Rotary Milking Parlors

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SYSTEMS ANALYSIS DAIRY

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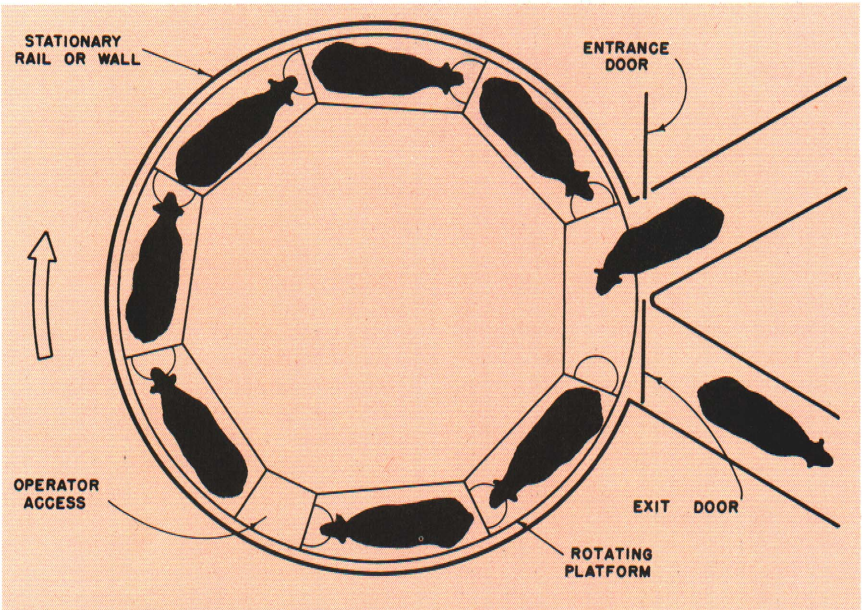

Figure 1—Rotary tandem

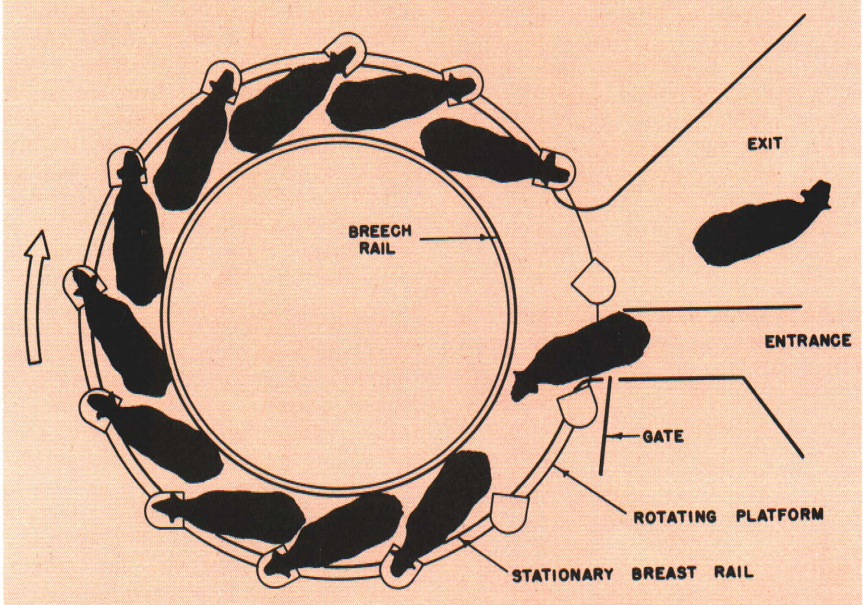

Figure 2—Rotary herringbone. Cow partitions or yokes not shown.

THREE TYPES OF ROTARY PARLORS are in use in the USA. They are the rotary tandem, based largely on European design; the rotary herringbone, a concept originally coming from Russia but more recently from Australia, New Zealand and Europe; and the turnstyle, developed in New Zealand.

The largest number of installations in the USA are of the rotary tandem type (Figure 1). Most have 8 stalls, but 5-stall to 22-stall platforms have been built or are proposed.

Cows stand head-to-tail, each cow occupying an individual stall. The smaller platforms, for example, the 8-stall with an inside diameter of about 19 feet, are designed for one-man operation. In most of the present installations, a second man is used to move cows onto the platform, especially where there is no crowd gate in the holding pen or a prep stall is installed. The larger platforms require two or more men inside preparing cows and attaching and detaching milking machines.

Most of the rotary tandems in the USA operate on a start-stop basis. After a cow has moved through the entrance door the operator starts the platform. The platform advances one stall length (this takes 15 to 18 seconds), automatically stops, and remains stopped until the operator again initiates rotation. Other installations leave the platform rotating continuously. If a cow is not finished milking upon reaching the exit, the platform may be stopped until she finishes milking. In other types the cow may be allowed to make a second revolution.

Most rotary herringbones operating in this country have 14 stalls arranged similar to Figure 2. Although some are designed for one-man operation, a second man usually is required at the entrance.

