

The liner action of a conventional milking machine on the teat can best be described as a minor 'crushing' or pinching. You can in fact feel that specific action by placing your fingers into a working liner. You can also feel more than the 'crushing' or pinching action of the liner. You can also feel the sensation of a movement of air over your finger after having it in the liner for around 30 seconds or longer. The longer you leave your finger in the conventional milking machine the more your fingers will become sore and sensitive to the inadequate "rest" phase it is providing. There have been many attempts to address this problem including the design of liners that have three sides to distribute the pinching action. These attempts have not been successful in eliminating the crushing or pinching and have done nothing to properly massage the length of the teat.

The CoPulsation™ Milking System has solved the failings of the conventional milking machines. This is a fact that cannot be disputed and can be readily felt by placing your fingers into the working liner. It has been further proven recently by research that we have published relative to the wear characteristics of liners used with our pulsation. Other research has demonstrated that teats are not swollen upon machine removal and are not wetted with milk as is typical of conventional milking machines.

There are several key characteristics to our milking system that all contribute to the dramatic difference in liner action it achieves. The primary contributor is the unique patented design of our pulsator. It is a simultaneous pulsator but still has two solenoids that act in a dependent manner. One solenoid controls the admission of vacuum to enable the liner to open for the milk phase. The other solenoid is dedicated to admission of the fresh air to permit the closure of the liner for the rest phase. This design provides for a significant reduction in air flow restrictions within the pulsator and makes it physically impossible for the mixing of fresh air and vacuum supplies as occurs in conventional pulsators. The two solenoids are never open at the same time and there exists a 30 millisecond delay between the closure of one and opening of the other.

This design permits the use of a very large diameter fresh air inlet hole in the pulsator that is .5 inches in diameter as compared to conventional pulsators that are typically less than .15 inches in diameter. The design also eliminates the need for the fresh air to force its way between the solenoid plunger and coil wall. Our fresh air solenoid plunger is offset from the fresh air inlet hole. The result is that fresh air can pass through our pulsator two to three times faster than a conventional pulsator.

The other key features are: a shell that has the pulse tube stem located about $\frac{1}{4}$ of the way up from the base of the shell for a more uniform distribution of fresh air into the shell, the shell pulse tube stem inside diameter is larger than most conventional shells to reduce the air flow restriction into the shell and the splitter tee has larger diameter openings for reduced air flow restriction.

The basic design features of our pulsation system simply follow basic air flow dynamic design practices to reduce the restriction to air flow. It has been our observation that there is a fundamental lack of understanding of the basic physics of fluid flow dynamics in the dairy industry.

The importance of having a pulsation design that can deliver air flow into the shell two to three times faster is based on the minimal energy that exists to provide movement of the liner. One must first consider the fact that a milking system operates at around 13inHg to 15inHg which is equivalent to only about 7 psi. This low pressure differential provide for very little available force or energy to move a liner, especially in the area where the teat resides when milking a cow.

When the fresh air flow into the shell is at a low rate as is the case for conventional systems, the liner will collapse at the point of greatest available energy which is below the teat. As the liner begins to collapse the pressure inside the liner where the teat is begins to rise. This is simple physics of the relationship between volume and pressure. The rising pressure decreases the available energy to close the liner and it simply stops resulting in the crushing or pinching of the teat as described above.

Our product changes the dynamics of the liner action by providing a fresh air flow into the shell that is sufficient to enable the liner to utilize the small available energy around the teat to allow the liner to actually collapse fully around the teat and along the full length of the teat. The liner also closes off fully below the teat and does not apply a crushing or pinching action. This unique liner action has several important facets. The first is that the liner provides a true compressive massage on the length of the teat, a fact physically felt with ones fingers. This compressive massage relieves the vacuum during the rest phase eliminating teat congestion by permitting proper blood flow. This action is similar to the benefits afforded by compression socks worn by individuals with poor circulation in their legs.

Another facet is the ability to close off the liner below the teat. This allows the canal to be properly rested. A conventional system fails to relieve the canal of the milking vacuum resulting in a continued, although reduced, milk flow during the rest phase. The failure rest the teat canal contributes to canal damage and scar tissue formation that blocks the flow of milk causing slow milking quarters and mastitis. It also damages and destroys the primary defense mechanism of the teat to prevent bacterial invasions. The proper closure action achieved by our pulsation can be observed by placing a clear flat plate over the end of a working liner and shining a light into the cluster to observe the liner action. One can also watch a cow milking and see the full and complete cessation of milk flow during our rest phase, something that does not occur with a conventional system as it effectively over-milks the teat the full duration of milking.

The final facet is that our unique liner action combined with the simultaneous pulsation prevents the wetting of the teats during milking. This is a fact readily visually observed and often noted by those using the milking system. Everyone is aware of the fact that conventional systems wet the teat with milk and of course the bacteria it contains causing the spread of contagious mastitis. Our milking system has been proven to virtually eliminate the spread of contagious mastitis and has in fact been successfully introduced into many herds specifically to resolve severe Staph aureus infections.

A general consideration of the differences in liner action is that conventional milking machines create a reverse milking action as a result of the liner pinching on the teat end. This pinching is effectively the opposite of hand milking driving bacteria up the teat canal. The bacteria that cause mastitis are non-motile and therefore require some force to drive them up the canal into the teat sinus. This force is either the reverse milking action or the reverse pressure pulse created by liner squall/slip. Damaged teat canals also contribute to enabling the bacteria to be pushed up the teat canal.

We have completed a study documenting the fact that cows milked with our product do not experience teat swelling as a result of the milking process. Cows milked with our product will typically have teats that are slightly smaller in diameter after milking than before. Teagasc in Ireland has published studies documenting the fact that conventional milking machines cause teat swelling during the milking process, a fact that should surprise no one given the failure of the conventional liner to massage the teat.

There exists significant additional evidence that supports the fact that our milking system is both unique and superior. There are videos that show the unique milking action and videos that show that ours does not create the teat wetting action while conventional systems do. The results on dairy herds is remarkable. Cows are substantially calmer and will choose our system over a conventional when one is on one side of a parlor and the other system on the other side. Cows requiring the use of Oxytocin injections to milk with conventional systems can be immediately weaned with our system. The milking parlors are significantly cleaner as the cows no longer automatically defecate upon entering because the conventional system induces pain and ours does not.

Many of our customers have discontinued the use of pre and post teat dipping due to the substantial improvement in teat health. A conventional system damages the teat canal opening requiring the use of teat dips and teat sealants. Cows milked with our system have such healthy teat canals that artificial means of preventing bacterial infections are not required.