Proverbial ingenuity, coupled with German efficiency and a love of perfection, are the best qualifications for developing successful ways of creating immaculate surfaces. Driven by these attributes of German engineering, OTEC, with its innovative technologies, has grown into the industry trendsetter in just a few years.
MARKETS

AUTOMOTIVE INDUSTRY

TOOLMAKING INDUSTRY

STAMPED, TURNED AND MILLED PARTS

AEROSPACE INDUSTRY

MEDICAL AND PHARMACEUTICAL INDUSTRY

CERAMIC AND PLASTIC PARTS

JEWELLERY AND WATCHMAKING INDUSTRY
AUTOMOTIVE INDUSTRY
MASS FINISHING
for automotive industry

DISC FINISHING UNITS
DRAG FINISHING UNITS
STREAM FINISHING UNITS
DISC FINISHING MACHINES
DISC FINISHING TECHNOLOGY (CF)

- Processing in an open drum (the process container) with a base plate in the form of turntable or disc
- Workpieces, together with a suitable polishing or grinding media, are set in motion by the rotation of the disc to create a toroidal stream inside the stationary drum
- Contact between the workpieces and the media generates a very intense finishing effect
  - up to 20 times more efficient than with systems such as conventional vibrators
- In the wet finishing process, a water/compound mixture is continuously added and drains off, taking with it the residues of the material removed
- Highlights:
  - Fast, absolutely reliable and reproducible results
  - Extremely cost-effective finishing, even for very small parts
    - (e.g. turned parts 0.5 mm Ø, material thickness 0.08 mm)
  - Simple handling
  - Wide range of applications, from deburring to mirror-finish polishing
CF Series are available with the right gap system between the disc and the upper cylinder for all processing techniques:

- **Zero gap system:**
  - For the wet finishing of very fine workpieces, the gap is reduced to zero
  - Benefit: It is possible to use very fine microfinishing media, no workpieces can get lodged in the gap

- **Ceramic gap system:**
  - With this system, the gap can be set to a precision of 0.05 mm
  - Benefit: use of very fine polishing granulates for best polishing results

- **Ceramic/polyurethane gap system:**
  - OTEC’s standard system
  - suitable for the most common wet finishing applications
  - Benefit: prevents anything from lodging in the gap and blocking the disc, ensuring a high degree of process reliability, low maintenance requirement
DISC FINISHING UNITS

Principle

- Stationary cylinder
- Movement of media
- Rotating disc
DISC FINISHING UNITS
Properties

- Modular concept - up to 6 process containers
- For dry and wet finishing process
- Process drums with hot moulded PU lining
- Aluminium profile chassis - easy to add on optional equipment
- Chassis of anodized aluminium profile (resistant to corrosion)
- Speed control via frequency inverter
- PLC touch screen control unit with digital display of:
  - processing time, speed, rinse cycle, dosing and other key process parameters
  - storage for up to 200 different finishing programs
SMALL GEAR WHEELS
CF Series
DRAG FINISHING MACHINES
DRAG FINISHING PROCESS (DF)

- Workpieces are clamped in specially designed holders
  - prevents collision of the workpieces
- These holders are dragged in a circular motion through a process drum containing grinding or polishing granulate
- This high-speed motion generates high contact pressure between the workpiece and the media, which in a very short time produces perfect results:
  - high-precision edge rounding
  - smoothing
  - mirror finish
- Absolute reliability
- Maximum cost-effectiveness
- Perfect finishing results
- Short processing times
- Realisation of multi-stage processes
  - Fine grinding and polishing
  - ✓ Quality equivalent to that obtained by manual polishing
DRAG FINISHING MACHINE
Principle
DRAG FINISHING MACHINES
Properties

- Custom-designed workpiece holders ensure that the workpieces are mounted as quickly and efficiently as possible and considerably simplify batch processing
- Over 100 different types of holder
- Water cooling system keeps the polishing granulate at a constantly low temperature
  - Extends the life of the process medium
  - Constant process quality
- Fast and easy change of the process container
- For dry and wet finishing process
GEARBOX- AND ENGINE PARTS

DF Series

unprocessed  processed
BALL PIVOTS CAR STEERING SYSTEM

- Removal of the oxide-layer after hardening
- Polishing of the sliding surface
BALL PIVOTS CAR STEERING SYSTEM

- Example of a ball pivot
STREAM FINISHING MACHINES
STREAM FINISHING PROCESS (SF)

- Workpieces are clamped in a holder and immersed in the rotating process drum filled with grinding or polishing media
- Abrasive effect by relative motion between the workpiece and the process media
- Deburring, edge rounding and polishing in a single operation
- Very short finishing cycles from 10 sec to max. 5 min
- Easy to automate
- High process reliability
STREAM FINISHING MACHINES

Principle

- Rotating process container filled with media
- Lifting unit allows fast component change within cycle time
- Rotating workpiece holder
- Angular adjustment holder
STREAM FINISHING MACHINES

