the discomfort of the machine is greater to the cow than the discomfort of retaining the milk, then the cow is likely to hold up her milk entirely, or to give down the milk little by little. This will either cause much stripping by hand, or if this stripping is not drawn, it will tend to dry up the cow early, and it may even cause diseased udders.

Third, the extraction of the milk from the cow. Aside from the small amount of milk (about one pint) stored in the milk cistern, the machine cannot extract the remainder of the milk without the aid of the cow. Some have used the milking machine as though milking was only a question of extraction. If this were the only point to consider, the milking machine would be almost perfect. This use of milking machines has in a measure given the public the impression that extraction of the milk is all there is to the successful operation of a mechanical milker. The range of mechanical adaptability of the milking machines for extracting milk from different cows is certainly great. The cow is a living individual; the milking machine cannot be attached and milk drawn as though she were some inanimate object.

### **Operator Should Understand Individual Cow.**

The general principles of milking described above applies to all cows, but individual cows differ. At the beginning of the lactation period, cows are more nearly alike. The farther the herd of cows advance in the

milking period, the greater the characteristics and peculiarities as to manner of milking will appear. It is these individualities that the milking machine operator should endeavor to learn, to make the milking machine do good work in the herd throughout the year, and one year after another.

### **Fit Milking Machine to Cow.**

The operator should see that the teat cups properly fit the cow. Some of the machines have the universal teat cup. This cup has a wide range of adaptibility. Other machines have different sized cups to fit cows having teats of different sizes.

Even though the teat cups are of the proper size, the operator should see that the teats are in normal condition. In cold, wet weather, the teats may wrinkle and contract. The operator should see that they are brought into normal shape and that the cups get a straight and proper grip on the teats.

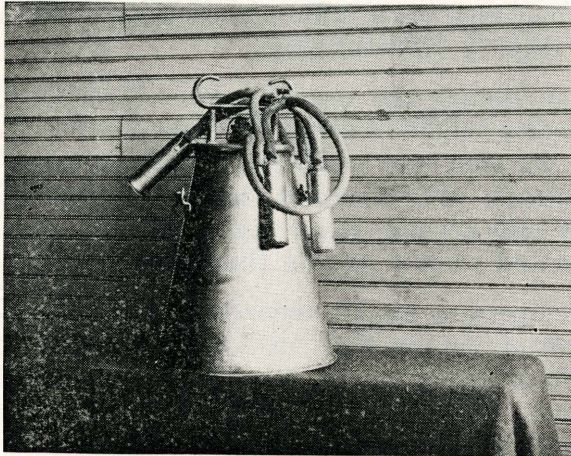
The operator should understand how to regulate the pulsation of the machine to suit the individual cow. The rate of speed of the pulsator varies with different machines. Even the length of squeeze and the length of release in the pulsation vary. These, the operator should understand how to adjust so as to make the machine do more efficient work without discomfort to the cow. A short, rapid pulsation is not suitable for a cow with long teats, that is a hard milker. On the other hand, a long, slow pulsation is not conducive to rapid milking if the cow has short teats and is an easy milker. No rules can be laid down for this. The operator must use his own judgment.

### **Prepare the Cow.**

In these experiments with the different kinds of

milking machines, it has been thoroughly demonstrated that it does not pay for the operator to be in too big a hurry to attach the milking machine. Some cows respond to the milking machine immediately, but others do not.

In the college herd there is one cow that gives down her milk at once. When the machinery begins to operate, this cow longs to be milked as though she was expecting her calf. By the time the milker reaches the



**The "Sharpless" Milking Machine.**

cow, she has released her milk supply. With such a cow the machine can be attached at once after the teats have been slightly moistened and brought into normal condition. Other cows in the herd do not give down their milk till the operator begins to work gently with the cow's udder. Cows that are almost dry may hold up their milk for a minute or more. The point is, that the machine should not be attached until the cow has given down her milk. Take time to prepare the cow properly.

