

► BY WILLIAM MAKELY AND ALAN RICHTER, EDITOR

# Quick-Change Artists

**Quick-change chucks maximize productive equipment time and provide a fast ROI.**

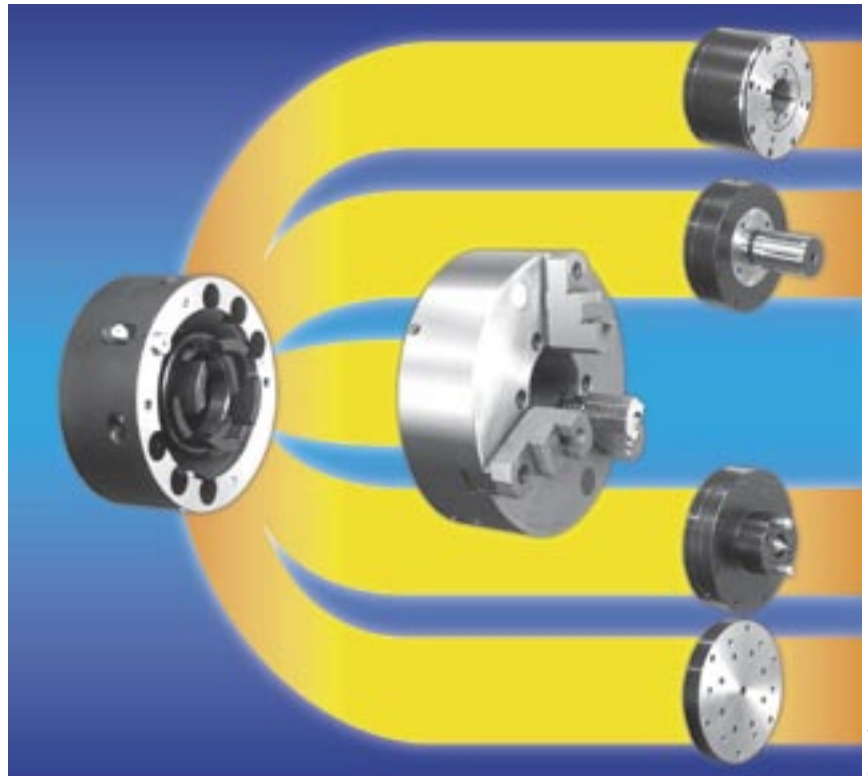
**T**ime is money, the old adage says, and no one knows that better than machinists. As such, reducing setup time has become increasingly important. Meanwhile, to reduce large inventories and support lean initiatives, customers who formerly placed large orders now require manufacturers and job shops to produce smaller quantities of machined products more frequently. This requires more—and varied—setups.

Machinists can maximize productive machine time by using quick-change chucks. Developed in Germany, they have been refined to provide even greater advantages over traditional changeover systems that involve time-consuming manual labor and costly setup time. A quick-change system can reduce workholder changeover time from an hour or more to minutes, boosting productivity and repaying the investment cost in less than a year.

## How They Work

Numerous manufacturers offer quick-change workholding systems, each with a slightly different configuration. Presented here is information about systems from Cincinnati-based Positrol Workholding; SMW Systems Inc., Santa Fe Springs, Calif.; Schunk Inc., Morrisville, N.C.; Pratt Burnerd America, Kalamazoo, Mich.; and Bock Workholding Inc., Ford City, Pa.

Positrol's Chuck Change system allows the user to change out complete



The Positrol Chuck Change system allows one base to hold a variety of chucks.

chucks on a lathe, grinder, gear hob or machining center. It incorporates a receiver that bolts permanently to a machine spindle and adapters that mount to each of the workholding devices. The system connects to the machine's existing hydraulic cylinder and drawtube and can accommodate a range of standard and special workholders.

Positrol also sells workholders that work with its system, as well as adapters that accommodate different workholding devices, enabling its customers to continue using their existing chucks.

Once the receiver is installed, chuck changes involve a four-step operation: the operator releases three cams holding the workholder to the receiver with

a counterclockwise half-turn of a hex wrench, pushes a release button, disengages the workholder from the drawtube by rotating it 23° and removes the chuck. Operators install a new chuck by reversing the procedure.

SMW Systems sells the Ultimate Chuck, which also bolts directly to the machine tool spindle through a direct-mount back plate. The chuck works with the machine's existing short-stroke cylinder, eliminating the need to replace actuators. SMW Systems can also supply a drawtube adapter to fully integrate the chuck with the machine.

The Ultimate Chuck allows jaws to be changed, repositioned or reversed by using a hex key to release the actuating mechanism with a quarter turn,

removing or repositioning the jaw, then re-engaging the actuator using the key.

