

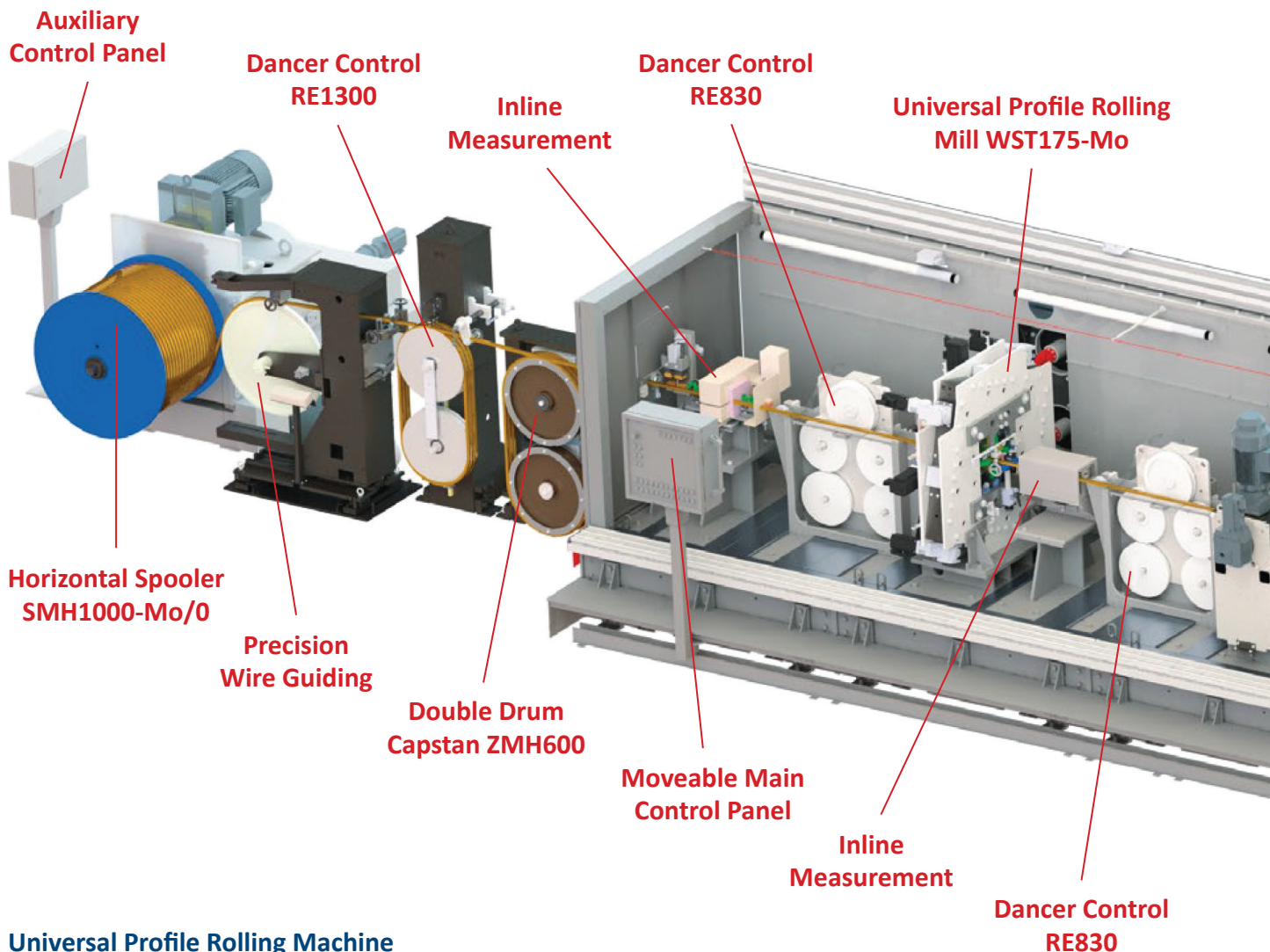


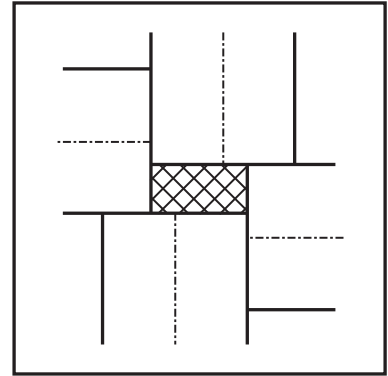
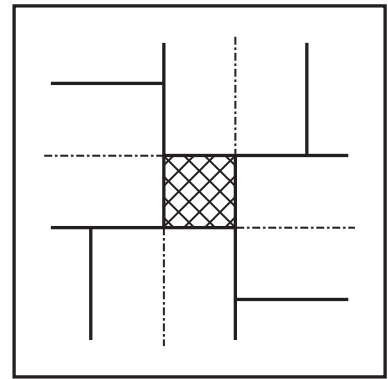
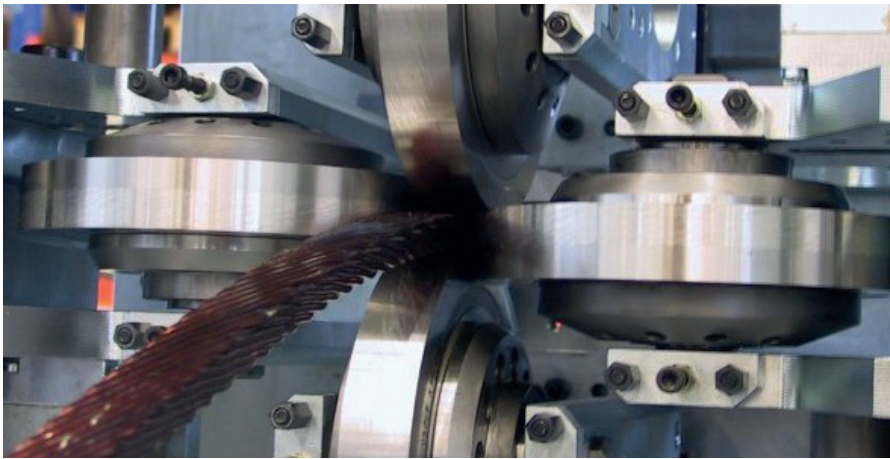
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## Rolling Mills

From complete production lines to individual component parts, Techna can supply rolling mills for the production of shaped, flat and round profile wires.

With over 70 years experience in the field, Fuhr Rolling Mills have perfected the technology of rolling complex profiles to within  $\pm 0.002\text{mm}$  accuracy.





Fully self-calibrating systems with integrated measurement and auto-adjusting rolls are possible, giving repeatability and reducing the reliance on operator skill for quality product.

Machine components are secured to a modular machine-bed which is fully contained to allow recycling of rolling lubricants. Extraction systems can be added to catch vaporised coolant.

Turnkey operation is standard, with state-of-the-art CNC controls, programming recipes and process visualisation. A sliding control panel allows observation and control of the production at any point. Interlocked safety fencing is also available.

Line speeds can be up to 1,000m/min, reducing the payback period of the investment by allowing for high production volumes.

