

CNC and robotic grinding  
and polishing technology  
for surgical instruments

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# Workpieces

- Surgical instruments
- Scalpels
- Surgical blades
- Microscissors
- Bone saws
- Tweezers
- Surgical forceps
- Bone nails
- Bone plates
- Prosthesis
- Hip joints
- Lancets
- Surgical screws



# Industries

- Surgical industry
- Hand tool industry
- Cutlery industry



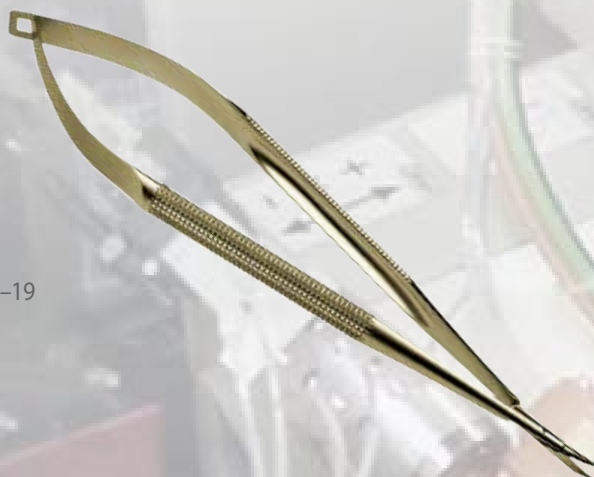


## Scalpels

Rotary index table grinding machine RST4-CNC, p. 18–19  
 Peripheral grinding machine WS-CNC, p. 16–17  
 Strip grinding machine BSM-CNC, p. 20–21  
 Contour grinding machine CG-CNC, p. 12–13

## Microscissors

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## Blades no. 12

Rotary index table grinding machine RST4-CNC, p. 18–19  
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## Surgical blades

Peripheral grinding machine PH/PB, p. 14–15  
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## Surgical screws

Profile generating center LP-CNC, p. 29

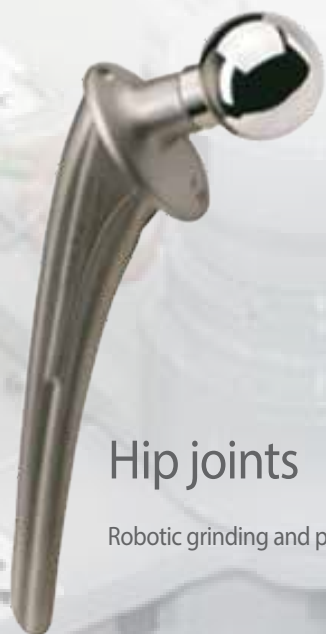


## Bone saws

Peripheral grinding machine PH/PB, p. 14–15  
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## Surgical scissors

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## Hip joints

Robotic grinding and polishing station RSP, p. 22–25

## Gouge Blades

Peripheral grinding machine WS-CNC, p. 16–17



## Surgical forceps

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## Bone plates

Double shaft polishing machine PS-CNC, p. 28



## Tweezers

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# Flat bevel grinding machines

BG0/RV/NT2-CNC

## Grinding of extremely curved workpieces

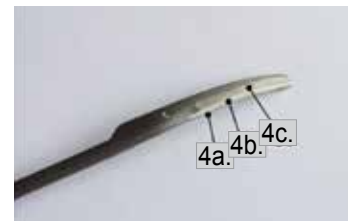
CNC grinding machine with four-axe grinding table for grinding extremely curved radii at surgical scissors, tweezers, forceps or similar workpieces

