CNC and robotic grinding and polishing technology for surgical instruments
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Grinding of extremely curved workpieces

CNC grinding machine with four-axle grinding table for grinding extremely curved radii at surgical scissors, tweezers, forceps or similar workpieces (more examples on the pages 10–11)

- two linear and two rotating axes for strongly curved radii
- sensor programming by scanning the contour with direct export of dimensions to programmer interface (see also p. 11)
- grinding table swivel +/- 50°, programmable hollow angle, e.g. on inside of scissors
- economic machining of small series
- grinding table with four-axle digital Windows® control
- automatic grinding wheel wear compensation via integrated CNC axis, using gage control with gage probe and digital display of grinding wheel wear
- automatic, central lubrication system with interval-controlled grease
- remote maintenance, diagnostics and debugging with teamviewer

Different machining in separate clampings, e.g.:

1. Half-moon
2. Hollow inside
3. Exterior
4a.–4c. Exterior facet grinding
BG0/RV/NT2-CNC with automatic loading/unloading, parts feeding by vibratory feeder, position recognition on conveyor using camera system and loading by six-axis robot.

BG0/RV/NT2-CNC grinding machine for sequential machining of half-moon and inside or inside of the top and the bottom shear blades on surgical scissors.

BG0/RV/NT2-CNC grinding machine for external machining of surgical scissors.
Surface grinding

CNC grinding machine with three-axle grinding table for bevel grinding of blades at knives, scissors, hand tools or similar workpieces.

In the field of surgery, the BG1/ZA/NT2-CNC is employed for grinding the inside shank of surgical scissors.

It can be combined with milling centers or bending stations (see p. 26–27).

• three-axle CNC grinding machine
• grinding wheel with 450 mm (17.7") diameter
• 11 kW, up to 3000 UPM
• grinding stroke up to 350 mm (13.8")
• automatic robotic loading with ABB, Mitsubishi, Kuka or other
• magazining of surgical scissors and instruments
Automation – with milling center and a press for bending surgical scissors

Automation – with a CNC bending station for surgical scissors
Applications BG-CNC

The grinding machines of the series BG-CNC are employed for grinding surfaces at knives, scissors, hand tools and similar workpieces.

Thanks to a big variety of types, flat surfaces can be machined (BG/NT2-CNC) as well as workpieces with extremely curved radii (BG/RV/NT2-CNC) and curved blades (BG/RH/NT2-CNC).

For grinding the inner and the outer side polyester bound grinding wheels are employed.
Applications

- Surgical scissors (external blade machining)
- Surgical scissors (lower shear blade, inside)
- Bandage scissors (outer side)
- Microscissors and spring scissors
- Spring scissors (inside)
- Tweezers (spring and contour)
- Clamping device for reception of half-moon, upper lever / lover lever
- Eye tweezers (inside)
- Sprind grinding / tweezers
- Surgical scissors (external blade machining)
- Bandage scissors (outer side)
- Surgical scissors (lower shear blade, inside)

Laser measuring of contour and transmission to operating interface
Contour grinding machines

CG-CNC

Contour grinding

CNC belt or stone grinding machine with two axis for contour grinding of tweezers, knives, scissors, hand tools and similar workpieces

- CNC wet belt grinding machine with belts with a length of 3,500 mm × 200 mm (137.8” × 7.9”)
- 15 kW, up to 4000 UPM
- contact wheel support in two versions: 80–200 mm diameter (3.2”–7.9”) or 30–100 mm (1.2”–3.9”) with additional bearing

- grinding stroke up to 550 mm (21.7”), grinding width 180 mm (7.1”)
- automatic magazine recognition for sequential machining of various part types
- automatic central grease lubrication system
- automatic cross oscillation
- adjustable belt arm 0–45°
- identification system for magazines for automatic program recall
- sensor programming, measuring of contour shape and feeding data directly to the CNC program by finished or raw parts
- remote control, monitoring and diagnostic via teamviewer
- different magazine constellations for the machining of tweezers or parts of tweezers (p. 13)
CG1-CNC with belt-clamping arm grinding belt oscillation (high edge)

Loading magazine for surgical tweezers (welded tweezers / high edge)

Loading magazine for surgical tweezers (single part)

Loading magazine for surgical tweezers (welded tweezers / high edge)

Loading magazine for components of surgical tweezers

Loading magazine, grinding of the inner side

CG1-CNC: various magazines with automatic magazine recognition

CG1-CNC: grinding machine with drum magazine and shifting station for the machining of surgical scissors
Peripheral grinding machines

PH/PB-CNC

Surface grinding

CNC peripheral grinding machine with three to five axes grinding table for grinding of the convex exterior and hollow inside of scissors.