**Rounding Rolling Mill WSE150-Mo**

**2-High Rolling Mill WSR225-Mo**

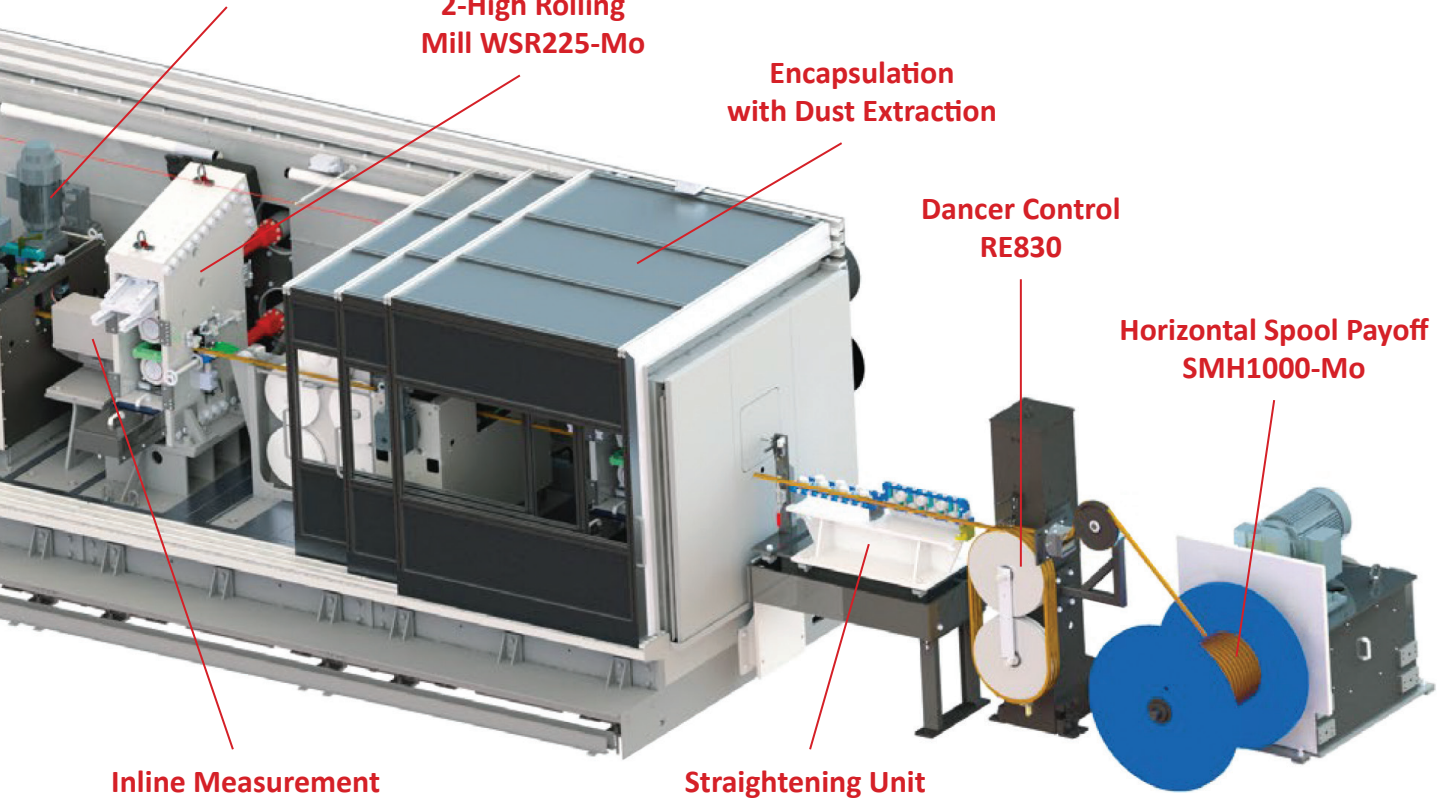
**Encapsulation with Dust Extraction**

**Dancer Control RE830**

**Horizontal Spool Payoff SMH1000-Mo**

**Inline Measurement**

**Straightening Unit**



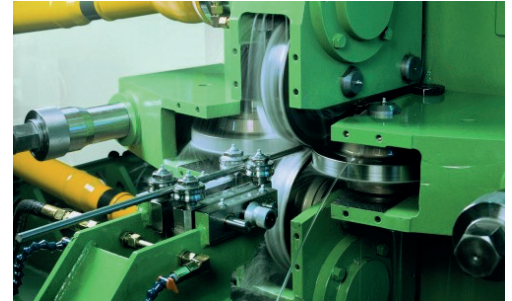
## Rolling Devices

Each design of rolling mill can be offered with the basic configuration of undriven rolls and manual adjustment. Additional options are available for roll force measurement, lubrication systems, high-precision step motor control for roll position, wire guides and individual rotary drive on each roll.

### WN Series - Profiles

The WN Series is the standard design for producing profiles with 4 adjustable rolls. They are used when profile wires need to be produced economically and normal levels of precision are sufficient. This series provides the largest 4-roll profiling mill available on the market.

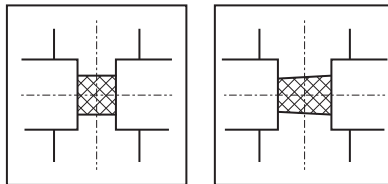
In the development of the WN profile rolling mill, great emphasis was placed on fast set-up in order to meet the requirements of flexible production. Rolling mills of type WN are robust, require little maintenance and are designed for operation in tough, demanding environments.



Order Ref.	Roll Diameter (mm)	Max. Roll Width (mm)	Rolling Force (kN)
WN2	100 - 110	25	20
WN4	125 - 140	30	40
WN8	160 - 180	40	100
WN10	235 - 260	55	250
WN12	290 - 320	64	450
WN14	360 - 400	90	650
WN16	460 - 500	110	1120

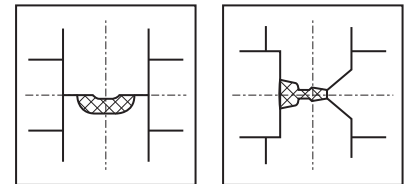
