MILKING MACHINES and PRACTICES on 60 Illinois Dairy Farms

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CONTENTS

Location of counties included in the survey. Twenty herds were visited in each county. (Fig. 1)

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MILKING TIME is harvesttime on the dairy farm. This is when the rewards for good breeding, feeding, and management are obtained. The kind of job which is done in harvesting the crop determines the size of the profit and other rewards received for all the planning and work that have been expended.

According to several studies, milking practices differ widely on dairy farms and can influence the total amount of milk produced during the year. In one study in a neighboring state, yearly butterfat production varied as much as 100 pounds between herds, as the result of milking practices alone.

SIXTY HERDS SURVEYED

To study milking procedures and the condition of some of the milking machines used in high-producing dairy herds in Illinois, 60 herds in Vermilion, McHenry, and Madison counties were visited at milking time during May, June, and July, 1961. The type of dairying in Vermilion county is representative of the east-central part of the state. McHenry county is in the Chicago milkshed and Madison county, in the St. Louis area (Fig. 1). The farm adviser or assistant farm adviser in each county selected the herds to give a representative sample of the better dairy herds in the area.

On the average, about 28 cows were milked per herd, with average daily milk production being 35 pounds a cow. The following breeds were represented:

Breed	*Number*	*Percent of total cows*
Holstein	1,497	87.6
Guernsey	101	5.9
Brown Swiss	70	4.1
Jersey	32	1.9
Other	9	.5

About three-fourths (72 percent) of the herds visited were milked in stanchion barns while the rest were milked in milking parlors. Most of the parlors were equipped with pipeline milkers. All the herd owners except one were shipping milk to a grade A market.

Milking practices and methods of operating the milking machines were observed and measurements were taken while the herds were being milked. Stop watches were used to time the interval between

priming and attaching the machine to the cow, and to determine the length of time the milkers were on the cows. The action of the pulsators was recorded on continuous graph paper by a vacuum recorder. This observation was made on idle units either before or after milking. A special vacuum gauge with a valve to allow varying amounts of air to enter the system was used to determine the condition and adequacy of the vacuum line and the level of vacuum at all stall cock locations in the system.

THE MILKING MACHINE

Almost two-thirds of the 60 herd owners used a suspended type of milking machine, while the rest used a claw type (Table 1). Most of the dairymen used either two or three milker units. Seventeen of the herd owners had pipeline milkers. The same number of dairymen, but not necessarily the same ones, milked in a milking parlor.

A milking machine will do a good job if it is operated in accordance with the manufacturer's directions and is kept in good repair. As might be expected, the condition of the machines in this study was directly affected both by the type of field service that the manufacturer representative offered in the area, and by the interest of the dairyman.[1]

Many of the dairymen were doing a satisfactory job of managing the machines. However, some problems were observed, which are discussed in the following paragraphs.

The vacuum pump, reserve tank, and line. In this study, vacuum reserve was considered adequate if the vacuum level on the line dropped no more than 2 inches and returned to normal within 2 seconds when vacuum was allowed to enter an empty pail before it was attached to a new cow. Vacuum levels did not change throughout the entire milking operation on several farms which were equipped with good vacuum pumps and vacuum reserve tanks of recommended size.

On over half the farms, the vacuum reserve was not adequate to do an efficient job of milking (Table 2 and Fig. 2). Some of the pumps were too small for the number of milker units used. Other pumps were worn badly, were not running fast enough, or were connected to vacuum lines with leaking stall cocks or vacuum regulators. The overall results were fluctuations in vacuum level, variations in pulsator rates, and slower milking.

In some installations the vacuum reserve tanks or the vacuum lines were too small. About 60 percent of the barns had vacuum lines which

[1] Since the time of this survey, at least three major milking machine companies in Illinois have added field testing equipment, such as vacuum recorders and air flow meters, to their servicing procedures.

