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A MILKER'S MANUAL

BULLETIN A-37

THE UNIVERSITY of ARIZONA

Cooperative Extension Service and Agricultural Experiment Station

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A MILKER'S MANUAL

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The author acknowledges the assistance of Dr. Vearl Smith for his contribution of subject matter contained in this publication.

Contents

A MILKER'S MANUAL

I–YOUR ROLE AS A MILKER

Milking, properly done, is a highly skilled job. You have to understand and like cows to be a good professional milker. As a professional milker you must work with the owner, herdsman, feeder, and veterinarian, to form a team for the efficient operation of the dairy.

Team work is essential in the consideration of the cows, their feed, breeding, and health. Cows may be fed for maximum production, bred to produce at high levels, and be in good health and yet, they will not produce at their best if you do not do a good job of milking.

You do not need a lot of schooling to be a good milker. However, you do need to have a good understanding of how a cow produces milk in order to apply the proper procedures in the milking routine.

This manual is written to help you learn and review basic milking knowledge. It can help you understand and develop milking routines that have proven to give the best results.

You Are A Man Of Many Skills

When a cow walks into the stall you must do more than empty the udder of milk. You, as the milker, must give each cow individual attention. **Make the most of this opportunity.**

In this day of large herds and machine milking, cows get a minimum of individual attention. You can and must play a **KEY** role in many management practices and decisions.

Your job of milking puts you in a vital spot. The results of nearly all dairy management practices in the dairy pass before you at milking time. Learn to recognize the results, good or bad, and take proper action.

TROUBLE SHOOTER

You can be an excellent trouble shooter for the owner, or herdsman. In your job you should be able to:

1. Recognize udder troubles.
2. Recognize the cows that refuse to eat their grain.
3. Recognize cows that are in heat.
4. Recognize the failure of milking equipment to function properly.

When you find any of these conditions, you must act quickly to correct them, or report them to the person who is responsible for the management of the herd.

UDDER TROUBLE

It is essential that you consider the condition of the udder every time you milk the cow. The health of the udder depends, to a great extent, on how you treat the udder in your milking procedures.

Any abnormal condition that you see, such as flaked or clotted milk, swollen or hard quarters, bruises, cuts, stepped-on teats, or other udder problems, must be cared for immediately.

COWS REFUSING TO EAT PROPERLY

Your watchful eye on each cow can be of tremendous help in the feeding of the dairy herd. You are in a position, in most cases, to be the first to notice when a **cow is off feed.**

In many cases, this is the first sign that something is wrong with the cow In the corral with other cows, a sick cow could be off feed for several days before being noticed by the herdsman or feeder.

MILKING EQUIPMENT

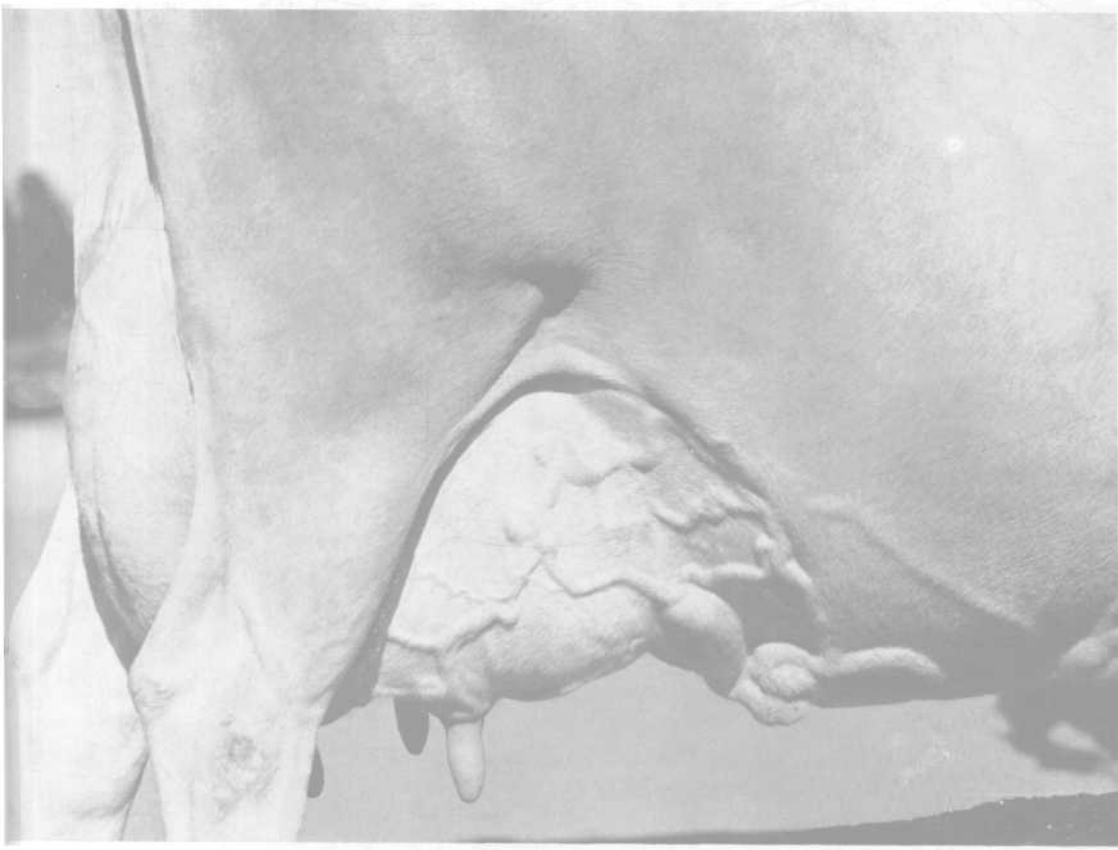
As a good milker, you must know how milking machines, vacuum pumps, and automatic washing systems work. You must know how to keep them cleaned, adjusted, serviced, and how to make minor repairs and adjustments. You must be familiar with and use the machine operations manual, and any other instructions given to you.

II–THE UDDER

Let us take a close look at the udder before we go into the recommended "Milking Routine."

You do your most important work with the udder of the cow. You need to know how the udder is attached to the body, how the shape affects its usefulness, and how it works in producing milk.

Udders have various sizes and shapes, depending on the maturity of the cow, stage of lactation, qual-



An Ideal Udder Of A Mature Cow—Jane Of Vernon

ity of the udder, and how well the udder is supported. Although you may seldom think about it, the udder is quite heavy. On a mature cow it will weigh from 25 to 60 pounds, and may hold 50 or more pounds of milk.

Suspension

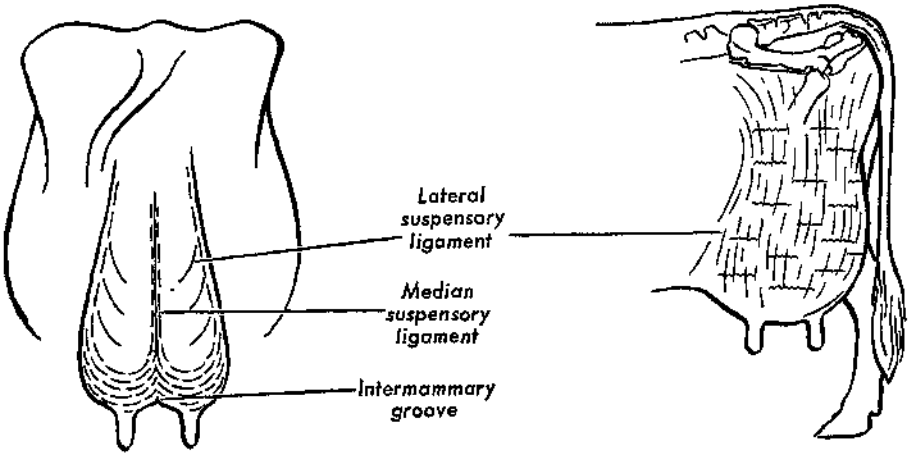
The udder is entirely outside the body cavity and is suspended by attachments of supporting structures to the body wall. The main supporting structures of the udder are the **median** and **lateral suspensory ligaments,** and the skin.

The arrangement of the median and lateral suspensory ligaments form a "sling" in which the udder is suspended. The skin, with other connective tissues, is fastened to the abdominal wall and aids in the support of the udder.

The udder is separated in halves lengthwise by the median suspensory ligaments which are two fused bands of connective tissue. These ligaments are attached to the abdominal wall and pubic bone. Looking at the udder from the rear, you can see this division as a groove between the halves (right and left) of the udder. The groove marks the position of the median suspensory ligaments.

At the bottom of the udder, the median suspensory ligaments separate. Sheets of this connective tissue fan out on either side across the bottom of the udder.

Extending down over the sides of the udder are lateral suspensory ligaments which are fibrous sheets of tissue. At intervals, sheets of tissue penetrate the glands to provide support for the internal structure.



Median Suspensory and Lateral Suspensory Ligaments, including the Intermammary Groove.

A strongly attached udder fits snugly against the abdominal wall in front, and on the sides, and extends high between the thighs in the rear.

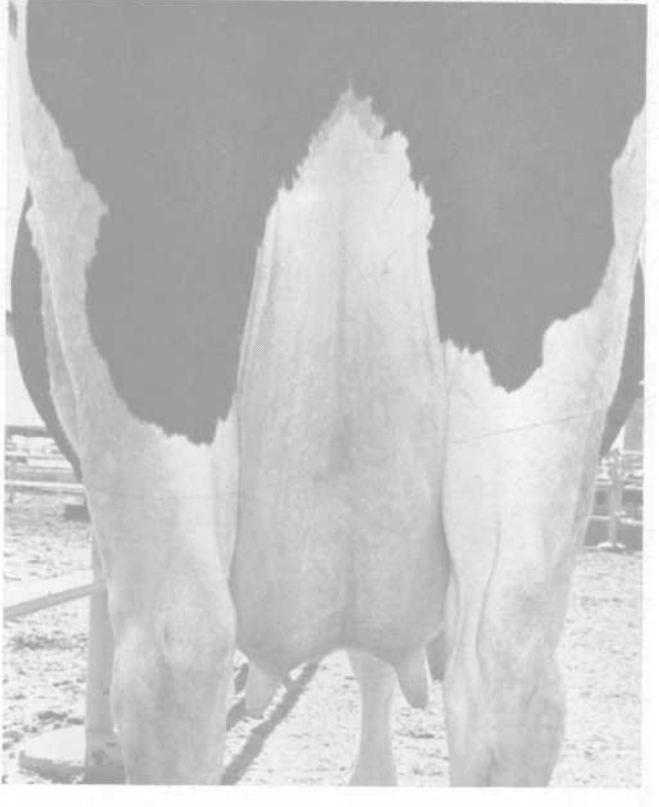
A "breaking away" of the udder from the body occurs when the supporting ligaments weaken or stretch. The floor of the udder "drops out" with a weakening or stretching of the median suspensory ligament.

When this occurs, the floor of the udder is rounded instead of grooved, and the teats "strut" or stick out to the side of the udder rather than hanging straight down. This is a serious fault of the udder, because it makes the udder difficult to milk with the milking machine.

In addition to the more easily seen outside support, a framework is provided for the support of the inner tissues that make up the udder. Connective tissues similar to the suspensory ligaments provide a framework within the udder to suspend the arteries, capillaries, veins, lymph vessels, milk-making tissues, and milk-collecting vessels and ducts.

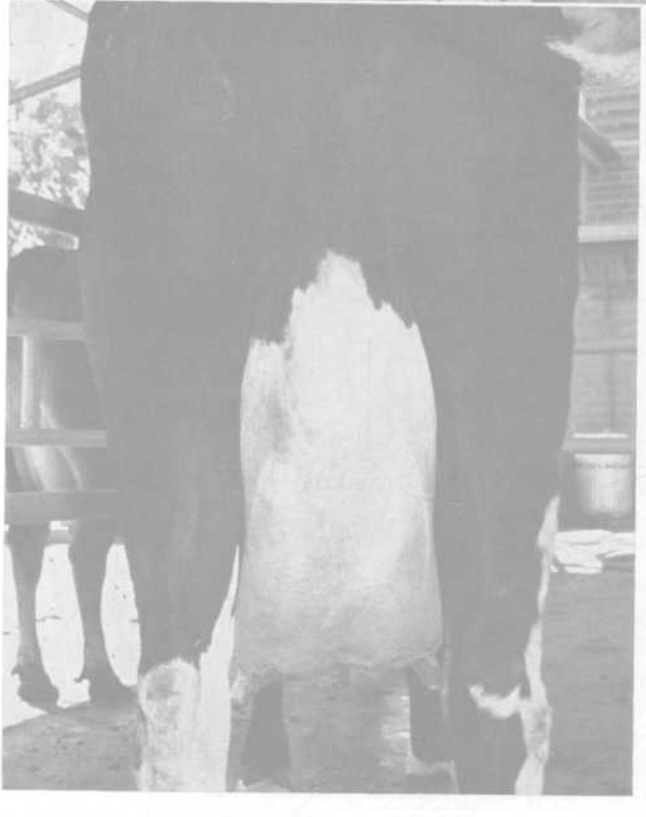
(See Photos on next two pages.)