## **DIFFERENCE IN COWS FOR MECHANICAL MILKING.**

The cows that have been and are being milked with the different milking machines in this experiment belong to the following leading breeds of dairy cattle: Ayrshire, Holstein, Jersey and Guernsey. In addition, various grades are also being milked by machine.

The individual cows within one breed, and the cows belonging to the different breeds, do not milk alike. This is true when milked by hand, and it is also true when milked by machines. Each cow must be handled and milked differently. If all of the cows were handled and milked alike by machines, mechanical milking of cows could not be said to be a success; but by understanding individual cows and adjusting the mechanical milking process in accordance with the characteristics of the cow, all of the cows in this experiment have been milked successfully, and practically, with the different milking machines.

The writer has in mind one party having a herd of grade cows who purchased and installed a certain milking machine. It was operated only a short time before its use was discontinued. This same machine was then purchased by another man who likewise owned a herd of grade cows. He was very successful in operating the machine with which the other man had made a failure. In fact, he was so successful with it, that he later purchased an additional unit. Another dairy farmer owning a herd of pure bred dairy cattle purchased a milking machine. The herdsman used it for a few months and then quit. This same machine was purchased by another dairy farmer also owning a herd of pure bred dairy cattle, and he had splendid success with this milking machine.



### **Nervous Temperament of Cows.**

There is much difference in the nervous temperament of cows. Some cows are quiet and appear never to be excited. Such cows pay little attention to whether they are milked by hand or whether they are milked by machine. Other cows, again, are sensitive. This is true whether they are milked by hand or by machine.

This nervous disposition of cows is probably shown most when the milking machine is first put into use. Most cows realize the change from hand milking to machine milking. When the machine is first used, most of the cows will turn their heads and look at the machine with an expression of nervousness in their faces. Especially is this true if the strange machine is operated by a strange man.

A few cows in a herd will at first refuse to give down their milk completely. However, if the machine is operated by the regular attendant, and the cow is properly prepared, then the cows that will not milk well from the first are few in number. Indeed, the number of cows that refuse to give down their milk when machine milking is first applied seems to be limited chiefly to the cows that are very nervous and give only a small amount of milk.

Machine milking should not be forced too fast. Allow the cows a reasonable amount of time to get adjusted to the new method of milking. Do not lose interest in mechanical milking if the amount of stripping is large at first.

Immediately after freshening, or when cows are

first taken from the calf, some cows reluctantly give down their milk. Excitement of any kind is likely to cause a cow to hold up her milk. Due consideration should be given to cows in this condition.