#### Square and Trapezoid Profiles

- Upper and lower roll as a special roll
- Side roll as universal roll



#### Special Profiles

- Roll set specially shaped for the particular profile
- Automatic calibration

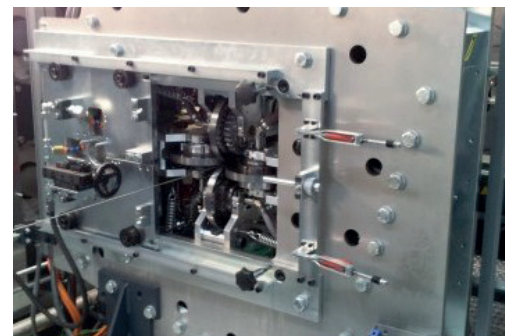


### WSN Series - High Precision Profiles

The WSN range offers the highest levels of rolling accuracy, with complex profiles produced to within  $\pm 0.002\text{mm}$ . The high stiffness that is required to do this is produced by the fundamental mechanical design concept, with surrounding frame and linear roll positioning by a wedge mechanism with linear guides free of play.

In the development of the WSN profile rolling mill, special emphasis was placed on short set-up times and reproducible settings in order to meet the requirements of flexible production.

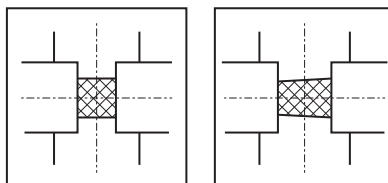
Rolling mills of WSN type impress with extremely low maintenance requirements. All components are protected from corrosion by galvanization.



Order Ref.	Roll Diameter (mm)	Max. Roll Width (mm)	Rolling Force (kN)
WSN 112	106 - 120	20	40
WSN 175	170 - 190	32	112
WSN 280	270 - 300	50	300
WSN 350	350 - 380	60	500

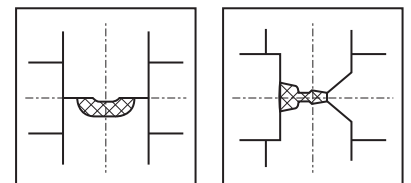
#### Square and Trapezoid Profiles

- Upper and lower roll as a special roll
- Side roll as universal roll



#### Special Profiles

- Roll set specially shaped for the particular profile
- Automatic calibration





## WSR Series - Flat Wire

2-high rolling mills are used mainly for the production of flat wire from round, or for further altering the profile of flat input wire.

