CBN wheel, quicker setup, first part perfect after setup, and the ability to use all of the machines in the cell simultaneously without central coolant system starvation. Cool-Grind Technologies has extensive experience with coolant application for the grinding of blades (Fig.2 & 6), vanes, NGVs, segments (Fig.5), IBRs, shaft (Fig.1) from inconel, titanium, and cobalt alloys.

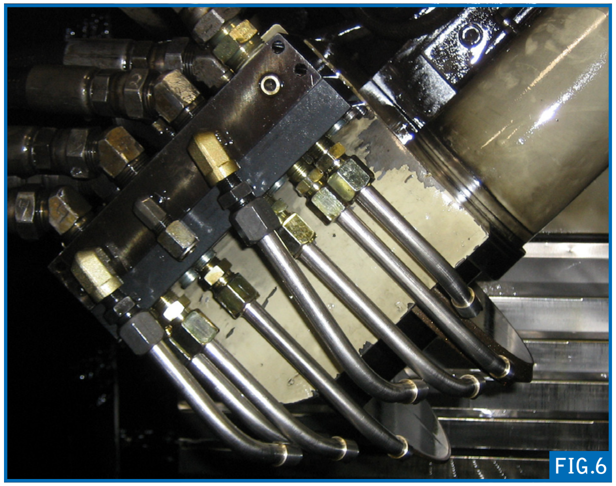

FIG.6

HOW WE CAN HELP YOU

Cool-Grind Technologies can offer you three different levels of support to make your process work with the required levels of quality and economics. Level 1 is supply of the basic nozzle to your specified aperture once you have done the design work. Level 2 includes technical design assistance at an agreed hourly rate, and includes analysis of data, review of setup and essential CAD work. Level 3 consists of a visit to your facility to audit your current process and setup, analyze and conceptually design an improved nozzle and pumping system, provide a report, design and build nozzle hardware, and install. Once a specific grinding application has been verified, additional kits can be supplied for installation by the customer.

Cool-Grind Technologies has over 2000 sq. ft. of manufacturing capabilities. Housing CNC machines, Lathe's, Milling machines, and Manual machines, all controlled and operated by 5 professional employees.

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COOL-GRIND TECHNOLOGIES LLC

COOL GRIND

"NOZZLES FOR A COOLER GRIND"
WWW.**COOL-GRIND**.COM

GRINDING TURBINE COMPONENTS
COOLANT NOZZLES

COOLANT APPLICATION OVERVIEW

Grinding is a thermally dominated process, which if done incorrectly can lead to surface damage to the work material, and unsatisfactory process economics. The power consumed by the process is partitioned into the wheel, work, chip and coolant. The amount that enters the workpiece must be cooled quickly to prevent high local temperatures and phase transformations from developing. Phase transformations are often responsible for tensile residual stresses, white layer formation, reduced fatigue life, dissolved oxygen, and surface and sub-surface cracking. Cooling of the process is achieved by the application of a cooling and lubricating fluid, as well as selecting process parameters that reduce the heat being generated.

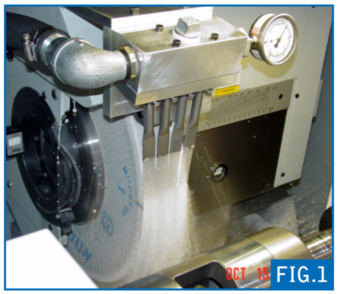
FIG.1

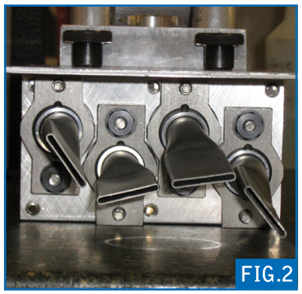
FIG.2

Over the last 16 years, Dr. John Webster (a.k.a Dr. Cool) has developed a tried and tested philosophy for optimizing the application of coolant into a grinding processes, with more than 250 successful field applications installed and close technical relationships with more than 20 universities around the World. The pressure, flowrate, temperature, and direction of flow all influence the cooling ability of the fluid. The pressure controls the velocity of the fluid, the flow rate and temperature controls the rate of heat transfer into the fluid. The direction allows the fluid to remove the air-barrier that travels with the wheel. The flowrate is dependent on the type of grinding wheel and the spindle power consumed during the process.