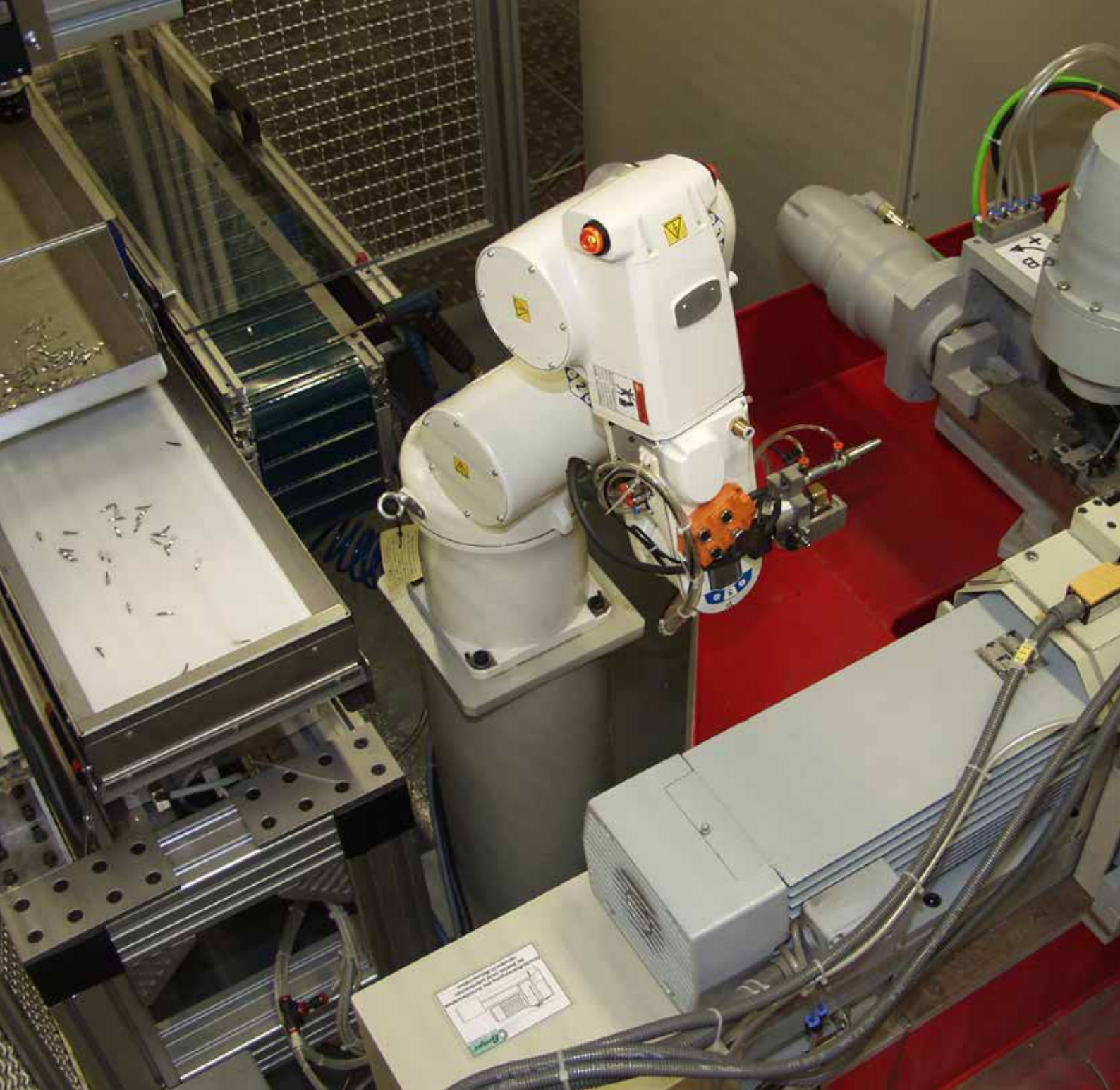


- two linear and two rotating axes for strongly curved radii
- sensor programming by scanning the contour with direct export of dimensions to programmer interface
- grinding table swivel  $\pm 50^\circ$ , programmable hollow angle, e.g. on inside of scissors
- economic machining of small series
- grinding table with four-axe 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

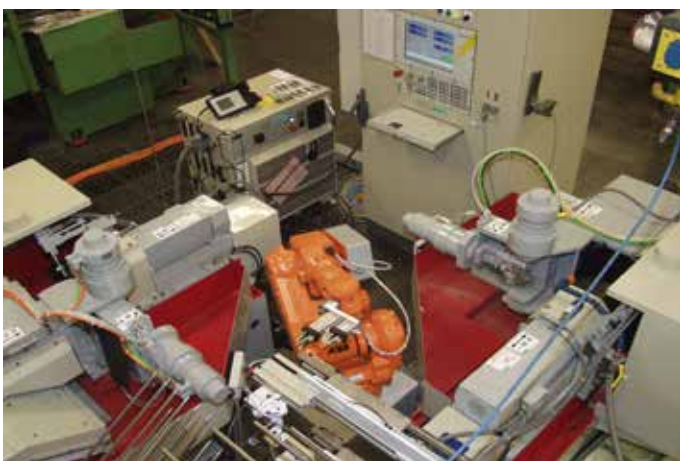
Different machining in separate clampings, e.g.:

1. Half-moon
2. Hollow inside
3. Exterior
- 4a.-4c. Exterior facet grinding

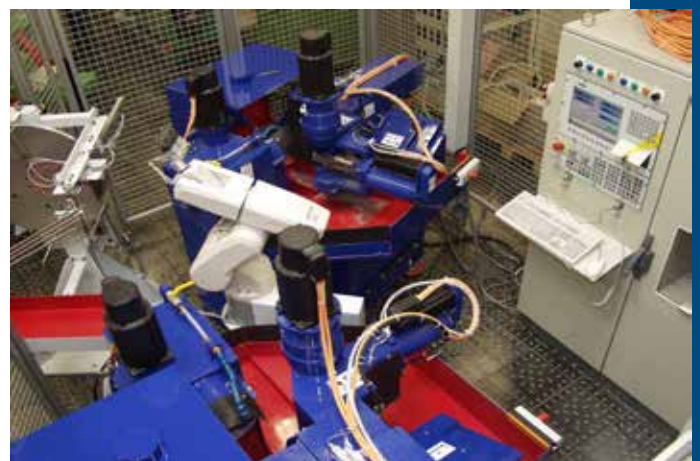




