Custom Solution Alleviates Tension Over Motion Control Concerns

The Project: Find a linear motion solution that will carry the spray jet in a water massage machine over 7 ft. within a challenging environment.

The Solution: A custom nut/lead screw assembly that does not absorb water was developed specifically to meet the needs of this application.

By Art Sesnovich
Aqua Massage International (AMI) is one of the world's largest manufacturers of hydrotherapy "dry water" massage machines. While the AMI brand may not be recognizable, most are familiar with its flagship product&#151the Aqua Massage Machine. Typically found in the center alleys of shopping malls, these capsule-like machines are often situated next to various vendor kiosks. For those who have not seen one, they are similar in appearance to an MRI machine, and have been described by some as a cross between a tanning bed and a car wash.

The Aqua Massage Machine offers results in 10 to 15 minutes, requiring the massage jets to move both rapidly and precisely.

When the company was first founded in 1990, its machines were intended for fitness and sports centers, spas, and clinical and chiropractic settings. Over the last decade, AMI has expanded its product offering to capture a rapidly growing consumer market.

As healthcare costs continue to rise, millions of people are actively seeking products and services to enhance their overall well-being. Increasingly, consumers are turning to alternative therapies like massage to release tension, soothe aching muscles, and relieve pain. Consumers have already poured more than $3.5 billion into massage services and products and some experts estimate that demand for these products and services will top $1 trillion by 2010.

While traditional massage is popular among consumers of all ages and attracts a particularly upscale, affluent clientele, dry water massage therapy is attractive to a broad consumer market, including people that would not otherwise consider a

traditional massage.

As opposed to traditional massage therapy which can take up to one hour, aqua massage therapy yields results in only 10 to 15 minutes. Additionally, aqua massage clients are able to stay fully clothed during the massage, no physical contact is necessary to complete the session, and an adjustable touch-pad control provides the client with the ability to adjust massage strength and location.

Optimizing Linear Motion

With customer demand at an all time high, AMI sought to optimize the quality of its machine's design. Specifically, the company needed a linear motion solution capable of guiding and translating the machine's spray water jet assembly, which moves back and forth along a linear shaft. The machine's 36 water jets travel along the shaft, massaging either the full length of the body or a concentrated area depending upon customer preference.

Unlike most other applications, the Aqua Massage machine presented an unusual design challenge. Not only did the linear motion assembly have to be accurate and durable enough to meet demanding speed requirements, it also had to meet the performance specifications while operating at an elevated temperature and over a distance of 7 feet.

A specialized nut was combined with one of Kerk's proprietary non-ball lead screws to offer a solution to AMI's motion control problem.

"Speed is a crucial factor since the pulsating water jets must be able to quickly adjust from 2 to 10 cycles per second without interruption," said Gerardo Aristi, Vice President of Operations at AMI. "We needed a linear solution with minimum radial play, vibration, and backlash between the screw and nut to ensure a tight fit, and thus a smooth experience for the customer," said Aristi. AMI turned to Kerk Motion Products, one of the world's largest exclusive manufacturers of non-ball lead screws and a vendor with whom AMI had a previous relationship. The challenge presented to Kerk was to produce a lead screw and nut assembly that could satisfy all these requirements.

"The Aqua Massage application posed many obstacles," said Bob Hawkins, an

applications engineer at Kerk. “The length-to-diameter ratio of thread engagement required for AMI’s machines is about 7:1, twice that of standard nuts. This presented a challenge in maintaining a constant thread fit. The challenge was amplified by the saturated environment in which the nut would operate.”

Custom Solution

After a thorough application analysis, drawing upon years of experience, Kerk recommended a unique nut material capable of meeting all of AMI’s requirements. “The thermal expansion coefficient of the nut material had to be roughly equivalent to that of stainless steel to prevent a binding condition while the machine was in operation. In addition, the nut material could not be hygroscopic, meaning a characteristic whereby something tends to absorb water.” Kerk quickly came up with a custom solution that relied on a specialized nut, combined with one of the company’s proprietary non-ball lead screws, which are manufactured from 303 stainless steel and produced with Kerk’s exclusive precision rolling process.

AMI was particularly impressed by the cost effectiveness of the solution, and the high level of engineering expertise provided by Kerk, compared to other vendors. “Kerk is able to approach an application from the ground level and provide the highest quality and most cost-effective solution based on its requirements,” said Aristi. AMI was also pleased with Kerk’s customer service, which has allowed the company to increase its production and meet growing demands.

“Kerk’s solution is significantly more reliable and cost-effective than competitive offerings,” said Aristi. “Our product delivery is now excellent with quicker than average turn-around on our blanket orders of 200 to 250 products. It was a challenge that many other companies could not have met.”

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For additional information on the technologies and products discussed in this article, visit the following websites:

- www.kerkmotion.com [1]
- www.amiaqua.com [2]

Art Sesnovich *has written for several magazines in the healthcare and manufacturing industry.*

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