CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

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MOTORIZED PULLEYS

DEFINITION, CHARACTERISTICS, APPLICATIONS

PRESENTED BY THE CEMA CONVEYOR PULLEY COMMITTEE

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Motorized Pulleys

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This paper defines motorized pulleys and highlights the characteristics of internal drive technology compared with external drive systems. It presents various applications and options for motorized pulleys in bulk material handling and food processing/unit handling.

Introduction

Developed in the 1950s in Europe, motorized pulleys, also known as drum motors, gained acceptance in North America 30 years later. Initial bulk handling applications included foundries, steel mills, glass manufacturing plants, phosphate mines, and ship-loading terminals. Initial food processing/unit handling applications included fish processing, package handling, airport security systems, and grocery store checkout stands. *See Figure 1.*

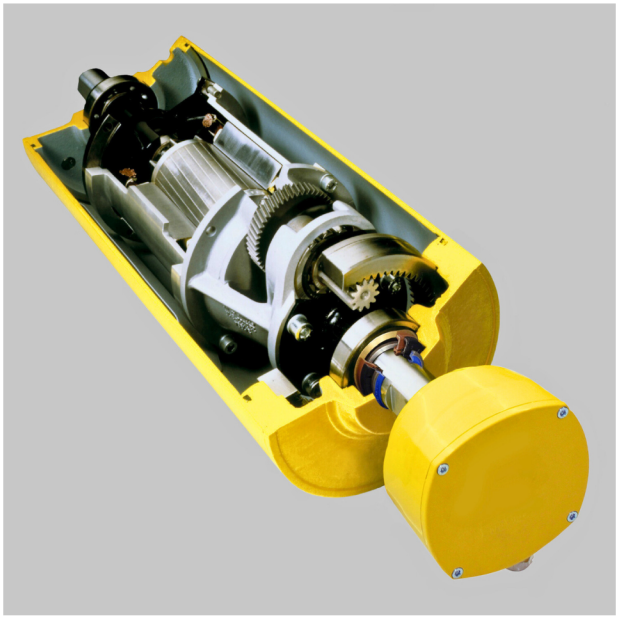

Figure 1. Motorized pulley with non-rotating drive train mounted on dead shaft within an oil-filled shell.

Definition

By definition, a motorized pulley conveyor drive system is:

- Internally powered with AC electric motor, usually three-phase.
- Hermetically sealed, enclosing all moving parts within the pulley shell.
- Oil filled to cool motor and lubricate all bearings and gears.
- Pre-aligned and mounted on a non-rotating dead shaft.
- Able to dissipate motor heat through the pulley shell, using the belt as an infinite heat sink.
- Capable of starting with Variable Frequency Drive (VFD), soft starter, or directly to the power supply across-the-line.
- Capable of driving flat belts through friction or positive drive belts with grooves or cogs.

Characteristics

Internally powered conveyor drive systems have unique characteristics when compared with external drive systems. Each internal drive system:

- Has a smaller footprint and is approximately 35% lighter in weight.
- Continuously splash lubricates all bearings, including main support bearings, motor rotor bearings, and gearbox bearings. *See Figure 2.*
- Transfers conveyor belt drive torque directly into conveyor structure and eliminates structural twisting during start-up.
- Reduces the need for extensive expanded metal machine guarding to protect plant personnel.
- Requires removal from the conveyor to replace the motor or gearbox.
- Synthetic oil requires changing after 50,000 hours of operation. Shaft oil seals should be changed after 30,000 hours of operation.

A motorized pulley's internal oil serves as both a lubricant and a heat transfer medium. Oil automatically and continuously splash lubricates all moving mechanical parts as the pulley shell rotates around the stationary drive train. Oil also cools the motor as its internal drip lips continuously pour oil over the motor to transfer heat into the conveyor belt through the steel pulley shell. In general, the standard depth of the oil level is set at one-third of the pulley diameter.

