Herringbone and Side-Opening Milking Parlors

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THE HERRINGBONE PARLOR has become the most common elevated milking parlor since its introduction in this country in the late 50's. Herringbones commonly vary in size from double-4 to double-10. Larger sizes have been built, but have shown little or no improvement in cows per man-hour. Nor do they have any advantages from the standpoint of milking quality. In some areas, double-3 herringbones are popular. While limiting the number of milking machines that an operator handles, the double-3 does not fully utilize one operator's capabilities.

Cows are handled in batches. This is a disadvantage in the larger herringbones (double-12 and larger) since a slow-milking cow will hold up all other stalls on that side. But it may be that cow movement is better when cows are handled in groups as compared with being handled individually as they are in side-opening and rotary parlors.

Side-opening parlors are in less widespread use than herringbones. They usually have two, three or four milking stalls on each side of the operator's pit, although larger side-opening parlors have been built. Cows move individually to the milking stalls, entering and exiting through manually-operated or power-actuated gates in one side of the stalls. Because cows are handled individually, a cow having a long milking time does not hold up any other stalls. But because cows are arranged head-to-tail, operator walking distance between udders is 8-10 feet as compared to 36-48 inches for herringbones.

PARLOR LAYOUT

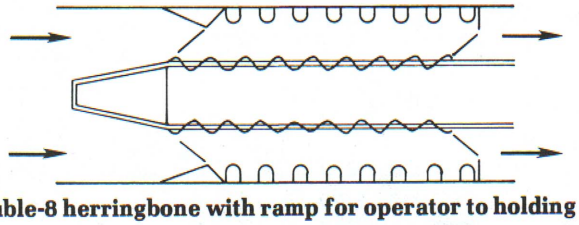
Cow movement is the primary consideration in the layout of parlors. Parlor entrance, parlor exit and parlor stalls should be designed to promote rapid cow movement and to reduce the necessity of the operator having to assist with cow movement. Factors such as pit design, type of milking system and mechanization are important considerations also, but without good cow movement the effectiveness of the parlor can be greatly diminished.

Entrance

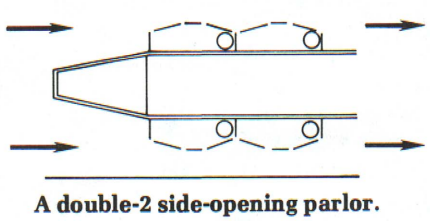
Straight entrance from the holding pen into the milking parlor is desirable but not always possible, especially if a new parlor is constructed within an existing housing area. But turns at the entrance from the holding pen to milking parlor will result in slower entrance time and more frequent operator interruption. Single cow movement parlors will be less affected than parlors with six or more cows per group. When animals are required to make turns, they require a longer time to move a given distance than when traveling in a straight line.

Doors and walls at the parlor entrance (and exit) are a hindrance to cow movement. A common parlor-holding pen arrangement (no wall between parlor and holding pen) allows cows to view the area at the entrance. (This may be a disadvantage in parlors where cows are handled roughly.) The common parlor-holding pen also allows the construction of a ramp into the holding pen to make it easier for the operator to assist cows into the parlor.

Common parlor-holding pens are being used in both warm and cold climates. An overhead garage door can be used to separate the parlor from the holding pen between milkings.



Double-8 herringbone with ramp for operator to holding pen.



A double-2 side-opening parlor.

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Exit

Turns of 90° or 180° are more commonly found at the exit from the parlor than at the entrance. Straight exit from the parlor is preferred. But turning the cow at the exit usually allows for the immediate return to the feeding, loafing or corral area. If cows must be turned, it should be at the exit rather than at the entrance to the parlor.

In a single return lane which is common in cold climate areas, one of the groups of cows must cross over the front of the parlor to exit. Single return lanes in colder climates are usually outside the building for the parlor and are often wide enough (8 ft.) to allow scraping with a tractor. A door at the exit, which is opened only at exit time, prevents a cow that turns around in the return lane from re-entering the parlor.