BG0/RV/NT2-CNC with automatic loading/unloading, parts feeding by vibratory feeder, position recognition on conveyor using camera system and loading by six-axis robot



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



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





# Flat bevel grinding machines

BG1/ZA/NT2-CNC

## 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).



BG1/ZA/NT2-CNC grinding machine – grinding of the inside shank of surgical scissors

- 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 a milling center and a press for bending surgical scissors



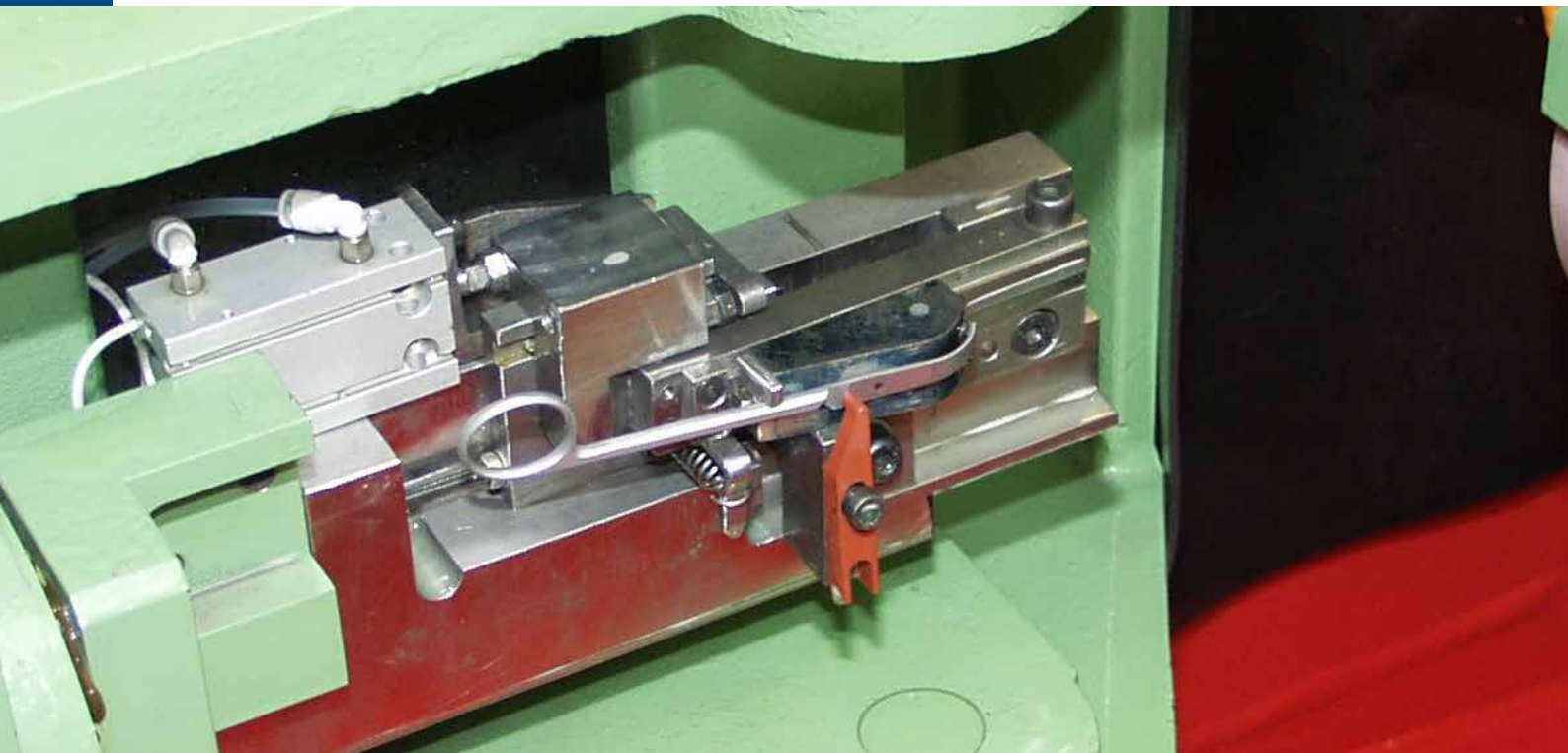
Automation – with a CNC bending station for surgical scissors



