A History, Description, and Comparison of Different Brands of Dairy Parlor Equipment and Which Designs are the Best Fit for Different Sized Dairy Operations

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Abstract

There are many different designs and brands of dairy parlor equipment made available to producers, and new technologies are continuing to be developed in order to reduce the amount of labor and work time needed on dairy operations. The introduction of new technologies to the dairy industry, such as automatic milking systems which have utilized the application of robot arms to accomplish a milking, have changed the way the dairy industry looks at production and how milk should be produced.

The motivation of this report is to look into the history and development of milking machines that have lead to the evolution of advanced milking technologies such as automatic milking systems, different companies that design milking parlors and the history and development of automatic milking systems. This includes discussions of considerations dairy producers should take when looking to convert from a conventional milking parlor to an automatic milking system, including environmental impact, waste management, and the rate of return on their investment into the new milking system. This report will also evaluate which designs are the best fits for large-scale dairy operations, along with which companies have the most adequate amount of technical support. These companies include DeLaval, BECO Dairy Automation, and BouMatic LLC.

It was found that DeLaval and Boumatic have the most to offer in terms of parlor designs, automatic milking systems, availability, and technical support, but that given the time and research BECO Dairy Automation could become a company that is as successful as its competitors.
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I. Introduction

The practice of milking cows has seen much change over the past couple centuries, moving from the common practice of manual hand milking to highly automated milking parlors (Engel and Hyde, 2003). Milking machine technology and milking parlor design has been implemented and developed since the 19th century, when the global demand for agricultural products and food increased due to the rapid growth of the population. While there were many problems perfecting the milking machine in the beginning, once the right technology was developed many more machines began to evolve into the technology that we have today.

As the world population continues to grow, according to the United States Census Bureau the population is expected to reach up to 10 billion by 2050, the demand for milk will increase and improvements in milking technology will continue to be made.

While the basic concepts of milking cows have remained unchanged, including that of milking cows quickly, cleanly, and gently, there has been much advancement over the past century in the understanding of the milking process when looking at the cow, the machine, and her milking environment as a whole. The teat cup and shell liner used today and in the past may be of the same design, but the change in understanding the whole picture has led us to faster milk removal. Present day dairy operations are now able to produce 10 times more milk per cow than when milking machine technology was first introduced, in a gentler fashion (Reinemann et al., 2003). On today’s dairy farms, two different methods have been distinguished when it comes to milking technology: high capacity (milking parlors and automatic milking systems.
This report will look at the basic history and development of milking machines, along with newer technologies and trends such as automatic milking systems (AMS), and various designs of milking parlors. Three different companies that manufacture milking parlors and dairy technology will be reviewed, including DeLaval Global, BECO Dairy Automation Inc., and BouMatic LLC. All three brands present much of the same designs, but will be compared based on ease of use, sturdiness of materials, cow comfort, ease of installation and maintenance, and the availability of an automatic milking system.

II. The History & Development of Milking Machines

In the second half of the 19th century we were faced with the issue of producing enough food to feed the rapidly growing population and the movement from rural areas into large, urbanized areas and cities. This meant that the means agriculture needed to expand and improve the available technology in order to meet the world demand for food and agricultural products. Dairy production has been and continues to be an important component of the agricultural economy, accounting for 16% of farm output during the beginning part of the 20th century. When milking by hand became unrealistic to meet production demands, inventors and producers alike looked to new methods of milking in order to increase milk output.

The earliest milking machines have been traced back to the 19th century, from anytime as early as 1819 (Erf, 1906), where tubes would be inserted into the teats, forcing the sphincter muscle to open and allowing milk to flow out of the mammary. Many of these tubes were made out of wood or of feather quills, and ones that would later become marketed were made of silver, ivory, or bone and were still sold into much of the 20th century. While these machines, which presented the method known as “catheter milking”,
were a step in the right direction, they caused many incidences of infection and spread of
disease among milking animals. This was a result of bacteria making its way into the
udder via the open sphincter muscle (Van Vleck 1996, 1998) and machine parts were not
being properly cleaned and disinfected.