Side View of a Strongly Attached Udder.

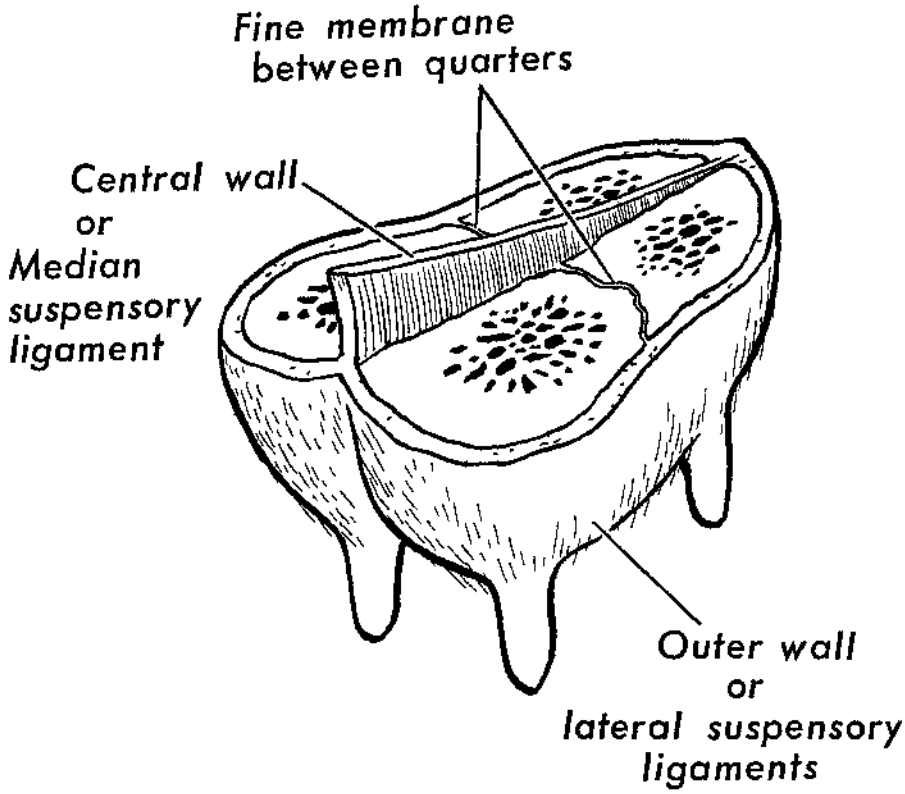


Rear View of a Strongly Attached Udder.

Side View of an Udder Breaking Away.



Rear View of an Udder Breaking Away.



Cross Section of the Udder.

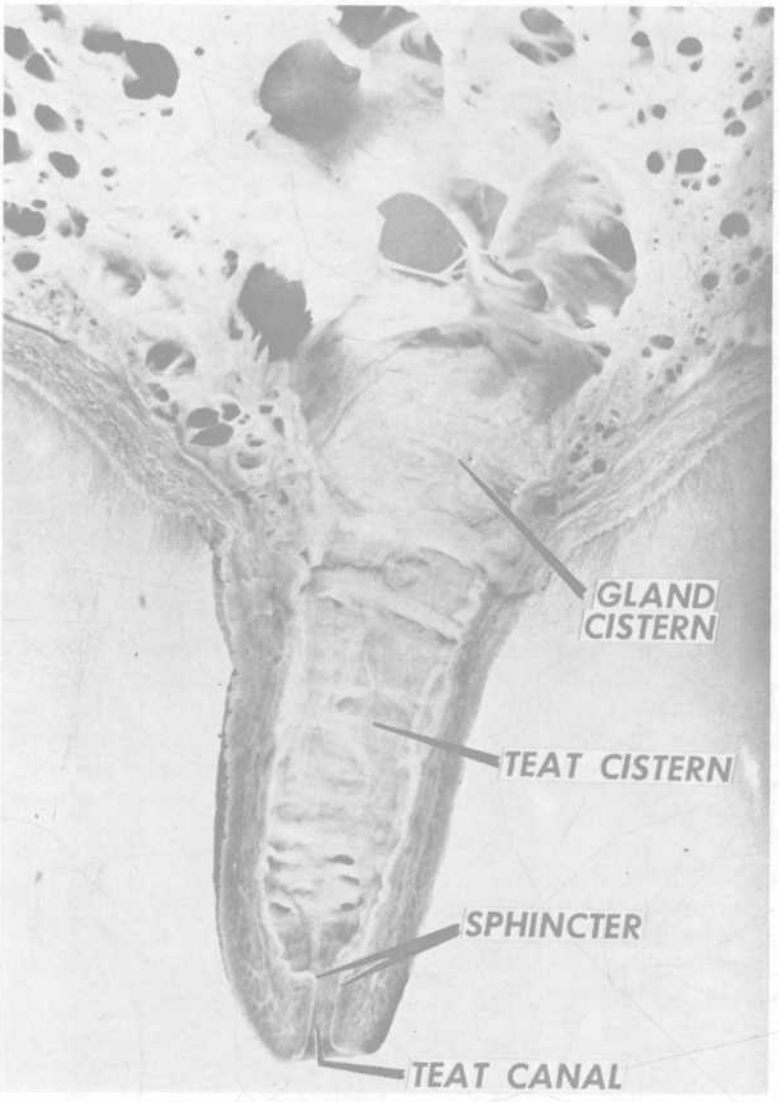
Four Glands

Each gland, or quarter, is a separate and distinct unit. There is no way for the milk to move from one half to the other, or from one quarter to another. Since the top of the udder follows the contour of the abdominal wall, the rear quarters are deeper but not as wide as the front quarters. Because of the greater depth, the rear quarters usually produce about 60 percent of the milk.

Generally, there is not a marked partition between the front and rear quarters, although there may be a slight grooving between the quarters. The two glands on the same side are smoothly joined together.

Teats

A teat may be shaped like a cylinder or a cone. The teat is a tube of skin which hangs down



Longitudinal Section of the Teat and Gland Cistern of the Udder.

from the udder. The size and shape of the teat which drains each gland is independent of the size or shape of the udder. Large udders may have small teats, and small udders may have large teats.

The opening in the lower end of each teat is known as the teat canal. The teat canal is about one-fourth to one-half inch long. Around the teat canal is a band of circular muscle fibers called the

sphincter muscle. This muscle keeps the canal closed so milk will not leak out.

The teat canal is formed early in the development of the fetus. The teat canal is formed by a folding-in of the outside of the teat. In some animals, the teat canal fails to develop. When this occurs, that quarter of the udder will make up normally at calving time. However, the milk cannot be removed and this is one cause for a "blind quarter."

Cows in heavy milk prodouction may leak milk if the sphincter muscle fails to work normally due to the weakening of the muscle, or injury. The speed and ease with which a cow milks out depends upon the size (diameter) and upon the stretching ability of the teat canal and the tension of the sphincter muscle.

The walls of the teat are relatively thin. The surface of the teat lining may be smooth or may have circular folds and pockets. In some teats these folds form a complete septum or partition across the teat. Unless the septum is pierced, the quarter will be "blind."

Milk-Collecting System

The duct system of the udder is made up of the teat cistern, the gland cistern, and many collecting ducts. The teat cistern is the cavity formed by the teat walls above the teat canal and has a limited capacity.

A ring of tissue, known as the annular fold, is usually present at the junction of the teat and udder. In some teats, the annular fold is large, so that the opening to the teat cistern is small. The flow of milk from the gland into the teat cistern may be restricted by the size of the opening, and cause the cow to be a slow milker.

Above the junction of the teat and the udder is a cavity known as a gland cistern. In some udders it has a capacity for as much as a pint of milk.

The milk-collecting ducts branch out in all directions from the gland cistern and extend to every part of each quarter. At the gland cistern some of the larger milk ducts have a diameter of three-fourths of an inch.

As the milk ducts extend upward and outward, they branch and rebranch. With each branching the ducts become smaller until they are invisible to the eye.

Alveolus

Each milk-collecting duct finally ends in a tiny milk-making structure known as an alveolus (al-vee-oh-lus). Each cubic inch of udder tissue contains an estimated one million alveoli.

An alveolus is a bulb-shaped structure with a hollow center. The walls are lined with a single layer of **epithelial cells.** These cells convert the raw materials carried by the blood into milk.

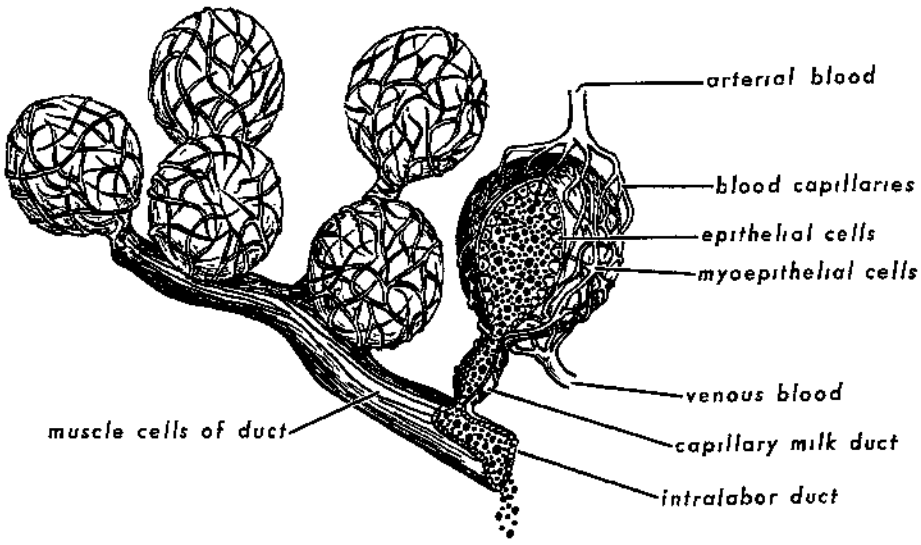
In close contact with each alveolus is a fine network of tiny blood vessels called **capillaries.** Through

the walls of these capillaries pass the raw material from the blood to the epithelial cells of the alveolus for the making of milk. The epithelial cells transfer the milk into the hollow cavity of the alveolus. The diameter of the alveolus increases in size from the accumulation of milk.

Completely surrounding each alveolus, like a net, are many fine strands of myoepithelial (my-o-ep-i-the-li-al) fibers. The function of these fibers is to force the milk from the alveolus into the milk-collecting duct system.

This process occurs when the cow is stimulated to "let down" her milk. The myoepithelial fibers shorten and squeeze the milk from the alveoli into the milk ducts.

By means of connective tissue, many alveoli are grouped together into a **lobule** (somewhat like a bunch of grapes). The capillary milk duct from each alveolus unites with the **lobular** duct.



The Alveolus of the Udder Showing the Microscopic Parts.

III–MAKING MILK IN THE UDDER

Milk is composed of approximately 87 percent water and 13 percent solids. Milk solids are proteins, lactose (milk sugar), fat, vitamins, and minerals.

The proteins, lactose, and fat of milk are different than those found in other natural foods. These food products are made in the milk-secreting cells of the udder from raw materials supplied by the blood.

Proteins

Milk proteins are made in the milk-secreting cells of the udder from the amino acids supplied by the blood. The process by which the milk-secreting cells convert the amino acids into milk protein is not clearly understood.

Amino acids are the units or building blocks from which proteins are made. The kind and number of amino acids that make up a protein determines the characteristics of that protein.

Casein is one of the most common and complex of the milk proteins and is made from as many as twenty different amino acids. Proteins are the most complex of the food substances.

Lactose

Lactose (milk sugar) is made by the milk-secreting cells from glucose (blood sugar) supplied by the blood. Two units of glucose are joined to form one unit of lactose.

Fat

The simple fatty acids are the building blocks from which some of the milk is made. These fatty acids are joined together in various numbers and combinations to produce the complete product that we call milk fat.

Some of the fats are taken directly from the blood with little or no change. Acetic acid is a good example. It is formed in the cow's paunch which serves as a storage and fermentation vat for feed.

Billions of bacteria and other single-cell organisms which live in the paunch break down feeds (such as hay, silage, green chop, and grains) into simple fatty acids and other substances. These acids, such as acetic (vinegar is a crude form of acetic acid), pass directly through the paunch wall into the blood stream and are carried to the udder.

Minerals

All of the minerals in milk are found in the blood, but at different concentrations. The milk-secreting cells take the minerals from the blood and secrete them in milk at higher or lower levels than in the blood.

