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Innovative Mechanical Merge & Pacing System for Multi-Lane Sausage Packaging

Executive Summary

A major sausage manufacturer in Iowa faced persistent challenges with inconsistent multi-lane (3- and 4-lane) product discharge ahead of a critical metal detector. Limited to only 60 inches of available line space and operating under tight budget constraints, the customer needed a reliable single-lane merge and pacing solution.

Traditional smart-lane systems requiring numerous servo motors were not feasible due to cost, complexity, and space limitations. Instead, a creative mechanical approach was developed using just two One Motion magnetic direct drives. The custom system featured a wide merge table and a unique "slaved pacing conveyor" cartridge with mechanically variable speed via different-sized rollers and spur gear sprockets.

Delivered in just 8 weeks, the fully mechanical system required zero logic or PLC controls for pacing. It replaced a previous system that had never worked reliably, eliminating the need for four dedicated operators per shift. The result: significantly increased line output and dramatically reduced labor costs, with excellent long-term performance.

Project Background and Challenges

The customer was discharging various sausage packs in 3- or 4-lane configurations depending on package size and production run. These lanes needed to be merged and precisely spaced before entering a metal detector. Key constraints included:

- Extremely tight footprint — only 60 inches of available space
- Tight project budget
- Variable lane counts (3 or 4 lanes) and product sizes
- Need for consistent, recipe-specific spacing through the metal detector
- Previous merge/pacing system that never performed reliably, requiring 4 full-time operators daily to manually correct spacing
- Desire to avoid complex controls, excessive motors, and high-maintenance solutions

A conventional multi-lane smart feeder would have required up to 14 motors and significant controls investment — far exceeding budget and space realities.

Innovative Solution: Mechanical Merge & Pacing System

The engineered solution combined a wide merge table with a highly innovative slaved pacing conveyor that achieved precise product spacing through purely mechanical means.

Core Design Features:

- Wide Merge Table: Allowed products from 3 or 4 lanes to naturally divert and consolidate without complex gating.
- Slaved Pacing Conveyor Cartridge: A drop-in cartridge containing the slider bed and belts, driven via spur gear sprockets from the main drive system.
- Mechanical Speed Variation: Different-sized rollers within the cartridge created the required speed differentials. Changing the top plate and cartridge configuration allowed recipe-specific spacing — all done mechanically.
- Minimal Drive System: Powered by only two One Motion magnetic direct drives, keeping complexity and cost low.
- Zero Logic Operation: No PLC programming or sensors needed for pacing functions. Spacing was achieved purely through mechanical design.
- Simple Controls: Basic VFD junction box with manual speed adjustment to fine-tune overall line speed for optimal metal detector performance.

- **Compact & Sanitary**: Full stainless steel construction optimized for the tight 60-inch space and food-grade washdown requirements.

The system was designed in SolidWorks 3D to ensure perfect fit within the existing line constraints and seamless integration with the upstream discharge and downstream metal detector.

Project Execution and Timeline

Working closely with the end user and OEM partner, the full project — from concept to delivery — was completed in just **8 weeks**. The mechanical-first approach eliminated lengthy controls development time and allowed rapid fabrication and testing.

The system was shipped fully assembled and tested, requiring minimal integration effort on site.

Performance Results (6 Months in Operation)

- **Transformational Labor Savings**: Eliminated the need for **4 dedicated operators** per day who were previously correcting spacing issues.
- **Increased Throughput**: Significantly higher and more consistent output through the metal detector.
- **Reliable Performance**: Replaced a non-functional legacy system with a robust mechanical solution that continues to perform as designed.
- **Low Maintenance & Simplicity**: Zero logic controls and minimal drive components have resulted in high uptime with straightforward operation and maintenance.
- **ROI Achieved Quickly**: Labor reduction and increased line efficiency delivered rapid payback despite the tight initial budget.

Technical Highlights

- **Drive Technology**: 2 × One Motion magnetic direct drives
- **Pacing Mechanism**: Mechanically slaved cartridge with variable roller diameters and spur gear drive
- **Merge Method**: Wide passive merge table
- **Controls**: Simple VFD junction box with manual speed control (no PLC logic required for core functions)
- **Construction**: Full stainless steel, food-grade design
- **Footprint**: Engineered to fit within 60 inches
- **Design Tools**: SolidWorks 3D for modeling and integration verification

Conclusion

This project demonstrates the power of creative, mechanical-first engineering when facing severe space and budget limitations in food manufacturing. By replacing complex electronic solutions with an elegant mechanical cartridge-based pacing system, the customer achieved better performance, major labor savings, and increased production — all within an aggressive timeline.

The success of this merge and pacing system underscores the value of innovative problem-solving and deep mechanical expertise in delivering practical, high-ROI automation solutions for challenging packaging environments.

Designed and Engineered by: James Grover of Hyper Klean

Images and renderings from the actual project are unable to be used based on NDA compliance.