Figure 1. Catheter Milking

The development of machines that simulated either hand milking or calf suckling
began shortly after the catheter method was recognized as inefficient and detrimental to
animal health. In 1851, Hodges and Brockenden acquired a patent in England for a
vacuum milking machine. This machine was made up of a large “gutta percha” cup that
fit over the entire udder and was connected to and operated by a hand pump. Merriam-
Webster defines gutta percha as “as tough plastic substance from the latex of several
Malaysian trees (...) that resembles rubber.” S.W. Lowe patented a cup fitted with a
diaphragm and four teat holes in Philadelphia in 1859, which used a hand-crank suction
cup that would draw milk from all four teats at the same time. In 1878, Anna Baldwin
patented her own milking technology similar to that of Hodges and Brockenden in
America that used a pitcher pump rather than a hand pump. These machines were a step in the right direction but still caused problems with the udder, damaging mammary tissue and putting the cow in the state of discomfort causing her to kick (Van Vleck 1996, 1998).

After 1878, researchers to aid in the construction of milking machines implemented three basic principles. The first principle stated that the milk tube is an apparatus made to provide an opening of the milk cistern, which will allow milk to flow from the udder. There was also recognition that the milk tube must be regularly sterilized to prevent spread of disease. The second principle stated that continuous downward pressure, as would be seen in manual hand milking, must be applied to the base of the teat where the milk tube attaches to the udder. And finally, the last principle stated that there must be some kind of suction, which is produced by exhausting air from teat cups and producing a vacuum. This type of suction emulates similar movements to that of a calf suckling on a teat (Erp, 1906).

The first successful commercial milking machine was invented and introduced to the market by a plumber in 1889. This machine, known as the Murchland machine, enacted the use of vacuum technology rather than pressure to the teats (Reinemann, 2005). This machine would be suspended around the cow, attaching to the udder, and would apply continuous vacuum to the teats. The teat cups were designed to keep the teat surrounded with milk. This machine received a patent in 1892 (Van Vleck 1996, 1998).
Inventors soon realized that pulsation was needed for efficient milking, and began to utilize the use of a hand-pump or foot-pump milking machine designs. The Mehring machine was a foot-operated milker emulated the effect that a pulsator would eventually have. This machine allowed for two cows to be milked at a time, with an operator sitting between the two animals operating a foot lever that would produce a vacuum.

The “Thistle” milk machine was the first to apply the use of a pulsator into the design. The Thistle used a steam driven pump, combining both suction and squeezing movements. A Hoard’s Dairymen reviewer, Dr. Bruno Martiny, rejected the machine for its intermittent flow. However, the USDA realized that the intermittent flow caused by pulsation was not out of the ordinary and was used efficiently in milking machines, and the machine was granted a patent in 1898. The Thistle was later rejected by the industry because of how difficult it was to keep it clean and sanitized (Smith and Harding, 1912).

The recognition of pulsation was the key step in the development of new designs of milking machine technology, with pulsation being one of the main factors of
technology still today. The basic elements of a modern milking machine are made up of a vacuum system, pulsation components, a means of transportation and collection of milk, and the milking cluster, which consists of four individual teat cups (Rossing et al., 1997).

It was not until the 1930s that a milking parlor design was developed, but was not fully adapted until the 1950s with the introduction of the Herringbone milk parlor in New Zealand (Hogveen and Ouweltjes, 2003). Milking parlors greatly improved the productivity of milking time and is an adaption that is still continued to be utilized and developed on dairy operations into the present day. The next big development in milking technology was the implementation of electronic milking technology during the 1970s, such as automatic takeoff clusters and individual cow identification (Hogveen and Ouweltjes, 2003). Individual cow identification made it attainable for producers to monitor the physiological status of an animal without having to personally visualize any symptoms.

There are two types of high-capacity milking parlors readily available to producers today: static parlors and rotary barns. Static parlors consist of models such as parallel and Herringbone parlors, where cows are brought into the milking parlor either individually or by groups. In rotary barns, all cows enter and exit the parlor individually and the milking stalls are located on a rotor. This rotor is constantly moving which does not allow for the milking operator to move around the milking parlor from stall to stall as they would in a static design (Hogveen and Ouweltjes, 2003).

In 1992, a new style of milking was unveiled for producers. The introduction of automatic milking systems to the dairy world has changed the face industry forever,
dismissing the need for the amount of labor that is needed in static parlors and giving cows the opportunity to approach the milking system at their own convenience.

