INIRAM
PRECISION MACHINERY, LLC

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The milling machine is specially designed and optimized for the efficient milling of finger-type and fir-tree roots of turbine blades. The machine is built as a triple-axis CNC vertical milling machine with horizontal drive spindle which drives the disk milling cutters positioned on the milling spindle. The machine base and the machine stand are heavy, rugged welded constructions and equipped with pre-stressed bearing/roller guides for linear slide movements. This machine concept allows an increase of productivity of 70% compared to conventional machines.

**Exchangeable tool drive units**

Unique feature and core of the machine is the exchangeable tool drive unit which allows the use of different machining heads. Special heads e.g. for milling of finger-type roots with a set of disk milling cutters as well as milling of fir-tree roots with insert cutters/solid carbide cutters are set-up outside the machine and get interchanged automatically by a head changer. Therefore the machine offers an excellent flexibility in high precision machining of different part features.

**Head changer**

For an easy and convenient exchange of the milling head the machine is equipped with a head changing device which is located besides the machine. After the machining head got loaded to the head changer (via crane etc.) it will be swiveled to the vertical exchange position and the head gets transferred into the machine. This feature allows minimal idle time and guarantees highest productivity.

Our 3F-TB-machines features:

- Especially engineered for milling of finger-type and fir-tree fastening of turbine blades
- Heavy duty and robust design with box-type guideways
- Disc milling cutter up to diameter 600mm
- Semi-automated changing device of the milling unit for minimized idle-time during tool change
The 5-axes, multitasking machine series HSTM finish complex parts in one clamping. Typical applications are turbine blades, vanes, blisks, propeller blades and other contoured, demanding parts and work piece materials. Our customers require machining and manufacturing with high precision, cost-effectiveness and high productivity. We guarantee it!

Advanced Process Technology

Process Expertise

Aerospace and energy are driven by part weight, part complexity and demanding part material. Our advanced and innovative processes accommodate the most critical machining and manufacturing operations. Hamuel multi-function machines are the leading strategy to produce parts completely in one set-up with speed and robustness.

Part handling and transportation interfaces through pallets and robots round out our holistic process capabilities. We offer the industry’s cleanest part finishes with our state-of-the-art MQL/dry machining technology. No messy machine compartment, no expensive coolant usage but dry chips and minimal energy usage.

HAMUEL HSTM series
CNC turn-mill center

Our HSTM-machines features:

- High rigidity
- High dynamic stiffness
- Temperature control in all axes
- Modular design
- Siemens or Fanuc control systems
- Ergonomic design
- Part loading front, top or side of machine
- Machine spindles for high speed and high torque
- Fixturing for turning and milling modes
- Small footprint
- Optional coolant arrangements
- Easy adaption for automated part handling via robot or pallet system

Every turbine blade no matter which dimension or material is finish-machined with optimum speed and high precision.

HAMUEL HSM series
CNC portal milling machine

Featuring high dynamic stiffness, precision axes drives and high torque curves in the low to high RPM-ranges, positions the HSM portal milling machines ideally for high productivity and high flexibility. Equipped with the most modern of drive and control engineering, the HSM portal milling machines maximise productivity and enable the greatest possible flexibility in machining of complex parts.

The HSM machines are designed to accommodate any part material for any machining and manufacturing run like:

- Steel
- Castings
- Titanium, Inconel etc.
- Composite materials
- Brass alloys
- Aluminium

Machine Specifications

Specially built, the layout of each individual machine depends on the customer requirements. The working travel in X, Y and Z is variable depending on the part dimensions. Two swivel axis on the tool side axes allow the machining of difficult-to-access part configurations. This fork-head assembly is attached to the vertical Z-axis. The C-axis swivels around the Z-axis while the horizontal swivel axis A is directly integrated in the head.

The universal spindle design enables the use of short cutting tools, minimizing vibration during cutting. This is also beneficial in regards of mechanical stress on milling spindle and machine.

Based on rigid and robust design of all machine components extended tool life and improved part finishes is guaranteed.