Table 1. — Type of Equipment Used, 60 Dairy Farms

Equipment		Number of farms	Percent of all farms
Type of milking barn	Stanchion	43	72
	Parlor	17	28
Type of milking machine	Suspended	38	63
	Claw	22	37
Combination of more than one brand of milking equipment		11	18
Number of milker units	One	1	2
	Two	24	40
	Three	26	43
	Four	3	5
	Five	2	3
	Six	3	5
	Eight	1	2
Pipeline milkers		17	28

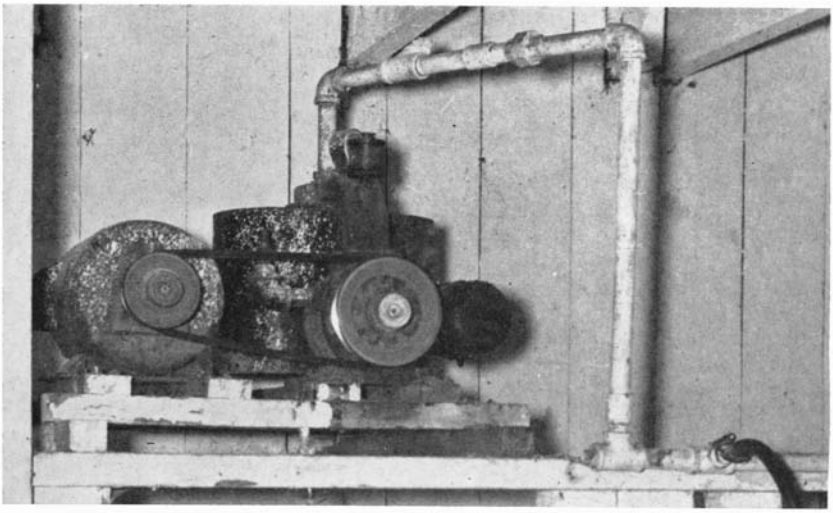
Table 2. — Level of Vacuum, Vacuum Reserve, Size of Vacuum Line, and Vacuum Gauges, 60 Dairy Farms

		Number of farms	Percent of all farms
Level of vacuum on vacuum line	In recommended range	46	77
	Above recommended range	8	13
	Below recommended range	6	10
Vacuum reserve	Adequate	27	45
	Inadequate	33	55
Diameter of vacuum line	½ inch	1	2
	¾ inch	35	58
	1 inch	20	33
	1¼ inch	4	7
Vacuum gauges	Machines with gauges	53	88
	Machines without gauges	7	12
	Faulty gauges	6	10

were ¾ inch in diameter or smaller. Many of these lines had numerous elbows and small mechanical obstructions.

Although some of the vacuum lines had moisture in them, only a few were partially clogged. Many of the dairymen flushed out the lines regularly. About 65 percent of the lines had drains in them.

Vacuum control valve and vacuum gauge. The control valve on the vacuum line is responsible for maintaining the vacuum in the line at a proper level for most efficient operation of the milker units. Most milking machine manufacturers now recommend that this valve be located near the pump.



Worn pumps, small vacuum reserve tanks, and small vacuum lines with numerous elbows and other obstructions lowered the vacuum reserve on many farms. (Fig. 2)

Because of inadequate vacuum reserve, rocks have been placed on this milker claw to add weight and thus help increase the rate of milking. (Fig. 3)

On more than half the farms, the vacuum control valve was at the end of the line. (Fig. 4)

Only 18 percent of the installations in this survey had the valve located near the pump. In about 60 percent of the installations, the valve was located at the far end of the vacuum line (Fig. 4), while in 22 percent it was in about the middle of the line.

Seven of the milking machine installations did not have vacuum gauges in the vacuum lines (Table 2). One of these installations had only 5 inches of vacuum on the line when all three milker units were in operation. The decrease in vacuum, with a corresponding decrease in milking efficiency, had occurred gradually over a period of several years as the vacuum pump became worn. Without the gauge the dairyman did not realize that such a drastic change had taken place.