In warm climates, return lanes on each side of the parlor are common. This allows constructing the pit floor on the same level as the milk room. The return lanes are usually inside the structure and are 33-36 in. wide to prevent cows from turning around. In colder climates, inside return lanes are worth considering, even though a wider building is required.

For herringbone parlors double-8 and larger, exiting of cows is significantly improved by building two 36-in. return lanes per side. For a double-10 herringbone, average exit time for 10 cows using a single 36-in. lane was 42 sec. compared to 37 sec. when using split return lanes.

Holding Pen

For larger dairies, the holding pen is generally an area specifically provided for just that purpose. This area should be located so as to provide straight entrance of cows into the parlor. In some smaller dairies, the holding area may in fact be a portion of the barn which can be cordoned off to hold cows prior to milking. For example, a milking parlor may be built into the end of a free-stall barn and a free-stall alley may also serve as a holding pen during milking.

A separate holding area is preferred, especially if more than one group of cows is to be milked. Cow movement patterns are more easily planned, coordination of feeding, cleaning manure from barns and milking is simplified, and a crowd gate may be installed in the holding pen to assist with cow movement into the parlor.

Initial cost savings is the only argument in favor of using a portion of the housing area for a holding pen. A crowd gate cannot be installed easily. And opportunities for expansion or for future division of the milking herd into production groups may be limited. While the multiple use of one area of the barn may have a place on small dairies, the constraints this practice places on the total system should be considered carefully.

Holding pen capacity should at least equal the number of cows in a group in the housing unit or corral. In turn, the number of cows in a group should be related to parlor throughput such that no cow is required to stand in the holding area for more than two hours each milking (one hour for especially warm climates or where cows are milked three times daily). Actual holding pen area should provide 15 square feet per cow. For parlors that are to continue milking while outside groups are being changed, holding pen area should be increased by 25% to allow for overlap of groups during the change.

Sorting of Cows

The milking parlor is a convenient place to sort cows requiring treatment, to be bred or to be moved from one production group to another. One method is to provide an area adjacent to the parlor into which cows can be diverted as they leave the parlor. A parlor with double return lanes will require such an area on each side of the parlor. This area may be equipped with lever-operated stanchions to hold the cows for treatment, etc. Another possibility is to have an additional lane parallel to the return lane into which sorted cows can be diverted. In any case, it is desirable to have the gates or doors that are used to divert cows be both visible from, and operated from, the pit area. If the treatment area is visible from the parlor, cows should not be treated in that area while the parlor is in operation.

MECHANIZATION

The herringbone parlor is probably the most adaptable to mechanization of all parlors, except for the polygon. As mechanizaton—especially automatic detaching units—is added to a milking parlor, the size of the parlor must be increased to utilize effectively both the operator and the mechanization. Operator walking distance in a side-opening parlor becomes excessive when this is done. Moreover, when considering the problem of coordinating the many milking stall gates in a side-opening parlor and the necessity of maintaining a separation of individual cows as they share alleys for entrances and exits, a practical limit for side-opening parlors is four stalls per side. For mechanized herringbones, a practical limit is 10 stalls per side.

Equipment can be installed for improving cow movement, stimulation of milk letdown, power and automatic gate operation and automatic milking machine detachment:

1—**Crowd gate:** Moves cows forward in holding pen. Should stop when it hits a cow, then restart after a preset delay. Avoid electrically-charged gate.

2—**Power gates:** Pneumatic operation of entrance and exit gates and doors. Controls at both ends of pit for herringbones.

3—**Feedgates:** Covers over feed to assist in cow movement and reduce operator interruptions to chase cows in herringbones.

4—**Stimulating sprays:** Spray nozzles located in herringbone milking stalls. Timed warm-water spray for stimulating milk letdown, not necessarily for washing the udder.