Fuhr's WSR Series offers higher stiffness than equivalent designs and results in higher precision of produced profiles.

Unique to the WSR is the ability to oscillate the rolls crosswise to the wire during rolling operation. This greatly increases the working life of the rolls as the entire surface wears at an even rate.

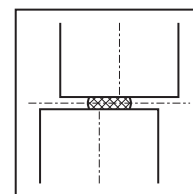
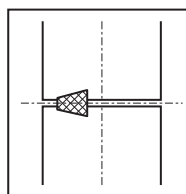


Order Ref.	Roll Diameter (mm)	Max. Roll Width (mm)	Rolling Force (kN)
WSR 112L	108 - 120	60	75
WSR 140XL	145 - 160	80	189
WSR 225	200 - 220	140	540
WSR 225XL	240 - 260	140	540
WSR 280	270 - 300	200	900
WSR 350XL	370 - 400	220	1300

### Profile and Flat Wires

By the use of profiled rolls, the WSR Series 2-high mill can also be used to produce profiled wire. The two rolls are aligned precisely to each other by the use of axial roll adjustment by servomotors.

Plain rolls are used to produce flat wire. Here the rolls oscillate across the wire to avoid track marks on the roll surfaces.

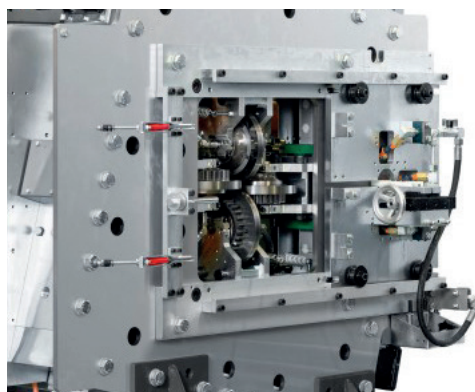


## WST Series - Universal Profiling (Turks Head)

The special feature of the WST profile rolling mill is the adjustability of the rolls in the axial direction. Each roll can thus be adjusted radially and axially to give the desired shape.

This special flexibility allows the WST type profile rolling mill to produce a whole range of wires with a rectangular or square cross section using only one standardized set of rolls. This saves the time, the cost and the labour required to change the rolls for the desired wire profile.

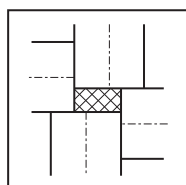
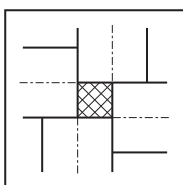
The WST type rolling mills have extremely low maintenance requirements. All components are protected from corrosion by galvanization.



Order Ref.	Roll Diameter (mm)	Max. Roll Width (mm)	Rolling Force (kN)
WST 112	106 - 120	20	40
WST 175	170 - 190	32	112
WST 280	270 - 300	50	300
WST 350	350 - 380	60	500

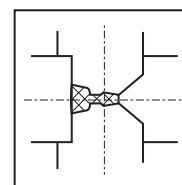
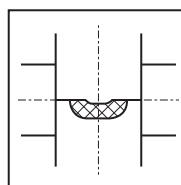
### Square and Rectangular Profiles

- All wire dimensions with a single set of rolls
- Specification of the wire dimension on the touch panel



### Special Profiles

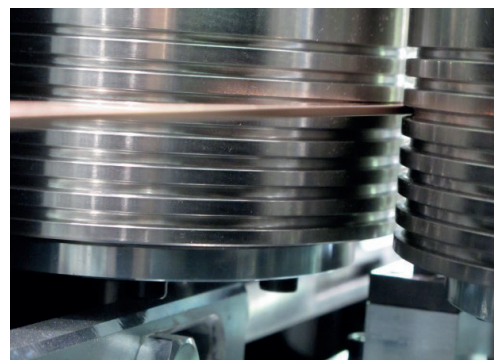
- Roll set specially shaped for the particular wire profile
- Automatic calibration



## WSE Series - Precision Rounding

WSE Series are used to roll defined edge radii on rectangular profile wires (known as rounding). The WSE range is characterized by two rolls on a vertical axis which can be adjusted in and out to allow for a range of width profiles. They can also be adjusted to switch between different groove profiles. Their use is almost always combined with 2-high mills (type WSR) or profile rolling mills (WN, WSN or WST type).

In the development of the WSE profile rolling mill, special emphasis was placed on fast reconfiguration and reproducible settings in order to meet the requirements of flexible production. This mill exhibits high rigidity due to the double-sided roll mounting and linear roll adjustment. WSE type rolling mills have extremely low maintenance requirements. All components are protected from corrosion by galvanization.