# 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).



Extremely curved scissors



Microscissors (inside)



Surgical pliers (manual loading)



Surgical pliers (automatic loading)



Measuring sensor for automatic contour detection, here for the machining of tweezers



Tweezers (spring and contour)



Eye tweezers (inside)



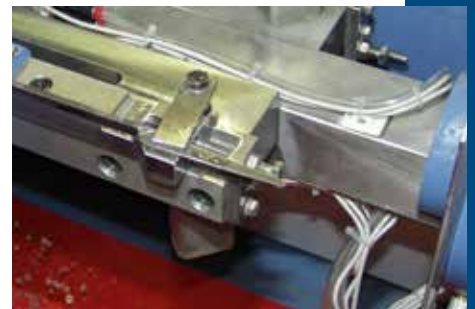
Surgical scissors (half-moon)



Microscissors and spring scissors



Spring scissors (inside)



Grinding of the inside shank of surgical scissors



Surgical scissors (external blade machining)



Surgical scissors (top shear blade, inside)



Surgical scissors (lower shear blade, inside)





# Contour grinind 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



Contour grinding machine of the series CG1-CNC for the production of tweezers

- grinding stroke up to 550 mm (21.7") , grinding width 180 mm (7.1")
- automatic magazine recognition for serquential 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



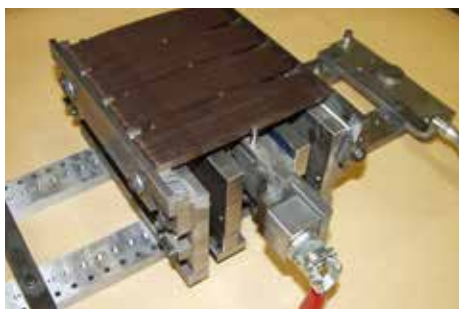
CG1-CNC with belt clamping arm and oscillation of the grinding belt



CNC grinding machine of the series CG-CNC with counter bearing for contact wheels smaller than 90 mm



Loading magazine for surgical tweezers



Loading magazine for components of surgical tweezers



CG1-CNC with automatic loading and unloading



CG1-CNC: various magazines with automatic magazine recognition



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



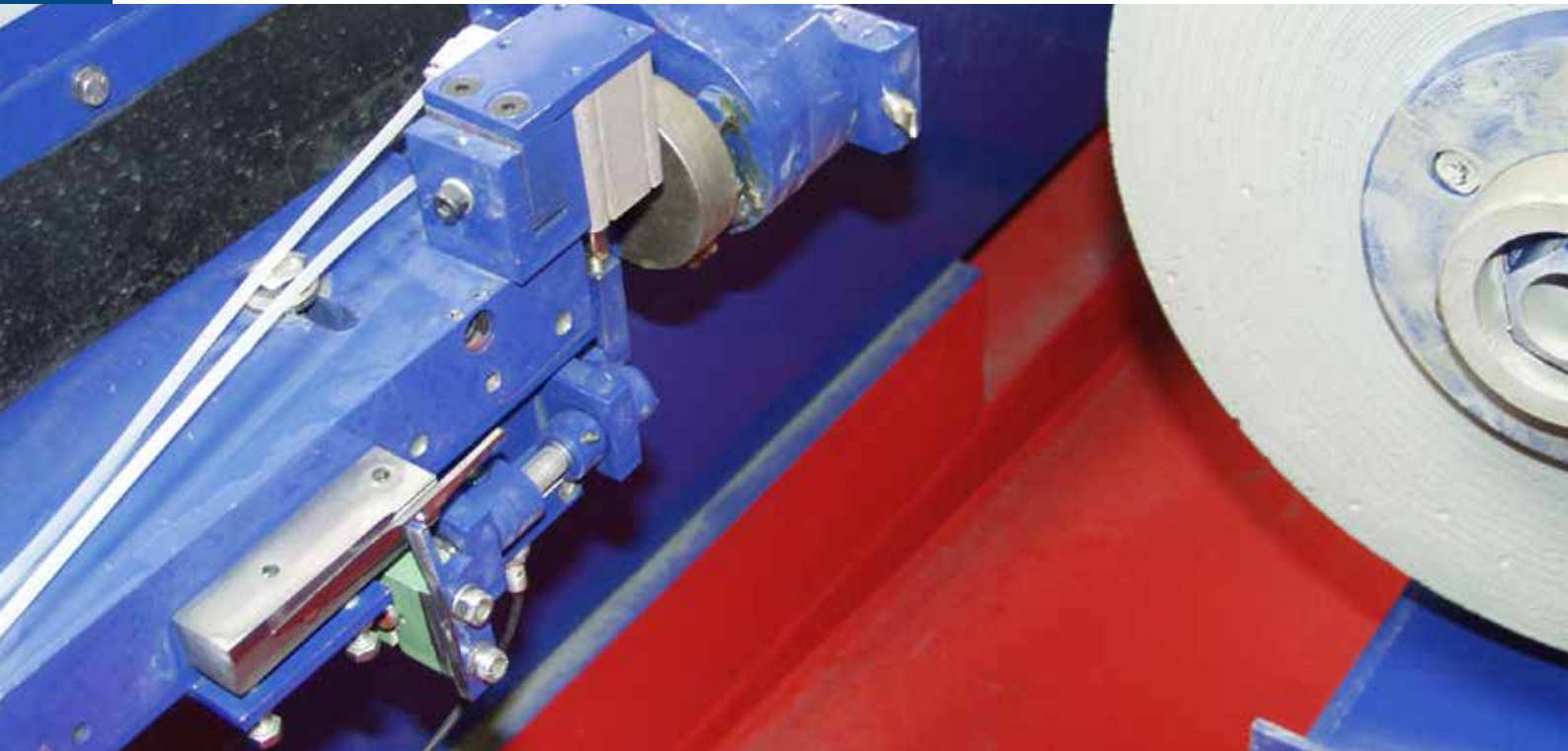


# Peripheral grinding machines

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.