Milk contains fourteen times as much calcium, seven times as much phosphorus, and four times as much magnesium as is found in the blood. By contrast, milk contains one-fourth as much chlorine and one-eighth as much sodium as found in the blood.

Vitamins

The level of some vitamins in the milk changes with the vitamin content of the feed. The vitamin A content of milk will be directly influenced by the quality (bright green color) of the hay. Sun-cured hay has a higher vitamin D content than hays not exposed to the sun.

Exposure to direct sunlight converts some substances in the skin to vitamin D. Therefore, if the blood levels of vitamins A and D are high, the milk will contain high levels of these vitamins.

The B complex vitamins and vitamin C (ascorbic acid) in the milk are made in the paunch and are affected very little by the feed consumed.

Flavors

The flavor of milk is based primarily on taste and smell. Cows consuming strong-flavored feeds will produce milk with an off-flavor. These substances, which impart flavors, pass from the digestive system into the blood and are carried to the udder where they enter the milk by filtration through the membranes of the milk secreting cells.

Eventually, the concentration of the flavoring condition will be about equal in the milk and blood. When the cow is taken off the feed producing the off-flavor, the concentration of the flavoring substance in the blood will be decreased by elimination through the kidneys or lungs, or both.

With a reduced concentration in the blood, the flavoring materials will filter out of the milk back into the blood. So, within a given time after eating, the off-flavor will disappear from the milk. When there is a problem of off-flavor in milk, the cows must be taken away from the feed causing this condition for at least four hours before milking.

Blood Supplies
The Raw Materials

Approximately 400 pounds of blood must pass through the udder to supply the raw materials for one pound of milk. Because blood is the source of raw materials for the making of milk, the supply to the udder is important. In fact, milk production may be limited by the nutrients in the blood and the amount of blood available to the milk-secreting cells of the udder.

IV–MILKING THE COW

The milking of each cow has been called "the most important five minutes" in dairying. This is true. All the production advantage gained from good feeding and breeding can be lost through a poor job of milking.

Milking is an art and a science. You, as a milker, must be interested in cows and the job you are doing to be a successful milker. Your skill as a milker depends on your ability to put together all of the correct procedures into an efficient routine.

A good routine must be developed around five well known reactions of the cow to the following:

1. Udder stimulation.
2. Delayed milking.
3. Disturbance.
4. Incomplete milking.
5. Overmilking.

Udder Stimulation

Milk is formed in the udder during the time between milkings. All of the milk is present in the udder before milking. The pressure in the udder gradually increases from one milking to the next as the result of the accumulation of milk.

The milk is stored in the alveoli. Before the milk is available to the calf or milker, the milk has to be forced from the alveoli into the larger ducts and cisterns. This is the "let down" of the milk.

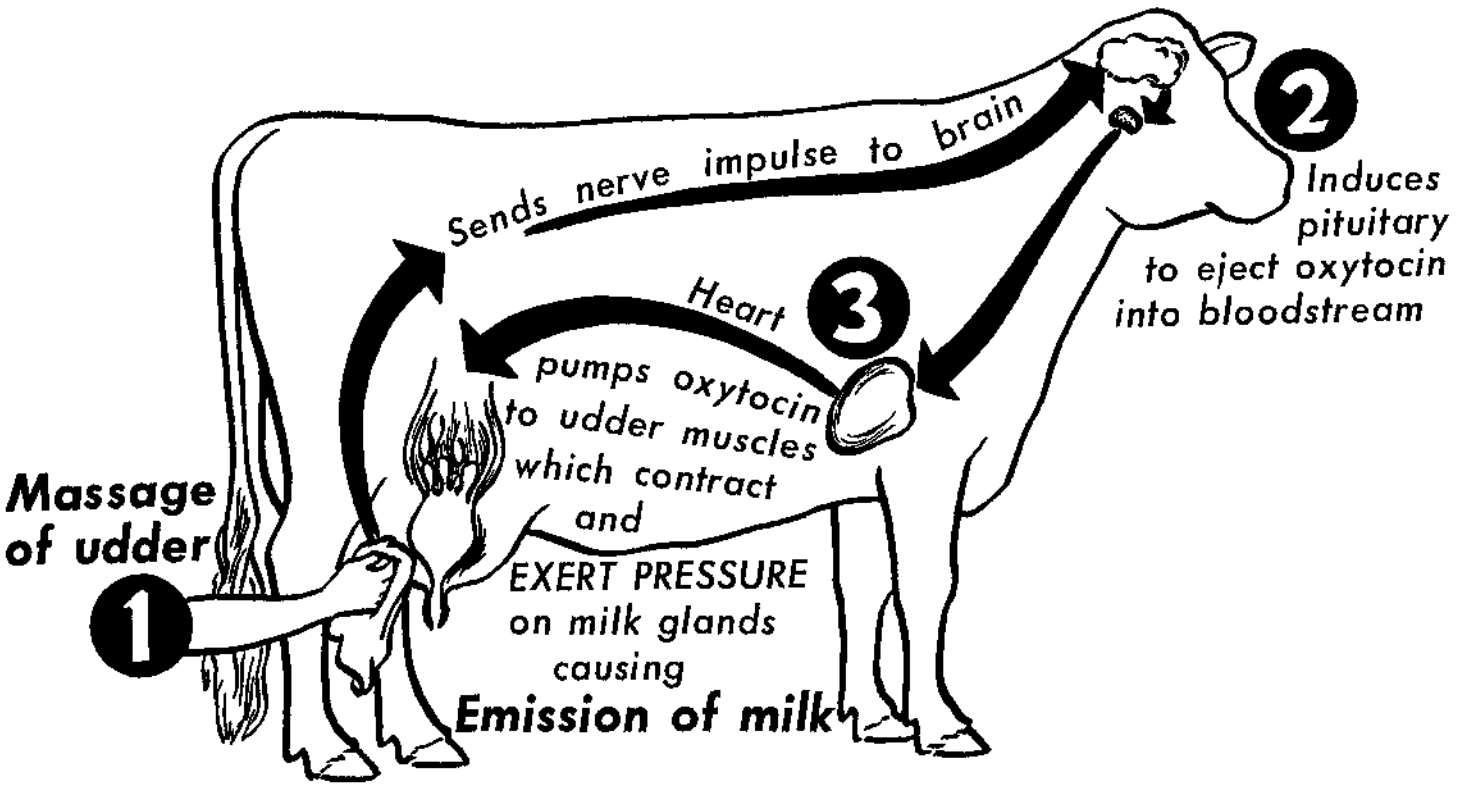
The most powerful stimulus for the "let down" (expulsion of milk from the alveoli) of milk is the sucking calf. Sensory nerves of the teat stimulated by the calf causes the release of oxytocin (ok-si-to-sin) by the posterior pituitary gland into the blood. The muscle fibers surrounding the alveoli contract in the presence of oxytocin and expel the milk into the large ducts and cisterns of the udder.

In machine milking, stimuli substitutes for the sucking calf have to be provided. These must be the same from day to day and applied a short time before milking. Under these circumstances a habit is soon established which the cow associates with milking and she responds with an effective milk "let down."

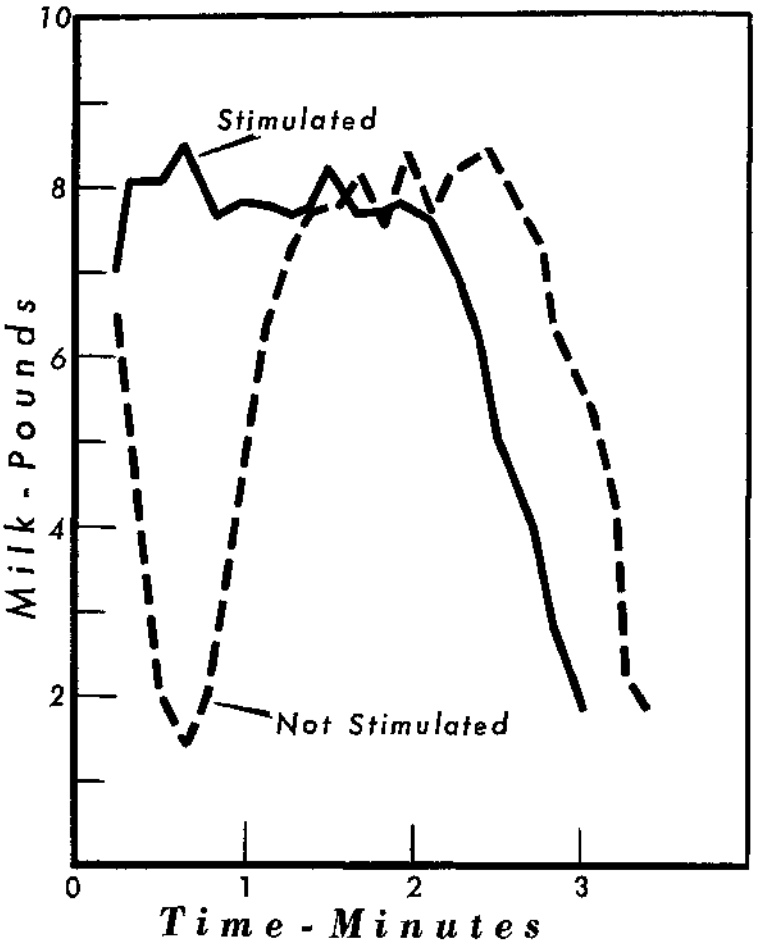
All activities connected with the handling of the cow before milking will act as stimuli for the milk "let down." Washing and drying of the udder, the "teating out" or foremilking each quarter into a **strip cup** are excellent stimuli.

In addition to the stimuli, the udder is cleaned in preparation for milking. By using a **strip cup** it is possible to check for flaky or clotted milk, which is an indication of udder trouble.

Another important benefit of good udder stimulation is the saving of machine time. This is the time you save by stimulating the cow before attaching the milking machine. The rate of milking the cow is increased and milking time is reduced.



The Release of Oxytocin into the Blood Results in the Emission (Expulsion) of Milk from the Alveoli



Comparison of Stimulated and Non-Stimulated Milking Including Pounds of Milk and Time in Minutes to Remove the Milk from the udder.

In the foregoing experiments (see chart) a milking machine was suspended from a scale to determine the amount of milk removed from the udder at any one time. In the solid line, the cows were stimulated **two** minutes before the milking machine was attached to the teats. In the broken line, the machine was attached to the teats without stimulation. Under this condition the time required for milking was a minute longer because the cow was not stimulated

until the machine was attached.

For the first 45 seconds to a minute, only a small amount of milk was removed because an expulsion (let down) had not yet occurred. Never put the teat cup of the milking machine on the teats until a "let down" has occurred.

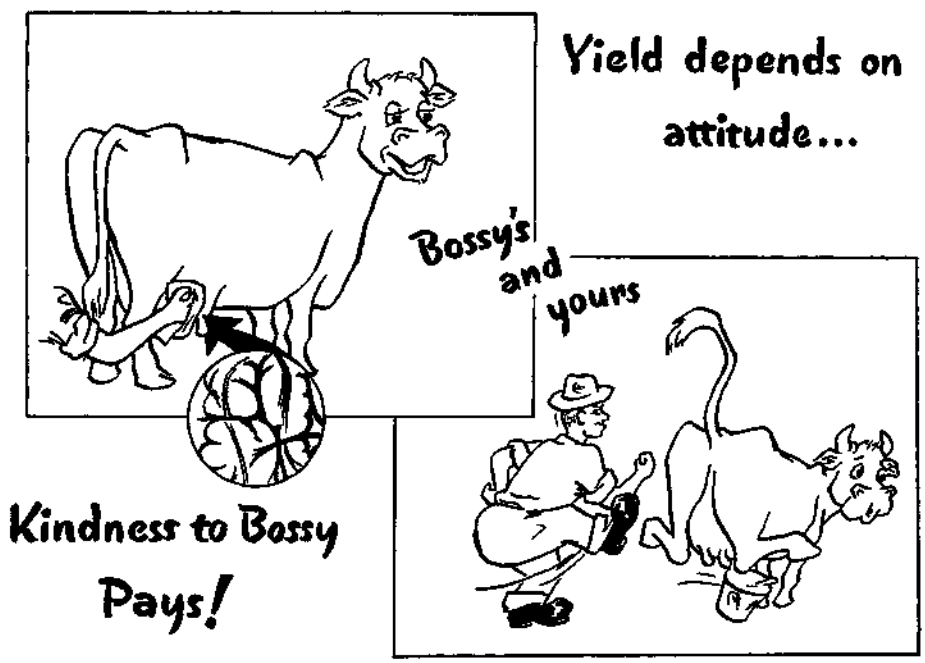
Delayed Milking

The availability of the milk after "let down" lasts for a limited length of time. Once a "let down" has occurred, the milk must be removed as rapidly as possible to obtain the greatest amount of milk. A second stimulation cannot be obtained soon after the first.