### **Some Cows Give Down Milk Slowly.**

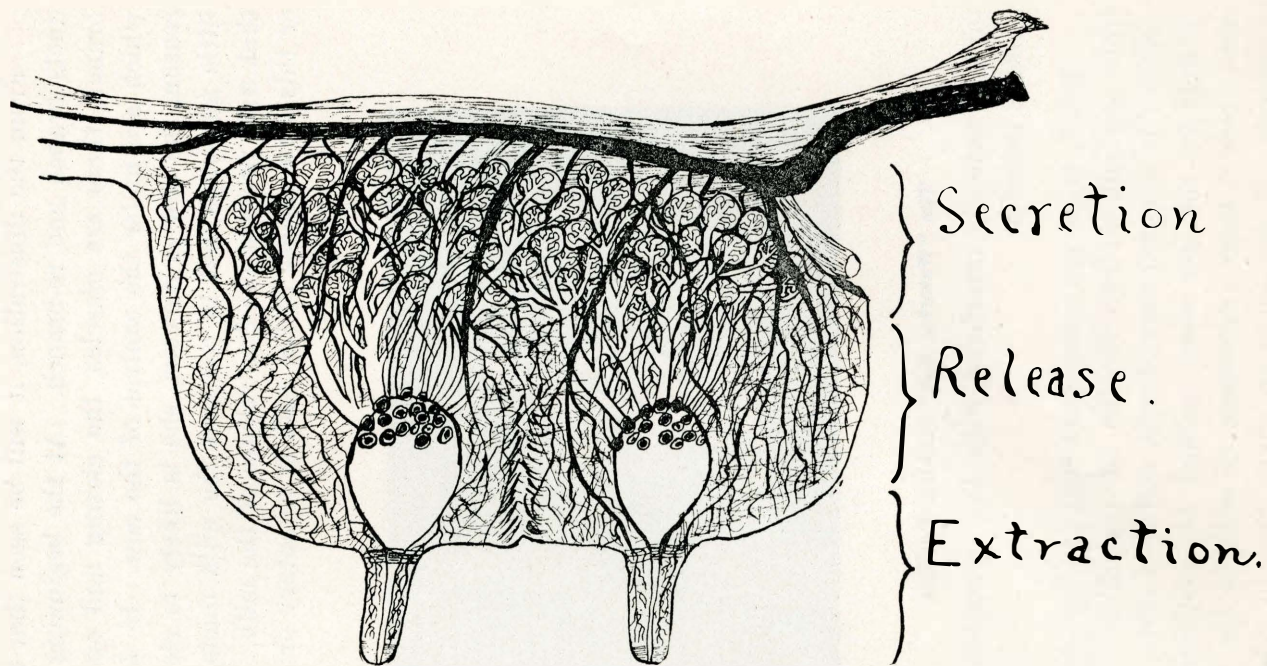
The cows that give down their milk slowly may be put under three heads:

First, cows that do not readily give down their milk when milking begins. There is much difference in cows in this respect, no matter what method of milking is employed. Some cows give down their milk as soon as the milker approaches them. In fact, some of the cows release the milk as soon as they hear the machinery in operation.

The manner in which the cow gives down her milk is a characteristic which belongs to that individual. It is possible that in some instances it is a habit. It is claimed by some that the habit of a cow in this respect may be influenced by regular milking time, and uniform method of starting a cow, during the first lactation period. Personal experience leads the writer to believe that, generally speaking, the manner of giving down the milk is natural, and therefore is an inherited characteristic.

Second, some cows give down their milk very slowly, or little by little. Usually cows belonging to this class are not heavy milkers, and such cows do not milk well by milking machines. This slowness of releasing the milk may be due to two things: first, the lack of ability of readily letting down their milk. The milk ducts may not be sufficiently large to allow the milk to come

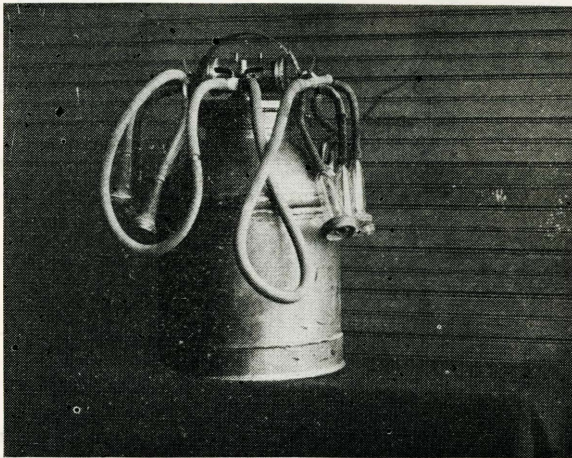
down from the upper part of the udder as fast as it is being milked. This is a natural characteristic, and cannot be changed. Secondly, it may be due to the cow willfully holding up her milk and releasing it only at intervals.



Schematic figure showing cross section of cow's udder, and illustrates the three processes that must function harmoniously together during milking.



From the illustration, it will be seen that the milk ducts branch and re-branch. At the beginning of each branch, there are muscles, the closing and opening of which are under the control of the cow. If for some reason, the cow is nervous, she is likely to close these little gateways and to contract the milk ducts, and in that way, prevent the free release of the milk. Whether this slow release of the milk is voluntary or involun-



**The "Waterloo Boy" Milking Machine**

tary, it seriously interferes with the operation of the milking machine.