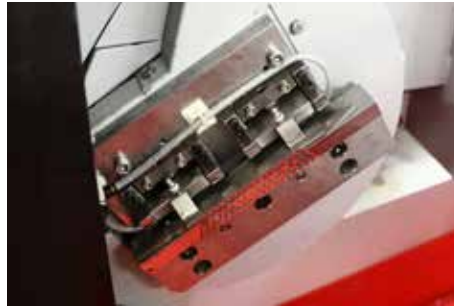


- three to five-axle CNC grinding machine
- peripheral wheel with 200–400 mm (7.9"–15.7") diameter (depending on the application)
- dressing unit with diamond-coated dressing roll and / or diamond fleece
- 11–18 kW, bis 5000 UPM
- grinding stroke up to 350 mm (13.8") or up to 490 mm (12.3")
- automatic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





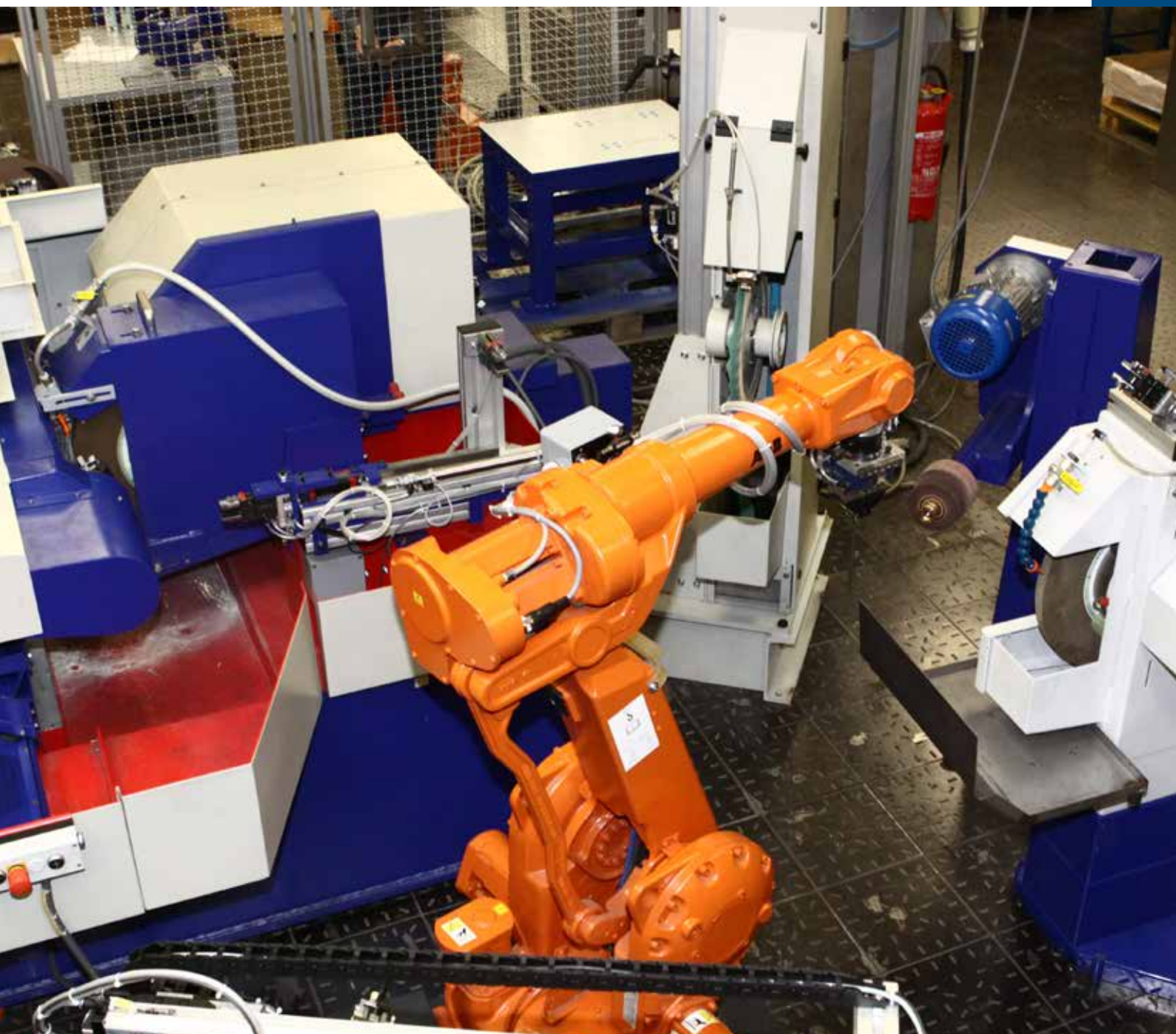
Grinding of the convex exterior



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



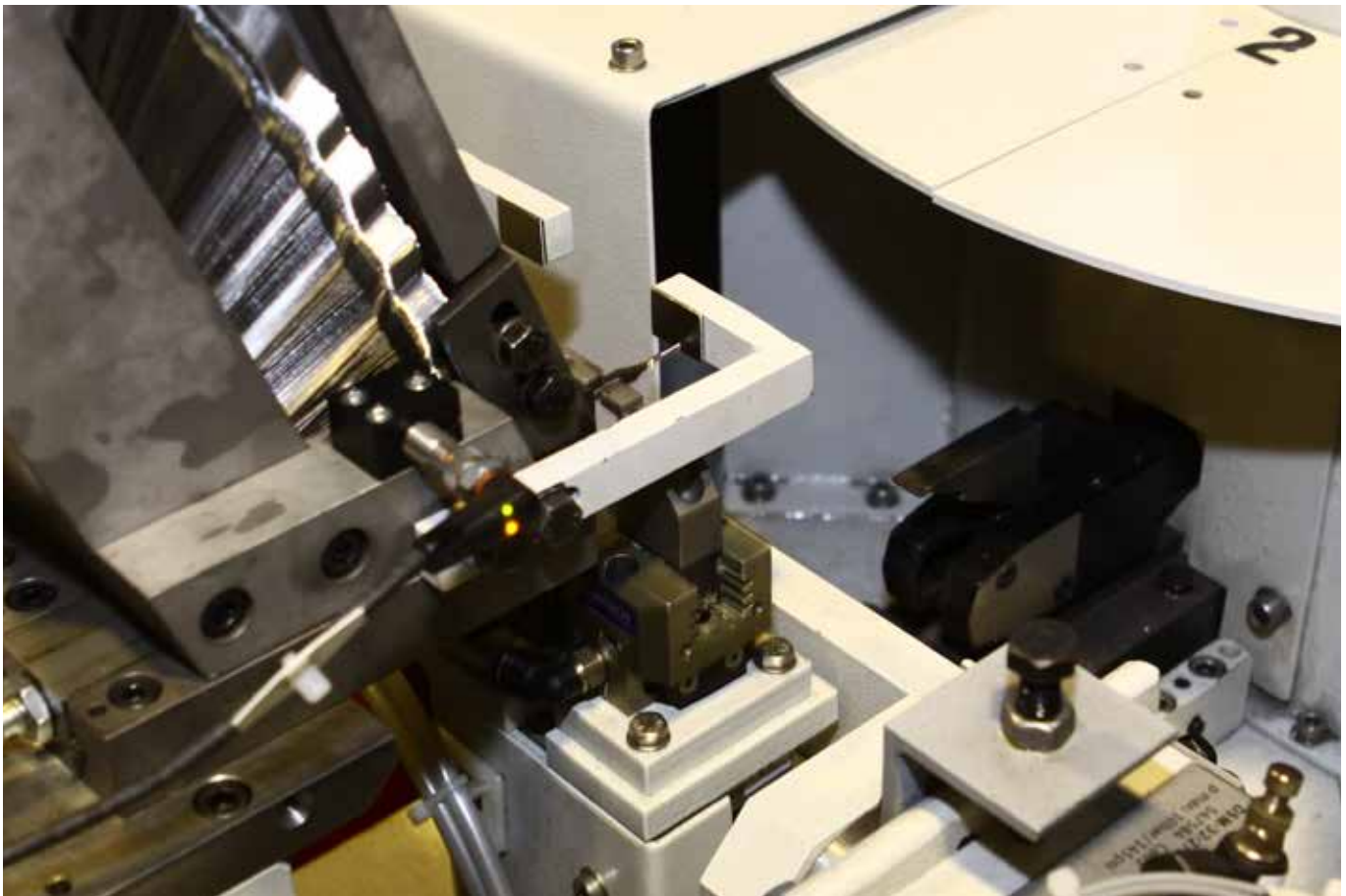
WS4-CNC for the production of saws (cross tooth with additional vertical and pivot axis)

- 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





Example of a line WS6-CNC for the production of gouge blades in combination with a camera measuring station and automatic loading and unloading



Universal grinding machine for different workpieces due to the choice between plunge and through-feed grinding and due to the use of dressing wheels and diamond coated dressing roll





# Rotary index table grinding machines

RST4-CNC

## Single grinding of scalpel blades

CNC rotary index table grinding machine for grinding of scalpel blades with through-feed grinding technique

- grinding / polishing stations with spiral grinding or polishing wheel with a diameter of 150 mm (5.9") and a width of 40 mm (1.6")
- speed up to 5000 UPM with mechanically synchronised gear
- scalpel contour freely programmable with five CNC axes at each grinding / polishing station



CNC rotary index table grinding machine consisting of:

- one precision rotary grinding table for indexing operation
- two rotary modules for spiral grinding stations 1 and 2 with CNC-axe 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, one for grinding and one for polishing / deburring
- 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 them in the unloading magazine
- unloading magazine composed of two magazining swords
- eleven-axis CNC control Bosch



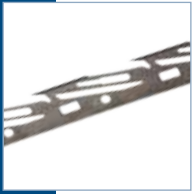
Rotary index table grinding machine RST4-CNC for grinding of scalpel blades