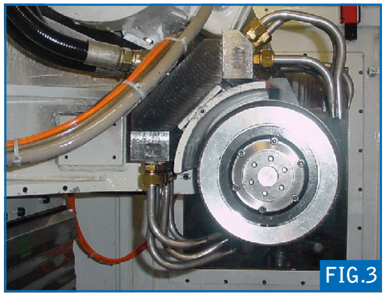
FIG.3

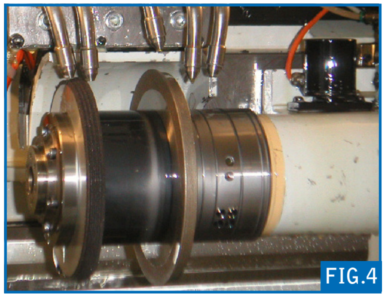
FIG.4

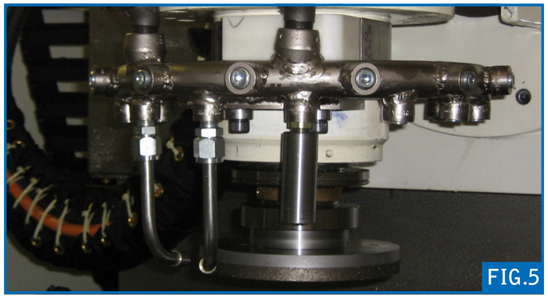
FIG.5

NOZZLE DESIGN

Cool-Grind nozzles are based on round and rectangular coherent jet technology, and produce a laser-like stream of coolant at high pressure. When applied at the optimum coolant flowrate and pressure, these nozzles can give the following advantages over plastic, bent tube, or fabricated nozzles:

- *Reduced dressing compensation required and lower natural wheel wear*
- *Thermal damage of the workpiece material is reduced, allowing higher productivity and reduced burr formation*
- *More of the applied flowrate will be effective, such that the overall applied flowrate is often reduced*
- *Reduced push-off due to lower hydrodynamic forces and reduced grinding power*
- *Reduction in entrained air, misting, foaming and vapor problems*
- *Reduced disturbance of the jet from the air barrier surrounding the wheel*
- *Robust set-up using generic, non-profiled, and easily reconfigurable nozzles by using releasable compression fittings*
- *Reduced tendency for the wheel to load with work material or binder*
- *Increased coolant pressure at the nozzle, due to reduced flow rate*
- *Easier aiming into the critical areas of thermal energy using laser aiming technology*
- *Greater distance from the nozzle to the grinding zone due to the high coherency*

EXAMPLE

Fig.3 & 4 above show a Huffman 205 grinder that is setup for grinding fir-tree root forms. The setup (Fig.3) requires multiple bends to position the jet into the process from the horizontal facing manifold, and suffers from high dispersion, rotation of the tubes in the compression fittings, difficult setup, too many nozzles, and low manifold pressure. The coherent jet setup in Fig.4 utilizes a new adapter and manifold system that positions the NPT threads more in line with the grinding wheels, allowing one bend per nozzle, releasable compression fitting for adjustment, and proven nozzle setups to be changed with the front manifold plate for later use. The setup also employs a hidden lower nozzle to supply coolant for dressing of the dressable CBN wheel.

The benefits the customer found with the new setup was 67% reduction in flowrate, double the pressure at the manifold, better precision, elimination of burn, 40% reduction in grinding power for same cycle conditions, 25% more parts per dress for the vitrified wheel, double the life of the plated

continue on next page »