Straightening in punch and shaping technology
Principle of roller straightening

- Metal sheets up to more than 50 mm in thickness and metal strips down to the thinnest sheets are straightened in straightening machines before further processing.
- The sheets are subjected to a process of bending back and forth between rollers arranged as shown above with decreasing curvature. The number of straightening rollers depends on the required straightening result. Hardest to straighten are sheets that have unevenness not only in the rolling direction, but also transverse to it. In this case at least one precision straightening machine is required and the straightening process may need to be repeated several times to eliminate the multiaxial tension states in the sheet. The best straightening results are achieved on a precision straightening machine designed with extremely limited stretching and equipped with roller deflection.
Why is straightening necessary?

- To eliminate residual stress
- To eliminate coil curvature
- Higher quality requirements for the final product
- To lengthen the service life of tools
- Faults in the tool are reduced
- To increase the stroke number of the punching machine
- To increase the shape stability of parts after punching
- To restore evenness to parts after punching
How is straightening performed?

**Normal run-through straightening**

- In this process the thickness of the material is adjusted at the machine discharge and the thickness feed rate is adjusted at the machine infeed. The corresponding values can be calculated with the convenience version of the control unit or can be taken from the feed rate diagram. The material is straightened in the run-through direction in this process.
Stress/strain diagram

- Deformation above the elastic limit
- Straightening occurs in the plastic range
Run-through straightening plus straightening of elevated edges

- In this type of processing the strip also undergoes "sword straightening". This effect occurs due to clamping of the strip before and after the straightening machine. The elevated edge straightening mechanism at the discharge is moved away from the centre. However, the actual effect of elevated edge straightening occurs in the straightening machine, since that is where the material is in a plastic state.
Run-through straightening with roller deflection

- This is the most extensive type of straightening.
- Strips that do not have the same thickness over the entire width and therefore have different lengths exhibit lateral curvature of the strip. A distinction is made in this case between edge ripples and centre ripples.
- To rectify these errors, a straightening machine with roller deflection is required. This allows for a feed rate of individual support roller blocks.
What are the requirements?

- The strip must exhibit uniform strength over the entire cross-section (no rolling skin).
- There must be an elastic limit.
Are the material properties changed?

- The elastic limit can easily be slightly increased by strain hardening of the material.
- Slight loss of magnetisation may occur
How can I achieve good straightening results?

- Good initial material
- The smallest possible straightening roller diameter + roller distance
- Straightening machine with low strain and bending
- At least 9 straightening rollers to straighten coil curvature
- At least 15 rollers for flat straightening, optimally 19/21 pieces
- Straightening rollers must be supported.
Layout of straightening machine
Straightening machine without support
Straightening machine without support

- **Advantage:**
  - Simple layout
  - No wear on straightening rollers caused by pressing against the support rollers
  - Cost-effective

- **Disadvantage:**
  - Larger roller diameter + roller distance, therefore poorer straightening results
  - Edge pressing against the bearing of the straightening roller (increased wear)
  - Bending of the straightening roller (straightening results)
  - Actually bending rather than straightening

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Straightening machine supported with intermediate rollers
Straightening machine supported with intermediate rollers

- **Advantage**
  - No marks visible on the strip that is being straightened
  - Increase in the rigidity of the machine
  - Cleaning effect on the straightening rollers by spiral groove

- **Disadvantage**
  - Numerous movable parts (wear + maintenance)
  - Price
Straightening machine drive

- Distributor gear
- Cardan shafts
- Drive motor
Drive

- All rollers are driven together by the distributor gear.
- Drive via three-phase motor, which has a frequency inverter as standard equipment. Depending on the application, a servo drive may also be used.
- Strip straightening machines are constructed with a run-through speed of up to 120 m/min for strip supply operation for pressing.
- Part straightening machines are designed for a maximum of 20 m/min.
Cardan shafts
Adjusting the straightening machine

Block roller setting via 2 axes
Manual roller mill adjustment with handwheels

- The upper roller mill is adjusted by 2 handwheels assigned to the machine infeed or to the machine discharge/infeed.
- The thickness of the material being straightened is adjusted on the discharge side.
- A feed rate below the material thickness is selected on the infeed side. The corresponding setting values can be taken from the feed rate diagram included with delivery.
- Two digital dial gauges are used to measure the machine setting.
Motor-driven roller mill adjustment with digital display
Motor-driven roller mill adjustment

- Setting made by 2 spur gear motors which adjust the height of the machine infeed and discharge respectively.
- Measurement of the machine setting is made by two position encoders. The measurement can be read digitally with an accuracy of 0.01 mm on the control computer.
Distributor gear
Inserting aid

Strip pressing device
Holding-down device
Insertion wedge
Quick change device
Quick change device
Control unit
Convenience version of control unit

- Help texts can be accessed from error messages for faster resolution of errors.
- History memory for querying faults that have occurred with a record of the date and time when the error occurred, when the fault was eliminated and when the fault message was deleted.
- Status display for all important operating states. Example: Tables in lower final position, insertion wedge in rear, etc.
- Help texts for the individual control menus (explanation of functions)
Presetting
Entering setpoint values

- Infeed
- Discharge
- Strip width
- Strip thickness
- Strip strength
- Number of strokes
- Feed length
Data storage
Memory storage for saving

- Width of band
- Strip thickness
- Infeed
- Discharge
- Feed length
- Number of strokes
- Speed
Product overview

Reels
Straightening machines
Feeds
Transverse shears
Reels
Carrying capacity 10-250 kN
Straightening machines
Thickness of material 0.1 - 25 mm
High-performance roller feeds
Thickness of material 0.2 - 12 mm
Reel for light strips
Double unwinding reel
Compact unwinding system
Straightening unit
Straightening unit
Strip system
Strip system for fine stamping press
Max. cross-section 500x14
Transverse part system
Cross-section 200x12 stainless steel