Rolling mills for copper wire

Increased productivity!

Copper flat wires rolled with turks heads
FUHR Mills & COPPER

• **Example**
  – Shaped wires for commutators
FUHR Mills & COPPER

- Example
  - Trolley wires for trains
FUHR Mills & COPPER

- **Example**
  - Flat wires for electrical transformers, motors, generators, ....
Magnet wire applications

- **Insulated Winding Wires**
  - single or multi-flat wire conductor
  - enameled or film insulated
  - used in transformers, motors, generators ...
Magnet wire applications

- **Insulation types**
Magnet wire applications

- **Continuously Transposed Conductors (CTC)**
  - stranded multiple flat wire conductor
  - enameled or film insulated
  - used in transformers, motors, generators ...
Magnet wire specifications

• **International standards IEC60317-... define:**
  – electrical properties
    • conductivity
    • insulation quality ...
  – mechanical properties
    • tensile strength ...
  – Dimensions
    • thickness and width
    • corner radii
    • tolerances
Traditional rolling process

- Round wire as raw material
- Optional in-line drawing
- Flat and edge rolling
- Spooling
Traditional rolling process

- **Disadvantages**
  - low width accuracy (e.g. > +/- 0.02 mm)
  - low straightness of lateral sides
  - low radius accuracy
Traditional rolling process

• **Disadvantages**
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• **Problems in enameling with dies**
  – irregular thickness of enameling layer

• **Problems in enameling without dies**
  – today’s requirements on precision can not be fulfilled
Calibration with dies

- **Advantages**
  - simple machinery
  - stable process
  - high precision

- **Disadvantages**
  - low speed
  - high tool costs because of
    - excessive wear of dies
    - great number of wire dimensions
## Standardized sizes

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Nennquerschnitte in mm².
Universal turks head

• **Alternative to edge rolling and shaped dies**
  – Adjustable
    • one set of rolls covers all dimensions
    • compensation of wear, heat expansion of rolls and wire springback by roll adjustment
  – Rolling contact instead of sliding
    • uncritical lubrication
    • higher speeds
Two high mill <-> Turks head
Two high mill <> Turks head
Two high mill ↔ Turks head
Universal turks head calibration

- **Comparison with edgerolling**
  - Better width accuracy
  - Straight sides
  - More precise radii

- **Comparison with shape drawing:**
  - Higher speed
  - Less wear
  - Adjustable dimensions
Production facts

• The following process parameters have been reached*:
  – Speed: 500 m/min
  – Accuracy: +/- 0.005 mm

* depending on size
Rolling mills for copper

Increased productivity!

Copper flat wires rolled with turks heads