The traversing system: An important production element

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General

Almost every wire and cable production or refinement process ends with the goods to be wound coming into contact with the traversing system.

Although the task of spreading the goods to be wound across the coil width may seem to be of little importance, it nevertheless determines the success of the many following steps:

Increased feed speed: rising material speeds place increasingly higher demands on smooth unwinding behaviour from coils during further processing, and progress is only possible if the traversing movement is sufficiently precise during winding.

Jolt free unwinding: Processes which demand low and constant pull-off forces place great demands on the winding quality and, consequently, on the traversing system.

Protection of material to be wound: To prevent or reduce damage to the material surface, careful traversing while maintaining minimum offsets between the separate windings is required.

Generation of particular winding patterns: An appropriately capable traversing system is indispensable, especially when particular winding patterns are required for production or optical reasons.

Winding on conical, bi-conical and asymmetrical coils: These coil shapes prevent the reel from collapsing when in an upright position and allow the material to be easily drawn off over one flange side.

Enhanced coil stability for flangeless winding: Traversing at a high pitch (feed per coil rotation) allows tension forces to be generated towards the reel middle that help prevent potential decomposition, during transport, as an example.

Reduction of downtimes: The neater a coil is wound, the higher the amount of material it can hold and this reduces production downtimes caused by the necessity to replace empty coils.

Sales incentive: The neat winding pattern conveys the idea of a high product quality. This not only applies to the wound material, but also to the machine being sold.

Variants

Traversing systems with purely mechanical and electronic control systems are most frequently used, while pneumatic and hydraulic and electro-mechanical solutions are less predominant.

The major components of electronically controlled traversing systems are mechanical motion elements (timing belt, chain or threaded spindle drive), an appropriate drive motor, an encoder for capturing the coil speed, controller, data input facility and connection cables.

Advantages, depending on the configuration, are:

- Short changeover times if stored programs can be loaded. In particular, this holds true for winders filling several coils;
- The use of sensors allows an automatic adjustment to coil dimensions;
- The following can also be directly controlled during winding: the traversing width, winding deviation offset, reversal time, traverse pitch and all material diameters.

Disadvantages include:

- Expense;
- Requires trained operators;
- Requires specialists in case of faults;
- Fault liability when used in stranding machines (sliding contacts);
- Optical sensors scanning the coil are often prone to soiling.

Mechanical traversing systems can roughly be classified as rigid or more or less flexible systems. As a rule, they are directly driven by the coil shaft, allowing for an easy correlation between coil speed and traversing speed. Apart from belt drives, threaded spindle drives are predominant here as motion elements.

Advantages and disadvantages strongly depend on the used system, but there are some generally applicable facts.

Advantages:

- Low costs;
- Simple technology;
- No trained staff required for operation and repair;
- Fault-proof, even in demanding environments.

Disadvantages:

- Restricted flexibility;
- No direct sensor control possible;
- The positively driven traversing system increases the torque requirements on the winding drive.

There are the following significant system-inherent differences in the group of mechanical traversing systems.

The belt traversing system makes use of the fact that a rotating belt's strands feature exactly identical speeds but opposing directions of travel.

A clamping mechanism arranged between the two belt pulleys is installed on a carriage, which also serves for material guidance. This mechanism alternately connects the carriage to the opposing belt strands, resulting in a positive reciprocating movement.

Advantages:

- Simple construction;
- Exactly identical speed in both directions of travel;
- Low maintenance requirements;
- Adjustable traversing width.

Disadvantages:
- Additional guide for carriage required;
- Imprecise reversal points since the change between unclamping and clamping cannot be clearly defined;
- No direct pitch adjustment.

Positively driven threaded drives

Cross-threaded and reversing screws are frequent implementations of this category.

Cross thread: The spindle features a right-hand and also a left-hand thread. The threads meet at the spindle end and force a coupler engaging into the thread by way of a point to travel back and forth when the spindle turns.

Advantages:
- Also suitable for very high stroke speeds;
- Exactly identical speed in both directions of travel;
- Simple maintenance;
- Well suited for flangeless winding due to clearly defined reversal points;
- Precise reversal point.

Disadvantages:
- Very rigid system allowing neither stroke nor pitch changes;
- Adaptation to changed coil or material dimensions requires the entire traversing system to be replaced (downtimes);
- Prone to wear;
- High maintenance requirements.

Reversing screw: The spindle features only one thread and changes its direction of travel at each stroke end. Switchover occurs by way of a reverse gear unit actuated by the reciprocating nut.

Advantages:
- Exactly identical speed in both directions of travel;
- Simple maintenance;
- Adjustable traversing width.

Disadvantages:
- No pitch adjustment;
- Imprecise reversal point due to the reverse gear unit;
- Prone to wear;
- High maintenance requirements.