5—**Wash and stimulation stalls:** Located in front of side-opening parlors. Cold-water wash or warm-water stimulation or both.

6—**Automatic detaching units:** Loosely coupled to the claw, detect end-of-milking, provide positive vacuum shut-off prior to machine removal, remove the milking machine from under the cow upon completion of milking.

This equipment may be included in a new installation, provisions may be made to add equipment at a later date

(as money becomes available or as herd size increases) or there may be already existing parlors where some of the mechanization may be used to advantage. Because labor may account for up to 80% of the annual cost of milking cows, only slight improvements in cows per manhour can offset rather extensive investments in mechanization.

Milking parlors are mechanized for various reasons. First and foremost is to reduce labor and/or increase herd size, thus reducing annual costs. And there are other reasons that may be equally important such as promoting a good job of milking or reducing drudgery, making the milking parlor a more pleasant place in which to work. But just as there are valid reasons for mechanizing, there are also invalid reasons, the worst reason being to use lower quality labor. More highly mechanized systems may, in fact, require a more capable person in the parlor.

RECOMMENDED OPERATOR ROUTINES

Operator work routines differ with herringbone and side-opening parlors and with the degree of mechanization in a particular parlor. Work routines will be described for parlors with no mechanization having one or two operators and parlors with automatic detaching units having one operator.

Herringbone—No Mechanization

Double-5 (and smaller) herringbones require only one operator and, if he follows a good routine, overmilking will be kept to a minimum. The operator should wash and check udders of 2-4 cows, then go back and attach milking machines in the same order. The number of cows to be dealt with at a time will depend upon the time spent in preparing udders. Good stimulation procedures call for spending 20-30 seconds preparing udders followed by a delay of 30-90 seconds before machine attachment. Udders should be washed and then dried with individual paper towels and few squirts of milk should be taken from each quarter before machines are attached.

Machine-stripping at the end of milking is a time-consuming and unnecessary practice and should not be a part of the work routine. However, teats should be disinfected as soon as possible after the milking machine is removed.

The operator should avoid the tendency to prepare the udders of the group of cows on the other side of the parlor immediately following their arrival. Rather, udders should be prepared in anticipation of a cow completing milking on the first side so that a machine is available approximately 30-90 seconds after a cow is stimulated. Installing a milking unit at each stall reduces this problem.

Only an exceptionally good operator should handle a double-5 herringbone alone.

Double-6 and double-8 herringbones without mechanization require two operators. Generally, one operator will be responsible for the front half of the parlor, the other the back half. Their individual routines will be similar to that described for the one operator in a double-4.

Two exceptionally good operators are recommended for a double-10 herringbone.

Herringbones larger than double-10 are not recommended. For throughputs in this range and above, consider a polygon parlor or more than one smaller parlor.

Mechanization other than automatic detaching units might be added to a herringbone without affecting the basic routine. For example, power-operated gates with multiple controls would be a convenience. Or installation of timed stimulating sprays would reduce the time required to prepare udders and would assure that each cow received a predetermined amount of stimulation. Or the installation of feedgates and a crowd gate would reduce the amount of time the operator would be required to assist with cow movement.

Herringbones—Automatic Detaching Units

Installation of automatic detaching units can significantly increase throughput measured in cows/manhour or lbs milk/manhour. Other mechanization can give modest increases. But detaching units eliminate the second operator in the larger herringbones. In fact, it is essential that only one operator be used in herringbones equipped with automatic detaching units. Two operators will not be kept busy and, in order to hurry the operation, may adopt practices that are not conducive to good milking or good cow movement. They may override the normal detaching sequence so machines may be removed prematurely. Batch-loading of the parlor (one side in, both operators prep and attach; other side in, both operators prep and attach; both operators wait) may result from too many operators. Also, the operators will tend to move cows roughly as they enter and exit. Overall throughput for the two operators may, in fact, be less than if one operator followed a more uniform routine.