- three to five-axle CNC grinding machine
- peripheral wheel with 200–400 mm (7.9”–15.7”) diameter (depending on the application)
- dressing unit with diamond-coated dressing roll and / or diamond fleece
- 11–18 kW, bis 5000 UPM
- grinding stroke up to 350 mm (13.8”) or up to 490 mm (12.3”)
- automatic robotic loading with ABB, Mitsubishi or Kuka and other
- magazining of surgical scissors and instruments
Grinding of convex exterior

Grinding of cross tooth system for bone saws

Grinding of the hollow inside by plunge cut method, hollow radius: 150 mm
Peripheral grinding machines

WS-CNC

Serrated grinding – plunge grinding and through-feed grinding

CNC peripheral grinding machine with up to three axes for plunge grinding of serrations at knives, surgical blades, scissors or similar workpieces

- CNC controlled with display of all operating information / programming of up to three axes
- horizontal wheel motion by AC servo motor driven by preloaded precision ball screw
- maximum grinding width 100 mm (3.4")
- simple workpiece oriented programming with entry of dimensions / parameters
- dressing of the grinding wheel with diamond coated dressing roll, tool steel crush roll or programmable single point diamond
- automatic compensation of workpiece plunge travel after each dressing cycle and maintenance of selected rotational wheel speed (by frequency variation)
- programmable moving at a straight grinding wheel
- composition of the grinding wheel at cross table for plunge grinding and through-feed grinding (WS6-CNC)
- cross tooth grinding at saws in connection with a vertical and a pivot axis for saws with a maximum length of 650 mm (25.6") during indexing operation
WS6-CNC for the production of gouge blades with camera measuring station and automatic loading and unloading

Universal grinding machine for different workpieces: choice between plunge and through-feed grinding, use of dressing wheels and diamond coated dressing rolls
Individual grinding

Example of use:

CNC rotary index table grinding machine for the grinding of scalpel blades with a pulling movement

- corresponding grinding station assigned to a rotary precision table
- processing of the grinding and polishing stations by "pulling" grinding with spiral wheel
- automatic loading and unloading system integrable
CNC rotary index table grinding machine of the series RST-CNC composed of:

- eight position rotary grinding tables for indexing
- two rotary modules for spiral grinding stations 1 and 2 with CNC-axis for both rotary modules, integrated into CNC control (B-axis)
- six mechanical clamping devices
- six workpiece plates exchangeable depending on the model
- two spiral grinding stations
- workpiece feeding by pneumatic pick- & place unit to feed scalpel blades to the magazining unit
- feeding magazine consisting of two vertical stacking magazines
- workpiece unloading by pneumatic pick- & place unit to unload scalpel blades from the station and to store it in the unloading magazine
- unloading magazine composed of two magazining swords
- ten-axle CNC control

Grinding machine RST4-CNC with four working stations

Grinding machine RST4-CNC – pull grinding of workpieces with spiral grinding wheel
Straight finish grinding, continuous grinding

The modular grinding station of the series BSM3000-CNC is designed as a single-sided grinding station BSM3000/E-CNC, as a doublesided grinding station BSM3000/D-CNC or as a doublesided polishing station BSM3000/DP-CNC.

In combination with de-coiler, measuring technique and re-coiler respectively breaker, 150 straight scalpel blades can be doublesided ground and polished in a minute (scalpel type 11).
BSM3000-CNC

- main motor: 15 kW or 2 x 15 kW
- frequency converter: 18.5 kW for programmable, constant peripheral velocity
- peripheral velocity: 30–50 m/sec (98–164 ft/sec)
- motorized angle adjustment: 0–35° with butterfly wings
- grinding wheel diameter: max. 300 mm (11.81")
- wheel / grinding width: max. 300 mm (11.81")
- bilateral precision spindle bearing
- cutting speed: max. 50 m/sec (164 ft/s)
- central lubrication
- configured for wet machining with grinding emulsion
- guideways are solid carbide or with carbide inserts
- various dressing systems available for grinding wheel profiles
Robotic machining of surgical workpieces

All-around machining of surgical tweezers

The robotic grinding and polishing systems of the series RSP can be equipped with different processing stations such as belt grinding stations, polishing machines or stone grinding stations.

For the production of surgical tweezers the robotic line can be composed in that way that an all-around machining of the workpiece can be performed.

- machining of the tip and the spring of the tweezer by a belt grinding station
- gripper station for all-around machining
- close grinding of the tip of the tweezers at the grinding wheel
Rough and final polishing of prostheses and hip joints

The robotic polishing station of the series RSP/2P is designed for polishing hip joints, prostheses and similar workpieces.

