Tsubaki Power and Performance for the Tire Manufacturing Industry

TSUBAKIMOTO CHAIN CO.
1 Tread
Contacts the road surface. The tread pattern is carved in order to discharge water and to prevent slipping.

2 Carcass
Cord layer coated with rubber to form the body of the tire. Its role is to endure load, shock, and air pressure.

3 Bead
Bundle of high-carbon steel. Its role is to fix both ends of the carcass and to fix the tire to the wheel.

4 Belt
Steel cords are mainly used, and their role in radial tires is to tighten the carcass and improve the rigidity of the tread.

5 Side wall
The tire deflects the most here, and its role is to endure shock and centrifugal force, and to protect the carcass.
A releasing agent is applied in order to prevent adhesion between sheets when manufacturing rubber sheets by blending the raw materials (natural rubber, synthetic rubber, carbon black, and sulfur).

**Batch off machines**

**Large Size Conveyor Chains**

Various line-ups are available to meet customer needs for longer life under harsh environments with water, chemical, and abrasive substances.

Advanced models with improved wear resistance and allowable load have been newly added.

**Applications**

- Wear resistance of roller improved over the DT Series
- AT Series, DTA Series, ATA Series, and more
- Anti-rust action better than DT Series
- RT Series, YT Series, and more

**Rubber sheet with releasing agent applied is dried using large size conveyor chains with bars attached.**

**Corrosion Resistant Drive Chains**

Various types of drive chains are offered for applications in corrosive atmospheres with water and chemicals.

**Applications**

- Stainless Steel Drive Chain (SS Series, AS Series)
- AS Series: Recommended for longer life in atmospheres with spraying releasing agent.
- Surface Treated Drive Chain (NP Series, NEP Series)
- NEP Series: Recommended for longer life in atmospheres with water present.

**Drive chain with corrosion resistance is used for drives for conveying sheets due to the presence of water and releasing agent.**

**Batch off machine**

**Conveyor drives and guides**

**Longer life**

**In-house comparison**

- Wear resistance between bush and roller

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**Internal salt water spray test result**

- NP Series
- NEP Series

- 50 hours later
- 700 hours later
The kneaded rubber material is extruded through the rolling roll into a sheet.

Component feeders
Rubber components are fed to the mixers and the extruders by conveyors and trolleys.

Power Cylinders
Electric linear actuator with good power savings. Power Cylinders with no power consumption during stand-by have higher power savings compared to hydraulic types that use pumps, and pneumatic types that drive compressors full time. Just simple electric wiring enables their use for various applications. They are used in traversing conveyors and trolleys, as well as opening/closing hopper bottom covers.

LCA assessment of Power Cylinders
Comparison evaluation result by Shinko Research Co., Ltd.

CO₂ emissions
- Annual CO₂ emissions (kg-CO₂/year)
- CO₂ comparison

Comparison conditions:
- Thrust: 3,000 N
- Speed: 200 mm/s
- Stroke: 500 mm
- Operation time: 24 hours/day × 365 days/year
- Including each drive system (servo motor, hydraulic unit)

Comparison evaluation result by Shinko Research Co., Ltd.

Hydraulic cylinder
- CO₂ emissions: 42 kg-CO₂/year

Power Cylinder
- CO₂ emissions: 91 kg-CO₂/year

CO₂ comparison
When Power Cylinder is set as 1
Hydraulic cylinder is 3.8 times more CO₂ emissions increase

LCA assessment is omitted, assuming transportation, disposal and recycling are equivalent for comparison purposes.
Reference: Japan Environmental Management Association for Industry MILCA ver.1.0, Manufacturer catalog and more

Mixture (Smelting) Process
High power & compact
Energy savings & simpler equipment
Rubber sheet extruders
Troi Drive
This gear reducer uses the drum-shaped Troidal worm gear to achieve high transfer capacity and high efficiency. Trapezoidal screws are also used, making it possible to adjust the clearance between the rolls. Meanwhile, minimal uneven rotation helps to improve roller positioning accuracy. Load repulsion is also limited through self-locking capabilities, thereby reducing potential motor problems.