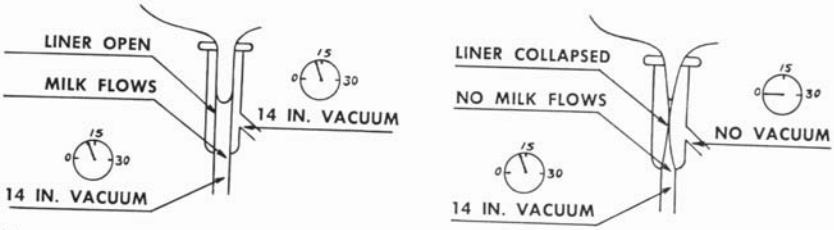
The level of vacuum on another farm without a gauge was about 20 inches when checked before milking time. A dirty screen on the vacuum regulator was responsible. After the dairyman cleaned the screen, the vacuum level returned to normal. This problem would probably have been avoided if a vacuum gauge had been installed in the line.

Pulsators. When a milking machine is put on a cow, the top of the rubber inflation seals off the air, and vacuum is applied to the cow's teat. Periodically the pulsator should admit air to the space between the inflation and the outer metal shell, causing the inflation to collapse and squeeze the teat. This squeezing, or massaging, of the teat is important. Without it, blood and body fluids may be drawn into the teat ends, causing congestion and discoloration of the teats and discomfort to the cow.

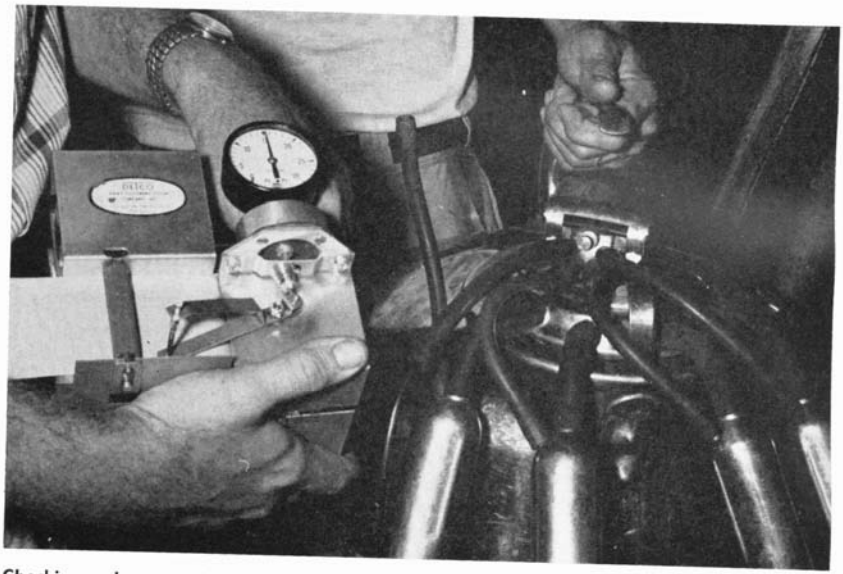
If the pulsator is to do its job well, it must allow air into the teat cups and remove it at regular intervals, so that the open, or milking, phases will be of uniform length, as will the closed, or rest, phases (Fig. 5). Generally speaking, pulsators on most milking machines in the United States should be open about 50 percent of the time and closed about 50 percent of the time.

A vacuum recorder was used to make a tracing of the pulsator rate and action on continuous graph paper while the milker units were idle (Fig. 6). Some of the faults that were found are shown in Figure 7.

Of the 227 pulsators observed, 69 (30 percent) deviated 5 to 10 percent from the open-to-closed ratio recommended by the manufacturer; 42 (19 percent) deviated more than 10 percent. Most of the deviations were caused by inadequate vacuum or by worn, dirty pulsators. A few pulsators were in such bad shape that the ends of the cows' teats were under constant vacuum. Such situations could damage the teat and lead to serious udder trouble.