The robotic cell is equipped with:

- two polishing stations of the series P3
- robotic polishing station either integrated into an existing production line or erected as a separate processing station
- programming in the touch-in processor with a CAD/CAM interface
- integration of measuring systems for the compensation of workpiece location and measurement tolerances
- various machining stations with a variety of tools available (e.g. grinding belts, grinding stones, polishing discs)
Robotic machining of surgical workpieces

RSP

Facet grinding of surgical scissors

The robotic grinding stations of the series RSP can be composed in that way that they are designed for facet grinding of mounted scissors.

Depending on the requirements and the workpiece shape different working stations are employed.

The robotic cell RSP4B/1K/1M here presented is equipped with:

- four belt grinding stations of the series BSS10
- vertical rotary magazine
- camera measuring station with two cameras
Sharpening of micro scissors

The robotic sharpening station of the series RSP/1S shown here is designed for the double-sided sharpening of disposable micro scissors.

- double-sided sharpening station of the series DS
- workpiece oriented programming
- robot gripper including a reception for dressing device
Integration and automation of CNC milling centers

Centring, drilling, milling

• preparation of the workpiece for further grinding process (p. 6)
• special device for CNC milling centers with centring, drilling, tapping and milling of carbide recesses on surgical instruments
• fixture development and manufacturing
• robotic automation and process linkage to grinding or bending machine

1.–4. drilling and milling in connection with a machining center and a special clamping device
5. bending press to achieve the bending
6. grinding machine BG1/ZA/NT2-CNC, three-axis CNC grinding machine for the machining of the shank / inside (p. 8)
Automation – with milling center and press for bending of surgical scissors
Double shaft polishing machines

PS-CNC

Rough and final polishing

The CNC double shaft polishing machine of the series PS-CNC is designed for the polishing of bone nails, bone plates and similar flat material.

The machine is equipped with a control where all the process parameters are entered and stored.

Thanks to a short retooling time of a few minutes the machine can be employed economically for small series.

- PLC control for the adjustment of the machine (travels, distances, speed, etc.)
- maximum machining length 1.000 mm (39.4")
- continuously speed-controlled polishing shaft drive
- polish injection control
- automatic correction of polishing shaft wear
- shaft contact pressure adapted to the strain
- integration of 360° rotatable tool for the machining of rotatory workpieces
Profile generating centers

LP-CNC

Profile generating

Profile generating center for polygon machining and serrating of cortical screws, pedicle screws, compression screws and similar workpieces

- universally applicable production machine with fixed workpiece spindle
- improved cycle times thanks to very short machining and storing times
- turning and milling technique united on the profile generating center LP110-CNC for polygon machining and serrating by rotary profile generating
- tool slide designed to integrate additional tools for a variety of operations such as drilling, threading etc.
- freely programmable synchronisation between workpiece and spindle by electronic gear
- CNC compound slide rest with tempered flat guides
- reduction of cycle times at a minimum in comparison to conventional methods
- feeding of cylindric workpiece by the hollow spindle head
- designed for easy operation, change over and maintenance due to a large sliding door
Measuring technique

Development of standard measuring systems for various applications for the measurement and compensation of automated measurements / contours

• measuring system for automatic contour identification and measuring of surgical articles
• compensation of tolerances of forged parts
• employable for machines of the type CG1-CNC and BG0/RV/NT2-CNC and different robots
• robotic automation and procession connection with grinding and bending machines
Magazine systems

The design of loading / unloading magazines depends on various requirements:

- required magazine capacity (e.g. one hour or one complete shift)
- shape of the workpiece (forged, conical or flat)
- variety of workpiece shapes / dimensions, that should be processed
- integration in the preceding production stage (e.g. stamping) or subsequent processing (e.g. polishing, glazing)
- in which way the pieces are orientated (e.g. disordered in a glide grinding line)
Strong partners under one roof ...

The trade marks Heinz Berger, Hauschild, August Nell, Julius, Werner Peters and LP-Laschet stand for highest quality in the field of machining and refining metal coils and tools, e.g. household and machine blades, cutting tools, surgical instruments, cast or forged tools. Their in-house robotic capabilities provide solutions to automation and process integration tasks.

Trend-setting innovations in the fields of robotics and CNC machines for grinding and polishing tools, as well as state-of-the-art technology for strip edge trimming by metal-cutting and surface finishing, are available for coil stock and tools that demand high quality.

The first automatic grinding machines from Berger in 1957, the development of the Julius edge trimming machine in 1980, the first CNC controlled double-scallop polishing machine by Hauschild in 1987, the use of more than 300 robots for automating Berger grinding machines since 2000, as well as Nell’s development of the BSM3000-CNC grinding machine for micro-grinding coil stock with camera control – all important milestones for the Group and key driving forces for the metalworking industry.

Thanks to a broad product line, the synergistic effects in our engineering, R&D and production departments, and a competent customer service team, the Berger Group provides complete solutions – particularly for custom requirements – all from a single source.

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