Third, there are some cows that readily give down from one-half to three-fourths of the milk. The remainder is released very slowly, and it is often held up entirely by the cow when milked by machine. Such cows show a large percentage of milk in the form of strippings. If such cows are given time to release the

milk fully before the machine is attached, and the work of the machine is not forced in the last stage of milking, this form of slow milking can be perceptibly helped.

### **Early Part vs. Latter Part of Lactation Period.**

Apparently some cows milk well by machine throughout the whole lactation period, while other cows respond quickly and readily to the milking machine during the first part of the milking period, and during the latter part they are irregular.

This is true when milked by hand, and it is true when milked by machine. However, the hand milker can adjust the milking to the cow. He knows exactly when the slowness of giving down the milk begins. The adjustment of the working of the milking machine to suit such a cow is not so easy. Unless the milker is very familiar with the manner in which each cow of the herd behaves towards the milking machine, he cannot well adjust the machine.

Generally speaking, the latter part of the lactation period is not a good time in which to introduce the milking machine. Some of the cows are likely to hold up their milk often enough and long enough to cause the cow to dry up earlier than she otherwise should.

### **A Probable Explanation.**

From a standpoint of the cow, it is the different kinds of slow milkers that are likely to cause most of the troubles encountered with milking machines. So far as the writer has been able to ascertain, the reason is probably this: Those who have milked cows by hand know

that about a pint of milk can be drawn from all cows. It is not necessary to wait for a cow to give down this milk. It is stored in the milk cistern in the lower parts of the cow's udder. A cow has no control over this. The obtaining of this milk is mechanical. It would be an easy matter to make a milking machine successful, if this were the only part of the milking process. It would simply be a question of extraction of milk from the cow's udder, for which all of the present milking machines in use in these experiments have wonderful adaptability.

In order for a milking machine to continue to do successful milking, both the operator and the cow play important parts. The secretion, the release, and the extraction, are three processes that must function properly and harmoniously together.

When this first part of the milk has been drawn, the hand milker must wait until the cow releases or gives down her milk. Then the hand milker proceeds to milk the two teats. In a short time there is no more milk. The hand milker then changes the operation to the other two teats. When there is no more milk in these, he returns to the first two, and so on until the cow is dry.

The milking machine is unable to do this changing from one half to the other half of the udder, and to stop milking and wait for more milk. The milking operation is continuous. The machine is not conscious of the time when the milk supply runs low. Unless the milk has been released by the cow, it is not in the lower part of the udder to be drawn by the milking machine.

If there is no milk released by the cow, the suction and pulsation of the machine is applied to the internal udder tissue of the cow instead of on the milk. When

this happens, there is much danger of the cow gripping herself, and does not give down or release her milk normally. The internal part of the cow's udder at this stage of milking many times is sensitive to this action of the milking machine. Some cows show signs of opposition and even discomfort by drawing up the stomach. When such a condition is reached, the milking machine and the cow are working at cross purposes and not harmoniously. The cow holds up her milk and the machine continues to draw. This condition, the operator should seek to avoid, if he expects the milking machine to work successfully.

There is a difference between the action of the machine on cows that are holding up their milk, and on cows that are entirely dry. The suction and pulsation on the cow's udder, when dry or at any other time, does not injure the cow herself except in so far as to hinder her giving down her milk normally.

The operator must learn how each individual cow milks and adjust the machine accordingly. Some cows will give down the milk, without any difficulty, even if the machine milks faster than the cow gives it down; while others again do not milk well unless the release of the milk by the cow goes on faster than the extraction of the milk by the machine.

