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IBAG High-Frequency Motor Spindles

Witte Vacuum Workholding System

IBAG Expands Small Spindle Product Line

IBAG, a well known Swiss manufacturer of precision high-speed spindles, has introduced new, micro-precision high speed milling and drilling spindles for the Swiss machine (automatic CNC lathe) market. The new products include the HT25, a 25 mm diameter, 60,000 RPM model (80,000 RPM optional), as well as the HT22 (a 22 mm diameter, 60,000 RPM model). The spindles are compact and powerful, utilizing DC brushless motor technology. The DC brushless technology allows the use of a small sized motor that has higher power, and runs cooler, when compared to standard AC motor technology. High power and high torque are required when milling tough materials like stainless steel, brass and other alloys. The AC motor technology of the past provided the power needed for these applications, but the motor size was too large and did not fit easily into the typical Swiss-style lathe tooling area. Today we have a better solution to save time.

The spindles are air-cooled, and require no external cooling by water or fans. The bearings used (both front and rear) are sealed hybrid-ceramic (steel races and ceramic balls), with permanent grease-packed lubrication. Oil-air is an option for higher speeds on all models. In addition to the use of sealed bearings, every IBAG spindle design includes an integral positive over-pressure air-seal. The air seal system injects a small amount of compressed air through the stainless-steel spindle body, and insures that dirt, coolant and other contamination does not enter the spindle housing. This protects the spindle bearings, extends spindle life, and increases up-time which is critical for high-production applications.

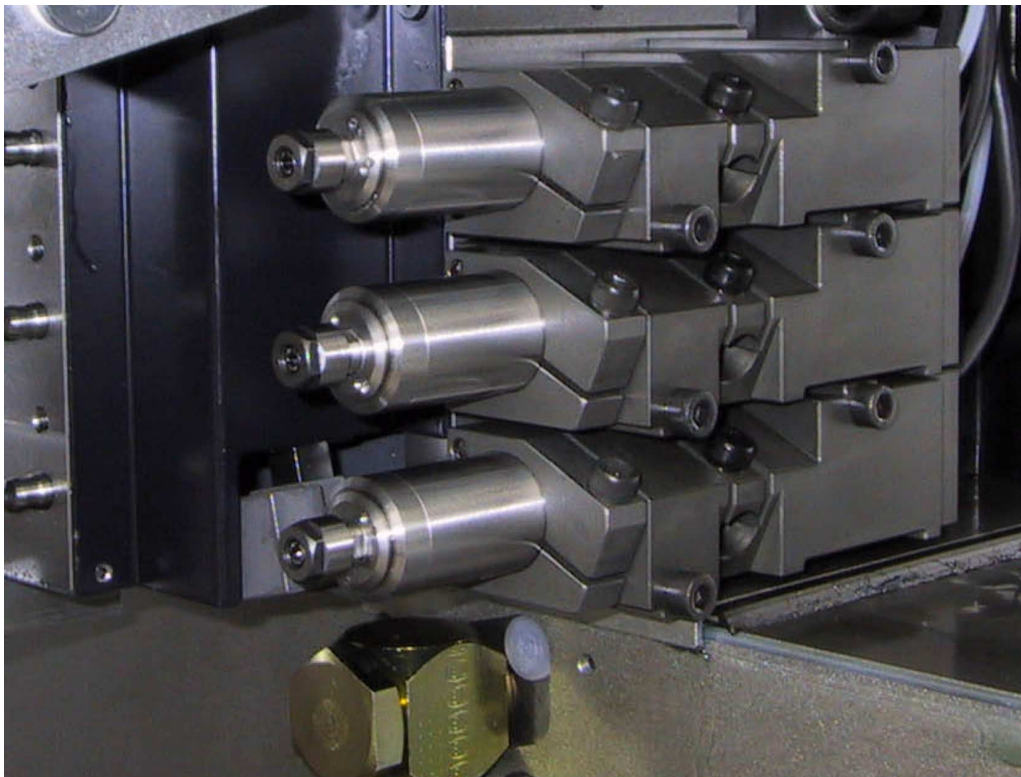
The maximum allowable taper run-out is 2 microns, which is the best in the industry. Tool retention uses a precision ER-8 collet system, with a maximum tool shank diameter allowed of 3/16" (5 mm). Wrenches and collets are supplied with all spindle systems. Every IBAG spindle is dynamically balanced to insure that the spindle runs smoothly and quietly with little to no vibration at all speeds. Excessive vibration not only reduces bearing life, it also shortens tool life and can even cause small tool breakage.