**III. The History of Automatic Milking Systems**

Automatic milking refers to the extraction of milk from dairy animals without the use of human labor. All automatic milking systems (AMS) that are available for use must utilize feeding concentrates in the automatic milker in order to entice the cow into entering the milking stall (Armstrong and Daugherty, 1997). These systems maintain two components so that every cow can be managed individually. These components are made up of the ability to affect production through milking frequency and infrastructure the hardware and software used to monitor the usage of the automatic milking systems and concentrate intake of each animal (Maltz, 2000). Automatic milking systems have become the focus of the milking research world; with the introduction of these systems possibly being one of the most significant technological advances in the dairy industry since the introduction of the milking machine during the 19th century (Helgren and Reinemann, 2006). From the introduction of AMS on the European market in 1992 up until 2003, over 1000 farms had put this technology in action on their dairy operation (Reinemann et al., 2003) and was this number had reached as high as 2200 farms by 2004 (deKoning and Rodenburg, 2004). This number will continue to increase as automatic milking technology becomes more precise and readily available for producers.
Automatic milking systems are comprised of milking stalls, robot arms, a teat sensing system, milking equipment, and udder cleaning devices (Rossing et al., 1997). These components have allowed for the dairymen and milking machine operator(s) to not have to be present as each animal is milked while also dismissing the need of visual health recognition from dairy owners and employees, because the system is able to recognize any possible problems with animal health from reading the udder, then report and document them in the farm records (Helgren and Reinemenn, 2006).
Automatic milking systems have given producers the opportunity to increase the amount of milkings from two times a day to three times a day without needing to increase the input of labor (Rossing et al., 1997) leading to a higher throughput and total milk yield.

Milk produced under an AMS basis is also regulated differently compared to milk produced on a conventional basis. The Pasteurized Milk Ordinance (PMO) that is issued by the U.S. Food and Drug Administration (FDA) outlines the rules and regulations for milk and dairy products that are produced and shipped across state lines in the United States. In 2001, changes to the PMO were proposed at the National Conference of Interstate Milk Shippers to study the impact of automatic milking systems on both the quality and safety of the nation’s raw milk supply. It was not until 2003 that changes were made to the PMO to accommodate automatic milking systems and for its regulations to be stated in the PMO (Helgren and Reinemann, 2006).

Present day, automated milking systems have become more readily available for producers to implement at their dairies and will become more of a common practice as the demand for food increases and the needs for human labor decreases.

**IV. Conventional vs. Automatic: Which is better?**

In a study conducted by J.M. Helgren and D.J. Reinemann, somatic cell samples and total bacteria count were taken from both conventional dairy farms and farms that had adapted the use of an automatic milking system. The results illustrated that it was not the milking method that had the biggest affect on milk quality, but the time of year showed the biggest impact on the number of somatic cells found in milk, with the summer months of July and August presenting the highest number of the year.
When looking at total bacteria counts in the milk of conventional farms and farms with automatic milking technology, it was found that there was no significant difference between the numbers collected from the two.

This study found that while there was a slight decrease in somatic cell count on AM farms as employees became more familiar with the technology, no significant difference between conventional and automatic milking systems in terms of somatic cell count and total bacteria count, and that a decrease in milk quality could only be
associated with the onset of extreme heat during the winter months (Helgren and Reinemann, 2006).

V. The History & Comparison of Different Types of Dairy Equipment

A. DeLaval Global

All information about DeLaval Global and their products was taken from the descriptions given on their company website (www.delaval.com). DeLaval Global is a company providing services worldwide, specializing in milking equipment and providing integrated solutions to customers. Gustaf DeLaval, a Swedish engineer who was the first to patent the centrifugal separator in 1878, founded DeLaval Global. Some of his other inventions included the milking machine and steam turbine, which set the foundation of success for the company.

DeLaval strives to make sustainable food production possible, aiming to reduce environmental footprint while also improving the production of food, profits, and the well being of animals and people. DeLaval not only offers complete milking machine products and parlor installations, but also provides cleaning detergents and accessories that allow for producers to sanitize all equipment properly and do their own on-farm milk testing.

In recent years, the growth of the dairy industry has caused many dairy producers to have to re-evaluate their dairy operations, often times looking into expansion and the remodeling of dairy parlors. According to the DeLaval company website, parlor designs that are anywhere from 15-20 years old will no longer meet modern cow traffic standards, herd size, or milk production demands. Not only are outdated stalls and parlors economically inefficient, but also could potentially lead to problems with milk quality.
and udder health, which could consequently lead to a lower income. Through the installation of new dairy equipment, producers could be able to increase profits by improving the quality and amount of milk produced on the farm. DeLaval milking machine products include but are not limited to milk meters, milk indicators, clusters, liners, tubing, vacuums, milking automation, complete parlors, sorting pens, tubing, and receivers.