Calender roll
The kneaded rubber material is extruded through the rolling roll into a sheet.
Component Process

Rubber sheets manufactured in the mixture (smelting) process are processed into components that form the tire, such as the tread and carcass.

(Tread) The component that is in contact with the road surface and is processed to the most suitable thickness and shape.

(Carcass) The component that forms body of the tire, it is a sheet with a cord layer that is coated with rubber.

(Bead) Bundles of piano wires, which are useful for fixing the carcass, or fixing it to the wheel.

Tread cooler conveyors
Plastic Modular Chain WT2706-K

All-plastic chain with excellent water-repellent and anti-rust properties is recommended for this process, which uses a lot of water for cooling. It is light weight and easy to maintain. In addition, the connecting pins are covered with links, preventing unexpected connecting pin breakage.

(WT2706-K overview)
- Chain pitch: 27.2 mm  Link height: 8.7 mm
- Just a single screwdriver is required for cutting and connecting, allowing sectional replacement
- Plastic plugs that are detectable with metal detectors are also available

Clean & easy to maintenance

Tread cooler conveyor
Treads, a component of tires, are hot after the rolling process and are cooled to normal temperature by immersion in water.

Maintain thrust & stopping accuracy

Calender rolls
LINIPOWER® JACK

Lini Power Jacks with trapezoidal screws are recommended in this process, in which rubber is rolled to a certain thickness. Using the motor together with the brake enables stable positioning, load maintenance, and power savings.

Calender roll
The rubber sheet rolled in the previous process is crimped onto the cord layer to roll into a thin sheet with a certain thickness again.
Components such as tread, carcass, and bead that make up the tire are accumulated, wound, and affixed to the drum to be formed into the shape of the tire. The tire formed in this process is soft, and is called a raw tire (green tire).

Component feeders

Plastic Modular Chain
Raised rib type WT1907-K

The gap at the junction is reduced to zero by combining with plates in a comb shape similar to that of escalators. This prevents roll-in of the end of rubber sheets.

(WT1907-K overview)
• Chain pitch: 19.05 mm  Link height: 14.3 mm
• Parts are all made of plastic for lighter weight
• Just a single screwdriver is required for cutting and connecting, allowing sectional replacement

Component feeder (cut process)
Components in sheet shape are cut and automatically fed to the drum that forms the tire.

Component feeder (end)
The table that feeds the cut components to the drum to form the tire telescopes.

Speed stability & quietness
Electrically-driven cylinders using ball screws and trapezoidal screws. Most suitable for applications with high-speed and high-frequency operation. This has excellent quietness, and is capable of operating with stable speed thanks to its design using an induction motor to turn the screws and move the rod forward and backward.

Component feeders
Power Cylinders
The tire is finished with excellent strength and elasticity by injecting, heating, and pressurizing (vulcanizing) the raw tire (green tire) manufactured in the forming process into the mold. This process applies grooves (tread pattern) on the tread portion that comes into contact with the ground.

Electric cables are routed through the body to ensure the support and guidance of cables between moving devices and fixed ends. Various types of products are available, including compact and large sizes, open types (TKP), and closed types (TKC, TKA). The closed type is recommended for protecting cables in the harsh atmosphere around vulcanizers.

The raw tire (green tire) is injected into the mold, onto which tread patterns and stampings are applied through heat and pressure.

This device enables efficient use of space and high speed conveying by traveling along the ceiling. It uses a non contact power supply as well to improve reliability. Tires from 13 to 20 inches can be conveyed. A gripper with a diameter smaller than the outer diameter of the tire is used, which enables simple and neat layouts.
Scratches, distortions, and more are checked in the verification process. Balance, uniformity, and more are verified by equipment, so only tires that pass are shipped out.

### Wide variety

**Balancing machines**

Balancing machine

Balance of the axle is measured using centrifugal force by rotating the tire.

