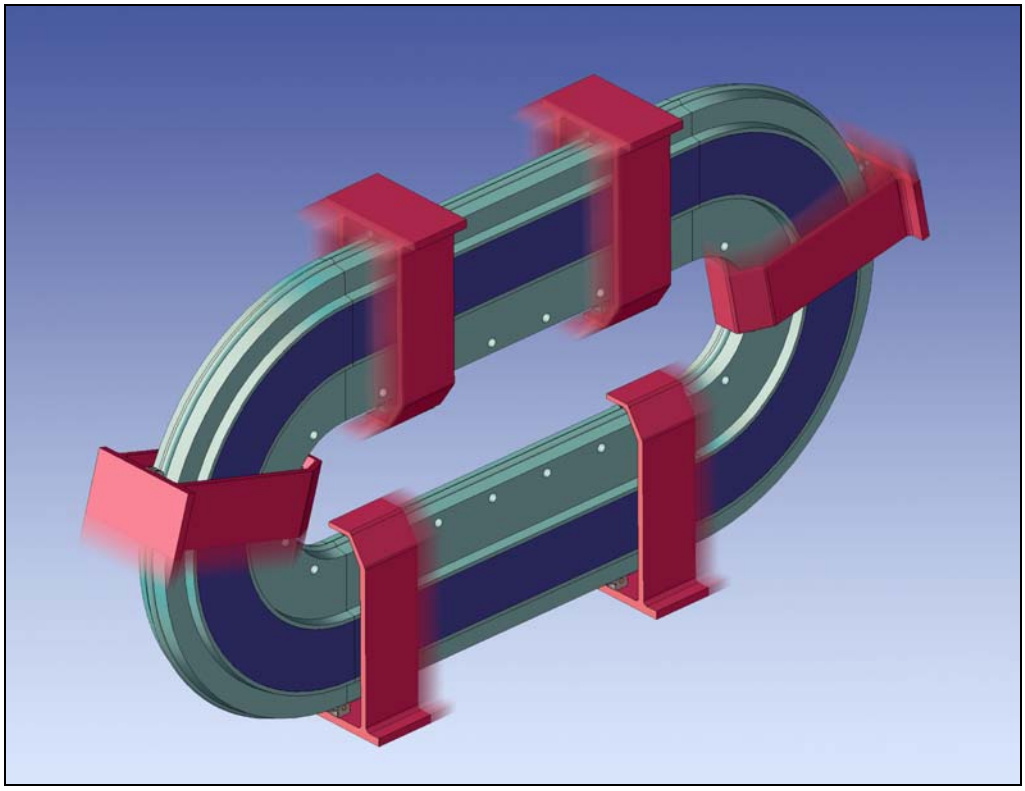
Jacobs *Automation*

Driving Your Competitive Advantage

PackTrak™

For Faster Changeovers



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The Need for Change(over)

A key issue in the consumer packaged goods ("CPG") industry is product proliferation, the explosion of brand variations for almost everything. In almost every product category, brands have changed from a single product, single package format to dozens of product variations with dozens of package formats. On top of this, product life cycles are getting ever shorter as these companies chase quickly changing consumer desires.

Given this environment, CPG companies are seeking manufacturing solutions that can be quickly re-configured to handle this pressing need for production line changeovers. A typical production line is capable of producing $20,000 of product per hour. Therefore, time lost to changeovers is expensive and solutions that address this problem can provide significant improvements to a company's profitability.

Existing changeover solutions are either hardware-based using change parts or software-based using rotary servomotors. The servo solution has gained traction in the marketplace due to it's software-based flexibility, but it still has a significant weakness regarding flexibility. Namely, many rotary servo applications convert their rotary motion into a linear or curvilinear motion to drive the actual tool (lug, seal head, bucket, etc.) through some form of a mechanical transmission like chains, belts, etc. This mechanical transmission often has limited or no flexibility since it is still a hardware-based solution.

What if each tool could be driven and controlled independently, without any mechanical transmission? Such a system would allow significantly faster changeovers for many types of machines.