DeLaval offers milking parlors of all sizes and styles. This includes the DeLaval Herringbone parlor HB30, the DeLaval Herringbone rotary HBR available from anywhere between 16 to 40 stalls, and the DeLaval Champion Parallel Parlor that carries up to 120 head in a double-60 platform style. All models of DeLaval parlors are designed for use on large-scale dairy operations that run for up to 24 hours a day.

**Figure 7. DeLaval Herringbone HB30 parlor**

The HB30 is designed to improve milking productivity while enhancing milker comfort and the position of the cow for safe and easy access to udder. The cow is positioned closely to the pit of the parlor, for easy access to the udder with plenty of space between animals and no posts that get in the way of machine attachment. This model also features a kick rail to ensure milker safety and a more rapid machine
attachment. This style of parlor also features in-parlor feeding, enabling the feeding of concentrates and individual rations during milking times. The HB30 works best in a new, wider building because of the front exit implemented in the milking stalls. DeLaval has found that the use of a front exit in milking parlors can save anywhere from one to two minutes of work time on each animal, improving total parlor throughput and herd production.

**Figure 8.** Aerial Design of HB30

![Aerial Design of HB30](image)

**Figure 9.** DeLaval Herringbone rotary HBR parlor

![DeLaval Herringbone rotary HBR parlor](image)
The DeLaval Herringbone rotary parlor is designed to optimize cow traffic flow, cow position and comfort, and high milk yield while using the minimum amount of employees. In this design, the cows never have to move backward when exiting the milking stall, making for swift cow entry and a higher throughput. This type of enter and exit strategy will also lead to a quicker milk let down because it reduces the amount of stress an animal will possess when coming in to the milk barn, and there is no need for an employee to assist cows in and out of stalls. The “wide exit strategy” also positions the cow into the most ideal milking position, that is as close to the milker as the animal can be without there being any detriments to employee safety. On average, each animal will spend a total time of 10 minutes on the platform but will vary depending on how long each cow will take to milk-out. DeLaval states that the rotary design makes for a high-profit milking operation because milkers are able to work at a steady rate, with an easy view of the udder and all materials such as hoses, teat dips, and paper towels close by.

All moving parts that have been designed specifically for this deck have been manufactured with sound muffling technology to reduce added noise in the milking parlor.
The Champion Parallel Parlor is based off of a vertical lifting design, specifically made to decrease the time between when one animal exits the milking stall and the next animal may enter. This design also makes for an open platform exit, which is ideal for cows larger in size or those that are pregnant. The Champion is built to withstand usage on a dairy farm that operates 24 hours a day. If a producer is planning to convert a parlor to a more up to date style, this design of parlor has eliminated gateposts in the cow platform and all sections have been preassembled in the factory to reduce time spent on installation.

DeLaval has developed an automatic milk start feature known as ComfortStart, which improves operator and milking efficiency while simplifying the total milking routine. ComfortStart can be installed and utilized with all of DeLaval’s milking parlor designs.
The ComfortStart system is linked to the milk controller, releasing the rope without retaining tension and starting milk time without pressing any control buttons, all the milker has to do is lift the cluster in order to initiate milking time. The cluster is released automatically and is easier to attach to the udder. The vacuum and air will adjust on their own and uniquely to each animal to reduce the incidence of mastitis. This product aims to improve cow comfort and udder health, as well as improving operator speed and comfort.

DeLaval’s automatic milking system, DeLaval VMS, can have a total milk-out of up to 792.5 gallons per day for just one milking unit, with one milking unit referring to one individual automatic milking machine. This system has been made with mastitis detection index (MDi) technology and a cow calendar. Because the cow mammary system serves as not just one unit but four individual mammary units with four quarters and teats, detection of mastitis must be recognized by looking at the quarters on an individual basis. The MDi technology is able to measure milk output by quarter, amount of blood per quarter, and milking interval per quarter, and will send the dairy manager if
the animal is at risk of developing mastitis. This technology is also able to measure milk quality and monitor each quarter to guarantee that each quarter is milked out efficiently.

**Figure 12. DeLaval VMS System**

B. BECO Dairy Automation Inc.

All information regarding BECO Dairy Automation Inc. has been gathered from the company website (www.becoknows.com). BECO Dairy Automation Inc. was founded in 1958 in Hanford, California. BECO was originally known as Brown Equipment Company, a dairy equipment carrier and dealership. The company began by selling, installing, maintaining, and servicing dairy equipment to local dairy producers and had maintained its reputation ever since its establishment. BECO has become well known for building dairies based on individual needs and focusing on improving milking performance and efficiency.