RST4-CNC with four working stations



RST4-CNC – machining of workpieces by through-feed grinding with spiral wheels

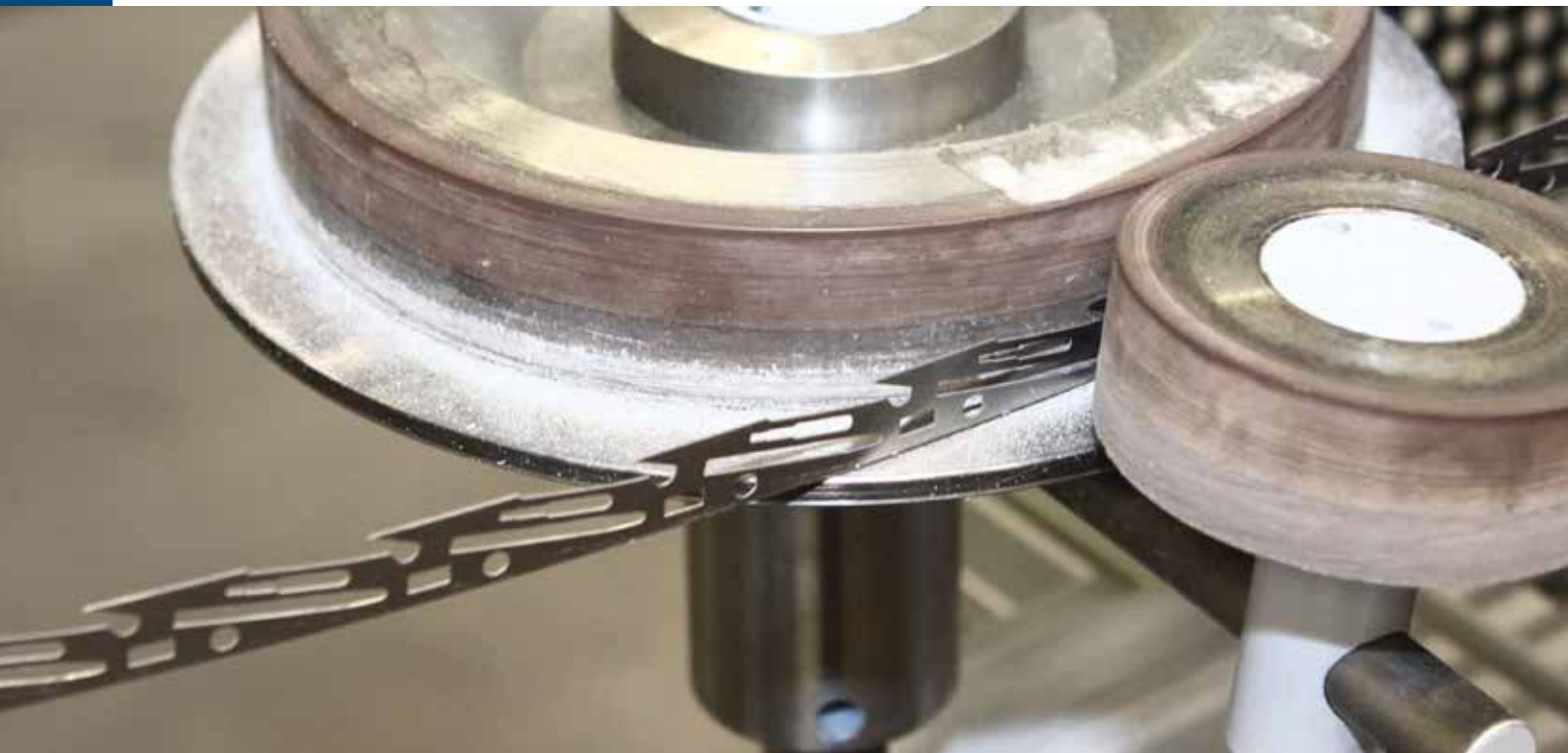


# Strip grinding machines

## BSM-CNC

### 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 grinding and polishing stations

RSP

## All-around machining

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 machines

Robotic grinding and polishing stations are employed:

- as manufacturing cells for a big range of parts such as forceps, bolsters on forged knives or tweezers
- in production lines, e. g. as a robotic deburring station or for part premachining



Robotic grinding and polishing station of the series RSP for the processing of tweezers

Example of application: processing of tweezers

- machining of the outer edge of tweezers, of the tip and the spring of the tweezer by belt grinding stations type BSS10
- gripper station or rotatable gripper for all-around machining of tweezers
- dense grinding of the tip of tweezers with a grinding wheel



RSP

## Rough and final polishing of prostheses and hip joints

The robotic polishing station of the series RSP polishes hip joints, prostheses and similar workpieces

- 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)



# Applications

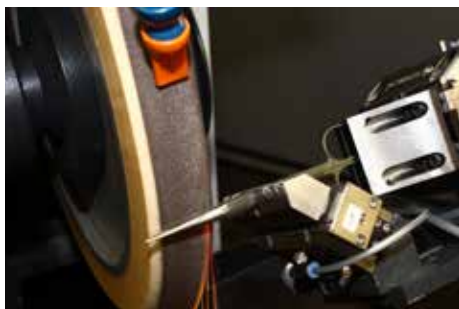
## RSP

The robotic grinding and polishing systems of the series RSP are employed for the machining of a big range of surgical workpieces.



- four- to seven-axis robots of different types and from different suppliers such as ABB, MITSUBISHI, KUKA, EPSON
- basic robotic program for the programming of robots, adaptation by teaching positions
- compensation of bigger workpiece tolerances (e. g. at forged parts) by additional measuring stations
- automatic inclusion of the measuring results in the robotic program
- use of grinding wheels, grinding belts or polishing wheels
- either tool motion or part motion robot controlled
- compensation of the grinding belt wear handled by robot control
- workpiece feeding by chain magazine, disc magazine, magazine cassettes, step conveyor and more





Robotic grinding of mounted surgical scissors



Machining of surgical scissors



Robotic grinding of surgical scissors



Robotic grinding of forceps components



Robotic grinding of surgical forceps



Robotic polishing of mounted forceps



Resurface welding of the carbide coating of surgical scissors



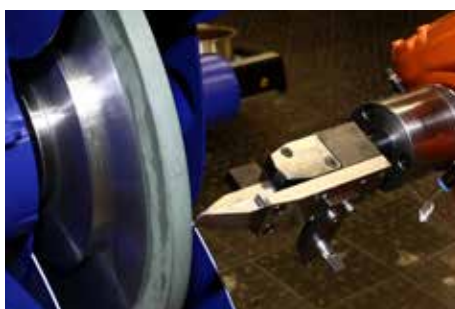
Robotic deburring of blades for eye surgery



Rough and final polishing of hip joints



Grinding of lancets



Machining of single-use microscissors



Robotic grinding of lancets



Robotic machining of microscissors



Robotic grinding system with two belt grinding stations BSS10, laser measuring and drum magazine