Disturbances

Cows are creatures of habit. Anything which tends to excite or frighten the cow will prevent a complete response to the milking stimulus. Anything which distracts, angers, or pains a cow will prevent the "let down" of milk. The cause for this condition is the release of Epinephrine (Adrenaline) into the blood.

Cows must be handled quietly and gently at all times, especially in moving the cows into and out of the milking parlor or barn. Such things as rough handling, excitement, unusual noise, or strangers, will prevent a complete response to stimulation.



Milk Yield Depends on the Attitude of the Cow and the Milker.

Incomplete Milking

Even though all of the requirements for a good milking routine are met, a certain amount of milk will remain in the udder. It varies from 5 to 20 percent, and is known as residual milk For a particular cow, the amount of residual milk is uniform from milking to milking. However, the amount of residual milk is a measure of the effectiveness of milking.

If the cow does not receive adequate stimulation from a preparation procedure, if too much time elapses between "let down" and milking, and if the cow is excited —the milking will be incomplete with more than normal amounts of residual milk. The variation of residual milk from milking-to-milking is caused by the above condition.

The correction of incomplete milking cannot be over-emphasized. **Habitual retention of large amounts of residual milk causes low production and early drying off.**

Overmilking

Overmilking is the term used to denote the time a milking machine is left on after removal of milk is completed. Evidence indicates the teats and udder are damaged if the machine remains on the cow after the milk ceases to flow.

The milking machine employs vacuum to remove milk from the teat. Even with good pulsator action, there is some congestion of blood in the teat This condition must be avoided as much as possible by removing the machine as soon as milking is completed.

When the gland cistern pressure decreases as a result of the removal of milk, the teat cups tend to creep upward and close the opening between the gland cistern and the teat cistern. Then with each pulsation, the soft tissues surrounding the juncture of the gland and teat cisterns, are drawn forcibly together and downward. Injury to the udder and teat linings will occur if machine milking is prolonged.

Overmilking also causes an eversion (turning wrong side out) of the teat canal. When the teat is everted, the mechanism for preventing bacteria from entering is partially destroyed and the cow is vulnerable to mastitis.

(See Photos on next page.)

Everted or Eroded Opening of the Teat Canal.

Normal Opening of the Teat Canal.

V–MILKING ROUTINE

Full cooperation of the cow during milking is an absolute essential. A milking routine which takes into consideration the behavior of the cow will get her cooperation. The milking routine is the sequence of operations that you must perform in order to meet the best milking requirements.

A good milking routine will do the following:

1. Increase milk production.
2. Produce cleaner milk.
3. Reduce the spreading of mastitis.
4. Increase the efficiency of milking machines.
5. Improve the utilization of the time for milking.

For best results, the cow must be milked regularly, gently, thoroughly, and promptly, with proper attention to sanitation. The following steps are practical and give good results.

Steps In The Milking Routine

STEP 1. ASSEMBLE AND DISINFECT THE MILKING EQUIPMENT

1. Use the milking machine manufacturer's operations manual to assemble the equipment. With a pipeline-milking system you should have a bucket-milking unit to be used on cows showing signs of mastitis, or cows which have been treated for mastitis. Also, this unit can be used to milk cows to supply your calf milk.
2. Disinfect all milking equipment with a solution of hypochlorite (200 ppm* available chlorine or iodophor (25 ppm* available iodine). This can be done by following the directions on the container of the material that is used in preparing the disinfecting solution.
3. Check all equipment operations and make any adjustment that is needed.

STEP 2. PREPARE THE COW FOR MILKING

1. Wash the udder with water from a hose. The water pipeline should be connected to a

(See Photos on next page.)

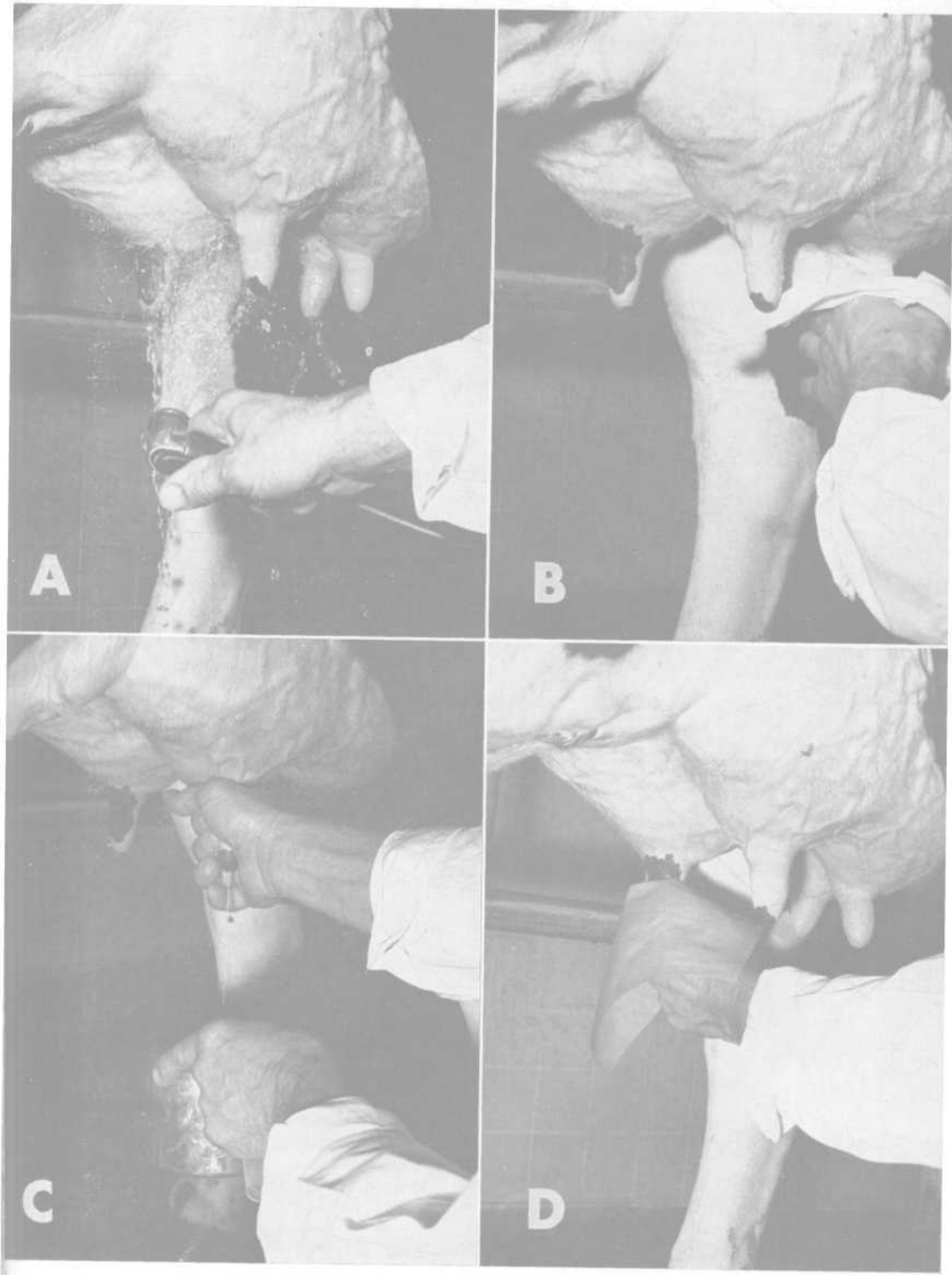
A—Washing Udder with Water from a Hose.

B—Drying Udder with Paper Towel—Discard the Towel.

C—Using a "Strip Cup" to "Teat Out."

D—Disinfecting the Teats with a Sponge or Towel.

* Parts per million


A
B
C
D

water heater and tap water line to provide warm water for washing. Use a brush for exceptionally dirty udders.

2. Dry the udder with a paper towel and discard the towel.

3. "Teat out" or foremilk two or more streams of milk from each quarter into a **strip cup** (never on the floor, or in the palm of your hand) and examine for lumps, shreds, or off-colored milk. These are signs of mastitis. If present, the cow's condition should be reported to the herdsman for treatment. A cow showing signs of mastitis must be milked with the bucket unit and the milk discarded. The bucket unit must be thoroughly disinfected before using on another cow.

4. Wipe the teats with a paper towel or sponge soaked with a sanitizing solution (200 ppm* available chlorine or 25 ppm* iodine).

The foregoing preparation will provide the necessary stimuli for the "let-down" of milk. This condition will permit a quick, complete milk out.

STEP 3. ATTACH THE TEAT CUPS

At least **one minute** should elapse after washing and "teating out" before the milking machine is attached to the teats. However, milking must not be delayed more than 2 minutes after preparation in order to get a rapid and complete milk-out. Most cows will milk in 3 to 6 minutes, depending on amount of milk and the milking characteristic of the cow.

(See Photo on next page.)

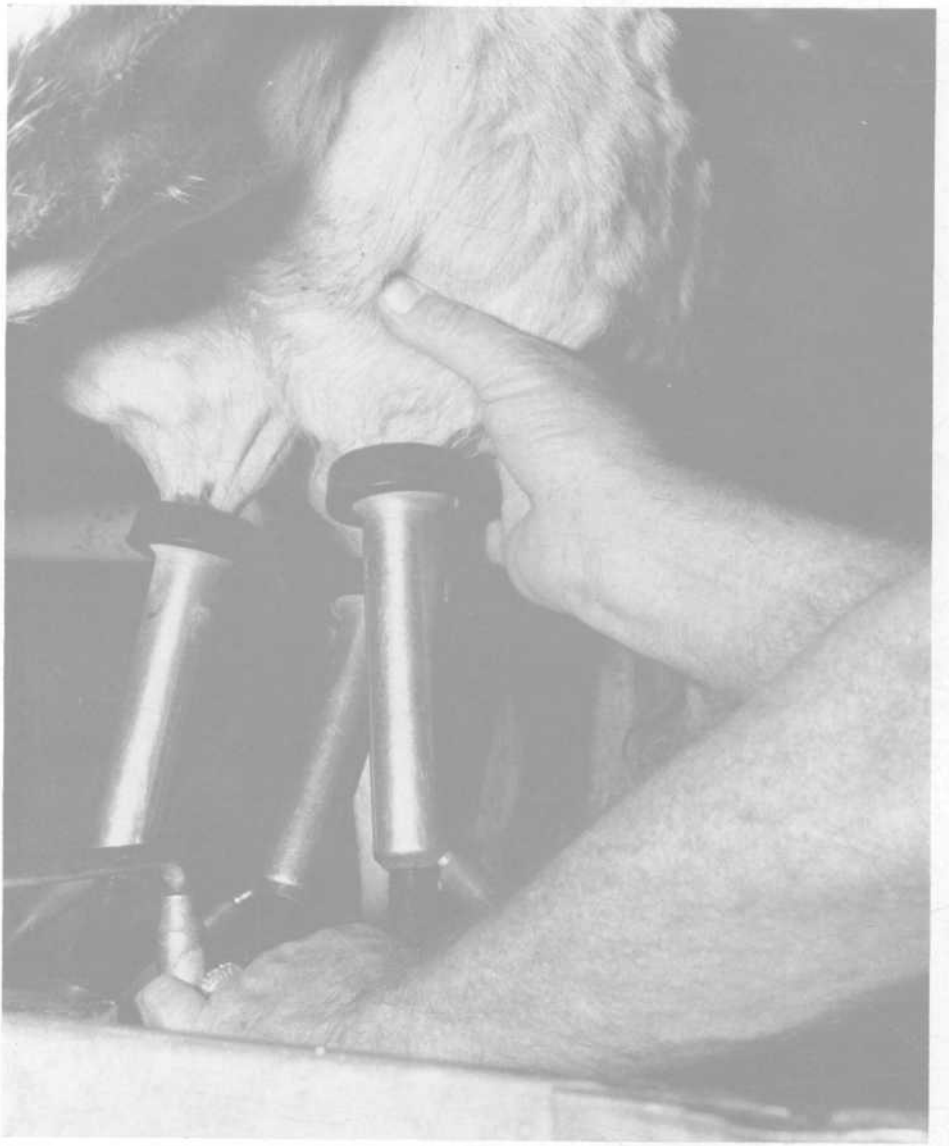
*Parts per million.

Attaching the Teat Cups to the Teats.

STEP 4. MACHINE STRIP

Machine stripping consists of pulling down on teat cups with one hand and massaging the udder downward with the other. Give special attention to those quarters which do not milk out as readily as the others. Start machine stripping when the lower part of the udder becomes flabby or the teat cups begin to crawl. Most cows will be dry after 20 seconds of machine stripping. Remember that it is impossible to get that last ounce of milk from the udder. It is much better to leave some milk in a particularly slow-milking quarter than to prolong milking an extra two or three minutes.

