

CASE STUDY



Streak-free clarity

Rack and pinion drives facilitate effective runway maintenance at airports.



Rubber abrasion on airport runways must be addressed promptly and comprehensively. The Montabaur-based firm Traffic Lines has devised a cleaning process that is markedly more efficient than earlier techniques.

High-precision rack and pinion gears from LEANTECHNIK are integral to this process.



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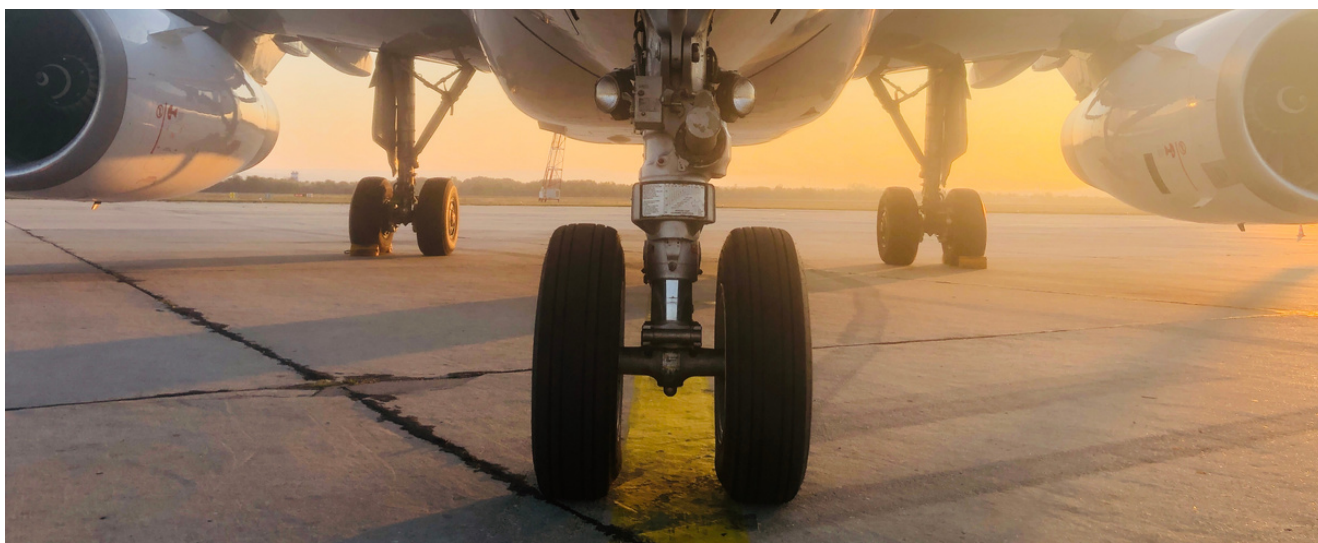
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When aircraft land on the runway, the friction between the tires and the asphalt results in considerable rubber wear. This issue can be exacerbated in wet conditions, which render the contaminated runway slippery and substantially extend the aircraft's stopping distance. Consequently, airports must routinely clean their runways to maintain air traffic safety.

Until now, traditional milling hoods have been employed to eliminate dirt. However, these systems, which utilize high-pressure water, often present a significant drawback: dirty water accumulates beneath the hoods. Consequently, the water jet initially impacts the backwater, resulting in diminished force. This reduction adversely affects the efficiency of the cleaning process. Additionally, some of the contaminated water escapes beneath the hood, infiltrates the pores of the asphalt, and becomes ensnared there, leading to unsightly streaks on the surface.



Engineers sought a more effective solution.

At Maschinenbau Cernota GmbH & Co. KG, the issue is well recognized. "We have been servicing and repairing high-pressure water cleaning systems from esteemed manufacturers for years," states Martin Appel, a graduate in industrial engineering. He and his colleagues are thus acutely aware of the devices' vulnerabilities. They were confident that: ...



The process can be refined. The engineers advanced the high-pressure water technique and adjusted several critical elements. This led to the creation of the "twister" – an innovative cleaning module utilizing ultrahigh-pressure water technology (3,500 bar). In contrast to traditional high-pressure water milling hoods, the system incorporates a patented annular gap extraction mechanism:

It promptly removes the dirty water, preventing waterlogging. The water jet thus strikes the surface directly, cleaning it significantly more effectively than traditional milling hoods. The extraction of loose rubber particles before employing the water jet further enhances the cleaning process.

The working width should be adjustable with flexibility.

The twister was engineered for the removal of road markings and is capable of eliminating paint, thermoplastics, film, and cold plastic agglomerates from surfaces measuring between 370 mm and 520 mm in width. Due to the module's limited working width, it is not ideal for larger areas, such as airport runways; therefore, traffic lines developed the duo twister specifically for this purpose. This model comprises two rotating twister units and was initially designed with a fixed working width of 3100 mm.