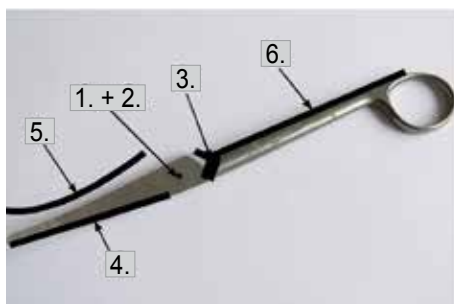
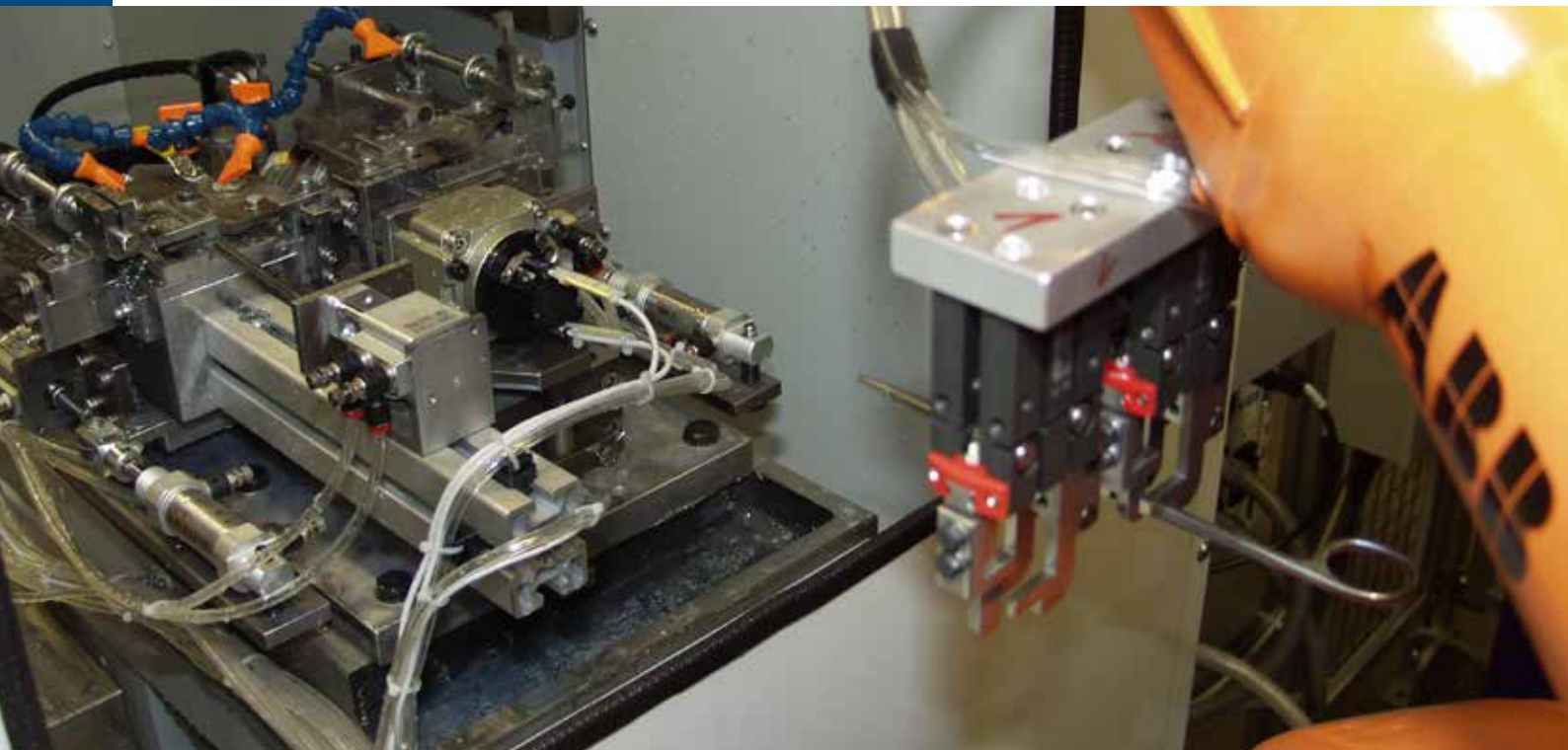
Robotic grinding system with two double belt grinding stations BSS1 and tactile measuring



# Integration and automation of CNC milling centers

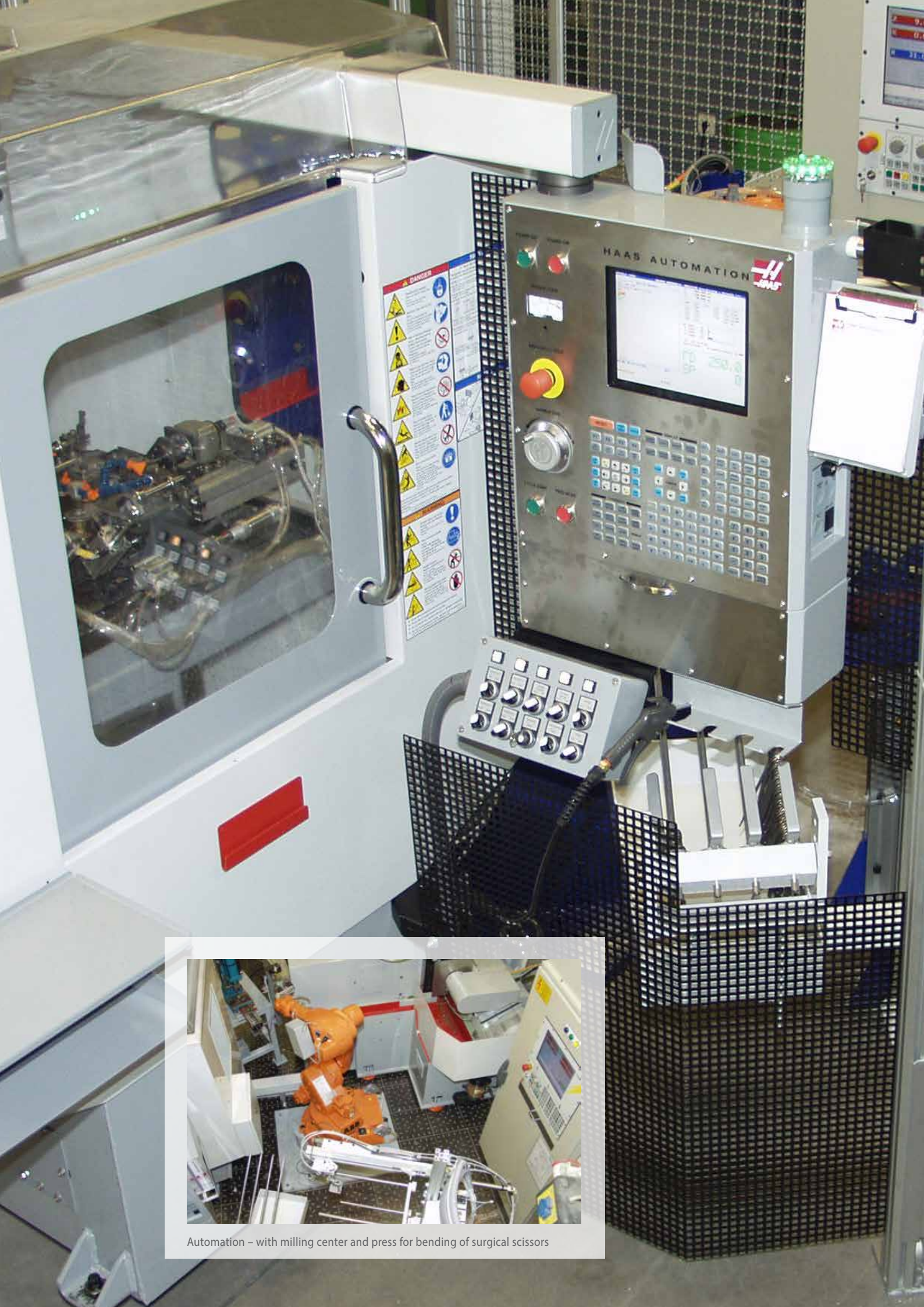
## Centring, drilling, milling

- 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



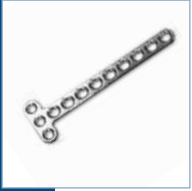
- 1.-4. drilling and milling in connection with a machining center and a special clamping device
5. bending press to achieve the bending
6. grinding machine BG1/ZA/NT2-CNC, three-axis CNC grinding machine for the machining of the shank / inside





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.