(See Photo on next page.)

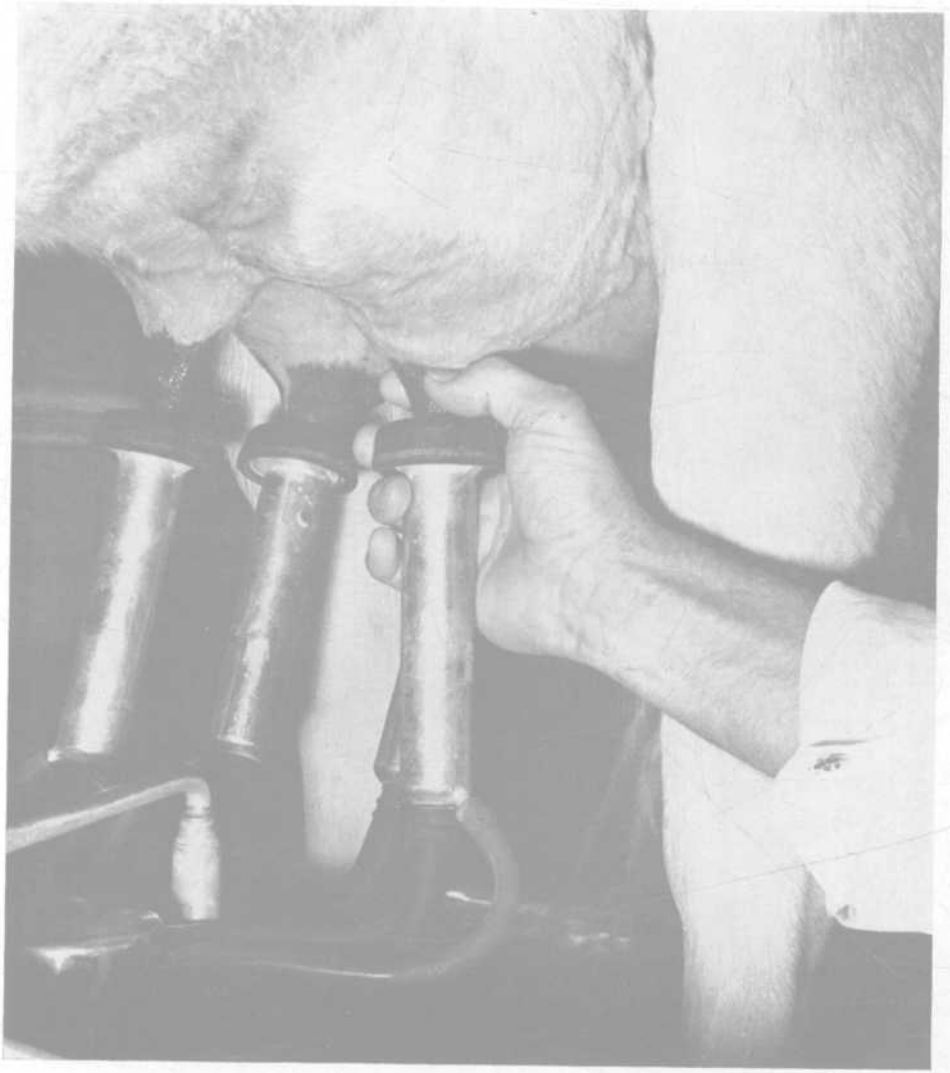


Machine Stripping.

STEP 5. REMOVE THE TEAT CUPS AS SOON AS THE UDDER IS MILKED DRY

To remove teat cups, take hold of them in one hand and close the milk cock with the other This will break the vacuum and permit easy removal of the teat cups. Suspended unit teat cups are easily released by pressing the thumb against the teat where it enters the teat cup. The vacuum is released and the teat cups are then easily removed by light downward pull. Injury can occur to the teats if the vacuum is not broken before removing the teat cups.

(See Photo on next page.)



Removing the Teat Cups from the Teats by Using Thumb to Break the Vacuum.

STEP 6. DISINFECT THE TEATS WITH CLEAN SOLUTION

After the teat cups have been removed, dip the teats with a fresh disinfectant solution. (200 ppm* available chlorine or 25 ppm* iodine). This will remove the milk from the end of the teat and prevent the invasion of bacteria into the udder through the teat. Also, this will prevent the attraction of flies that may be a source of spreading infection.

(See Photo on next page.)

*Parts per million.

Final Disinfecting of the Teats with a Special Dipper, Sponge, or Paper Towel.

STEP 7. DISINFECTING THE TEAT CUPS

After the teat cups have been removed from the udder of the cow, they should be immersed in a pail or container of tap temperature or lukewarm water to remove **all the milk** inside the liners. They should then be dipped in a warm solution of an approved sanitizer. If the teat cups are placed in the sanitizing solution immediately, the droplets of milk will soon make it ineffective. Water and sanitizing solution should be changed after using for 12 to 15 cows.

STEP 8. CLEAN-UP

All milking equipment must be cleaned thoroughly immediately upon the completion of milking the cows in the herd. **If** milk is allowed to get dry on the equipment, it becomes more difficult to clean properly. Follow the recommendations given in the section on sanitation of this manual. Thoroughly clean the milking parlor or barn and the holding corral with water from a hose with added pressure provided by a water pump.

Efficient milking requires that cows be handled by groups with two or more being milked at the same time. Naturally, individual differences in the cows and in speed and skill of the operators complicate the development of an efficient milking routine. However, such a routine is a **must.**

You must remember that cows are injured most by over-milking. This is usually caused by leaving the milker on a quarter after the milk flow from the quarter has stopped, or by placing the milker on the cow before "let down" has occurred. Milkers who are striving for faster, more efficient milking routines should try to handle units at maximum efficiency rather than increase the number of units per operator.

The number of units per operator should not exceed:

1. Conventional "Stanchions" — type barns with bucket milking machine — **two units per operator.**
2. Conventional "Stanchions" — type barns with pipeline milkers—**two or three units per operator.**
3. Elevated-type parlor barns with individual stalls and pipe-line milkers — **three to four units per operator.**
4. Herringbone-type elevated milking stalls with pipe-line milkers — **three to four units per operator.**

VI–MILKING TIME

The question arises: Just how long should it take to milk a cow? The results of several experiments have shown that the average time required to remove the milk from the udder will vary from less than 3 minutes to over 6 minutes, with an average of 3 to 6 minutes per individual cow.

Variation in Total Milking Time (232 cows in mid-lactation)

Under 3 minutes	36%
3-4 minutes	38%
4-5 minutes	17%
Over 5 minutes	9%
Average for herd	3 min., 37 seconds

The primary cause of variation in rate of milking between cows at the same stage of lactation is the strength of the muscle surrounding the teat canal. The stronger the muscle the slower the cow will milk. Other factors may affect the speed of milking, but at present, they are not fully understood.

The amount of time required for milking the same cow will vary with the stage of lactation. The total time for milking is greater for the early part of the lactation. This is due to more total milk being produced. The rate of milk flow is greater during the early part of the lactation and slowest at the end of the lactation.

True Milking Time

The true milking time is the time required to remove the milk from the udder. This includes the time that the teat cups are attached until they are removed after machine stripping. This time will vary from 3 to over 6 minutes per individual cow. For a herd, the "true milking time" should average between 3 and 6 minutes, depending on production, milking facilities, training of cows to fast milking, and many other conditions.

Working Time

The working time is the time required in working with the individual cow in performing all of the necessary operations for a good milking routine. This includes letting the cow into the milking stall, feeding the cow, preparation of the udder for milking, foremilking using the strip cup, attaching the teat cups to the teats, machine stripping, disinfecting the teats, and letting the cows out of the milking stall. Time studies have been made and the results show that this can be accomplished in 1 to 2 minutes per individual cow.

One minute should be allowed for the milk "let-down." Therefore, the true milking time, plus the working time, plus the "let-down" time, and an additional 1 to 2 minutes to allow for adjustments in handling individual cows, would average 6 to 10 minutes for the cow to be in the milking stall. With a milking unit at each stall, the milking machine should be idle for 3 to 4 minutes and milking 3 to 6 minutes.

The number of cows that can be milked per man hour is determined by the number of units and stalls, and the average time that the cow is in the stall. In a three-in-line elevated parlor, the cows per man hour would average 18 to 25 cows per hour. With a four-in-line parlor, the cows per man hour would average 25 to 30 cows per hour. However, additional time must be allowed to bring the cows in from the corrals, setting up, cleaning up, as well as milking problem cows.

Selecting Machine Milking Cows

Every dairyman must recognize that certain types of cows present problems in a milking routine. Most herds have a few cows that create milking problems. To be ideal for machine milking, a cow should have a sound, well-balanced udder with teats of medium size, hanging straight down from the corners.

Desirable milking characteristics, such as rapidity and completeness of milking, are hereditary. Rapidity of milking is influenced by structural differences, such as size of the teat openings and shape of udder. Failure to "let-down" is usually associated with nervous disposition.

These characteristics are of as much economic importance as high milk production. More and more emphasis will be placed on the selection of bulls that transmit desirable milking characteristics to their daughters.

Udders that are markedly tilted, badly quartered, broken down in the middle, or that hang too low do not adapt to machine milking. Large teated cows; slow milkers; cows with short or small teats that won't hold a teat cup; cows with meaty udders requiring extra stripping; or cows having other faults requiring special attention should be culled from the herd.

VII–MILKING EQUIPMENT

All milking equipment must be installed properly and maintained in good condition in order to do a good job of milking.

Install Milking Machine Properly

Lack of universally accepted standards for milking machine installations has caused considerable confusion and expense.

Each company has had its own methods of determining capacities and size of milking machines. There have been great variations and standards that the various companies have adopted.

Fortunately, recent developments in the use of vacuum recorders, air-flow meters, vacuum gauges, and other devices have made it possible to check milking machines more thoroughly. Consequently, it is now possible to more accurately measure and evaluate the installation and operation of the milking equipment.

Vacuum Supply System

Modern milking machines use vacuum as the force to withdraw the milk from the udder. For our purpose, any pressure below atmospheric (normal air) pressure will be considered as vacuum.

Vacuum Pumps

Vacuum pumps in use are of two general types, rotary and piston. Either type will give satisfactory results, providing a pump of sufficient size and capacity is used. However, the rotary-type pump will usually have a quicker recovery than the piston-type pump.

When you install a vacuum pump, choose one that will displace at least 25 percent more air than is actually necessary to operate all of the milking units, releasers, and in lifting and transporting the milk. This will allow for friction losses and will compensate for reduced efficiency as the vacuum pump gradually wears with age.

In selecting a vacuum pump, be sure to consider all possible changes that may be needed later. Remember that the pipe-line type milkers generally will require twice as much vacuum as a bucket-type milker.

Providing the vacuum line is free from leaks and restrictions, the following are indications that the present pump is short on capacity:

1. When one unit begins to suck air, the other units drop to the floor.

2. There is little or no air entering through the controller valve during the milking operation.

3. Each time a milking unit is placed on or removed from a cow the vacuum level, at a stall cock or at the teat cups, falls several inches and then recovers slowly. (This indicates that the pump is not developing sufficient vacuum reserve.)

4. When a vacuum recorder machine or a vacuum gauge is attached to the short air tube on the milking machine, definite open and closed phases are not shown. (This can best be noticed on the pulsation curve of the vacuum recording machine.)

Remember, for a vacuum pump to produce its rated capacity, the drive belts need to be kept in good repair and at proper tension as recommended by the equipment manufacturer. The manufacturer's recommendations on pulley diameters also need to be followed.

Vacuum Pump Motors

Select a motor or motors sufficiently large to operate the vacuum pump. Strive to maintain a constant power supply for efficient operation of electric motors. Check voltage during milking time. Low voltage causes overheating of motors and in turn reduces power output.

Vacuum Supply Line

When making a new installation or reconditioning of the old one, the pipe from the vacuum pump to the vacuum reserve tank should be at least 1¼ inches in diameter, and preferably 1½ inches. Use as few elbows, tees, and reducers, as possible in your installation.

Reducing friction losses is the aim of these recommendations. If the diameter of a pipe is doubled, its capacity is increased four times and friction losses are proportionately less. One elbow in the line creates approximately as much friction as eight feet of straight pipe, depending on air flow, temperature, and humidity.

Vacuum Controller

The vacuum controller should be placed just ahead of the sanitary trap, or on the vacuum reserve tank if the tank is close to the milk receiver. Use a vacuum controller sufficiently large to allow enough air to enter the system so that the vacuum level doesn't exceed that recommended by the manufacturer.