The single operator follows exactly the same routine as he would in a herringbone without mechanization with the exception of machine removal. All cows do not have to be in position on a side before he begins to prep and attach. If the operator begins his routine at the front of the parlor and lets the remaining cows come in, improved cow movement and increased throughput will result. Since detaching units remove milking units, the number of units that the operator is responsible for is not of concern from the standpoint of overmilking.

Mechanization besides detaching units should be considered, especially for larger herringbones. Power-operated gates with multiple controls are especially important to one operator.

Side-Opening Parlors — No Mechanization

Without mechanization, one operator should handle no more than a double-2 side-opening parlor. Since cows enter individually, the routine will likely be to prepare the udder and immediately attach the milking unit. Under these circumstances, udder preparation is especially important. Keep in mind that a delay of 30-90 seconds from stimulation is desirable. A proper routine would be to prepare the udder, then check or attach a machine at a different stall before returning to attach this machine.

Double-3 and double-4 side-opening parlors without mechanization should have two operators. Generally, operators should tend to work on opposite ends of the pit to reduce walking distance.

The addition of prep stalls to a double-3 side-opening parlor can eliminate one operator. However, the remaining operator must be particularly attentive to removing milking units upon completion of milking.

Side-Opening Parlors — Automatic Detaching Units

Side-opening parlors with automatic detaching units can have one operator. Significant improvements in cows/manhour would be expected for double-3 and larger.

Prep stalls/wash stalls are a common form of mechanization in side-opening parlors. They can serve to provide a predetermined warm-water spray so that stimulation of milk letdown occurs prior to the cow's arrival at the milking stall. However, stimulation begins when a cow enters the prep stall. There is no way of anticipating when the milking machine will be attached to this cow. As a result, the delay for many of the cows may be other than the desired 30-90 sec. If a prep stall is installed in each side of the parlor, the operator should alternate between opposite sides of the pit when attaching machines. Prep stalls will then be used alternately and the stimulation delay will be more uniform than if units are attached in succession to cows from the same prep stall.

PERFORMANCE AND COSTS

Performance of milking parlors can be assessed in various ways including cows per manhour, lbs milk per manhour, quality of milking and operator well-being. Throughputs given in this section should be considered only as approximations. Performance of any milking parlor is dependent upon many factors.

The effects on throughput of operator proficiency and average milk production level are shown in Table 1. The throughputs given in this table are based on the results of time studies and computer simulation. Values are given only for herringbone parlors equipped with automatic detaching units and crowd gates and being operated by one man but are intended to be representative of ranges of throughputs that might be expected in other parlors and with other combinations of mechanization. Operator proficiency is classified as slow, medium or fast. Basically, in these parlors with detaching units, proficiency ranking depends upon the average time required to attach a milking machine, the skill of the operator and the faith that the operator places in the mechanization. For example, if the automatic milking machine detaching unit is initially adjusted properly, the necessity of returning to the cow to readjust the unit will be minimized. Or if the operator adequately prepares the cow for milking (good stimulation of milk letdown), milking time will be minimized. Average milk production is classified as low or high, on the order of 38 lbs or 56 lbs per cow per day, respectively. As can be seen, lower throughput with higher producing cows is more desirable than higher throughput with lower producing cows on the basis of lbs milk per manhour.