### High efficiency

**Small-Size Gear Motors**

Various series including Gear Motors, Hypoid Motors, and Croise Motors are available to offer selection to match with the installation space. They also comply with efficiency regulations for motors that are becoming drastically restrictive all over the world. These are new generation small-size gear motors with superior power savings and performance.

(Complies with high-efficiency regulations in Japan, North America, China, Korea, and Europe)

- **Gear Motors**: Light weight and compact size are achieved by using a helical gear.
  - Motor: 40 W to 5.5 kW, reduction ratio 1/5 to 1/1200
- **Hypoid Motors**: Space saving is achieved by using a hollow shaft.
  - Motor: 40 W to 5.5 kW, reduction ratio 1/5 to 1/1200
- **Croise Motors**: Using a worm gear realizes superior shock resistance and quietness.
  - Motor: 0.1 kW to 3.7 kW, reduction ratio 1/10 to 1/300

**LINIPOWER® JACK**

High-performance jack combining ball screws and trapezoidal screws with high precision worm gears. The ball-screw-type is used in uniformity machines. It is suitable for high-speed and high-frequency applications, and realizes large thrust (force to press drum) with a small drive source.

(Basic capacity)

- 0.5 kN to 100 kN
**G8 Series Drive Chain**

- **Drive Chain & Sprocket**
- **RS Roller Chain**

These lube-free chains employ our special, oil-impregnated bushes for a long service life. Environmentally friendly NSF H1 certified oil is used for impregnating. This reduces maintenance man-hours and keeps the environment clean.

**Corrosion-Resistant Surface Treated Neptune Chain**

This chemical-resistant chain stands up to corrosive or alkaline chemicals thanks to its special surface treatment. It retains its strength and easily replaces steel chains. RoHS compliant.

**Plastic Modular Chain**

Plastic Modular Chain consists of plastic parts only. It can convey anything from light components to heavy vehicles, and realizes reliable drive even with a belt sized conveying surface. It also allows any person to easily replace parts (maintenance), and is also easy to handle thanks to its light weight.

**Large Size Conveyor Chains**

Large size conveyor chain most suitable for conveying heavy objects. Our long experience allows a line-up of various specifications to provide solutions to customer problems. Large size conveyor chain is called “Smart Conveyor Chain”, under the concept of offering the best chain for the customer’s application.

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**CABLEVEYOR®**

Various series are available to meet customer needs including: TKP standard-type for general purposes, TKC closed-type, TKA type with excellent protection of cables from dust, and TK high-strength type made of steel. In addition, cables for movement are also available. Consider using them as well.
Power Cylinder & LINIPOWER® JACK

**LINIPOWER® JACK**
Jack combining ball screws/trapezoidal screws with high precision worm gears.

**Power Cylinder**
Electrically driven cylinder integrating ball screws/trapezoidal screws with a motor.

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**Eco & clean**
Electric power savings are higher than with hydraulic or pneumatic types, and CO₂ emissions are also reduced. In addition, this product has no piping, which eliminates oil and air leakage from connections.

**Secure holding of heavy loads is possible**
Basic configuration has a motor with a brake mounted. Secure holding of heavy loads is enabled at any desired position, even when power is lost.

**Simple layout**
Operation is enabled just by connecting a power source. No large scale equipment or work is required, such as hydraulic pumps and compressor piping.

**Accurate speed and position control is possible**
Electric control of each motor enables discrete speed change. In addition, accurate position control and multiple point positioning are possible.

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**Small-Size Gear Motor**
Gear Motor with the advantages of helical, hypoid, or worm gears.

- **Gear Motor**
  Parallel shaft type helical geared motors. Helical gears provide high efficiency and low noise. Small, lightweight, and compact

- **Hypoid Motor**
  Right-angle geared motors. Hypoid gear provides high efficiency. Low-profile compact body. Line-up of hollow and solid shafts.

- **Croise Motor**

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**TROI Drive**
High-performance worm gear enabling high transmission capacity and high efficiency.

- High-power and compact.
- Available in solid or hollow output types.
- Contributes to layout compactness.
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