An entrance gate controls cow access to the platform. Some means

must be provided to control cow exit, such as a yoke that closes on the cow's neck soon after entrance or some form of mechanically operated divider (not shown in the figure). Whatever the type of partition, there is occasional difficulty with two cows attempting to get into the same stall at the entrance. With present designs, there is little choice but to stop the platform for a cow whose milking time exceeds that allowed by platform rotation.

The turnstyle parlor (Figure 3) was developed in New Zealand. Several concepts make it quite different from other rotary parlors. The cows walk onto the platform and stand radially while being milked. This means that the cows must back off the platform to exit. Also, it is convenient to milk the cows between the hind legs, a practice carried out in some New Zealand herringbone parlors.

The operators work on the outside of a solid platform rather than on the inside of a circular ring-type platform as in the rotary tandem or rotary herringbone. Usually one of two operators prepares the cows and attaches machines just after the entrance point. The other detaches machines and does any post-milking treatment prior to exit. From these positions the operators can take care of any problems at the entrance or exit. This is an advantage not present in the rotary tandem or rotary herringbone.

Turnstyles operate on a start-stop basis. Although the time per stall is adjustable (normally about 30-45 seconds), the ratio of stationary time to movement time is fixed. Either operator can interrupt the sequence. If a cow has not finished milking just prior to the exit, the usual practice is to place a chain or bar behind this cow so she makes a second revolution.

Turnstyles ranging from 14 to 44 stalls are in use in New Zealand; those in the USA have 17 stalls. While most have single stalls open at the entrance and exit, some of the larger installations rotate two stalls with each movement and cows board and exit two at a time. Thus, two stalls move past a given point per time increment.

Quality of Milking

Assessment of the quality of the milking operation in a parlor is more subjective than assessment of throughput. However, two parameters related to milking quality—stimulation procedures and length of time the milking machine is on the cow—can be measured. Assessment of stimulation procedures consists of measuring the duration of udder preparation and the delay from udder preparation to attachment of the milking machine. Length of time the milking machine is on the cow is the time interval from machine attachment to machine detachment and may include machine stripping. When automatic detaching units are in use, this time interval is ordinarily independent of the operator.

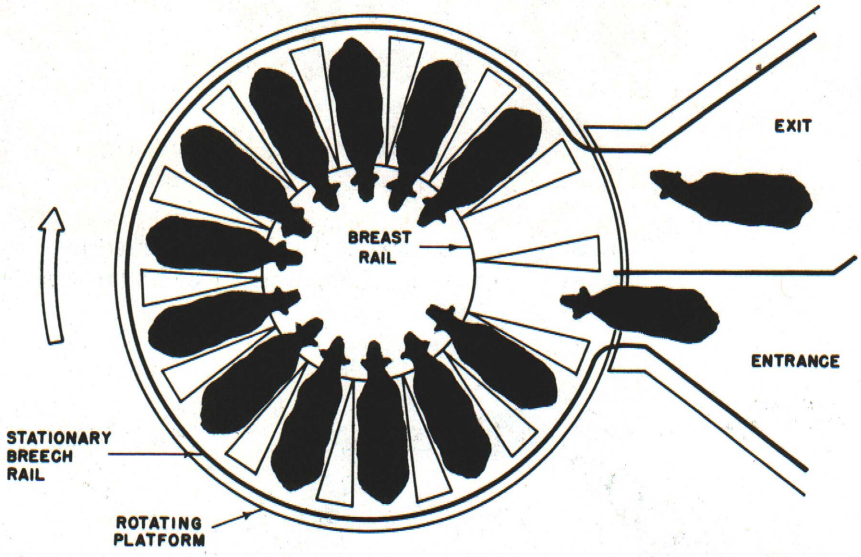

Figure 3—Turnstyle

Proper stimulation of milk letdown is important to udder health and milk production and contributes to faster milking. Essential aspects include: (1) warm-water wash and massage of the udder for at least 30 seconds; (2) a delay of 30-90 seconds between stimulation and machine attachment to assure that milk letdown has occurred. In some rotary parlors without prep stalls, improper stimulation procedures are being used. This is shown in Table 1. Average time spent in udder preparation in these eight parlors was 11.8 seconds; average delay between udder preparation and machine attachment was 8.0 seconds. Once the cow enters the platform, the operator typically washes the udder, sometimes dries the udder, sometimes foremilks, then immediately attaches the milking machine. Better stimulation of milk letdown would occur if a prep stall were located in front of the entrance to the platform. But a prep stall is an added hindrance to cow movement.

Table 1—Stimulation procedures in some rotary tandems without prep stalls.

Parlor	Average stimulation (s)*	Average delay (s)*
A	7.8	7.2
B	13.2	9.0
C	10.2	7.8
D	13.8	10.8
E	29.4	12.0
F	5.4	7.8
G	7.4	11.2
H	7.0	14.3

*Seconds

A herringbone parlor is more conducive to good stimulation procedures. It is up to the operator to decide just how much time will be spent in udder preparation (unless timed stimulating sprays are used). But if the operator properly prepares the udders of three or so cows and goes back and attaches milking machines in the same order, the interval between stimulation and machine attachment will likely fall in the recommended 30-90 second range.