Collet 360° turnable with polished pieces



Double shaft polishing machine of the series PS1000-CNC for rough and final polishing of bone plates

- 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





Universal profile generating center with drill and hollow mill

# 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 rotatory 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

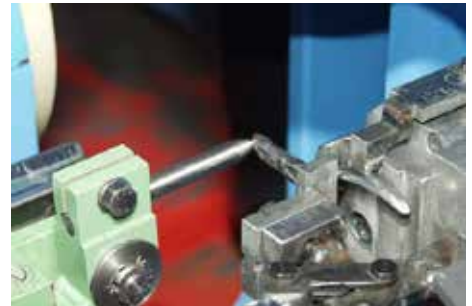
- measuring system for automatic contour identification and measuring of surgical articles
- compensation of tolerances of forged parts
- employable for machines of the type CG1-CNC and BG0/RV/NT2-CNC and different robots
- robotic automation and procession connection with grinding and bending machines



Camera measuring system for robots for position recognition of tweezers

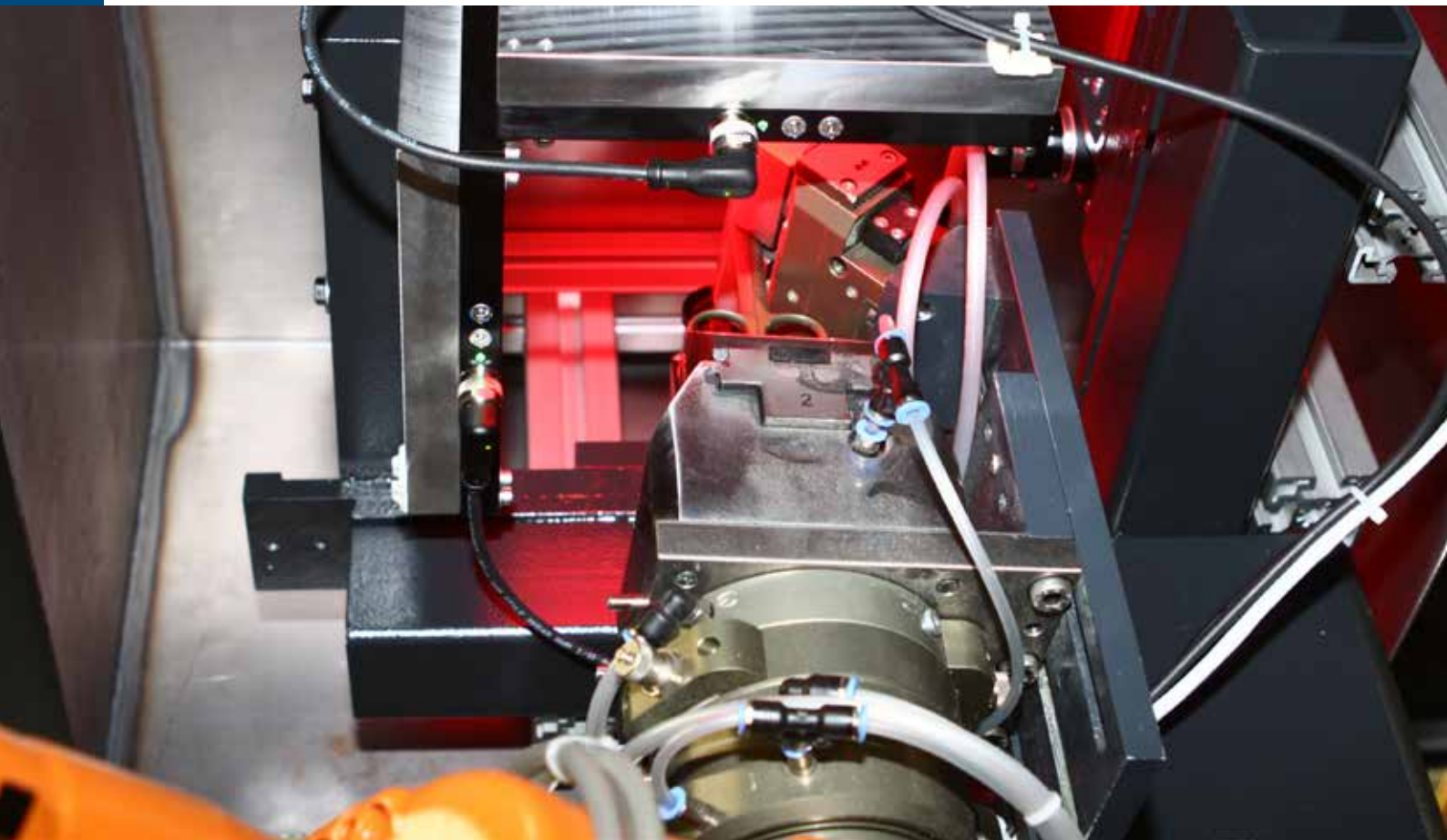


Laser measuring system for robots for the measuring of the outer side of surgical forceps parts



Measuring system for automatic middle measurement of surgical forceps with BG0/RV/NT2-CNC

Camera measuring system for the measurement of surgical scissors (picture here below)







Loading magazine for welded tweezers

## 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)



Partial sort up by vibrating plate



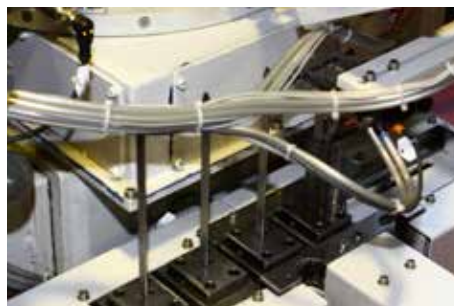
Drum magazine for surgical scissors and instruments



Stacking magazine for tweezer parts



Drum magazine for surgical forceps



Stacking magazine for surgical blades



Bar loading magazine for tweezers with position recognition

# 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.

Heinz Berger Maschinenfabrik  
Hauschild

August Nell jr.

Julius Maschinenbau

Werner Peters

LP-Laschet

... the Berger Group!