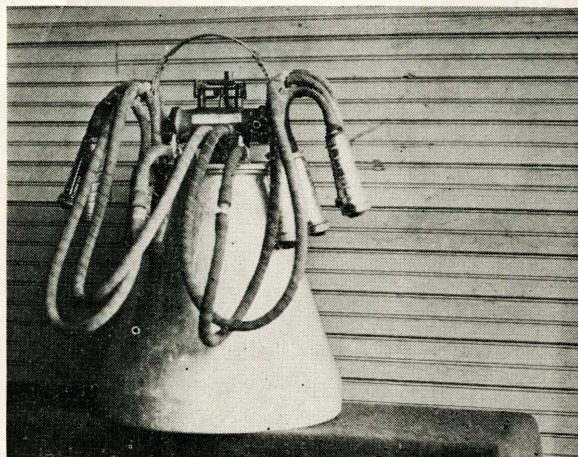
### **Abnormally Shaped Udders and Teats.**

The milking machines have a very wide range of adaptibility for milking cows having unevenly shaped udders, and teats of different size. However, if the udders of a few cows in the herd are abnormal, the adjust-



ments will probably be so numerous that machine milking will be more or less discouraging.

Some herds contain cows, the hind udders of which may hang low, the front udders high, and vice versa.



**The "Perfection" Milking Machine.**

The part of the udder that hangs low usually gives the most milk and the part hanging high usually gives the least. The portion of the udder that hangs high carries the greater part of the weight of the teat cups. Weight applied to the teat cups causes the cow to milk out quicker. This means then that one portion of the udder will milk out quicker than the other. At times this may cause the teat cups to fall off. The skin of the empty part of the udder may fold, air may be let in and this will cause all of the cups to be released.

It is evident that the length of the rubber tubes could be adjusted so that the weight on all of the four unevenly placed teats would be the same, but this would

mean a change of tubes or cups each time such a cow is milked.

In addition, the empty part of the udder may be affected by the suction and pulsation. When a cow is being milked, and she is giving down her milk properly, the mammary organ is relaxed. So far as known, the cow cannot close one part of the udder and relax on the other part. If a cow has milked out entirely on the front quarters, and not on the hind quarters, the suction or vacuum applied to the front quarters probably extends through the teat, the milk cistern, the ducts and vacuoles, to the gland lobules and even to the alveolian cells. With some cows, especially the easy milkers, this long applied vacuum on the empty portion of the udder may be injurious. The probability is that if discomfort is caused to the cow, she will either have udder trouble in the empty part of the udder, or else she will tighten the muscles and shut off the upper part of her udder from this suction. This probable action of the cow would cause her to hold up her milk in the quarters that milk out last.

Again, there are cows having teats of uneven size and shape, and teats of poor quality. While it is true that there are very few cows having so abnormally shaped teats that the machine cannot milk them, with the aid of the right sort of an operator, it is also true that cows having well shaped and medium sized teats are easier to milk by machine and the teat cups are much easier and quicker to attach properly.

When teats are of proper size and shape, the milking machine gets a straighter and better hold, and there is probably less danger of having sore teats. In all of

the time that these different milking machines have been in use, there have been only three different cows that have been troubled with sore teats that could in any way be laid to the milking machine. These teats became hard, red, feverish, and a trifle swollen at the end. This soreness probably was due to a congestion of the blood caused by the steady suction. This soreness lasted but a short time. It gradually disappeared without removing the milking machine. It is possible that the quality of the teat may have been a partial cause of this trouble. These teats were naturally inclined to be a little hard and fleshy in consistency.

Usually a herd would contain only a few cows that would be undesirable for mechanical milking from this standpoint. However, difficulties in machine milking would be obviated if such cows were culled out.

### **Cows Well Adapted to Mechanical Milking.**

Cows that have the right nervous temperament, that give a large flow of milk, that give down their milk readily and quickly, that have symmetrical udders and squarely placed teats of proper size, are especially suited for machine milking. In the college herd, there are about 35 out of 40 cows that could come under this head. It is reasonable to assume that this herd is normal.