Open or milking phase (left) and closed or rest phase (right) of milking machine. If pulsator is working properly, the open phases should all be the same length, and so should the rest phases. (Fig. 5)

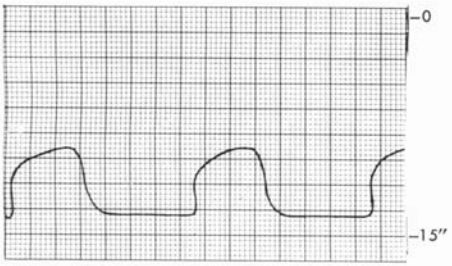


Checking pulsator action on an idle machine with a vacuum recorder. (Fig. 6)

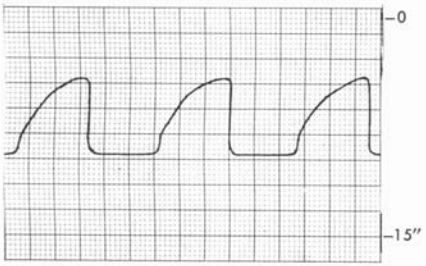
About three-fourths (76 percent) of all the pulsators were operating at the approximate speed recommended by the manufacturer. Nineteen percent were running too fast and 5 percent were too slow.

Voltage at the stall cock locations on all of the magnetic installations was within the range recommended by the manufacturer (Fig. 8). Thus, voltage apparently did not contribute to the problems observed with the functioning of the pulsator on this type of machine.

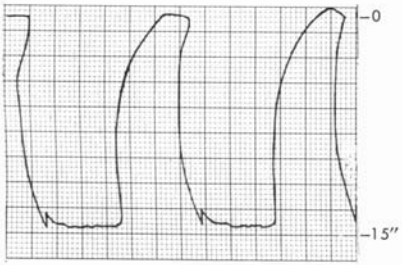
Condition of inflations. In general, the inflations were in satisfactory condition. An arbitrary rating of good, very good, or excellent was given to 81 percent of the inflations observed. Seventeen percent



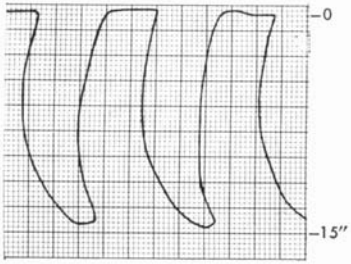
A. Pulsator not closing; constant vacuum applied to cows' teats.



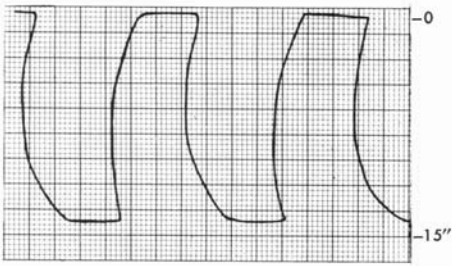
B. Neither opening nor closing completely.



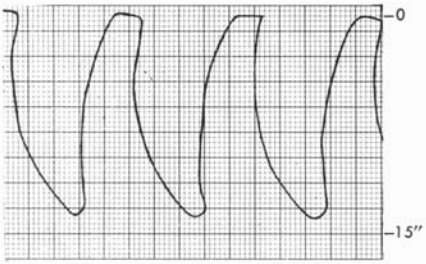
C. Short closed phase. Vacuum unstable.



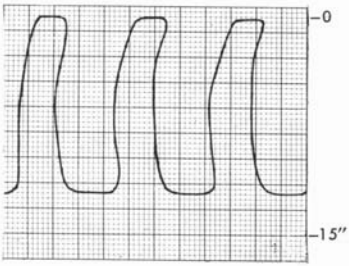
D. Short open phase.



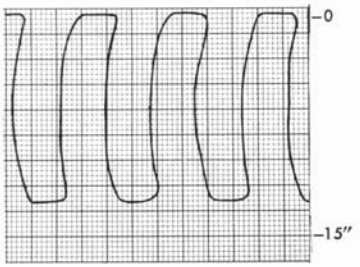
E. Pulsator working properly with an open-to-closed ratio of about 50:50.