Vacuum Reserve Tank

Vacuum fluctuations can be reduced by including a vacuum reserve tank in the milking system, providing the vacuum pump has adequate capacity. The resulting stabilized vacuum supply will generally improve the performance of pipeline milkers. A vacuum reserve tank, if used, should have about a five gallon capacity for each milk unit used. It should have an automatic drain or petcock at the lowest point.

Vacuum Level

Measurement of vacuum for milking machines is in inches of mercury, whether a mechanical vacuum gauge or a mercury manometer is used. Most milking machines on the market today operate at vacuum levels between 9 and 16 inches.

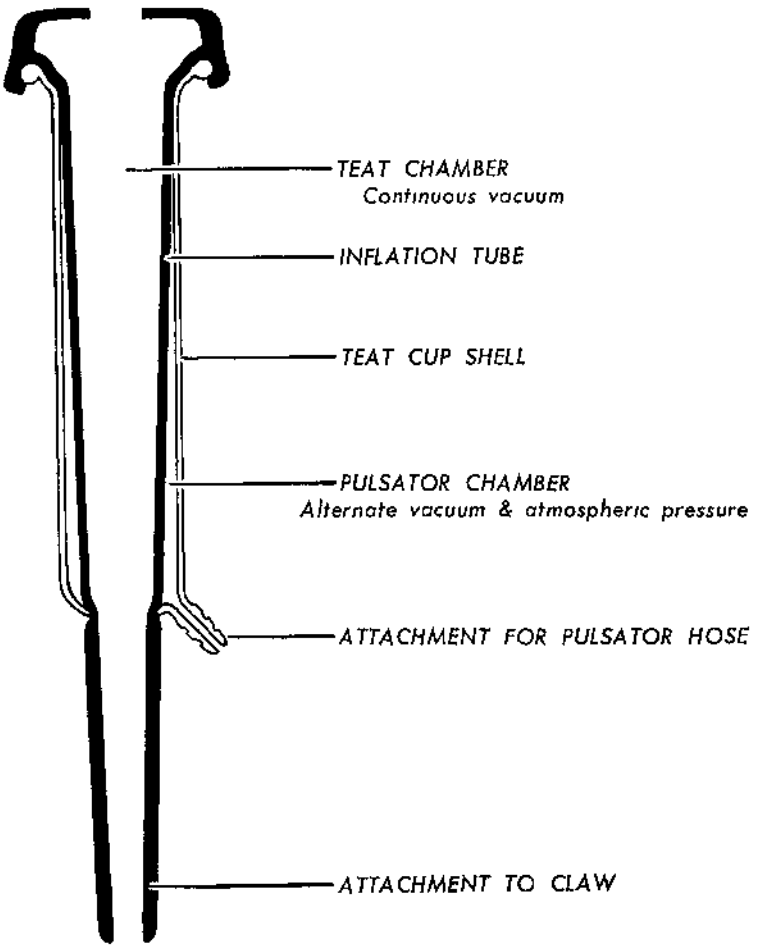
A gauge reading of 12 inches means that the applied vacuum is sufficient to lift a column of mercury to a height of 12 inches. Man-

ufacturer's recommend vacuum levels should be used. These range from 10 to 15 inches of stable vacuum at the teat cup during milking.

The Teat Cup

The outer cylindrical shell of the teat cup is usually made of stainless steel. An inflation tube (teat cup liner) fits into the shell to form an airtight pulsator chamber between the walls of the inflation tube and shell. A side tube from the pulsator chamber connects with the pulsating system.

The upper end of the inflation tube is open to receive the teat. The bottom end of the tube narrows as it passes through the shell to form the milk tube.



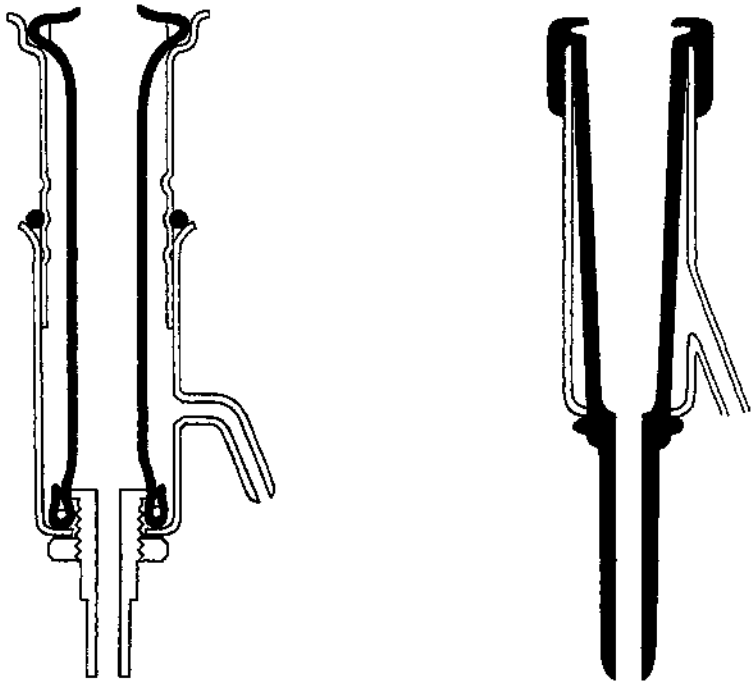
The Parts of the Complete Teat Cup.

There are inflation tubes of many designs. Basically these are developed from two designs, the stretch liner and molded liner. These can be either narrow-bore liners or wide-bore liners and fit the same type of shell.

Narrow-bore liners generally cause less teat irritation than wide-bore liners. They tend to position themselves so the top of the liner is lower on the teat. This allows less opportunity to injure the delicate udder tissues at the top of the teat. It also reduces the tendency for milk flow to be restricted by the liner.

Wide-bore liners position themselves higher on the teats and may cause injury to the delicate udder tissues. Injuries are most likely to occur if the teat cups are placed on the teats before the "let-down"occurs and are left on after milk flow has ceased. Injury will occur if the teat cups are allowed to crawl beyond the base of the teat after milk flow has ceased.

If this type of liner is used, after it has lost its elasticity, it will tend to have a harsh slapping action. This irritates the teat and also the lower portion of the udder which may be pulled into the teat cup liner.

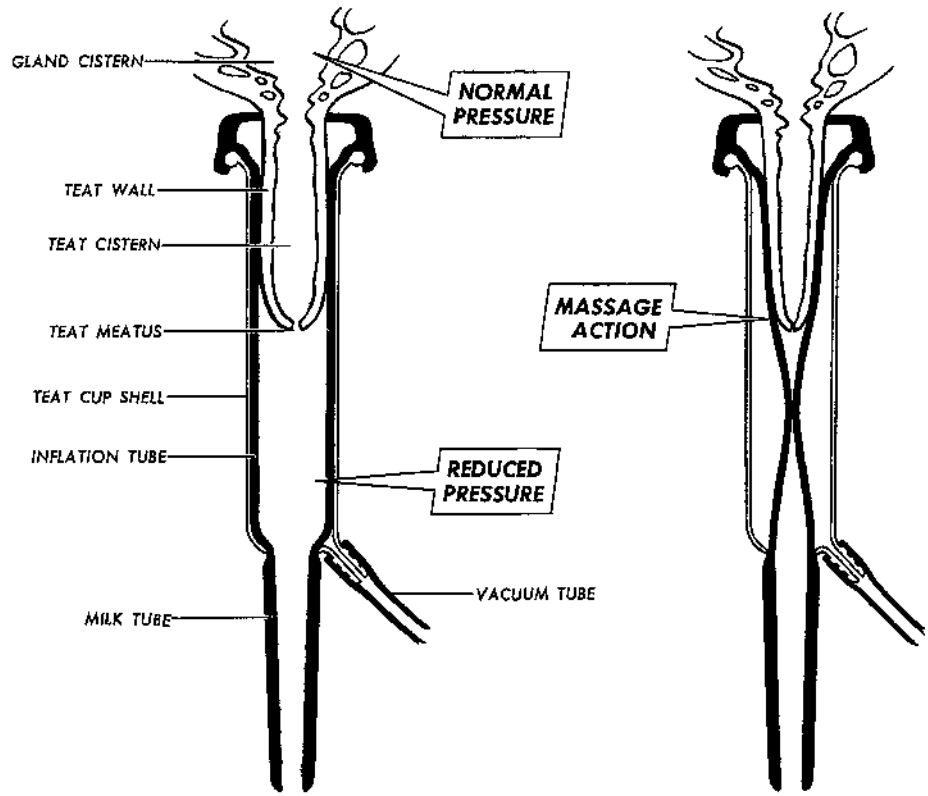


Stretched and Molded Liners.

The teat-cup liner is designed to expand and collapse in relation to the change in pressure regulated by the pulsator. In the **expanded phase,** the pressure is reduced inside of the teat cup liner. This dilates (opens) the teat canal resulting in the flow of milk.

This is the milking phase of the pulsator cycle. During this time there is an equal vacuum pressure in the pulsator and teat chambers. The atmospheric pressure surrounding the teat is thereby reduced. Under these conditions the pressure inside the teat cistern is higher than the pressure outside of the teat. This forces the milk through the teat canal.

During the **massage phase,** the teat-cup liner is in the collapsed stage of the pulsator cycle. In this phase (non-milking) the air has been admitted into the pulsator chamber, between the teat cup liner and shell. Since the teat



Reduced Pressure During Expanded Phase and Massage Action During the Collapsed Phase of the Pulsator Cycle.

chamber is under relative constant vacuum (inside of the teat cup liner) the teat cup liner collapses because of the difference in pressure between the teat and pulsator chambers.

As the inflation tube collapses, it provides a massaging action which promotes circulation in the teat. If this collapsed phase is to short and the vacuum phase (reduced pressure) is too long, the teat may become congested with blood. If this congestion is severe and lasts too long, injury to the teat will occur.

Milk Line

Install milk lines on a slope from the point where the milk enters the lines toward the receiving jar or milk pump. Use stainless steel or pyrex glass line no smaller than 1½ inches in diameter. Slope it uniformly at least 1½ inches in 10 feet. Eliminate elbows and upward inclines.

Locate the milk line as low as practical to avoid excessive lifting of the milk from the cow's udder to the line. In installations, where milk must be lifted by vacuum, an adequate vacuum supply will minimize vacuum fluctuations at the teat cups and reduce the back-and-forth surging of the milk in the milk hose, thereby keeping oxidation and churning to a minimum.

Low-level pipeline systems, where the milk line is below the udder level, help overcome major conditions of stress. Why? Because the milk moves from the udder to the receiver jar by gravity, making it possible to maintain a more constant vacuum level in the milking system. However, many milking parlors and systems are not adaptable to low-level installations.

Don't put more than eight milking units on a 1½ inch milk line. In a multiple-row barn, provide a separate inlet into the receiver jar for each 1½ inch line.

Avoid tees in the line. In a two-line barn or parlor, loop the milk line across the opposite end of the barn from the milk receiver.

Milk Valves

Milk valves should admit milk into the top half of the milk line. This eliminates excessive movement of air through milk and minimizes oxidation and churning of milk.

Pulsators

Pulsators direct the flow of air into and out of the pulsator chambers of the teat cup. This causes the alternate expanded and collapsed phases of the teat cup liner.

Pneumatically controlled and electrically controlled are the two types of pulsators in use. Speed of the pneumatic type depends on the amount of air allowed to pass through it. This is regulated by adjusting a locking-screw valve.

A built-in electric timing device controls the speed of electrical types. Master pulsators of both types are also available, but electrically timed ones are most commonly used.

If master pulsators are used, install them as near to the milking

units as possible. Too great a distance from pulsator to the milking units or too many units per pulsator will cause sluggish action. Use the manufacturer's recommendations to determine the number of milking units to operate on one master pulsator.

Pulsator speeds must be constant from day to day to obtain uniform milking. The number of pulsations per minute at which a particular machine operates at maximum efficiency is recommended by the manufacturer. Although most pulsators are designed to operate from 40 to 60 pulsations per minute, a few manufacturers recommend slightly higher or lower rates of pulsation.

Operating ratios of pulsators, expressed in terms of milking phase to resting phase, can be checked with a pulsation recording machine. Information available indicates that pulsators operating air ratios between 50-50 and 60-40 (50 percent to 60 percent milking, 40 percent to 50 percent resting) are safest for most milking conditions.

VIII–MAINTAIN MILKING EQUIPMENT PROPERLY

Milking machines generally are the most used and frequently the most abused or neglected equipment on many dairies. This is shocking, but true, according to surveys and observations in many states.