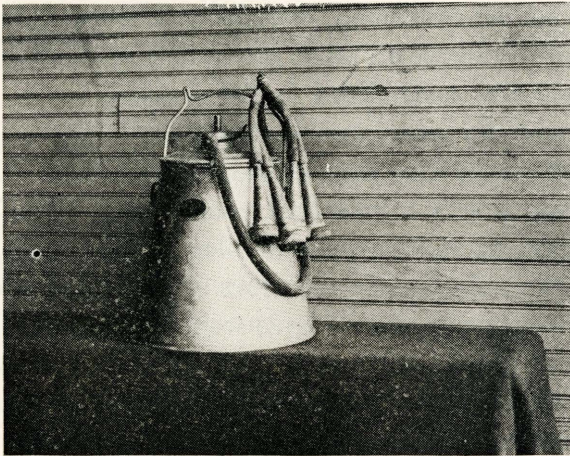
In the average dairy herd there is probably a similar percentage of cows that would give no difficulty at all in machine milking, if a prudent operator had charge of the machine.

In a herd composed largely of scrubs, unimproved types, and of range cattle, the percentage of cows that



will milk successfully with the milking machine would undoubtedly run lower.

From a commercial standpoint, the success of a milking machine is judged, not so much from the large number of cows that will milk successfully, as from the small number of cows in the herd which cause the difficulties. If three or four cows in a certain herd appear to give a full flow of milk at one milking and a small flow at another, or if the teat cups fall off from one or



**The "Hinman" Milking Machine.**

more of the cows, or if one or more of the cows have caked udders, or if some of the teats are hard and sore at the end, or if a few cows go dry three or four months previous to freshening, the milking machine is likely to be blamed. It pays to eliminate the unsuccessful cows and have the herd composed of cows that normally give no trouble for machine milking.



## **SELECT AND BREED RIGHT COWS.**

The dairyman who expects to use the milking machine in his herd and use it successfully should realize that the kind of a cow is an important factor in making mechanical milking a lasting success. If there are cows in the herd that are defective in any or all of the above mentioned points, the owner should not expect the milking machine to be the greatest success. Such defective cows as a rule are not good appearing cows. They should be culled from the herd.

If such cows are kept in the herd, their offspring should not be continued, especially if these defects, and habits of giving down milk, prove to be a dominant character and are transmitted to the progeny.

One of the most important things, in this connection, is to use great care in selecting a herd bull. The wise dairyman selects a bull that comes from large producing ancestors, that is pure of blood, and of good type. In addition, the female ancestors should have good nervous temperament, should have well shaped mammary organs, and should milk well. The male ancestors should be known to have daughters having milking characteristics that are suitable for mechanical milking. A tried sire known to put good mammary organs on his daughters is a good acquisition in a herd.

By thus applying care in this selection and breeding of the herd, in a short time there will be none of the cows left that cause the chief difficulties in the successful operation of a milking machine.

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## **SUITABLE CONDITIONS FOR MILKING MACHINE**

### **Barn Not Too Cold.**

On the average dairy farm, where dairying is made

a special business, conditions and equipments are usually favorable for obtaining good results with the milking machine. The milking machine may be operated in any kind of a barn or shed, but in the northwest, or in cold weather, open and cold barns may cause so many little troubles that the person is likely to become discouraged with the work of the milking machine. Under such conditions, even the cows crouch and grip their own bodies. The pulsator does not work so well in frosty surroundings. The moisture in the connectors and in the vacuum pipes freezes. The moist rubber tubes and teat cups may become icy when removed from the disinfectant solution and also after rinsing in water. The disinfectant solution is also likely to freeze. This latter, at least in part, may be prevented by adding salt to form a brine. A reasonably warm barn is one of the prerequisites for the most successful and agreeable use of the milking machine.

It is also a great advantage to have heating facilities for conveniently obtaining hot water for cleaning the parts of the milking machine and even steam for sterilizing the pails.