F. Short open phase. Excessive vacuum.



G. Short closed phase.



H. Pulsator working properly.

TRACINGS OF PULSATOR ACTION ON IDLE UNITS. Tracings A through E are for high-vacuum machines; F, G, and H, low-vacuum machines. (Fig. 7)

Using a volt meter to check the voltage on the line. (Fig. 8)

Some of the types of available inflations are shown below. (Fig. 9)

were rated fair, and 2 percent, poor. Shape, resiliency, and presence or absence of small cracks on the inside of the inflation were considered in making the final rating.

The fact that dairymen bought new inflations rather frequently was partly responsible for the good condition of those in use. About 75 percent of the 60 dairymen purchased two or more sets of inflations

for their milking machines each year. Fourteen dairymen bought new inflations at three-month intervals.

Eighteen percent of the dairymen kept two sets of inflations on hand. One set was rested for a week or more while the second set was in use. On most of the farms, the inflations were boiled in a lye solution to remove the fat deposits before they were put in dry storage. This procedure seemed to help prolong the life of the rubber in the inflations.

Small holes in the shank of the inflation just below the metal shell were observed frequently.

Type of inflation. Most of the dairymen reported that they were satisfied with the type of rubber inflations they were using (Fig. 9). A few said they had tried the narrow bore for a short time but had changed back to the standard bore. Two who were using the standard bore inflation had given some thought to changing to the narrow bore.

About 75 percent of the dairymen were using the standard bore inflations while 25 percent used the narrow bore. Two dairymen used both types in the same barn, but took care not to switch from one type to the other on the same cow.

Miscellaneous problems. Cracked and leaking rubber air hoses were observed on a few milker units. In one instance the action of the pulsator was impaired because of a leak in the air hose.

Two cracked milker inflation shells were found. In both cases the leak was around the small air hose connection on the side of the metal shell.

MILKING PRACTICES

Either good or bad milking habits can easily be developed in cows. The milking machine operator is the key person in determining whether the cows are milked out rapidly or slowly. He can easily train the herd to do either one, depending upon how he handles the milking routine.

Number of milker units per man. The most common problem observed in this study was that the milker tried to operate too many milker units. The result was that the machines were not taken off the cows as soon as they were milked out. This led many cows to develop slow milking habits.

Both the number of cows milked and the length of time the milker units were operating were recorded at each farm. From this information, it was possible to calculate the number of cows milked with each milker unit per hour.

Table 3. — Number of Cows Milked per Milker Unit per Hour

Number of men and units	Number of cows milked per unit per hr. in	
	Stanchion barns	Parlors (pipelines)
1 man with 1 unit	12.6	...
1 man with 2 units	9.7	9.7
1 man with 3 or more units	6.3	8.1
2 men with 2 units	12.0	10.2
2 men with 3 units	8.9	7.7
3 men with 3 or more units	6.7	...

The number of cows milked per unit per hour decreased as the number of units operated by one man increased (Table 3). In fact, it is interesting to note that the average man operating three bucket milkers in a stanchion barn could not milk as many cows in an hour as a man using two units. With three units, one man milked an average of only 6.3 cows per unit per hour (18.9 cows per hour). One man with two units milked an average of 9.7 cows per hour (19.4 cows per hour). When one man handled only one unit, the average jumped to over 12 cows milked per unit per hour.

Apparently most men, if they wash and prime the cows ahead of the milker and carry the milk to the milk house, cannot keep up with more than two units. As a matter of fact, many large commercial dairies with union help limit the number of milker units to two a man when he is carrying milk to the milk house. Three units a man are recommended in barns equipped with pipelines to carry the milk.

Most men can handle three units better in a parlor with a pipeline than in a stanchion barn. In this survey, one man milked an average of 8.1 cows per unit with a three-unit pipeline milker in a parlor.

Average time milkers on cows. The length of time that the milker units were on a cow varied considerably from farm to farm. The average for all farms was 5 minutes and 40 seconds. One dairyman removed the units in an average of 3 minutes and 14 seconds after they were put on the cows. On two of the farms the average was over 9 minutes. Prolonged machine stripping, operating too many units, and washing and priming cows too long before attaching the machines were some of the apparent reasons for slow milking.