The milking equipment must be well maintained to do a dependable job of trouble-free milking. Note the following important maintenance check points:

1. **Vacuum Pumps**—Check daily and service frequently. Keep clean and properly lubricated.
2. **Motors**—Avoid dust. Lubricate and service as indicated by the manufacturer.
3. **Belts** — Keep taut — discard when worn—keep extra belts on hand for use in emergency.
4. **Valves, drains, stall cocks**—Keep free from leaks. Replace gaskets when worn.
5. **All electrical equipment**—Ground properly to eliminate dangers to workers and animals.
6. **Pulsators** — Clean and service at least every two weeks, more frequently if operated in dusty conditions. Mark unit pulcators so that faulty units can be identified for repair or replacement. Vacuum recorders or pulsation recorders are very useful in locating malfunctioning pulsators.
7. **Rubber and plastic parts** (inflations, air tubes, milk tubes, plugs, caps, etc.)—Keep clean and replace when elasticity loss allows parts to change shape, when leaks develop, or when erosion of surfaces occur. Alternate use of two sets of liners helps to prolong useful life of natural rubber liners. When not in use, clean thoroughly with lye solutions and store in a cool, dark place to allow rubber to regain its elasticity.
8. **Vacuum lines**—Keep clean and free from restriction and leaks. Avoid dead ends.
9. **Proper vacuum level**—This varies according to recommendations of manufacturer. Occasionally have a milker serviceman check vacuum gauge for accuracy and vacuum level at teat cups during milking.
10. **Vacuum regulator**—Clean frequently. Locate between cows and the vacuum pump.

IX–SANITATION

You, as a milker, must be concerned with two main sanitation problems.

The first is ensuring that no non-milk material gets into the milk or milk-handling system. Dirt from the cows, from your hands, and from surroundings must be kept out. Milk from cows that have been treated for mastitis or other diseases should be kept separate.

The second sanitation problem is the care and cleaning of the milking machine and other equipment. The local public-health officials will have approved the initial milking barn set-up and washing arrangements. You, then, have the responsibility of caring for the equipment in the approved manner. The equipment must be kept in good repair.

The Cow

Dairymen find it almost impossible to produce quality milk or to develop and maintain an efficient milking routine if their cows are not kept clean. Yet, lack of cleanliness is too common.

Clipping of cows to facilitate their washing before milking is a good practice. This should be done in the fall and early spring, and at other times as necessary. The clipped area usually extends from the tailhead forward and downward to the region of the navel, over the flanks, thurls, legs, tail, belly, and udder.

The udder and teats of the cow will be well cleaned if the procedure outlined for milking is followed.

Before Proper Clipping of the Cow.

After Proper Clipping of the Cow.

Equipment

There are two characteristics of milk that provide an ideal condition for the development of bacteria. **First,** milk is a well-balanced food in which bacteria thrive. **Second,** the milk (as it comes from the cow) has the ideal temperature for bacterial growth. **For these reasons, milk must be cooled as soon as possible in order to prohibit bacterial growth.**

Milking equipment must be cleaned thoroughly, immediately after each milking, to remove all milk residue which might provide food for bacterial growth. In spite of germicidal treatment, dirty equipment will harbor bacteria ready to multiply rapidly, and will contaminate the milk when it flows through the equipment.

General Rules Applying To The Cleaning Of All Milking Equipment

Only a general outline of cleaning can be given here. Specific instructions are available for each different brand of equipment.

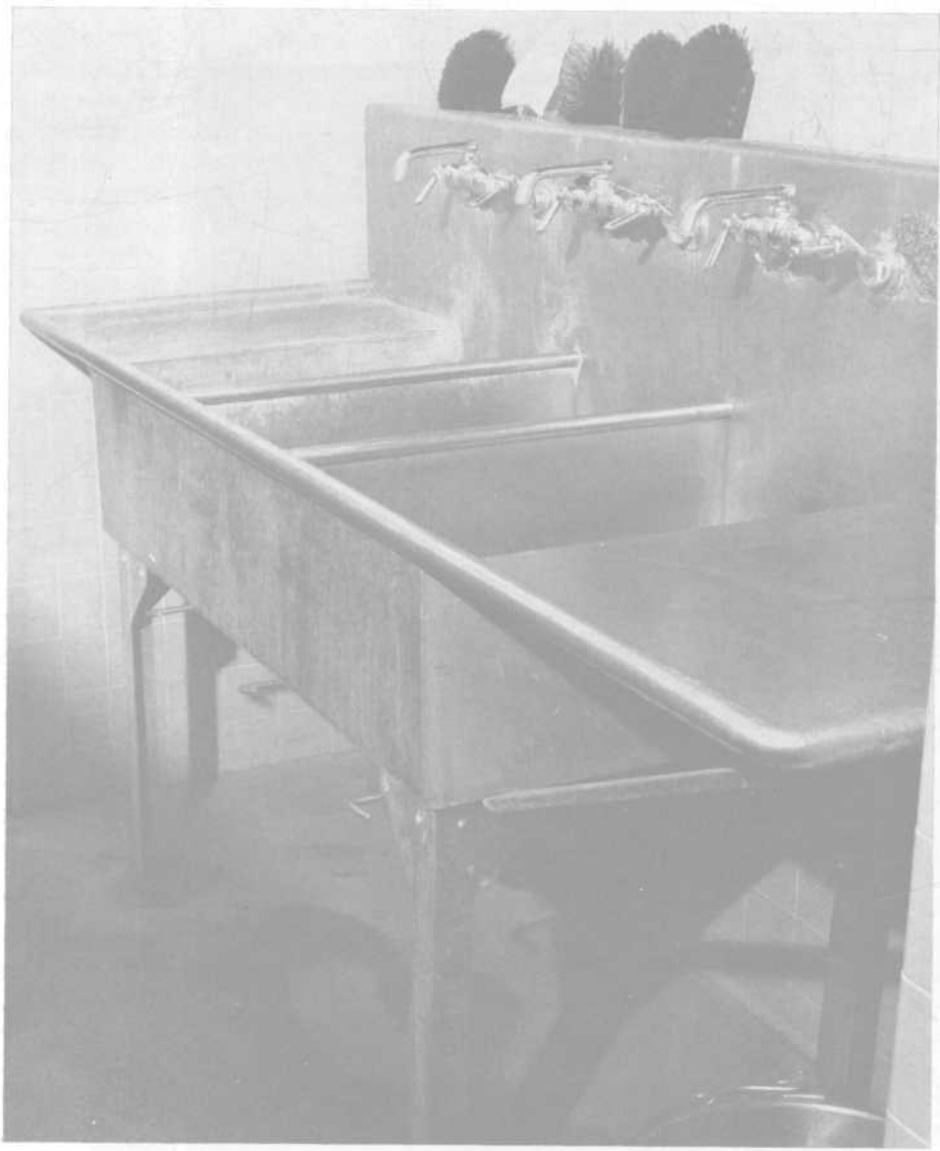
1. Rinse with tap water immediately after the last use to prevent formation of a resistant film made up mostly of protein and mineral elements of the milk.

2. Wash in warm detergent solution to complete the removal of milk fat and protein. Acid and alkali detergents are available, and should be used separately in a balanced rotation, depending on the hardness of water. Under most conditions the type of material used is less important than the thoroughness of the job.

3. Rinse in warm water to remove the residue of milk and washing chemicals. Plenty of clear water and good drainage to encourage drying are important. Bacteria cannot grow without moisture.

4. Treat the utensils with a germicide prior to use. This is usually a chemical treatment, using sodium hypochlorite (200-300 ppm* available chlorine), or an organic iodine compound such as iodophor (25 ppm* available iodine). The equipment must be thoroughly cleaned to allow the necessary contact between chemical and bacteria. Whatever type of sterilization is used, the recommended time and solution concentration must be made in order to obtain the proper action of the sterilizing chemical. Do not rinse with water after the chemical treatment.

* Parts per million.



Three Compartment Washing Tank to Wash Small Utensils.

Washing
Bucket Type Machines

While the machine is on the last cow, a bucket of tap water (3 gallons or more for each bucket) should be readied for the rinse. Immediately after the machine has been emptied of milk, place the teat cups into the water. The vacuum will draw the water through teat cups and milk hose into the bucket.

Every few seconds, raise the teat cup assembly out of the water and allow air to enter. This will provide a surging rinsing action. After the entire bucketful of water has been drawn through, the vacuum is shut off, and with the lid in place, the water is swirled thoroughly around the bucket.

When this water is discarded, most of the milk residue goes with it. Rinse off the outside of the equipment.

It is helpful, though not essential, to draw a detergent solution through the unit assembly by vacuum. The next step is to take the assembled unit apart and place the parts into enough detergent-wash solution to cover them. If necessary, they may be allowed to stand this way for a time without increasing washing problems.

To complete the wash, every surface of the parts must be scrubbed with a brush. This requires brushes of several shapes. Washing the machine is much easier if a good supply of all necessary brushes is on hand.

A deposit of minerals (milkstone) from the milk and rinse water may form after repeated washings. This deposit can harbor bacteria and render sanitization ineffective. It is an alkaline deposit not easily removed by common alkaline detergents.

The occasional use of selected acids in the wash program is one method of preventing milkstone deposits. They might be used once or twice a week, depending on the hardness of the water used for washing. Using some acid in the rinse water every day is an excellent way to prevent "water spotting."

Use plenty of clear water for the rinse. This takes away the remaining milk, detergent, and acid residues. Utensils are then set up to drain and dry on a proper rack for the equipment.

The milking machines must be disinfected before use. The most common method is chemical. The machine parts are put together and the disinfectant is drawn through the unit with vacuum.

Use 3 gallons or more of 200 ppm* hypochlorite or an organic compound (iodophor) 25 ppm* available iodine drawn through the assembled unit alternately with air for rinsing action. When all the solution has been drawn through the unit, shut off the vacuum and swirl the solution around in the bucket. Pour out the solution and the unit is ready for use. Do not rinse the unit again with water.

*Parts per million.

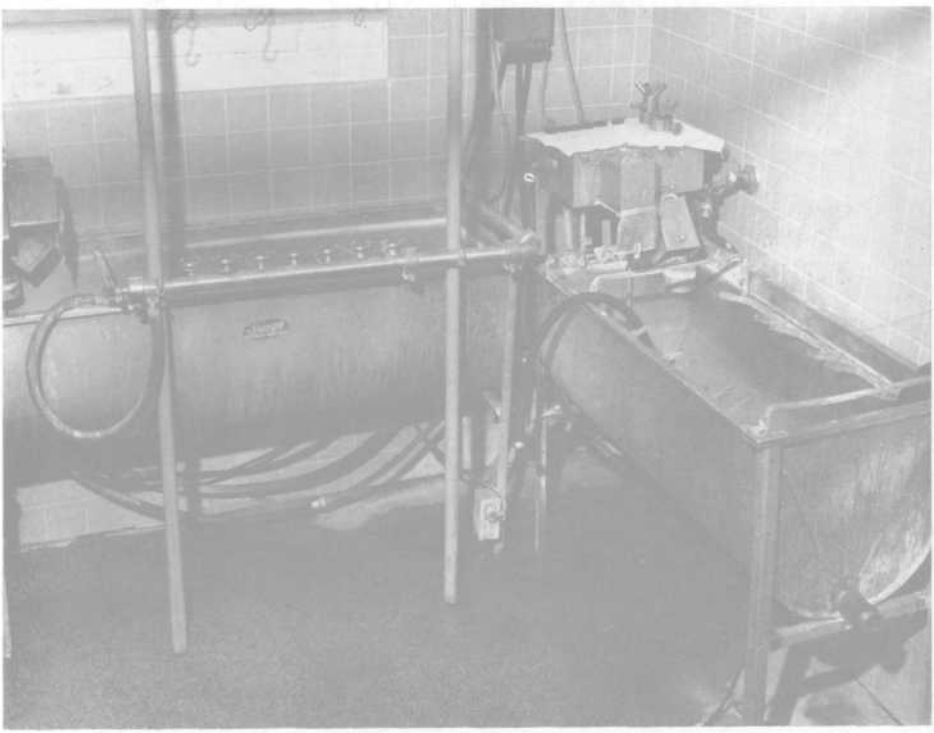
Cleaning Pipeline Milkers

"Cleaning In Place" (CIP) procedures can be applied to all of the milking machine parts if the proper equipment is available. Rinse, wash, or disinfectant solutions can be moved through the system by one of the following methods:

1. Vacuum circulation. The solution is drawn from a solution tank (through the teat cup assemblies, if desired) through the milk lines into the vacuum breaker by the milker vacuum and is then drained back into the solution tanks.
2. Pressure circulation. A pressure pump is used to circulate the solution from the solution tank and back.
3. Some makes of milkers have specialized line-washing equipment which may or may not allow simultaneous flushing of the milker assemblies. The same steps are used in cleaning those more complex systems. (In using the specialized line-washing equipment, it is necessary to close the outlet system or make a special hook-up in order to avoid getting water into the milk.)