Installation is simple, as most models can fit into existing 25 mm or 20 mm tool blocks. This compact length allows use of the spindles in tight tooling situations. If maintenance is required, it is a simple task to remove the defective spindle, insert a spare, and continue on in production. There is no special alignment or long run-in schedule required. To further support production IBAG stocks exchange spindles on the shelf, so when a bearing rebuild or service is required it is a simple matter of exchanging the defective spindle for a fee. Repairs and rebuilds are performed at IBAG North America in North Haven, CT.

The IBAG spindles are driven by a compact, high-frequency converter, also designed and manufactured by IBAG. The new drive carefully controls the speed, voltage and current to the spindle, and automatically compensates for increased loads. The spindle speed is variable, and is controlled by either a manual push button or remotely by a CNC signal. The drive displays actual speed and power consumed, and can be run manually or interfaced with any CNC to allow for automatic operation. The CNC interface can use spare M-codes to activate the IBAG spindle as needed. Some OEM's even allow spindle speeds to be programmed using steps or macro programs. In addition, the IBAG drive interface provides critical status signals to the CNC, in the event that if an alarm occurs on the IBAG system, the CNC can be safely stopped.

While it is not possible to drive multiple spindles from one drive (DC motor technology does not allow this), it is possible to "share" one drive between multiple spindles. IBAG offers a switch box capable of operating up to 4 spindles using only one drive. In that way, the drive is switched between each spindle by the CNC as it is needed. This does provide a cost savings; however, it also sacrifices some cycle time as the spindles are switched over. High production applications should consider utilizing a drive for each spindle. Drives can use either 110 or 220 VAC power.

Spindle models available now include shorter versions (for small machines and tight tooling situations), higher speeds (up to 100,000 RPM) and even right-angle models. A 20 mm diameter product line will be available by mid-2008.



IBAG spindles offer the following benefits:

1. Significantly increase cutting speeds for small diameter drills

Most driven tooling on CNC lathes has limited speed, typically around 5,000 RPM. For a small diameter drill, this limited RPM can severely restrict the maximum feed rate, and subsequently, increase the cycle time required to drill the hole. The use of precision high-speed spindles can decrease the cycle time for drilling by a factor of 5X or faster.

2. Increase capability to mill using small diameter cutting tools

Many small parts require secondary operations to complete detailed milling operations. This requires that the part be removed from the primary setup, clamped into a new machine, and have the machining performed. Not only does this increase the cost of the part, it also contributes to inaccuracy, as the part must now be accurately located in the new setup to insure that the overall accuracy is not lost. If it was possible to perform the milling on the original setup, time would be saved and quality maintained. By utilizing IBAG's small precision milling spindles as live tooling on the Swiss machine, it is possible to perform delicate milling operations on the original setup. The high speed, power and rigidity of the spindle allow small end mills to be used at high speeds in stainless steel, brass and other alloys. The use of high speed cutting also minimizes burrs, which also helps to minimize de-burring operations.

As an example, when milling a modified Torx 20 female drive socket in a 316 SST bone screw, a conventional milling process would require 3.3 minutes, running a 4-flute, 0.032" diameter end mill at 3000 RPM. When using the IBAG HT25 spindle, utilizing a proper surface speed of 300 SFPM, it is possible to run the end mill at 36,800 RPM and reduce the cutting time to 45 seconds. In addition to the tremendous time savings, the part can be completed almost burr-free. This is not possible when cutting at conventional milling speeds.