BECO specializes in three different types of parlor designs. This includes the BECO XR Rotary, BECO XC Parallel, and is in the process of developing a Herringbone
style parlor. BECO offers a wide variety of milk parlor equipment, but has not developed the company’s own design of an automatic milking system.

Figure 13. BECO XR Rotary

This rotary design has been made with thrust rollers that are placed 15 feet apart all around the inner rotary deck to ensure long term, extreme reliability. PTP rollers are used to distribute weight evenly among the platform, which will reduce shock and wear on the track surfaces without side contact. The unique 6-way swivel is filled with constant lubrication and suspends weight to reduce wear and extend the life of the system. The extended deck of this rotary allows for cows to enter into the milking stall more quickly while remaining calm and feel secure.
The BECO XC-Parallel has been designed with the ultimate goal of reaching total cow comfort during milk time, while also easing operator use and minimal maintenance on equipment. BECO claims that the XC-Parallel paired with the milking automation system is economically efficient and practical for the producer. This parallel design has the “front-forward” design of entry, gently easing the cow’s udder toward the milking unit attachment and milker. All front ends on the stall are able to move for easy cow release, along with the sequence gates moving up and down for easy cow exit, decreasing the incidence of cow injury. The steel beam design ensures extreme durability and a clear span across the operator portion of the parlor, with no overhead beams that may interfere with air movement and parlor lighting. The operator control panel is set at every three to five sections of the parallel, making indexing, cow release, and cow entry convenient from any location in the milking parlor while monitoring total cow milk out and pulsation at each stall.
C. BouMatic LLC

All of the information utilized about BouMatic was taken from their company website (www.boumatic.com/us-en). BouMatic is a worldwide company focusing on the improvement of the dairy business by attaining a deeper understanding of their customers and the challenges that could be faced in the future. BouMatic is the largest privately owned company in the dairy industry and is focused on continuing to look towards the future. BouMatic Milkers Inc. was founded in 1939 by Lawrence Bouma in Ontario, California and began distributing equipment in 1956 through Bouma Distribution Agency. BouMatic was bought by Dairy Equipment Company in 1961, and is relocated to Wisconsin. By 1994, BouMatic had established operation in multiple locations including Australia, England, France, Israel, Japan and Saudi Arabia. In 2004, Boumatic purchased Gascoigne-Melotte Group to improve its global market position and product lines. By 2006, these two companies had been fully integrated into what is now known as
BouMatic LLC, a leader is global dairy technology providing producers with optimum solutions and results.

BouMatic has designed three different styles of milking parlors. These include the GT2 Parabone milking system, the Xcalibur 360EX Rotary, the Xcalibur 90LX Parallel, and the Xpedia 90RX Parallel. The BouMatic company website does not provide any information in the United States regarding the Xcalibur 90LX Parallel.

Figure 16. GT2 Parabone milking system

Figure 17. GT2 Parabone milking system

The GT2 Parabone milking system combines the best features of a Herringbone parlor along with the best features of parallel stalls to reach an economical parlor solution. This design of milking system brings together the rear milking style of a Herringbone parlor with the optimum cow positioning of a parallel barn. There is plenty of open space.
for rapid cow movement without dividers that has been designed not only with cow comfort in mind but also the safety of the milking machine operator.

**Figure 18.** Xcalibur 360EX Rotary

BouMatic has claimed that the Xcalibur 360EX Rotary is the ultimate milking system design. It is specifically built for dairy parlors that operate around the clock with a cow-friendly, concrete platform and newly designed stall consoles. It possesses a drive system, central pivot and swivel, nylon rollers, and a double I-beam rail. This rotary was designed for improved cow comfort, with easy cow loading and unloading along with cow positioning being the main focus. All milking units detach automatically after milk out and rest below the platform, out of the way of cows exiting and entering the rotary stall. BouMatic has done studies on dairy operations where this design of rotary has been installed, and it has been shown to give the optimal return on investment because of improved equipment performance, cow comfort, improved operator efficiency, and long lasting materials.
Xpedia 90RX Parallel

The Xpedia 90RX Parallel is a system that gently directs cows from the milking stalls to allow loading of the next cow to begin faster. This “exit reel” touches the cow at the brisket rather than the shoulder because shoulder contact can be painful for the animal. This lets the cows remain relaxed during her milking time. The exit reel starts at 90 degrees and rotates to begin to moves the cow out of the stall, then slows giving the cow free access to exit. One the reel has gently moved the cow completely out of the stall, the next animal will be permitted to enter and her milking time will begin immediately.