Stimulating before milking. Most of the milkers washed the cow's udder and teats before milking. About three-fourths (73 percent) attached the machine within 3 minutes after the cow was washed; and about one-third (30 percent) within 1 minute (Table 4). On the aver-

Table 4. — How Milking Time Was Affected by Time Lapse Between Priming and Attaching Milker Unit, 56 Dairy Farms

Priming time	Average time milkers on cows	Number of farms
30 seconds to 1 minute	4 min. 51 sec.	17
1 to 3 minutes	5 min. 31 sec.	24
3 to 6 minutes	6 min. 46 sec.	10
6 or more minutes	6 min. 12 sec.	5

age, the cows were milking out faster on these farms than on the farms where more time elapsed between washing and attaching the machine.

About 10 percent of the herds were being washed and stimulated to let their milk down 6 minutes or more before attaching the machine. A few herd owners were washing all cows in the herd before the milking operation started. Such practices can only lead to slower milking. The longest milking times were recorded where the dairyman primed the cows 3 or more minutes before putting the machine on the cows. This is to be expected since the let-down hormone, oxytocin, reaches the udder about 1 minute after stimulation, and its beneficial effects are then at their peak. They start to wear off in about 10 minutes; so milking should be completed by this time.

Type of disinfectant. Most of the dairymen washed the cows' udders sometime before attaching the machine. Following is a summary of the types of disinfectants used:

Disinfectant	*Number of farms*	*Percent of all farms*
Chlorine base	42	70
Iodine base	5	8
Quaternary ammonium solution	2	3
None	10	17
Soap	1	2

Of those who did not use a sanitizing agent, the majority washed the cows with a spray hose in a milking parlor. The dairymen who used a chlorine-base disinfectant started with a mixture that contained about 200 ppm chlorine before the first cow was washed. Of the seven who used either quaternary ammonium or an iodine-base solution, all were in Vermilion or McHenry counties. Inspection regulations restrict these materials in the St. Louis milkshed.

How udders were washed. Other than those using a spray hose, most of the milkers washed all the cows with the same solution. The water was warm when the first cow was washed.

Forty-nine (82 percent) of the herd owners used only one cloth or

sponge to wash every cow in the herd, while nine used a clean paper towel for each cow. Two did not use anything. Of these two, one dairyman splashed or sprayed the water on the udder, with no attempt to either wash or dry the udder and teats; the other did nothing before attaching the machines.

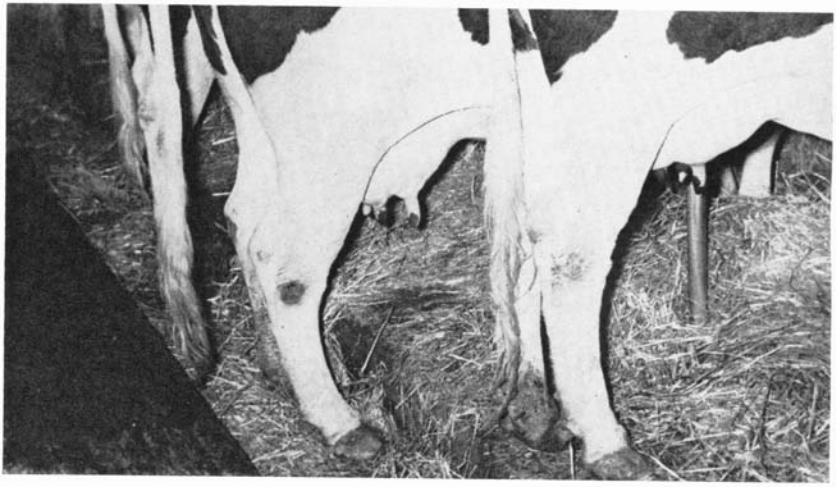
Strip cup. Only four of the 60 dairymen used a strip cup regularly. Many did not even have one. A few had a strip cup, but didn't use it. Most of the dairymen who were not using a strip cup thought that it took too much time and effort for the benefits received.