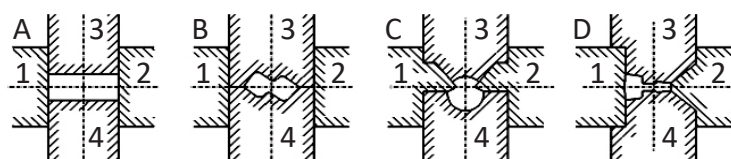


Order Ref.	Roll Diameter (mm)	Max. Roll Width (mm)	Rolling Force (kN)
WSE 96	96	52	25
WSE 150	150	80	60

## Rolling Heads

### WN Series - 4-Fold Profiling Head

Four rolls in one plane. Each roll is individually adjustable by hand. Optional quick release for effortless wire threading. Universally applicable to many kinds of profile wire.



A = Rectangular Profile with variable thickness

B = Special Profile produced with two rolls

C = Catenary Contact Wire

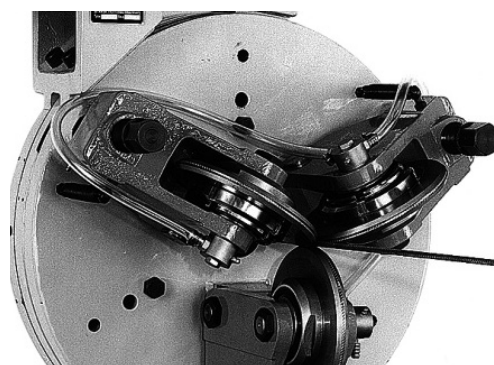
D = Collector Profile for DC motors



### WF Series - Ribbing Head

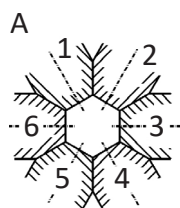
Three rolls in one plane, individually adjustable by hand. Optional motorised roll adjustment for all three rolls synchronously.

The WF Series roll heads are generally used for ribbing of reinforcement or pre-stressed steels. They are also ideally suitable for the production of triangular or hexagonal (in two steps) profiles.

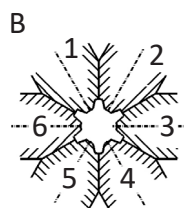


### WA Series - 6-Fold Profiling Head

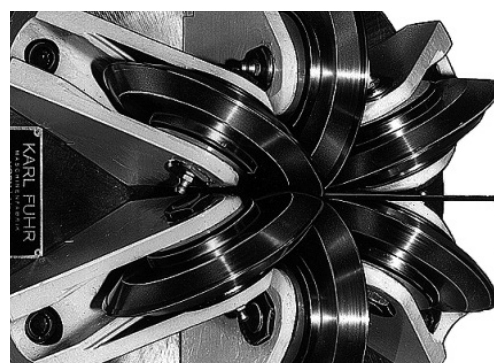
Six rolls in one plane. Suitable for hexagonal wire or special profiles.



A = Hexagonal Profile



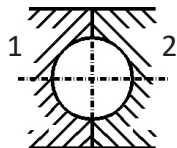
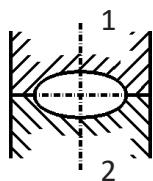
B = Special Profile (e.g. for Nails)



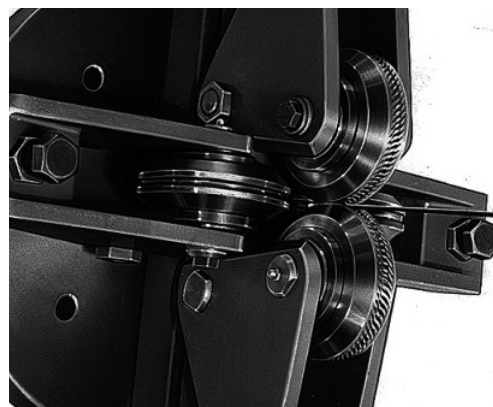
## WB Series - Reduction Head

Two roll pairs in two different planes process the wire sequentially.

WB Series roll heads are suitable e.g. for cross section reduction of round wire with the so-called round – oval – round sequence.

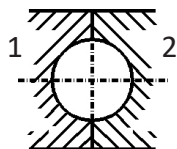
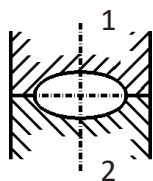


1st Step = Round wire is rolled oval  
2nd Step = Oval wire is rolled round

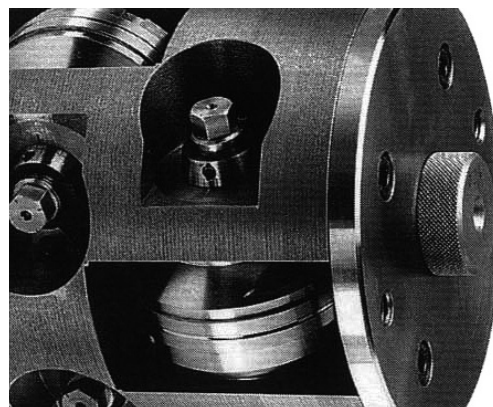


## WKA Series - Reduction Roller Cassette

Two roll pairs in two different planes process the wire sequentially. Like WB Series, but far more compact design. Suitable for cross section reduction of round wires as an alternative to drawing dies.