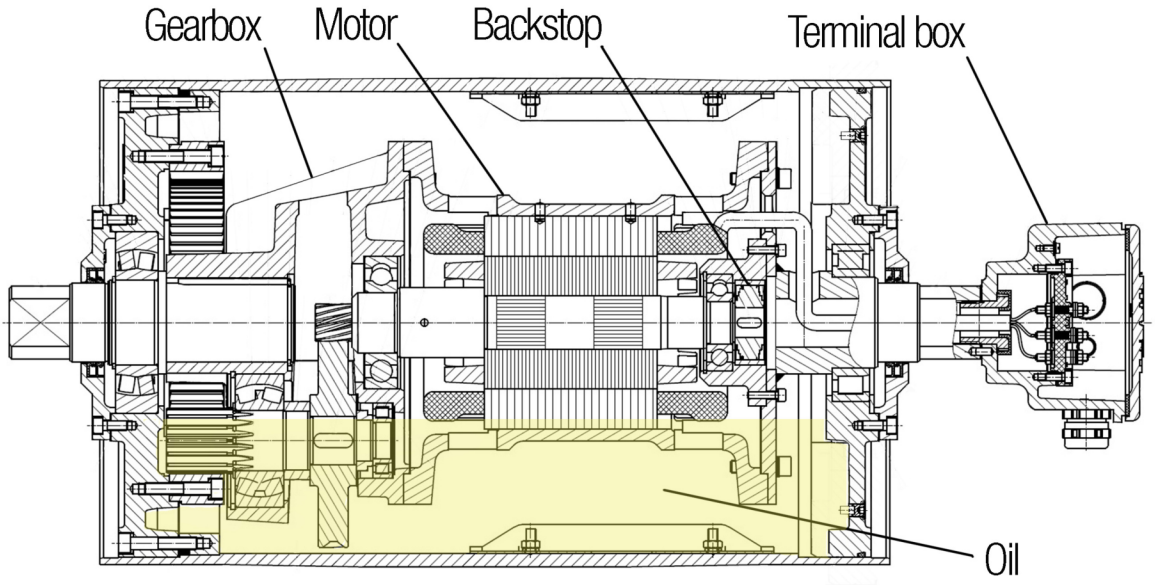

Figure 2. Cross-section shows typical oil fill level, oil plugs, drip lips, drivetrain, and all bearings enclosed within hermetically sealed pulley shell.

Bulk Material Handling

Motorized pulleys have been deployed in bulk material handling operations such as mining, construction, electric power generation, material recycling, and cement production. These drives, in general, have larger diameters and more powerful motors than drives for food processing and unit handling applications.

Applications

Internal drive technology has been applied as a viable alternative to external drive systems in:

- Situations in which conveyor drive space and weight are restricted. Examples include portable crushing & screening plants for construction, portable sand separator plants, and portable recycling plants. *See Figure 3.*
- Drive locations which are difficult to access for maintenance.
- Conveyor locations subject to flooding, such as reclaim tunnels in high-water table locations. *See Figure 4.*
- Lightweight and slender conveyor structure applications in which structural twisting during start-up could cause belt mistracking. *See Figure 5.*
- Corrosive applications such as salt mines and transfer terminals at ocean ports.
- Abrasive applications, including iron mines, steel mills, recycling plants, and foundries.

Figure 3. Motorized pulley (15 HP) driving 36-inch wide bottom ash discharge conveyor on portable metal recycling system at US waste-to-energy power plant.

Figure 4. Motorized pulley installed in reclaim tunnel subject to flooding. Note partial lagging on outer thirds of pulley shell.

- Dual drive applications in which space is restricted. “Pony drives” on long underground mine conveyors and nested dual arrangements on bucket wheel reclaimer discharge conveyors are two examples.
- Tail drive applications, especially when the drive must be mounted in mechanical takeup.

Figure 5. Motorized pulley transfers conveyor belt drive torque directly into structure, eliminating structural twisting during start-up.

- Noise-sensitive areas, in which conveyors are near residential areas.

Food Processing and Unit Handling

Motorized pulleys have been deployed in food processing (such as protein, fruit, vegetable, nut, bread and/or ready-to-eat processing and packaging) and in unit handling (such as packaging machines, luggage handling, security scanning equipment, and grocery store check stands). These internally powered drives, in general, have smaller diameters and less powerful motors than drives for bulk material handling applications.

Applications

Internal drive technology has been applied as a viable alternative to external drive systems in:

- Food processing conveyors in which drives must be frequently sanitized with high-pressure and/or high-temperature liquids. *See Figure 6.*
- Automated packaging applications in which conveyor drive space is restricted.