The PackTrak™ Solution

Jacobs Automation, a Loveland, OH automation technology company, has developed a just such a motion control system, called PackTrak™, targeted at the packaging and converting market (for technical details, see How Does It Work? below).

This motor system has the following characteristics:

- Independent Control: The motor is capable of independently controlling multiple movers that are on its track. Each of the movers shown in Figure 2 can be servo controlled independently.

- Passive Movers: Each mover is passive, meaning it has no external attachments to it such as a power or communications cable or tether. Such connections would create an "octopus" that could severely limit the usefulness of the technology.
- True Absolute Position Sensing: Each mover's absolute position is determined at power up without any homing required. Systems that require a homing operation at power up or after a reset waste time and oftentimes waste product.
- Curvilinear Path: The motor path can be curvilinear (i.e. it isn't limited to being straight). The illustrated example shows a racetrack with two straight sections and two 180^{o} arc sections. Further, the path can be closed so that the movers recirculate.
- Sanitary Design: The motor surfaces have been designed to allow for washdown and to eliminate any crevices or undrained cavities that could create a sanitation problem.

Benefits

What are the benefits of this technology? The answer depends on the application. It could be improvements to one or more of the following:

- Faster Changeovers
- Higher Production Rates
- Reduced Maintenance
- Reduced Material Costs
- Smaller Machine Footprint
- Improved Sanitation

For applications that require frequent changeovers, it provides the flexibility to change machine pitch without any hardware changes since each of the movers is independently servo controlled via software defined motion profiles. For applications where reliability is paramount, machine downtime and maintenance can be reduced through the elimination of wear prone mechanical transmission parts. Similarly, machine speeds often can be increased by 25% or more because the inertia, friction and wear of the mechanical transmission is eliminated. In applications where size is important, PackTrak™ offers the potential to reduce the machine footprint. Finally, if machine sanitation is important, it offers the benefit of eliminating the crevices and cavities often found in mechanical transmission elements.

The most fundamental benefit of this technology is that it offers the potential to dramatically reduce end-users costs. Analyses conducted by Jacobs Automation show the potential to reduce the total cost of packaging by 25% or more when PackTrak™ is employed. With such cost savings potential, PackTrak™ should be considered for any packaging application that requires independent control of multiple discrete items and/or curvilinear motion. (Undoubtedly, applications of this technology exist in other industries and these will be explored in the future.) Both machinery OEM's and end users can benefit from the opportunity to break free from the chains of the past and reap the benefits offered by PackTrak™.

How Does It Work?

PackTrak™ is a direct-drive, moving-magnet linear servomotor. Referring to the cross-section in Figure 1 below, the mover carriage is mounted on four sets of track rollers that ride on opposing rails. Two sets of drive magnets are mounted opposite each other on the inside surface of the carriage. The stationary armature coils in proximity to each mover are energized to provide the desired force on the mover. To achieve independent control over each mover, the current to each coil is controlled independently, which is one of the key differences relative to a traditional 3-phase motor design. Position feedback is provided by an array of sensor elements mounted on the stator. A position magnet mounted on the carriage activates the sensor elements. This position is then fed to the servodrive to close the loop.