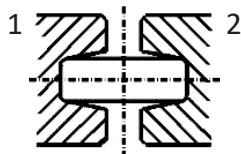
1st Step = Round wire is rolled oval  
2nd Step = Oval wire is rolled round



## WR Series - Rounding Head

WR Series roll heads are used e.g. for rolling edge radii (so-called edging) on flat wires. Roll adjustment by hand. Optional quick release for effortless wire threading or motorised roll adjustment.

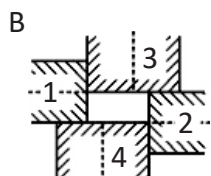
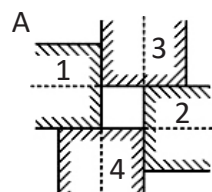
The combination of two WR Series roll heads produces the same possibilities as the WB or WKA Series.



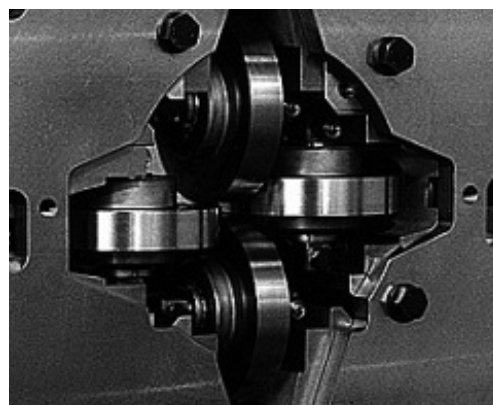
## WT Series - Turks Head

Four rolls in one plane. Universal head for rolling rectangular and square profiles with just one standard roll set, i.e. without changing rolls.

With the use of profiled rolls, special profiles can also be produced as with the WN Series.



A = Square Profile  
B = Rectangular Profile





## Spoolers

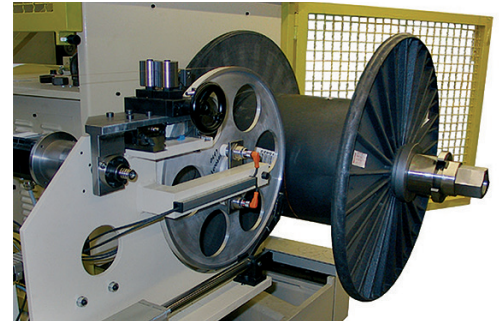
Fuhr's range of spoolers offer high precision wire winding and can be used with a variety of spool designs and materials.

The production of coreless coils is also possible with the use of an expanding mandrel.

Line speeds can be up to 1,000m/min.

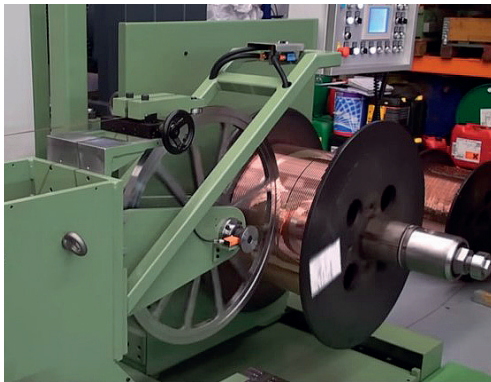
### Options available include:

- Static spool with traverse to control layer winding
- Traversing spool with pitch and stroke width control via control panel
- Dancers for speed synchronisation and tension regulation
- Precise material guiding - can include guidance of the wire to the winding point on the reel via a moving guide wheel
- Faultless layer winding for square and rectangular wire cross sections
- Automatic measuring of empty reels via optical sensors
- Lifting tables for loading and unloading



## SMH Series - Cantilever Spool Support

Single sided cantilever spoolers give easy access to change reels and are used when the bore of the reels are big enough for them to be mounted on a stable spindle. This means that coil bore and weight must be in an appropriate relation to one another.



Order Ref.	Gross Load Capacity (kg)	Max. Reel Diameter (mm)	Oscillation Stroke (mm)
SMH630-Mo	1000	800	-
SMH630-Mo/O	1000	800	630
SMH1000-Mo	2000	1000	-
SMH1000-Mo/O	2000	1000	860
SMH1600-Mo	4000	1600	-
SMH1600-Mo/O	4000	1600	1290

## SMH-Pi Series - 2 Sided Spool Support

2 sided spool support allows for larger payloads and higher winding speeds than SMH Series.