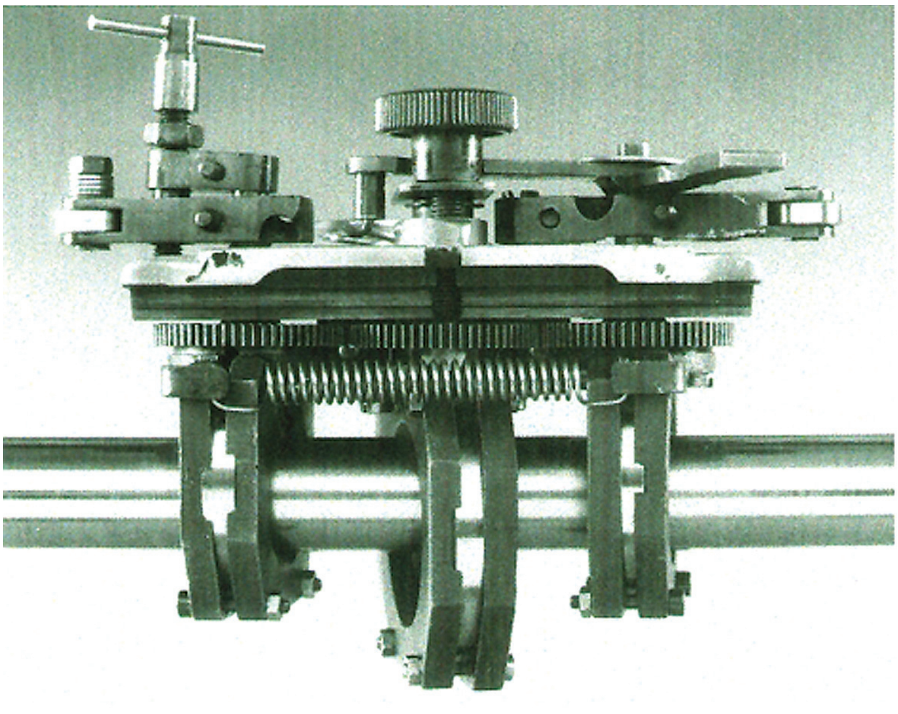
Non-positive helical drives: For winding applications, the flexible rolling ring drive variant of non-positive helical gears is predominantly used. The following description refers only to this product.

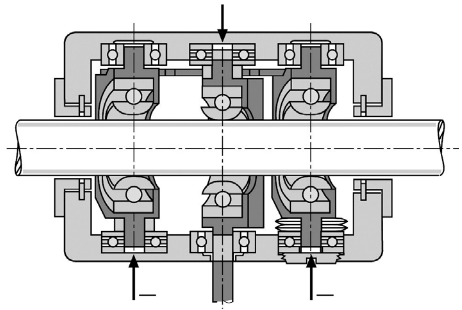
Rolling ring drive: The rolling ring principle that transforms rotary to reciprocating movements was developed in Northern Germany by Uhing in 1952 and has been patented worldwide.

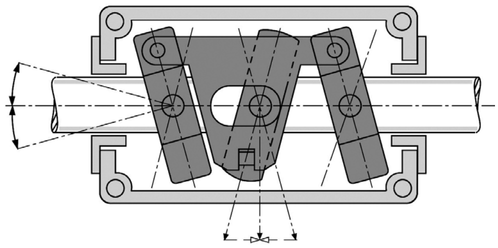
Initially used as carrier drives for knitting machines, the rolling ring drive soon proved to be extremely successful for winding applications. Other manufacturers also use the rolling ring principle today.

Its function corresponds to that of a threaded drive with a right or left, coarse or fine pitch. A plain shaft directly driven in a single direction by the winding shaft via a belt or chain serves as spindle and track for the rolling ring drive.

▼ *The rolling ring principle was first developed in 1952*







▲ *Stroke direction reversal and pitch selection occurs inside the rolling ring drive*

Automatic stroke direction reversal and pitch selection occurs inside the rolling ring drive.

Advantages:
- Continuously adjustable pitch and stroke width;
- Free movement lever for disengaging from and displacing on the shaft;
- Stroke reversal occurs within milliseconds;
- Simple, robust construction;
- Automatically synchronous rotation with the coil due to the direct drive;
- Low maintenance requirements;
- Also suitable for bi-conical coils by retrofitting self-adjusting end stops;
- High-efficiency, low torque requirements.

Disadvantages:
- Minor pitch offsets between directions of travel can occur;
- Restricted application with very thin wires;
- Time-consuming adaptation to special coil shapes;
- Restrictions with regard to certain winding patterns.

Next to electronically controlled traversing systems, Uhing offers a comprehensive range of rolling ring drives for shaft diameters from 15-80mm and side thrusts of 30-3,600N. Stroke speeds up to 4.2m/sec are possible.

A comprehensive assortment of accessories allows for an optimum adaptation to the respective application.

Further developments

Use of sensors: As an accessory to its rolling ring drives, Uhing has developed the non-contact FA flange detecting system that automatically adapts the traversing length to the respective coil in use.