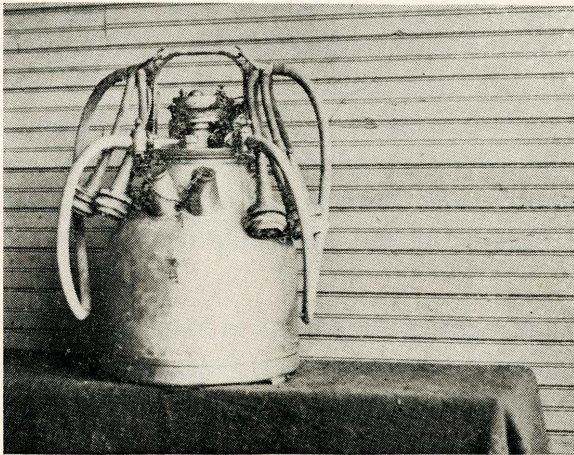
### **Keeping Milking Machine Sanitary.**

The sanitary aspect cannot be neglected in any phase of the dairy business. Milk decomposes readily. Any portion not removed from the rubber tubes, cups and other parts of the milking machine and allowed to remain in them any length of time is sure to bring about unsanitary conditions.

The milking machine is very efficient in excluding all kinds of visible dirt. The sediment from the udder,

sides of cow, and barn surroundings, at times seen in hand-drawn milk, has no chance to gain access to the milk drawn by a mechanical milker. However, special care need be used in keeping strictly sanitary the teat-cups, tubing and pails, so as to keep the bacterial content of the milk low.

That these different parts of a milking machine are a constant source of germs, is clearly seen from the fol-



**The "Burrell Lawrence Kenedy" Milking Machine.**

lowing figures: The average number of germs per cubic centimeter in the milk drawn from the first cow with the machine, kept as above described, was 5,325. The average number of germs in a cubic centimeter of milk from the second cow drawn by the same machine was 3,017, and from the third cow milked by the same machine the number per cubic centimeter was 3,012.

The pail and rubber tubes and all cups were thor-

oroughly cleaned and scalded. The tubing and cups were kept in a disinfectant solution between milkings. The latter were practically sterile. The milk pail, after being cleaned, rinsed and steamed, was kept in the milk room in an inverted position on a shelf between milkings.

These figures show that even though great care is taken in cleaning the pail, the pail is a source of germs in the milk. Since steam has been available in the dairy barn, all milking machine pails are thoroughly steamed just previous to milking. This has been the means of reducing the germ content greatly. This method should be followed where certified milk is being produced by machine milking.

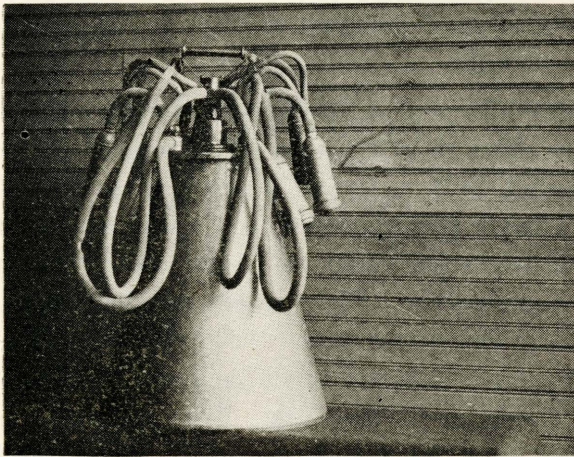
A practical way of keeping a milking machine sanitary is to rinse it thoroughly at once after the milking is completed, before the milk dries on to the different parts. This is accomplished by having a vacuum connection in the wash room, and then attach the machine to the vacuum pipe. Then insert the teat cups in the rinse water and slowly raise them up and down. This causes the rinse water to gush back and forth and wash off the remainder of the milk. Then take the machine apart, and with the special brushes, these parts are cleaned in luke warm water containing some washing powder. Then rinse these different parts in clean water and transfer them into the disinfectant solution.