Boumatic offers the company’s own brand of an automatic milking system, the ProFlex. This system is able to recognize each animal and record the date, time, and duration of each milking while also taking into account total herd production and milk quality data. This design allows for cows to voluntarily approach and enter the ProFlex system, which will ultimately reduce the psychological stress on the cow and lead to a high milk output. Each system has been equipped with MilkLogix technology. This technology will analyze milk quality from each quarter while separating any milk that does not comply with industry standards while alerting dairy operators of the problem so it may be looked at and fixed as soon as possible. All ProFlex systems are delivered to dairies fully assembled and have been tested at the factory in order to ensure fast and efficient installation.

VI. Discussion

After researching and placing each model side by side, it is easy to recognize how much each parlor design has in common with the same parlor design as a different brand. For example, all of the companies have taken much account into the importance of cow
comfort, emphasizing the need for easier animal entrance and exit out of the milking parlor and stalls specifically in the rotary designs. All milking systems have been designed with total milk output in mind thus ensuring the economic stability of a given dairy operation.

DeLaval and BouMatic are the frontrunners in terms of automatic milking system technology and the size and scale of the companies. However, BECO could reach the same heights as these two well-known companies. DeLaval and Boumatic are worldwide companies offering a wide range of products and service, where as BECO has just one dealer in Hanford, California and serves mostly local dairymen. DeLaval offers their dairy products at multiple dealers around the nation, with two main offices located in Missouri and Illinois. Multiple dealers around the nation also offer Boumatic products, with one main office in Madison, Wisconsin.

In recent years, the volatility of milk prices and costs of productions have caused many dairy producers to look to new means of production, whether it be through the expansion of their dairy operation or implementing new technology into their dairy. There are many factors that need to be thought over before the decision to add new technology is made. Dairymen must look at if the addition of new technology will cause the dairy parlor to be retrofitted or if they will have to start construction on a new barn. If they do choose to retrofit, they will then have to decide how they will continue to milk during construction. This could include converting the parlor from a conventional style to one with AMS in sections and continue milking procedures in the areas that are not being converted. The driving factor in this decision relies on the economics of the dairy and whether the choice to retrofit or begin new construction will have the highest rate of
return. If new technologies such as AMS are utilized, dairy producers will also have to decide if they wish to continue milking the same number of cows or adding to the herd, to increase total milk output and the rate of return on the addition of new technologies. Environmental considerations must be taken into account as well, including waste management, water availability and affects on air quality.

In relation to herd size, traditional styles of parlors such as parallel barns and Herringbone parlors are an unrealistic option for larger sized herds such as those in the thousands. Many large herds have put rotary barns to use on their dairy, because they have allowed for dairy producers to reduce the amount of labor needed in the parlor because rotary barns do not need for employees to guide animals into the milking stalls. Automatic milking systems are also a viable option on larger dairy herds, because they eliminate the need for as much labor and the animals can enter the milking stalls at their own leisure.

**VII. Conclusions**

Milking systems have come a long way since the 19th century, and the technology will continue to be developed and adapted in order to achieve the highest milk production to meet the global demand for food. There are many different options of styles, brands, and designs of dairy parlor equipment and milking machine automation available to dairymen today and it is ultimately the decision of the dairy owner to decide which brand and design are the best fit for their operation.

Since most dairy farms can be milking thousands of cows, the DeLaval Herringbone HBR parlor design is most suitable fit for today’s modern dairy operations. This design requires a minimal amount of employees, the most efficient enter and exit
strategy, and all supplies needed for milking at strategically placed in order for easy access and a faster milking process. DeLaval is also the only company that has designed their rotary with a sound muffling technology, which can reduce the amount of loud noise in the dairy parlor reducing animal stress and allowing for better communication among milk parlor operators.

In regards to automatic milking systems, the best fit for most dairy operations is the automatic system available from Boumatic, the ProFlex. This is mostly due to the fact all ProFlex items have been tested and assembled at a factory before reaching their order site, making for the easiest installation and smooth transition if a producer were in the process of moving their operation from one of static means to an automatic system.

Automatic milking systems still have a long way to go before their technology is perfected, but with time this technology has great potential to revolutionize the way the dairy industry operates. Regardless of what method or technology producers choose to use whether it be a static, rotary, or automatic system of milking, the common goal is to produce a wholesome product and deliver it to the world while being economically and sustainably efficient.
References


http://www.becoknows.com/


http://www.delaval.com/


http://www.merriam-webster.com/disctionary/gutta-percha