Table 1 — Throughputs for herringbone parlors with detaching units and crowd gate operated by one man as affected by operator proficiency and average herd milk production

Average milk production	*Operator proficiency*	*Herringbone parlor size* d-4	d-6	d-8	d-10
		-----cows per manhour----- (lbs milk/manhour)			
Low	Slow	46 (870)	61 (1,160)	74 (1,400)	76 (1,440)
Low	Medium	50 (950)	70 (1,330)	84 (1,600)	88 (1,670)
Low	Fast	54 (1,030)	76 (1,440)	92 (1,750)	100 (1,900)
High	Slow	37 (1,040)	51 (1,430)	64 (1,790)	73 (2,040)
High	Medium	41 (1,150)	59 (1,650)	72 (2,020)	82 (2,300)
High	Fast	43 (1,200)	65 (1,820)	79 (2,210)	90 (2,520)

Throughputs in cows per hour are given in Table 2 for herringbone parlors with various mechanization. With no mechanization, the more efficient herringbones (d-4, d-8 and d-10) generally achieve 900-1,000 lbs milk per manhour. The larger herringbones equipped with automatic detaching units and other mechanization may achieve 2,000 lbs milk per manhour or more (see Table 1).

Throughputs for side-opening parlors are given in Table 2. Double-4 side-opening parlors, when mechanized, may achieve 1,500-1,600 lbs milk per manhour.

The values from Tables 2 and 3 and the investment data in Table 4 form the basis for the annual milking costs in Table 5. Investments are given for the building to house the milking parlor and holding pen (not including milk room and utility room), for base equipment (not including bulk tank) and for two levels of mechanization. Partial mechanization includes investments for crowd gates, power-operated gates and automatic detaching units. The column under mechanization headed by "All" includes investments for crowd gates, power-operated gates and automatic detaching units plus stimulating sprays and feedgates for herringbone parlors or prep stalls for side-opening parlors.

To obtain from Table 4 the total investment for a particular parlor, add investments for construction, base equipment and the appropriate level of mechanization. For example, the total investment for a double-8 herringbone with all mechanization would be the sum of $19,800, $43,800 and $29,800, or $84,400. Costs for construction and equipment are not absolutes; rather, they vary between

builders and manufacturers, between localities, and even for the same type of equipment within localities. Costs given are representative and comparable.

Annual milking costs per cow and hours of actual milking are given in Table 5 for various herringbone and side-opening parlors. Annual ownership costs of the buildings and equipment were made up of charges for depreciation, interest, repairs and insurance. The labor charge per man unit was $10,000 annually including fringe benefits. Other annual cost details are given in footnote *, Table 5.

Adding mechanization (especially automatic detaching units) to a milking parlor will decrease annual milking cost if the savings in labor is sufficient to offset the annual cost of the added mechanization. For example, adding partial mechanization to a double-8 herringbone decreases annual cost per cow for herd sizes of 200 cows or more, but not for a herd size of 100 cows. As more cows are milked in a given parlor system, annual cost per cow decreases because annual ownership costs are divided by a greater number of cows. Any parlor system must be used to capacity to attain a minimum annual cost per cow.

Cost information is a single input into the decision-making process of selecting a milking system. The parlor size and degree of mechanization that might be best for a particular dairyman are not necessarily those which, in combination, result in lowest annual milking cost.

Table 2 — Cow throughput in cows per hour* for herringbone parlors with various mechanization under good management.

Mechanization	*Herringbone parlor size* d-4	d-6	d-8	d-10
	-----(cows per hour)‡-----			
None†	37[1]	60[2]	74[2]	86[2]
Crowd gate	42[1]	65[2]	81[2]	94[2]
Crowd gate and stimulating sprays	42[1]	68[2]	84[2]	97[2]
Crowd gate and feedgates	42[1]	68[2]	84[2]	98[2]
Crowd gate, stimulating sprays and feedgates	44[1]	71[2]	87[2]	101[2]
Detaching units	41[1]	59[1]	72[1]	78[1]
Detaching units and crowd gate	45[1]	64[1]	78[1]	85[1]
Detaching units, crowd gate and stimulating sprays	47[1]	67[1]	81[1]	89[1]
Detaching units, crowd gate and feedgates	47[1]	67[1]	82[1]	89[1]
Detaching units, crowd gate, feedgates and stimulating sprays	49[1]	70[1]	85[1]	93[1]

Steady-state throughputs. Parlor setup and cleanup and changing groups not included.