Experiments with the different kinds of disinfectants have been conducted. There are several substances that are satisfactory. For cheapness and simplicity, there is nothing better than ordinary lime. It excels as a deodorizer. It freshens and sweetens the different parts of the milking machine. From a standpoint of disinfecting, it compares favorably with any of



the other substances. The ordinary limate purchased in paper sacks has proven handy and efficient. With this, it is easy to make up a standard and fresh solution. This latter should be done at least once each week. In some instances, it is necessary to prepare a fresh solution twice a week. A 2 per cent solution by weight is suitable. A stronger solution than this does no harm.

In connection with keeping everything connected with the milking machine plant sanitary, the vacuum



**The "Empire" Milking Machine.**

pipes should be carefully looked after. Except when the pail gets too full of milk, there is not much danger of milk gaining entrance into the vacuum system. Considerable moisture, however, evaporates from the milk and condenses in the vacuum pipe. In addition, dust and other foreign substances will accumulate. This, together with the moist condition, will often cause foulness in the vacuum pipes. It is well to wash out the

vacuum pipes about once a month. Should milk gain entrance into the vacuum pipes, they should be cleaned out as often as is necessary. Where no vacuum pipes are employed, the pump should be kept strictly sanitary.

### **Closely Watch for Appearance of Abnormal Milk.**

In connection with obtaining sanitary milk from a mechanical milker, one point should receive special consideration, and that refers to abnormal milk. There are times when a cow's udder or part of a cow's udder gives milk that is not normal and sanitary. If the operator is not watchful, such milk may easily gain entrance to the pail. This is especially true shortly after freshening, or when the cow's udder is gargety and swollen. The appearance of stringy, lumpy, colored, and other abnormal milk, cannot be blamed to the milking machine. Such abnormalities are likely to occur with individual cows whether they are milked by hand or by machine. It is the duty of the operator to be on the watch for difficulties of this kind.

### SUMMARY.

1. Before the milking machine is installed, cull out the cows having very uneven quarters, and teats that are extremely small and extremely large. Even though the milking machines have a large range of adaptibility in this respect, uniformly shaped udders and teats are advantageous.

2. The operator should know how each cow in the herd gives down her milk, and how she milks mechanically, and adjust the work of the milking machine according to the individual cow.

3. The cows that give only a small amount of milk and habitually release their milk little by little are not best suited for mechanical milking.

4. Breed and raise cows that are adapted to mechanical milking by, first, selecting a herd sire that comes from ancestors having good udders and teats and that milk well, or select a tried bull that is known to put good udders and teats on his daughters; secondly, by not raising the daughters of the cows that have abnormally shaped mammary organs and that are known to give down the milk irregularly.

5. The operator of the milking machine should understand how to adjust the parts and the working of the milking machine to the different cows. He should have a mental picture of how each cow in the herd releases the milk, and how the work of the machine harmonises with the cow. The machine and the cow must work together and not at cross purposes.

6. The operator should take time to prepare the cow. He should see that the teats are all in normal con-

dition. With most cows, the machine should not be attached until the cow has given down her milk.

7. With some cows, and near the end of the milking process, the teat cups will climb upwards. The lower part of the quarter is thus wedged in to the upper part of the teat cup. This may shut off the flow of milk. The operator should gently pull down on the teat cups to release this grip or pressure before the machine is entirely detached. If this bothers much, a weight may be suspended from the lower part of the teat cup during milking. By gently lifting and pressing the halves of the udder in the latter stage of milking just previous to detaching, it will help the machine to milk the cow dry.

8. If the above points are observed, many cows need no stripping. The operator soon learns from the amount of milk, and from the looks of the cow's udder whether the cow is milked clean. However, to be sure, the operator should try every cow by hand. This should be done at once after milking. It may be accomplished by shutting the vacuum off and stripping directly into the teat cups, holding the cups in the left hand and stripping with the right; or it may be done by stripping into the pail.

9. The different parts of the milking machine should be kept sanitary by thorough cleaning, and by keeping the parts in a disinfectant solution between milkings such as previously described.



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