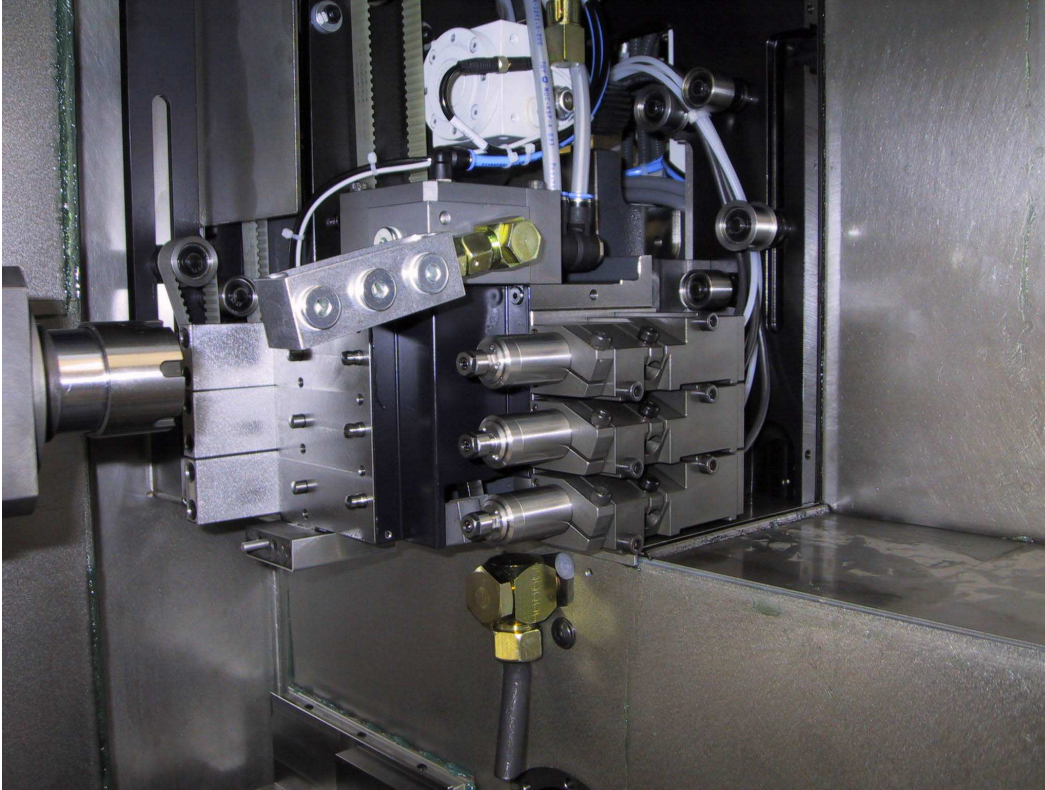
3. High Torque, Power and Accuracy in a Compact Package

The IBAG HT25 spindle delivers high speed, high power and high torque in a sub-compact package. This allows it to be used in modern CNC machines. The high accuracy of the IBAG spindle taper (under 2 microns), and high-precision balancing, also optimizes the use of very small diameter drills and end mills. Higher run-out values, even in the micron range, can adversely affect the cutting quality and accuracy of small micro-tooling. It is impossible to drill with a tool diameter of 0.020" when the run-out of the tool may be in the 0.001" range. The tool will walk, wear excessively, and in many cases, immediately break when it touches the work piece. High precision is a requirement when utilizing micro-precision tooling.

4. Easy to Integrate & Flexible

The IBAG spindle system is simple to integrate into a new or existing CNC lathe. The spindles are designed to fit into the existing tooling area, and are tough enough to survive in coolant, chips and swarf. The spindle housings are made from stainless-steel, and are protected from contamination by an integral air-seal. The spindle can be integrated with the CNC to control operation (on-off and speed), and to monitor any faults by the CNC.

As the IBAG spindle speed is programmable from the CNC, it is a simple task to change over to a new part by re-programming the required speed for each spindle cutting tool. When spindle or drive replacements are required, defective spindles and drives can be quickly replaced with exchanged units.



Summary

The tremendous productivity improvements realized by using this technology cannot be underestimated. As smaller parts are becoming typical for the medical industry, and new technologies such as nano-technology emerge, we must utilize the most efficient methods for producing these parts. Slow spindle speeds will not provide the production rates, or quality required to produce this type of part on a cost-competitive basis. US based manufacturers must utilize any and all means to reduce production costs, improve quality and boost productivity. The use of micro high-speed spindles, on Swiss-style turning equipment, will provide a means to optimize operations that are traditionally the most challenging, and consume the most cycle time on a small part. With the development of new machines with even smaller foot prints, smaller spindles (20 mm and 16 mm) may play an even greater role in making possible the best efficiency and through-put possible.