It allows different positions of identical coils on the winding shaft to be detected and reversal points to be accordingly corrected.

The FA key component is a huge but extremely reliable light barrier. When one of the coil flanges interrupts the light barrier's beam, the pneumatic reversal on the traversing unit receives a switch-over signal.

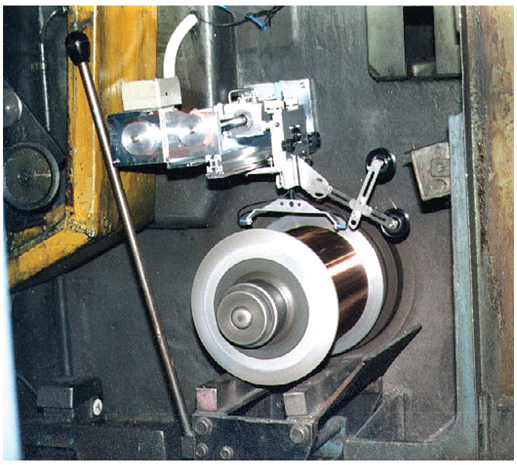
The FA is either fastened directly to the rolling ring drive or to an intermediate slide. For applications where the spool performs the stroke, the stationary light barrier is fastened to the machine chassis.

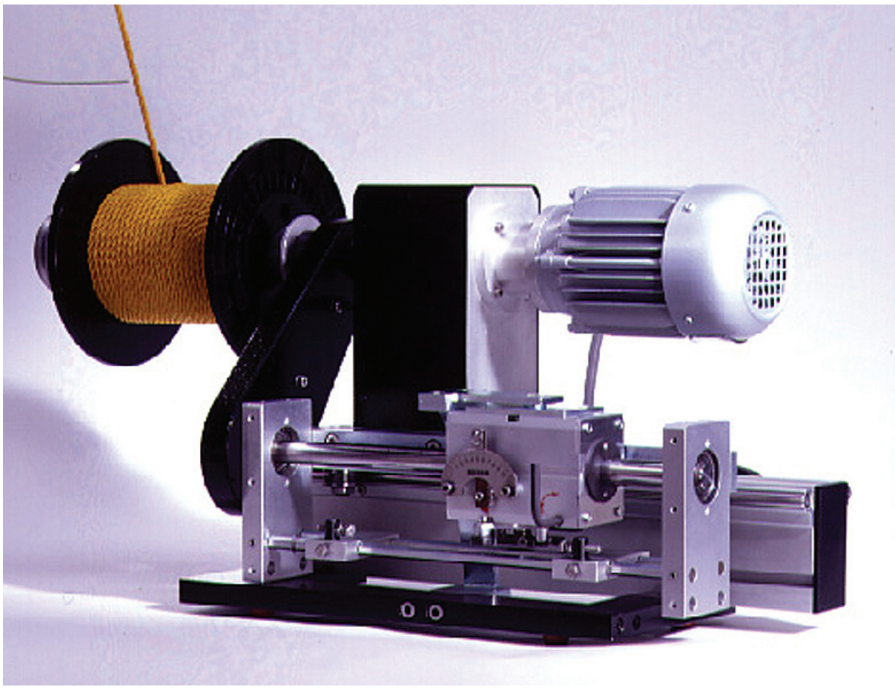
It uses a correction angle that changes when the traversing unit reverses. This compensates for system-inherent switching delays.

A simple relay controller is responsible for signal processing with constant coil speed.

▼ *A range of rolling ring drives*

▼ *The FA details*





▲ *A moving spool winder*

A Programmable Logic Controller (PLC) can be used with constant material speed and decreasing coil speed.

The light barrier has proved to be the ideal solution in heavily soiled environments and where varying illumination and reflection conditions prevail.

For application in confined spaces, in particular for stranding machines, Uhing developed a system where a rolling ring drive's end stops perform an automatic non-contact search for the spool flanges and the correct reversal position.

This system also allows for correction movements during winding, for example to adapt the pitch to bulging spool flanges or changed spool positions.

Technical enhancements and new materials: Considerable cost and weight savings have been made possible by using plastic injection parts to a larger extent for rolling ring drives up to shaft diameters of 40mm.

Apart from ball bearings, screws and reversing springs, the latest Kinemax and RGK15 and RGK20 drives are entirely made of high-tech plastic. These products are not only economically priced but also extremely corrosion-proof and require no maintenance.

Electronics: In addition to purely mechanical traverses that can be retrofitted with sensors (FA) to offer a high degree of operator convenience, Uhing also offers fully electronic traverses controlled via a traversing computer. These have proven their worth, in particular, when processing extremely thin material.

Moving coil system: Solutions where the spool performs the stroke are also possible, in addition to the conventional variant where the traverse distributes the material between the flanges of an axially stationary spool.

This is advantageous for ribbons and other material that cannot or must not be laterally deflected. ■

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