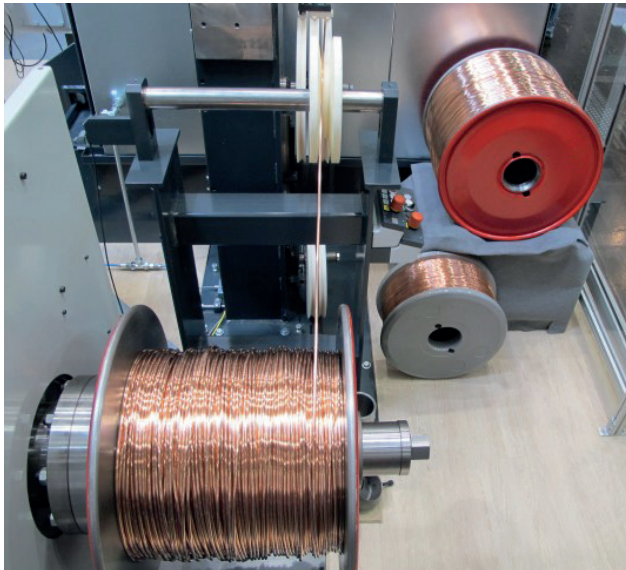
Order Ref.	Gross Load Capacity (kg)	Max. Reel Diameter (mm)	Oscillation Stroke (mm)
SMH630-Mo-Pi	1500	1000	-
SMH630-Mo/O-Pi	1500	1000	630
SMH1000-Mo-Pi	3000	1300	-
SMH1000-Mo/O-Pi	3000	1300	860
SMH1600-Mo-Pi	6000	1600	-
SMH1600-Mo/O-Pi	6000	1600	1290

## Payoffs

A range of Payoffs available to suit input spool type.

### Horizontal Reel Payoff

- With cantilever or double-sided reel Take-Up
- For reels from 500kg to 4,000kg
- Optionally with oscillation for straight input into the line, particularly useful if flat wires have to be rolled in two passes



### Horizontal Coil Payoff

- Driven carrier roller to support the wire coil
- Hydraulically adjusted bending rolls for adjustment of the wire
- Integrated roll adjustment mechanism with hydraulic setting
- Optionally available with a double Payoff
- Wire diameter 12 to 32mm



### Rotating Coil

- Driven unwinding plate for mounting of wire carriers
- Speed controlled or with dancer regulation
- Wire diameter 5 to 16mm



### Static Vertical Coil Payoff

- For pulling off round wire from pallets, carriers or out of drums
- Continuous operation by welding the ends of the wire together while the line is running





## Other Components

### Drawing Machines

- Diameter reduction of the incoming wires to minimise goods in stock
- Lubrication with emulsion
- Optional water cooling of the drawing drum



### Dancer Control

- For the regulation of the wire tension between the rolling mills
- Wire submersion cooling
- Wire path in accordance with dimensions:
  - a) Straight line operation for large cross sections
  - b) Deflection operation for small cross sections



### Wire Measurement

- Contact measurement using rolls for width and thickness
- Automatic wire dimension control by comparison between target and actual dimensions
- Trending diagram in operator panel
- Data export as csv file or via network interface



## Applications

Fuhr's rolling mills supplied by Techna are trusted by world leading manufacturers to produce a wide array of products. Rolled wire forms a critical component of many modern day supply chains and must be produced economically with high repeatable precision. Products manufactured on Fuhr rolling mills support a variety of major industries to the extent that it can be difficult to get into a car or even turn on a light switch without involving a wire rolled in a Fuhr mill.

### Automotive and Transport

#### Piston Ring

Profiled wires are rolled on Fuhr rolling mills for the production of these key components, before being bent into piston rings. Micrometer levels of precision as offered by our WSN series are required as the oil-film coating these piston rings is less than a thousandth of a millimetre thick and deviations from a given profile will change this value.



#### Thread Insert (Helicoil)

The rolling of high precision diamond shaped wire is the key to producing a high quality threaded insert. These are used in very high volumes in a range of industries including aviation (tens of thousands of thread inserts are required per aircraft). Fuhr mills can produce the precision required even at high line speeds, thus allowing high volume production on a single line.



## Starter Gear Ring

Fuhr rolling mills roll wire of medium carbon content into a profiled wire with a trapezoidal cross section. From this profile wire, a ring is then bent and welded. In further processing steps the rings are machined, the teeth are cut, hardened and tempered.



## Spiral Spring

Spiral springs are used in a range of applications in automotive production. These include the roll-up function of seat belts and adjustment of the backrest on front seats. Flat wires are rolled from high carbon steel wire and the spring properties are generated either by the strain hardening achieved in the rolling process (cold rolled springs for safety belts) or from subsequent heat treatment (oil tempered seat inclination springs).



## Wiper Blades

To distribute the contact pressure of a windscreen wiper blade evenly, there are two thin, elastic stainless steel inserts in the rubber profile of the blade. Fuhr rolling mills have been extensively used in this application, producing both the stainless steel inserts of the wipers and the arch of the single wiper blade, which are both rolled from round wire.



## Clutch Spring

Dual mass flywheels are used on some vehicles between the crankshaft and clutch. The two halves of this flywheel are connected together with two or four circularly curved spiral pressure springs. To produce these, round wire is slightly flattened by a rolling process on two sides before entering the spring coiling machine, in order to reduce the unit length of the springs without significantly reducing the spring force.



## Retaining Clip (Circlip)

Demanding applications require circlips with very accurately defined properties that cannot be achieved by the usual method of punching. With Fuhr rolling mills, high carbon steel round wire is rolled into slightly trapezoidal wire with flat faces and relatively sharp edges. Due to the difference in circumference of the inner and outer faces, as the wire goes through the final bending process by pre-rolling the wire into a trapezoidal shape, the final shape after bending is returned to a rectangular cross section.