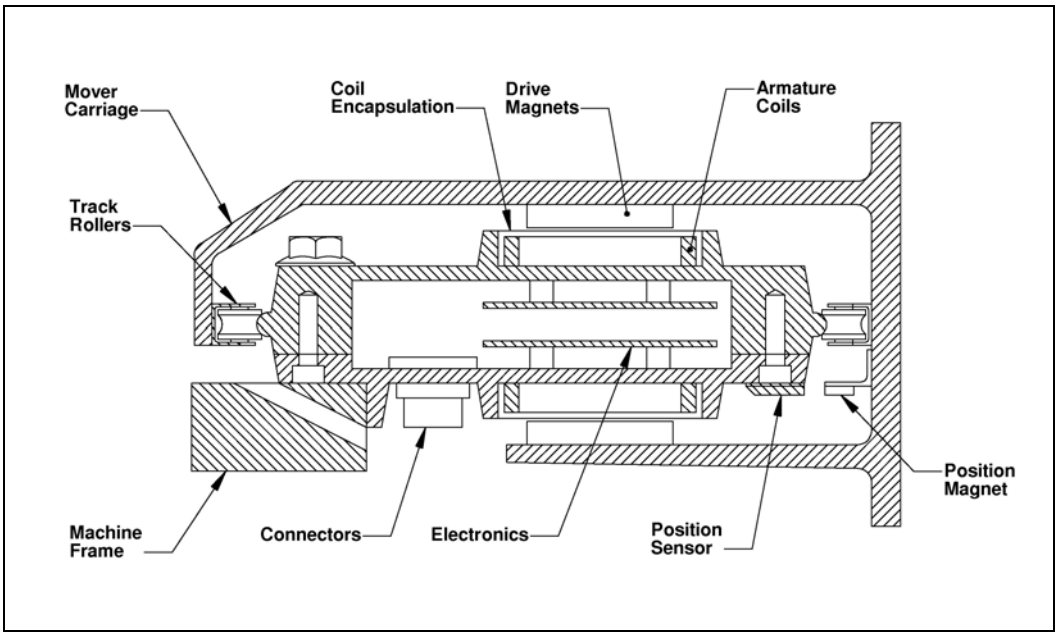

Figure 1. PackTrak Cross Section

Sample Application

Figure 2 presents a sample application of this type of motor to a horizontal form, fill and seal (aka flow wrapping) machine. In this example, the motor is applied to both the product infeed and the cross sealer. For the infeed, the motor drives eight (8) lugs that register to an incoming product at high-speed with a non-uniform spacing and adjusts it to a uniform spacing and inserts it into a film tube. For the cross sealer, the motor drives six (6) pairs of opposing seal heads, adjusting their position to match the printed registration mark on the package. This application typically runs at linear speeds of 1 to 3 m/s and requires a dynamic registration accuracy of 1.0 mm.

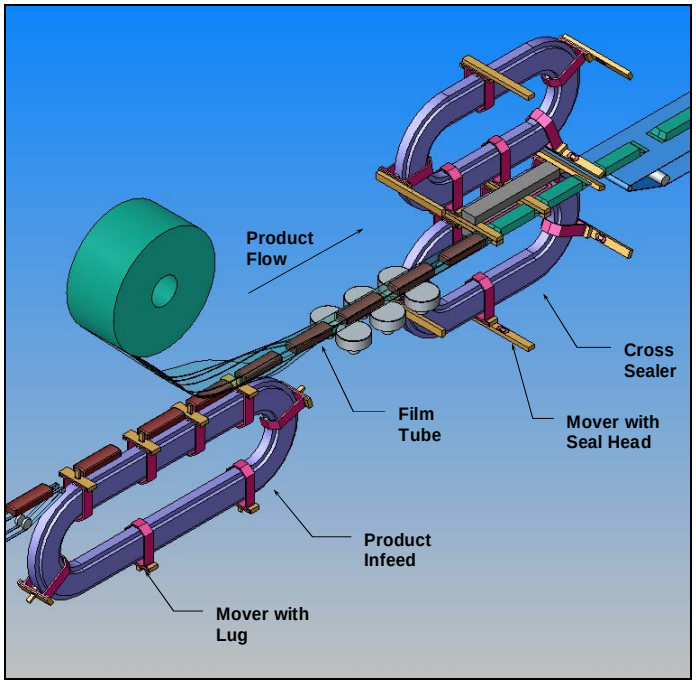

Figure 2. PackTrak™ Motor Applied to Flow Wrapping

Compared to today's HFFS machines, a PackTrak™-based flow wrapper provides:

- Faster changeovers – fixed-pitch infeed lug chains are replaced with independently adjustable lugs
- Higher speeds – not limited by chain speeds or belt friction
- Smaller footprint – long smart belts and infeed are replaced with a short infeed section

As this sample application demonstrates, PackTrak™ provides the opportunity to revolutionize packaging automation. For both OEM's and End Users, it provides the opportunity to upgrade their machinery to provide faster changeovers, higher speeds, etc., ultimately improving their bottom line.

For More Information

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