Dipping teat cups between cows. Fourteen of the dairymen were dipping the teat cups in a sanitizing solution between cows. Only a few of these men, however, were actually getting the solution up into the inflation, where it would be most beneficial. The reason was that they did not open the valve to let trapped air in the teat cups escape.

Stripping cows. Prolonged hand stripping was done in only a few herds. However, nineteen (32 percent) of the milkers did some hand stripping. In most cases the procedure was to quickly check each quarter to make sure it had been completely milked out.

All but three of the dairymen stripped the cows either partly or entirely by machine. Some of them used hand stripping after some machine stripping.

Dipping teats after milking. Only one dairyman routinely dipped the ends of the teats in a sanitizing solution after the cows were milked.



Stalls built for Jerseys or Guernseys were too small for Holsteins. (Fig. 10)

HOUSING

The cows in 43 of the 60 herds were housed in stanchion barns. Seventeen herds were housed in open sheds and milked in milking parlors.

Stanchion barns. Most of the stanchion barns were several years old. Many were built for smaller cows than the ones now kept in them, and as a result some of the cows were quite crowded. This was especially true where Holsteins were being kept in stalls originally made for Jerseys or Guernseys (Fig. 10).

Average size of all the stalls in the stanchion barns was 3½ feet by about 5 feet. The smallest stalls found were 3 by 4¾ feet and the largest were about 4¾ by 5¾ feet. The average estimated weight of all the cows taped was about 1,260 pounds. Recommended stanchion stall sizes for cows of various weights are given below:

Weight of cow (lb.)	*Width of stall*	*Length of stall*
800	3 ft. 6 in.	4 ft. 8 in.
1,000	3 ft. 9 in.	5 ft. 0 in.
1,200	4 ft. 0 in.	5 ft. 4 in.
1,400	4 ft. 3 in.	5 ft. 8 in.
1,600	4 ft. 6 in.	6 ft. 0 in.

Some of the barns were old converted horse barns. It was not always possible to obtain the most desirable arrangement in these structures. The feed supply and milk house were sometimes poorly located in relation to the rows of stanchions. This increased the time required to feed grain and carry milk, and so slowed down the entire milking operation. On the other hand, many of the barns were conveniently arranged and labor requirements were kept to a minimum.

About half the barns had partitions between the stalls. Most of the partitions were round metal pipes about 2 inches in diameter, which were anchored to both the stanchions and the floor.

The concrete floors in the alleyways of some of the barns were quite smooth and became slippery when wet. This caused some slipping as the cows made their way to and from their stalls, and could be a possible source of injury.

Exercise lot, loafing shed, and milking parlor. On farms where the cattle were housed in loafing sheds, the most serious problem was that often there wasn't enough concrete in the lot to keep the cows out of the mud (Fig. 11). Other problems were high door sills, large rocks, logs, and old fencing, which were observed in some of the loafing lots. These could all cause udder injury.

More concrete in the lots would be desirable on some of the farms. (Fig. 11)

Loafing sheds generally provided plenty of loafing space for the cows. At least 75 square feet of loafing-shed space per cow was available on most farms, and seven of the farms had more than 100 square feet.

Most of the milking parlors were of the elevated type with the pit of the parlor at ground level. The cows had to walk up a ramp or steps to get into the milking stall. The elevated stalls did not cause any observable problems in milking procedures. With a few exceptions, a more definite, regular routine of milking was followed on the farms with parlors than on the farms where the milking was done in a stanchion barn.

SUMMARY

Sixty dairy herds with above-average production were visited at milking time to observe milking practices and the condition of the milking machines.

Inadequate vacuum reserve due to small or worn vacuum pumps or small reserve tanks, sticking vacuum control valves, and faulty pulsators were the most important problems noted with the milking machines. The condition of the milking machines was related both to the interest of the dairyman and the type of field service offered in the immediate area by the manufacturer representative.

Trying to operate too many milker units, priming too long before the machines were put on the cows, and keeping cows in stalls too small for them were the most serious problems in milking practices and management.

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