## Drive Train (CVT)

The task of the CVT (Continuously Variable Transmission) chain in a drive train is the transfer of power from one pair of conical pulleys to the other. Fuhr rolling mills are used to roll the bolts and the link plates used within CVTs. Here, particularly great emphasis is placed on precision, since the slightest error will have significant cumulative impact on the total length of the chain due to the large number of chain links.





## Energy and Utilities

### Continuously Transposed Conductor (CTC)

To improve efficiency and package size, the windings of electric motors, generators and transformers are increasingly produced with rectangular profile wire. This needs to be rolled from round copper wire to a high level of accuracy to allow for insulation to be applied and give a tight winding.



### Flexible Pipe Armouring

Special interlocking profiles are used to form the armouring that allows undersea umbilical pipes to withstand massive pressures and safeguard the operation of offshore platforms. The largest WN series Fuhr profile rolling mills are best suited to this production due to the size of the profiles and the stiffness of the steel grades used.



### Photovoltaics

Fuhr provides mills for the rolling of PV interconnect ribbons. These are used in the production PV modules by connecting the individual component PV cells. They also roll the rectangular busbars that carry the current produced from round copper wire.



### Trolley Wire

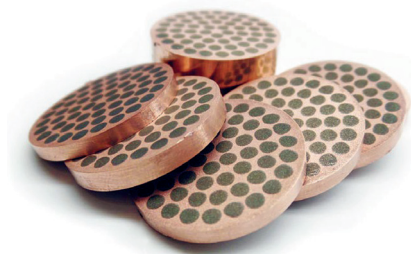
This method of providing power to rail systems employs rolling mills to reduce the cross section and increase the strength of the copper conductor. Profiling is then done in another pass by a machine like the WN series for the most economical production.



## Medical Engineering

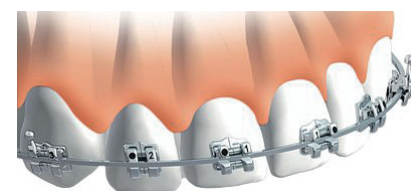
### Superconductors

Magnetic Resonance Imaging (MRI) uses superconductors produced from rectangular profile wires to give the higher packing density required in the coils. Ideally, Fuhr type WST universal profile rolling machines are used for this purpose, thereby dispensing with roll changes for the production of different round wires.



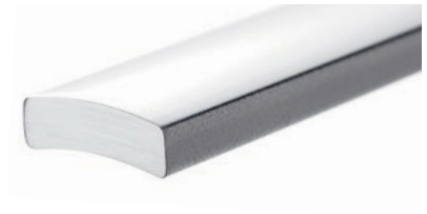
### Tooth Brace

The brackets glued to the tooth surface are produced from a specific profiled wire produced by cold rolling. In addition the wires which then join the brackets are formed from high strength stainless steel wires with square cross-sections. These apply pressure to the brackets as well as tensile and torsional forces.



## Implant

With Fuhr cold rolling technology, splints for the stabilization of bone fractures are produced from stainless steel or titanium (see photo). The so-called memory metals that are employed in stents for widening coronary vessels are also brought into shape by cold rolling.



## Spectacle Frame

Both the bridge as well as the lens holders are produced in the cold rolling procedure from either stainless steel or titanium. This is in addition to the spectacle hinges which are cut from longitudinally profiled wire.



## Construction

### Bridge Cable

Modern demands for improved performance have increasingly led to the use of profiled wires in the bunching process. Fuhr mills have been the name to trust in rolling mills for over 70 years.



### Reinforced Steel Bar

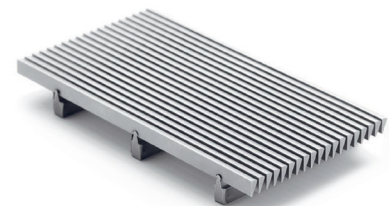
In the early 1950s, engineer and company founder Karl Fuhr developed a procedure for the ribbing of construction steel wire, marking the inception of the cold rolling process for reinforcing steels. Fuhr now supply the latest generation of rib roll heads as well as replacement rolls for this application.



## Production Technology

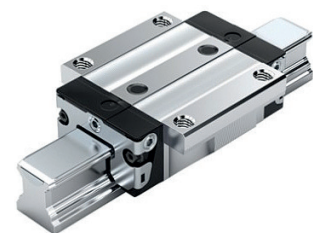
### Filter Screens

The triangle wire used in the production of these screens needs to be rolled with precision to meet tight specification of the filter gap. Fuhr WSN series offers this capability and can be offered with rolls that adjust automatically to keep the wire within set tolerances.



### Profiles Rail Guides

Production is done from coil to bar and replaces conventional single rod manufacturing steps such as hot rolling, bar drawing and the intermediate coating, cleaning and heat treatments. The high precision of these bars allows direct downstream processing by induction hardening and profile grinding.



### Bimetallic Saw Blades

Rolling saw edges from high speed steel for these parts offers a unique challenge due to the high hardness value. Fuhr are experienced in working with a range of materials and have the engineering skill to solve challenges.