†*None denotes a parlor with base equipment including stalls, feeders, feed distribution and storage, pipeline milking system, ventilation, plumbing, hot water, electrical and other.*

‡*Superscript (¹, ²) denotes number of operators milking.*

Table 3 — Cow throughput in cows per hour* for side-opening parlors with various mechanization under good management.

Mechanization	*Parlor size* d-2	d-3	d-4
	-----cows per hour‡-----		
None†	33[1]	49[1]	56[2]
Crowd gate	36[1]	51[1]	60[2]
Prep stalls	42[1]	51[1]	63[2]
Crowd gate and prep stalls	46[1]	55[1]	66[2]
Detaching units	44[1]	54[1]	59[1]
Detaching units and prep stalls	48[1]	60[1]	65[1]

Steady-state throughputs. Parlor setup and cleanup and changing groups not included.

†*Base equipment as in footnote †, Table 2.*

‡*Superscript (¹, ²) denotes number of operators milking.*

Table 4 — Investments in herringbone and side-opening parlors, 1976 prices.

Parlor	Construction*	+ Base equipment† +	Mechanization Partial‡	OR All§
Herringbone, double-4	$12,500	$24,700	$15,500	$17,100
Herringbone, double-6	16,200	29,700	21,100	23,600
Herringbone, double-8	19,800	34,800	26,700	29,800
Herringbone, double-10	24,000	39,900	32,300	36,000
Side-opening, double-2	18,800	20,000	10,100	14,100
Side-opening, double-3	24,300	29,600	10,700	14,700
Side-opening, double-4	32,300	37,100	13,400	21,400

*Building for parlor ($15 per square foot) and holding pen ($8 per square foot).

†See footnote †, Table 2, for base equipment.

‡Partial mechanization includes crowd gate, power-operated gates and automatic detaching units.

§All mechanization includes crowd gate, power-operated gates and automatic detaching units plus stimulating sprays and feedgates for herringbone or prep stalls for side-opening.

Table 5 — Annual milking cost per cow in different milking parlors, 1976 prices.*

Parlor	Mechanization†	No. of operators	No. of milking cows 50	100	200	400	600
			$/cow (hours/milking‡)				
Herringbone, double-4	None	1	223 (1.4)	145 (2.7)	107 (5.4)		
Side-opening, double-2	None	1	228 (1.5)	152 (3.0)	114 (6.1)		
Herringbone, double-6	None	2	274 (0.8)	179 (1.7)	131 (3.3)	107 (6.7)	
Herringbone, double-6	Partial	1		184 (1.6)	112 (3.1)	75 (6.3)	
Side-opening double-3	Partial	1		179 (1.9)	113 (3.7)	80 (7.4)	
Herringbone, double-8	None	2		180 (1.4)	124 (2.7)	96 (5.4)	86 (8.1)
Herringbone, double-8	Partial	1		208 (1.3)	120 (2.6)	76 (5.1)	61 (7.7)
Herringbone, double-8	All	1		213 (1.2)	121 (2.4)	75 (4.7)	60 (7.1)
Side-opening, double-4	All	1		225 (1.5)	131 (2.9)	84 (5.9)	68 (8.8)
Herringbone, double-10	None	2		190 (1.2)	124 (2.3)	91 (4.7)	80 (7.0)
Herringbone, double-10	All	1		244 (1.1)	135 (2.2)	81 (4.3)	63 (6.5)

*Annual cost was based upon: depreciation of 12 yr for parlor and holding pen and 7 yr on all equipment, interest at 8% on unpaid balance, insurance at $4.65 per $1,000 of original investment, repairs at 2.5% for parlor and holding pen and 5% on equipment, labor charged at $10,000 per man year.

†None denotes base equipment only as in footnote †, Table 2. Partial and all mechanization are defined in footnotes ‡ and §, Table 4.

‡Parlor setup and cleanup and changing groups not included.

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