Properties

- Fastest finishing machine worldwide
- Up to 5 workpiece holder
- Manual or automatic loading and clamping
- Manual or automatic angular adjustment of the workpiece holders
- Automatic change of the workpiece holders possible
- For dry and wet finishing process
- Fast and easy change of process container
- Easy change between different kinds of work pieces possible
SF MACHINES FOR SERIES PRODUCTION

- SF for series production with automatic loading and unloading
Alternating twist of the workpiece up to +/- 2000/min
- Tangential acceleration up to 40G
  - Extremely intense and precisely controllable abrasive effect
  - Very short finishing cycles
- Very low Rpk-values (<0.1µm) in a short time
- Processing also in inaccessible areas of intricate workpieces
**SF ACCESSORIES**

**Workpiece holders**

- Custom-designed workpiece holders
- Depending on the machine, up to 4 holders per machine can be used
- Ready for automatic loading
- Clamping on internal and external surfaces
- Optional: with HSK 63 interface
- Optional: with blocking air
- The clamping situation is analysed individually
- Standard holder (automatic clamping)
  - Multi blade mandrel
  - Collet
  - Gripper

**SF ACCESSORIES**

Workpiece holders

- Multi blade mandrels
- Collets
- Grippers
FINISHING OF CAMSHAFTS
Workpiece holders

- Fixing of the work pieces in a multi blade mandrel
- Not necessary to change the work pieces manually
FINISHING OF CAMSHAFTS

Conventional grinding

<table>
<thead>
<tr>
<th>$R_s$</th>
<th>$R_z$</th>
<th>$R_{\max}$</th>
<th>$R_{pk}$</th>
<th>$R_{vk}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 µm</td>
<td>6.1 µm</td>
<td>8.0 µm</td>
<td>1.8 µm</td>
<td>3.4 µm</td>
</tr>
</tbody>
</table>

Pulsfinish

<table>
<thead>
<tr>
<th>$R_s$</th>
<th>$R_z$</th>
<th>$R_{\max}$</th>
<th>$R_{pk}$</th>
<th>$R_{vk}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 µm</td>
<td>5.2 µm</td>
<td>8.0 µm</td>
<td>0.1 µm</td>
<td>6.8 µm</td>
</tr>
</tbody>
</table>
FINISHING OF CAMSHAFTS

Racing

- Camshaft of a racing car
- Process time < 2 min
- Huge improvement of surface quality

Surface quality

Edge before (left) and after (right) process
**SF PROCESS**

Deburring & edge rounding

- SF Process combines smoothing of the surface with
  - Deburring
  - Edge rounding
  - While the contours of the workpieces remain largely intact

Before (left) and after (right) the SF process
GEARS

- Smoothing
- Deburring
- Edge rounding
- Surface adapted for improved lubrication
- Little notching effect

Gears before (left) and after (right) SF process
CONTROL ROLLER
Complex geometries

- Finishing of complex geometries
  - Deburring
  - Smoothing
  - Edge rounding
- Improvement of the whole surface in a short process time
**INJECTOR NOZZLES**

- Nozzles
- Needles
- Parts of pumps
- Guides
- Pump shafts
- Gear parts

- Customer requirements:
  - Polishing before and after coating
  - Rounding of edges to 1-2 µm
  - Smoothing

- Average process times are around 5-15 sec!
WORM GEAR SHAFTS

- Jets
- Needles
- Pump parts
- Guideways
- Pump shafts
- Transmission parts
- Customer requirements:
  - Polishing before and after coating
  - Rounding of edges
  - Smoothing
AUTOMATION

Options

Automation of machines:
- Easy automation by robot or loading and unloading system
- Can easily be integrated into a customer’s system

Linear Gantries

Robot
RESIDUAL COMPRESSIVE STRESS

- SF process introduces residual compressive stress into the workpiece
- Higher resistance to bending load
- Higher bending fatigue strength
- Longer lifetime
- Lower notching effect

Residual compressive stress in cams shafts after SF process
**REDUCTION OF FRICTION COEFFICIENT**

- Friction measurement in the “2-disk rolling test” (Amsler)
- With drops of Mobil SHC 624 oil and 10% slip
- Friction value reduced by up to 30%
SURFACE IMPROVEMENT

- Removal of grinding grooves
- Significant reduction in roughness
- Granule impact results in the formation of closed micro-cavities for an improved lubrication

Surface before Pulsfinishing process

Surface after Pulsfinishing process
BENEFITS FOR CUSTOMERS

- Noise reduction (up to 3dB possible, for example, with gears)
- Up to 10% lower heat development
- Better lubrication of surfaces
- No roughness peaks ($R_{pk} < 0.1 \, \mu m$)
  - Less wear, no running-in necessary, longer oil life
- The coefficient of friction can be reduced by up to 30%
  - Higher efficiency, lower energy consumption

→ Entire improvement of component properties
FINISHING CENTRE

- State of the art measurement technology
- Very experienced and highly qualified staff members
- Process research together with institutes and universities
FINISHING CENTRE

- Finishing of sample workpiece with no obligation and costs
  - Individual customer advice
  - Detailed documentation
  - Finishing concept tailored to your needs
THANK YOU FOR YOUR ATTENTION.