USING AUTOMATIC WASHING EQUIPMENT

1. Rinse immediately after milking with cool clear water (at least 3 gallons per milker assembly). The pipeline system



Automatic Washing Equipment.

should be flushed with cold water, until the discharged water is clear.

2. Prepare enough detergent solution to fill the pipeline system and provide plenty of extra detergent solution in the solution tank. The water should be 160° F. Circulate 15 to 20 minutes, brushing each milk cock in the pipeline.

3. Rinse with plenty of warm water (110° to 120° F) until the water runs clear. Run the rinse water onto the floor rather than recirculating it.

4. Before milking, disinfect with hypochlorite (200 ppm* available chlorine) or organic iodine compound (25 pmm* available iodine) solution. After drawing 6 to 8 quarts of the disinfectant through each milking machine assembly, circulate the solution through the system for at least 10 minutes. It may be more convenient to disinfect the milker assembly separately. **Do not** water-rinse after disinfecting.

Cleaning Bulk Tanks

The cold-water rinse is extremely important for effective tank cleaning. Usually, the tank truck driver will rinse the tank down at the time of pick-up. Make it convenient for him to use plenty of water.

In the wash procedure, a chemical is used which permits cleaning and disinfecting at the same time. This is called "sanitizing." At weekly intervals (more or less often depending on water conditions) milkstone remover treatment should be included between the rinse and the sanitizer scrubbing.

1. Remove the outlet valve and clean it thoroughly. Use a bucket of the sanitizing solution and a properly shaped brush. Replace valve and close it.

2. Remove parts — agitator, gauge, etc. — and scrub in a sink full of sanitizing solution.

3. Sprinkle the dry powder of the sanitizing preparation on the surface of the tank. Brush this material (actually a paste made by keeping the brush moist with water from bottom of the tank) on to all surfaces of the tank. Scrub well, paying special attention to corners. This will leave a moist film of sanitizing material on all surfaces.

4. Replace the detached parts, close the tank, and let it stand 10-15 minutes.

5. Rinse with plenty of cold fresh water. Drain and close the outlet and top. The tank is ready for use.

There are CIP set-ups which are adapted to cleaning bulk tanks. These use high pressure spray systems which use the usual four steps of the cleaning procedures—rinse, clean, rinse, disinfect—or the rinse, sanitize, rinse, routine. Adequate circulation time for each step is essential.

* Parts per million.

X-MASTITIS

Mastitis, by reducing milk yield and shortening a cow's productive life, causes tremendous economic losses every year. Surveys show that it is not uncommon to find infection in as many as 50 percent of the cows in some herds. Authorities have estimated that the cost of mastitis is about $12.50 for every producing cow in the nation. Mastitis costs include loss of cows, reduced milk yield, and expenses of treatment.

Mastitis is any inflammation of the udder affecting the secretion of milk. The form and severity of the infection varies a great deal. In **acute** cases the udder may become inflamed, swollen, hard, and the milk may be thin, with flakes or lumps, or otherwise abnormal in appearance.

A severe attack may cause the udder to dry up or may even result in the development of abscesses or gangrene. In contrast to this, **chronic** infections and mild cases may exhibit no outward sign of inflamation and may only be revealed by chemical or bacterial tests of the milk.

Once a cow has had mastitis she is never as good as before. Acute inflammation, if not quickly detected and treated, results in the destruction of milk-secreting cells and replaces them with scar tissue. Even chronic infections cause damage to the milk-secreting cells and a gradual reduction in milk yield. In addition, chronic cases may serve as a reservoir for the further spread of the micro-organisms.

The indiscriminate use of antibiotics and other chemo-therapeutic agents in treating mastitis can cause a very serious problem of chemical residues in milk. These chemical residues have resulted in restrictions which are very troublesome and costly to both dairymen and milk processors.

Prevention through proper milking and management practices is the key for a successful crusade to reduce losses from mastitis. Many practices and conditions increase the susceptibility of the udder to infection. Among them are the following:

Improper Milking Practices

The delicate tissues of the udder can be injured and the incidence of mastitis increased by action of the teat cups. This is true when the teat cups are attached before the milk "let-down," and if they are left on the teats after the milk flow has stopped. The possibility of injury is increased with improper vacuum, malfunctioning pulsators, leaking air tubes, and swollen or worn-out liners.

Fast, complete milking is a must. Remove teat cups when milk flow ceases. Clean vacuum line regularly. Make certain that the vacuum controller and pulsators are working properly and that the vacuum pump is of adequate size to effectively operate all of the milking units being used.

Take advantage of milk "let-down." Adequately stimulate the cow, and attach the milking unit one minute later.

Don't leave the machine on too long. Keep two sets of rubber parts, one set in use, the other stored in a 5 percent lye solution. Change sets each week. Replace rubber parts when damaged or worn.

Exposure To Infection

Mastitis-causing organisms are easily transmitted from a diseased udder to a heathy udder. Milk first the heifers and cows known to be mastitis-free. Then, the animals suspected of being infected, and last the badly infected animals. Badly infected animals that do not respond to treatment must be sold.

After milking each cow, rinse teat cups in tap or lukewarm water and then in a sanitizing solution. Change rinse water and solution after 12 to 15 cows.

Dip teats in an antiseptic solution immediately after milking. Wash, disinfect, and dry hands as you move from cow to cow. Clean milking equipment immediately after use. Do not forestrip onto the floor.

Raise your own replacements or purchase bred heifers. If herd replacements are other than heifers, have them examined by a veterinarian to be sure they are free of mastitis.

Injury

Chapping, scratching, cutting, crushing, or bruising of the teats and udder will destroy or impair the natural resistance to infection and facilitate the entrance of micro-organisms.

Prevent udder and teat injuries, whether from milking abuses or from corral hazards. Keep corrals and working areas clean. Provide good drainage for corrals.

Other

Because some cow families appear to be more susceptible than others, heredity is thought to be a factor. Perhaps conformation of the udder, teat normality, and potency of bacteria-static substances in the udder are involved.

Contrary to some belief, rations which contain large amounts of corn or those high in protein do not actually cause mastitus infection.

Diagnosis

Prompt detection, accurate diagnosis, and effective treatment are basic in the establishment of a successful control program.

The help of a local veterinarian should be utilized in working out a mastitis-control program. His experience and technical knowledge makes him invaluable in mastitis prevention, diagnosis, and in the selection of proper treatment for its cure.

Use the strip cup at each milking to detect changes in the appearance of the milk. At regular intervals use a bromthymol-blue test, Whiteside test, or "California Mastitis Tests" (CMT) to determine if there is irritation or inflamation

of the udder which has escaped detection.

Examine the udder following milking and examine udders of dry cows for abnormalties. In areas where facilities are available, arrange with your veterinarian for periodic collections of milk and laboratory tests from all quarters of the cows that do not respond to treatment.

Where cows do not respond to treatment, arrange with your veterinarian to conduct laboratory tests on milk from all four quarters. He can then advise the proper treatment.

Treatment

Random infusion of udders with antibiotics often fail to give the desired results. This is because of the wide variety of organisms involved in mastitis infections. Some readily respond to treatment, while others are much more resistant.

It may be difficult or impossible to clear up long standing infections. In these cases, base your treatment on laboratory findings or advice of a veterinarian. Take care in administering udder infusions to avoid introduction of organisms not controlled by antibiotics.

Before an injection, clean the teat with soapy water, and then carefully swab off the teat end with a piece of cotton, saturated in alcohol.

Treatment without adoption of good management and sanitation practices is of limited value. Infection is a good bet to re-occur.

Caution

Do not market milk from treated cows for **at least 72 hours** after last treatment, or longer if so prescribed on the drug label or by a veterinarian. This also applies to cows treated for hardware, pneumonia, etc.

XI-EMPLOYEE-EMPLOYER RELATIONSHIP

There should be a clear understanding between the dairyman and his employee of what actual work and responsibility is involved in a particular job, method of pay, time of payment, etc.

In practically all cases, employment terms and conditions are made by verbal agreement. At a later date, differences of opinion often arise between the dairyman and his employee concerning what was actually said or meant in this verbal agreement.

Too often these sessions end in the employee quitting in a "huff" or his being "fired" in a very unpleasant manner. The former employee then spreads the "word" that so-and-so is impossible to work for. In turn, the dairyman does little to help the worker's reputation within the dairy industry.

Many of these unpleasant situations could well be avoided if the dairyman and the employee would take time to complete a written agreement at the time of hiring. A "good" discussion of the job would help if a written agreement seems too formal. The outline on the following pages can be used as a guide.

XII-AGREEMENT OUTLINE

Agreement Outline

between

Employer

_____

and

Employee

_____

The purpose of this Agreement Outline is to define clearly the respective responsibilities of the manager or owner, and the employee.

I. Responsibilities of the Employer:

A. Payment for services made by Employer:

1. Cash wages to be paid
   Weekly $_____ Twice a month $_____
   Total monthly $_____
   Payment to be made on_____of each month.

2. Deductions:

Social Security	$_____	
State Income Tax	$_____	
Federal Income Tax	$_____	
Employee Insurance Benefits	$_____	
Other	$_____	
Total Deductions		$_____
Total cash payment to Employee		$_____

3. Non-Cash Wages:

Social Security paid by Employer Monthly	$_____
Industrial Insurance paid by Employer Monthly	$_____
Other Insurance paid by Employer Monthly	$_____
Housing (monthly value)	$_____
Utilities (monthly value)	$_____
Meat, Milk, etc. (monthly value)	$_____
Other	$_____
Total value of monthly income to Employee	$_____

B. Other considerations granted by Employer:

1. Time off described as follows:
   Weekly:_____
   Monthly:_____

2. Vacation time described as follows: (Pay Status)_____
   _____

3. Bonus or incentive payment based on the following conditions:_____
   _____

4. Time off for sickness or other emergencies based on the following conditions (Pay Status): _____
   _____

II. Responsibilities of the Employee:

A. Outline of Work:

1. Until further notice milking will start daily at_____A.M., and/or_____P.M._____

2. To follow the milking procedure outlined in the "Milker's Manual" with changes or additions as follows:_____
   _____

3. To feed grain to the cows in the barn as follows:_____
   _____

B. Care and adjustment of milking equipment:

1. To watch equipment closely and make adjustments or report problem promptly to _____

2. To maintain vacuum line and vacuum level as follows:_____
   _____

3 To take care of the teat cup inflations as outlined in the "Milker's Manual" (Bulletin No. A-37) with changes or additions as follows:_____
   _____
   _____
   _____

C. Care of bulk tank, milk room and milking barn.

1. To follow the procedures as outlined in the "Milker's Manual" with changes or additions as follows:
   a. Bulk Tank (Clean-up procedure, temperature, agitator operation, etc.): _____
   b. The Milk Room (Wash down, ventilation, fly control, care of miscellaneous equipment, storage of supplies, etc):_____
   _____
   c. Milking Barn, holding pen and ramps to be washed after each milking. Other things to be done are as follows: (Fly control, ventilation, disposal of waste feed, paper towels and other used supplies, etc.) _____
   _____

D. Cow Observation and Care:

Watch cows closely at milking time and do the following, or report to_____

1. Mastitis: (treatment to be given, isolation, or report to person responsible for treatment and isolation) _____
   _____
2. Cows in Heat:
   a. Identify the cow by neck chain number, mark cow with painstik or other temporary marking.
   b. Put the cow into the breeding pen.
   c. Report to the person responsible for breeding.
   d. Call A.I. technician---Phone _____
3. Cows that are "off-feed," injured or showing other signs of illness, report to person responsible for care and treatment.

E. Records to keep or use:

1. Measure milk put into tank during your shift and record before milking, end of milking (each time herd is milked).
2. Keep a record of heat periods, breeding dates and calving dates in the Breeding and Calving Record Form (available from your County Agent) or in the following manner:_____
   _____
3. Keep a record of the grain fed to the cows in the milking barn. The feeding schedule to be provided each month.
4. Other records to be kept are:
   a _____
   b._____
   c._____

F. Other work:

Other jobs the employee will be expected to do or help with are:

1. Veterinarian assistance as follows: _____
_____
2. Breeding as follows: _____
3. Production testing (DHIA, official) as follows: _____
_____
4. Calf Feeding as follows: _____
_____
5 Corral cleaning and repair as follows: _____
_____
6. Feeding cows, heifers and bulls as follows: _____
_____
7. Other jobs as follows: _____

Any time you are in doubt as to what job is to be done, or how to do it, contact me or _____ for instructions.

III. Duration:

This agreement shall become effective _____ 196__, and shall continue in effect indefinitely. A reconsideration or termination by either party can be made upon _____ days' notice.

_____ _____
Date Employer

_____ _____
Date Employee

This publication is issued by the
Cooperative Extension Service and
the Agricultural Experiment Station
of The University of Arizona. See
your local County Extension Agent
for additional information.