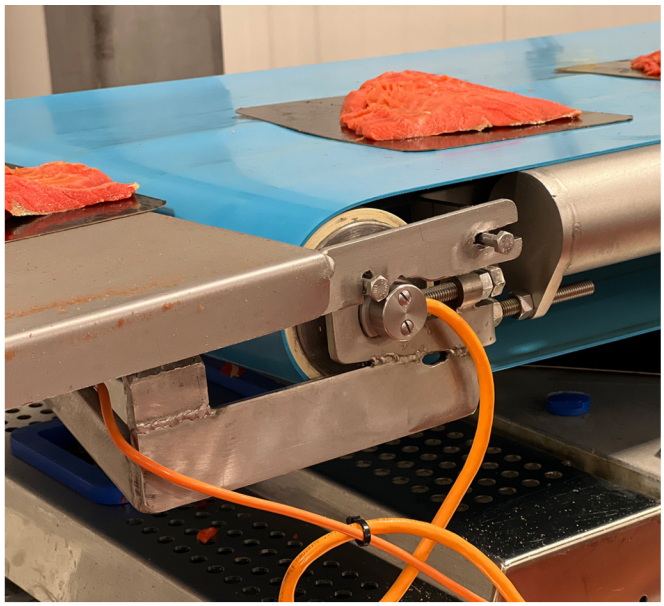

Figure 6. Stainless steel motorized pulley driving solid positive drive belt in protein processing.

- Drive locations that are difficult to access to maintain, such as high conveyors located near building ceilings without access ladders or enclosed spaces.
- Corrosive applications such as table salt processing/packaging.
- Dual drive and/or tail drive applications where drive must be mounted in mechanical takeup.
- Noise-sensitive public areas such as airport luggage handling systems.

Options

- **Lagging:** Various types of rubber lagging are available in a variety of groove patterns. Ceramic-embedded rubber lagging is also available. Some higher-powered models have partial lagging, where the center third of the pulley is left unlagged, to dissipate heat directly through the steel shell and into the belt. *See Figure 4.* Various colors and types of rubber lagging are available either with a smooth surface finish or with transverse, longitudinal, or diamond groove patterns. *See Figure 6.*
- **Backstops and Brakes:** Optional internal backstops or internal brakes may be attached to the motor rotor on the low-torque side of the internal gear reducer. *See Figure 2.* These devices are smaller than external backstops or brakes attached to live shaft drive pulleys. They are also well protected from the environment within the hermetically sealed pulley shell.
- **Special Exterior Finish:** Optional exterior finishes include stainless steel components including shell, end housings, and hardware. Special epoxy paint is also available.
- **Labyrinth Seals:** Optional labyrinth seals are available to protect shaft seals in harsh, abrasive, or corrosive environments. Grease canisters are available to automatically purge these special seals. Optional labyrinth seals are also available to protect shaft seals in high-pressure wash-down applications.
- **Shell Profile:** Many motorized pulleys are crowned to help train the belt in friction drive applications. Noncrowned cylindrical shells with welded keys to drive sprockets are also available. *See Figure 7.* Additionally, steel shells with grooves or cogs to drive positive drive belts are available. *See Figure 8.* Non-crowned cylindrical shells are also available.

- **Internal Encoders:** Magnetic shaft encoders, which supply high-resolution signals to an external decoder and control unit, are available. This option is for applications that require accurate control of belt speed, direction, and position.
- **Electrical Terminations:** Drum motors may be connected to electrical power either by power cords, as shown in Figure 6, painted terminal boxes, as shown in Figure 7, or stainless steel terminal boxes, as shown in Figure 8.

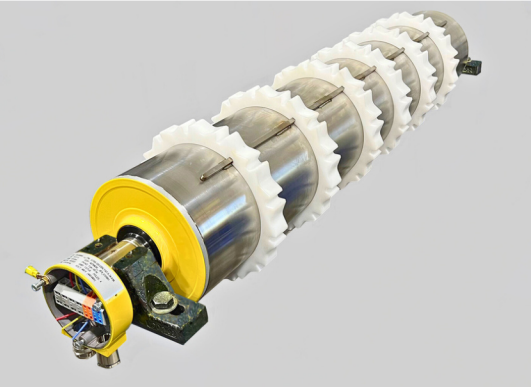

Figure 7. Motorized pulley with key and sprockets designed to drive segmented positive drive belts.

Figure 8. Stainless steel motorized pulley with longitudinal grooves to drive positive drive belt.

About CEMA

Established in 1933, the Conveyor Equipment Manufacturing Association (CEMA) is a non-profit organization of manufacturers, engineers, and integrators that propels the conveying equipment sector forward through development of industry-specific knowledge, standards, and safety programs that contribute to industry innovation and the overall betterment of the conveying industry.

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