Without automatic detaching units, the length of time that the milking machine is on the cow depends upon the operator. In order to minimize undesirable over-milking, the number of milking machines that one operator handles is usually limited so that he will be available to make the decision as to when milking is completed and subsequently remove the milking machine. Operators in a rotary parlor have a tendency to remove a milking machine as the cow approaches the exit, not necessarily when the cow finishes milking. This is especially

Table 2—Cow throughput* in cows per manhour and lbs milk per manhour for some rotary parlors.

Rotary parlor type	Mechanization added to base parlor	No. of parlors	Daily milk per cow (lbs)	Cows per hour	Cows per manhour	Milk (lbs. per manhour)
8-stall tandem	crowd gate	6	46	57	57	1,311
8-stall tandem	crowd gate, prep stall	3	40	65	38	760
8-stall tandem	crowd gate, prep stall, detachers	3	43	58	36	774
8-stall tandem	crowd gate, detachers	1	49	47	47	1,151
17-stall turn-style	crowd gate	3	41	96	48	984
13-stall herringbone	crowd gate, prep stall, group wash	3	39	69	35	683
20-stall tandem	crowd gate detachers	2	52	118	49	1,275

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

true in rotary parlors where one operator is responsible for both attachment and detachment.

Shown in Figure 4 are machine removal locations for nine rotary tandems. Operators removed 97% of the machines in either the exit stall or the stall just before the exit.

Performance and Costs

Performance of milking parlors can be assessed in various ways, including cows per manhour, lbs milk per manhour and operator well-being. Table 2 gives values obtained from time studies for cows per manhour and lbs milk per manhour for several rotary parlors.

The 8-stall rotary tandems had one or two operators. In general, two operators were used when a prep stall was used—the second operator's primary responsibility was to chase cows into the prep stall and onto the platform. A single operator has a difficult time encouraging balky cows onto the platform from his position inside. Tunnels have been built under the platform to help alleviate this problem.

Table 3—Investments in rotary parlors, 1976 prices.

Parlor	Mechanization	Construction*	Equipment†	Total
8-stall tandem	Crowd, detach	$26,500	$44,900	$ 71,400
14-stall herringbone	Crowd	$42,500	$64,300	$106,800
17-stall turnstyle	Crowd	$37,600	$71,800	$109,400

Building for parlor ($15/sq. ft.) and holding pen ($8/sq. ft.)

†*Includes stalls, feeders, feed distribution and storage, pipeline milking system, ventilation, plumbing, electrical, other and mechanization noted.*

Automatic detaching units are recommended when one operator is used inside a rotary tandem (or rotary herringbone) to reduce the tendency towards fixed time milking. But the addition of a prep stall to improve stimulation procedures reduces labor efficiency as can be seen in Table 2. A second operator is usually required to chase cows into the prep stall.

Good cow movement is important in any milking parlor. But the fact that each cow must meet a deadline in a rotary makes it that much more critical. When cows do not make it on in the allotted time, platform sequence is interrupted. If the operator must leave the pit to assist cows onto the platform, the unit may be stopped for as long as one to three minutes. Any increase in platform rotation rate lessens the access time for the cow and increases cow movement problems.

Each of the turnstyles in Table 2 had two operators. Automatic detaching units may be installed on a turnstyle, but it is unlikely that they will replace the second operator. Since operators work on the outside of the platform, a single operator may have trouble supervising the other side of the platform.

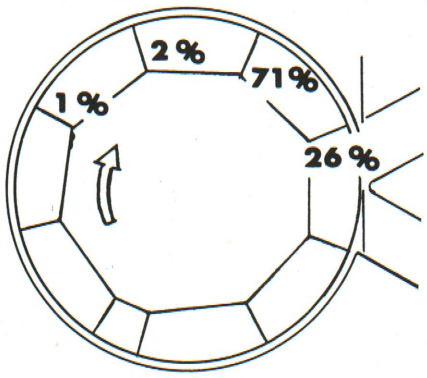

Figure 4—Milking machine removal locations in nine rotary tandems.

Table 4—Annual milking cost per cow in different rotary parlors, 1976 prices.*

Rotary Parlor Type	Mechanization	No. of operators	No. of milking cows 100	200	400	600
			$/cow (hrs/milking†)			
8-stall tandem	Crowd, detach	1	191 (1.8)	117 (3.5)	81 (7.0)	
14-stall herringbone	Crowd	2	273 (1.1)	164 (2.2)	110 (4.4)	92 (6.7)
17-stall turnstyle	Crowd	2	280 (1.0)	166 (2.1)	109 (4.2)	90 (6.3)

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.

†*Parlor setup and cleanup and changing groups not included.*

Investments for buildings and equipment for three rotary parlors are given in Table 3. Investments are given for the building to house the parlor and holding pen (not including milk room and utility room) and for base equipment plus mechanization noted (but not including bulk tank).

Annual milking costs per cow and hours of actual milking are given in Table 4. 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 Table 4.

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.

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