"Given the market's swift demand for modules up to 4200 mm wide, we expanded the duo twister," recalls Martin Appel. "Our objective was to develop a solution with a continuously adjustable working width, reaching a maximum of 4200 mm." The challenge lay in constructing a precisely adjustable framework equipped with a self-locking mechanism to prevent any alteration in working width during the cleaning process, particularly due to vibrations affecting the module. Following extensive research, the engineers identified the optimal component: rack and pinion gears from LEANTECHNIK. "These gears align with our stringent quality standards and provide an excellent price-performance ratio," Martin Appel explains, justifying the decision.

Guaranteed precise and synchronous positioning.

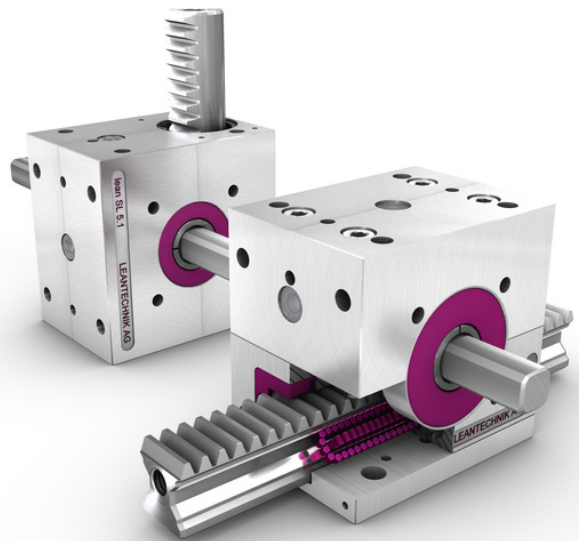
LEANTECHNIK rack and pinion gears are distinguished by their precision and durability. Esteemed companies globally employ them in advanced positioning systems across various sectors, including automotive manufacturing, food processing, and packaging. The rack and pinion gears are offered in the lifgo® and lean SL® series, designed for diverse applications. Lifgo® gears are ideal for scenarios requiring the precise and synchronous positioning of heavy loads. They are produced in multiple configurations, with lifting capacities ranging from 2,000 to 25,000 N, achieving lifting speeds of up to 3 m/s. Additionally, variants are available for applications involving extended travel distances, gripping and centering movements, or a combination of both.



Gearboxes can be combined with one another as desired.

Simple synchronous positioning tasks that do not require transverse force absorption are optimally executed with lean SL® rack and pinion gears. These gears are offered in three sizes and two configurations. They can support lifting forces ranging from 800 to 8,000 N and facilitate lifting movements at speeds of up to 0.6 m/s. In addition to the standard model, LEANTECHNIK manufactures a variant designed for gripping and centering movements. For applications with constrained installation space, the exceptionally compact lean SL® 5.m is available, weighing merely 0.36 kilograms and engineered for lifting forces of up to 300 N. The lean SL® rack and pinion gear adeptly manages even substantial loads; in size 5.5, it can accommodate lifting forces of up to 25,000 N.

All lifgo® and lean SL® rack and pinion gears can be freely combined and arranged in series, making them ideal for applications requiring long travel distances. Their unique design principle renders them suitable as the foundation for a diverse range of positioning systems.

**Substantially expedited and more comprehensive runway maintenance.**

Cernota incorporates lean SL® rack and pinion gears in the lean SL® double 5.3 version (lifting capacity: 8,000 N) within its duo twister modules. The gears are equipped with a hollow shaft featuring a keyway (Ø35H7) for connection to the drive unit, facilitating highly dynamic, low-backlash, and load-changing movements. LEANTECHNIK additionally provides three alternative pinion shaft ends for its rack and pinion gears.

Each duo twister module features a gearbox that facilitates the movement of two racks. "This enables the customer to precisely adjust the working width as required," explains engineer Martin Appel. This presents a significant advantage, as traditional high-pressure cleaning systems typically have fixed working widths of less than 2 meters. "Given that the touch-down zone spans approximately 16 meters, these vehicles often need to maneuver back and forth, or multiple vehicles must operate in staggered formations," states Appel. "With our duo twister modules, a single vehicle can accomplish the same task in considerably less time." Users can operate the modules for 6.5 hours continuously, cleaning areas of up to 5,000 m² per hour.



Not only are airports interested in the new procedure.

By employing LEANTECHNIK rack and pinion drives, Cernota successfully optimized the continuously adjustable working width. The track width can now be modified to the millimeter, and due to the self-locking mechanism, it remains stable throughout the entire cleaning process. Additionally, the working height of the duo twister modules can be electrically adjusted with precision to suit the ambient conditions.

Meanwhile, the market is demonstrating significant interest in the innovative milling system; inquiries have been made not only by airports but also by construction companies and racetrack operators. The modules are capable of removing road markings, oil stains, and concrete slurry without leaving any residue.