

High Torque Retention Knobs

Approximately 95% of gun parts are manufactured by milling. Tool life is vital to keeping up with production cycle optimization. Therefore, more advanced, rigid machines are being leveraged with the highest grade and exotic materials to overcome associated tool life problems.

One constant challenge to tool life is chatter (or, vibration), which corresponds to the relative movement between the workpiece and the cutting tool. "The condition not only causes poor finishes on the parts, but can damage and significantly reduce the life of end mills," said a JM Performance Products (JMPP), Inc. spokesperson. "Carbide end mills are particularly susceptible to damage. Poor fixturing, workholding and machine maintenance all contribute to chatter and its associated problems. Chatter in cavity milling also creates uneven wear on cutting tools and shortens tool life—rendering it to be self-sustaining until the problem is corrected."

Recently, Evolution Gun Works, Inc., a designer and manufacturer of parts and accessories for rifle and pistol models, had been experiencing significant chatter on its machining centers. EGW principals wanted to eliminate the potential for poor surface finishes on parts (which would require secondary bench operations) and critical damage to expensive workpieces.

To address these issues, EGW President and Founder George Smith investigated converting from standard off-the-shelf retention knobs to a specific high torque retention knob from JMPP. After a demonstration, Smith believed the theory behind the patented knobs was solid, and would resolve improper seating of the toolholder in the spindle that results from toolholder deformation. Essentially, if the toolholder does not fit the spindle precisely, a critical "loose-tool" factor occurs that can create the perfect storm for chatter, poor tool/spindle life and decreased productivity.

"Investigations of vibration and chatter issues point to this improper seating of the toolholder in the spindle because when a standard retention knob is tightened, it can produce a bulge in the taper that prevents full contact and correct seating in the spindle," said the spokesperson. "As a result, the toolholder is unable to pull completely into the spindle, and contact is made at the small end of the holder instead of at the large end at the gauge line."

JMPP's patented knob design is longer and reaches deeper into the cross section of the holder's threaded bore. "As a result, all thread engagement occurs in a region of the toolholder where the cross-section is thicker to resist deformation. A precision pilot increases rigidity, the knobs are hard turned to ensure precision fit and are balanced by design with threads cut to start and finish 180° from each other," said the spokesperson. The high torque knobs work in existing toolholders.

EGW manufactures gun parts and accessories that use high-grade exotic materials including 410, 415, 420 and 17-4 stainless steels; 4140 and 4340 tool steels; 7075 and 6061 T6 aircraft-grade aluminum; and Tungsten guide rods.

EGW converted all of its CNC mill operations to JMPP's high torque retention knobs. According to Steve Seaman, EGW's CNC Shop Foreman, "The knobs were easy to use and we saw the effect instantly. We would run an end mill and have chatter, then change to the JMPP high torque retention knobs with the same lot of material, same coolant, on the same machine, with no chatter. The resulting surfaces are now consistently smooth with no imperfections."

Eliminating chatter also reduces wear on cutting tools and machining centers, minimizing machine downtime. This is essential, since tool life is key for firearms manufacturing where demanding requirements of materials like stainless steel is prevalent. The end product is easier to clean and not effected by gun powder residue. Military applications are using these less corrosive exotic materials because the discharge's high flash/burn powders do not affect them.

JMPP President John Stoneback stated, "The total system remedy is to eliminate all vibration sources that can lead to harmonic responses. Run the job on the 'tightest' machine available. The more the machine's engineering and spindle are tight and robust, the less chatter will occur. Less expansion in the toolholder helps the most on longer tools and run-out as well as chatter. Our high torque retention knobs are at the forefront of closing this productivity gap, and can help milling operations conservatively achieve a 10-20% competitive advantage."

JMPP Plant Manager Craig Fischer also noted EGW's savings on polishing with high torque, or lower-deformation, knobs: "Milling producers can achieve upwards of 14 times the savings on polishing by using JMPP's knobs," he said, citing an example where the process takes 2 minutes vs. 28 minutes for standard knobs.

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