### Wedge Design

Although practically all quick-change systems incorporate a wedge-bar chuck, Schunk's wedge system on the THW-plus quick-change-jaw lathe chuck drops straight down. This prevents chips and other contaminants from entering into the chuck body's pocket and causing repeatability problems and premature wear.

Steve Hartung, Schunk's product manager for rotating workholding, explained: "With our system, you only have to turn a wrench 90° to remove one set of jaws, as opposed to our competitors' [products] where you have to turn the wrench, say, 180° or better. What that does is slide the wedge all the way over. When it does that, it exposes the chuck body and anything that's sitting there will dump down

inside the chuck body."

End users need to grease all chucks for them to perform properly, but it's even more important with a wedge-bar chuck, which has more moving parts than other types of chucks.

To enhance grease retention, Schunk etches microgrooves into the internal moving components, such as the piston and wedge. "Grease retention is extremely important when you have chucks, especially wedge-bar chucks, that need to repeat very well in today's tight-tolerance environment," he said.

One company offers an alternative to the wedge-bar design, which is typically not counterbalanced. Pratt Burnerd America's lever-wedge design is counterbalanced, so jaw force is maintained at high spindle speeds rather than being lost due to centrifugal force. "It's a counter-centrifugal chuck," said B.J. Lillibridge, vice president of the power chuck manufacturer. "Our 8" chuck is rated at 5,500 rpm and we rate it at 90 percent jaw retention, or only 10 percent loss at 5,500 rpm with a standard-weight jaw."

To allow machining at the maximum available speed, Lillibridge noted that other chuck manufacturers use a smaller, lighter-weight master jaw and top jaw to reduce the weight and mass of the jaws. This decreases the loss of jaw force at higher speeds. "The disadvantage of that is if the customer has, say, standard top tooling with 1.5mm x 60 serrations, he cannot use those top jaws from his old chuck and put them on that quick-change-jaw chuck," he said. "They won't fit. Our chuck has larger master jaws, so we can use those jaws. Because it's a counterbalanced chuck, he can use his existing top tooling."

In addition to quick-change-jaw systems for lathes, systems are available for vertical machining centers such as the one from Bock Workholding Inc., Ford City, Pa. The product has a locator plate, with a standardized grid pattern that bolts to the top of the ma-

chine table. An expanding dowel pin drops through the fixture, vise or other workholding device into the locating plate, "and that gives you ±0.001" repeatability," said Joseph Cousins, president of Bock.

He noted that switching from one vise to another takes about 10 minutes, but the system has two quick-change capabilities. "The main system that goes on the table allows you to change the entire vise or fixture," Cousins said, "and the



A quarter-turn of the hex key lets these jaws from SMW Systems adjust to any position.

vise itself has a quick-change feature. It allows you to change machinable jaws very rapidly—a few seconds."

### Faster, Safer, More Versatile

With quick-change chucks, the time savings is significant, but that is not the only benefit.

"With a quick chuck change," said Eric Weber, Positrol sales manager, "a machine runs more efficiently because it can quickly switch to the right chuck for the job, and proper workholding enables machines to run faster, completing jobs more quickly. Machines are also better utilized because they can run a number of different operations, changing from a 3-jaw chuck to a collet chuck for running bar stock, allowing more effective work scheduling. One machine can run any

part at any given time."

Steve Brown, vice president of operations at SMW Systems, echoed that thought. That's because the Ultimate Chuck, rather than enabling users to change chucks, allows them to quickly change from hard to soft jaws, which can be reused without boring. This increases efficiency. With the system, they can also switch to a selection of specialty jaws designed to hold a variety of workpieces, including round and nonround bar stock.

"The Ultimate Chuck has a very long jaw stroke, typically double that of a standard power chuck," he pointed out. "This is quite helpful, especially for the first-operation chucking on rough diameters."

Additionally, the Ultimate Chuck lets the user quickly adjust the jaws radially, which allows a single set of jaws to grip a wide range of diameters. "Some quick-change-jaw chuck designs attach the jaw in a single diameter position only," Brown said. "With those, a different set of jaws is required for every diameter you want to grip—a costly disadvantage."

Many companies emphasize the safety aspects of these systems, because switching to the right workholding setup for a job, as opposed to "making it work" using the workholding already set up on a machine, makes for safer operation.

"If the jaw is not seated correctly and you crank that machine up and create a high centrifugal force, that jaw could come out of the chuck and cause damage to your machine or—worst-case scenario—the operator," said Schunk's Hartung.

Generally, systems have special safety features. For example, SMW Systems' Ultimate Chuck prevents the hex key from being removed from the chuck until it is properly locked in place.

### Savings and Flexibility

The Charles Machine Works Inc., Perry, Okla., reaped multiple benefits



Pratt Burnerd's quick-change master jaw design allows an end user to utilize his existing top tooling regardless of the type of serration.

when it switched to quick-change-jaw chucks from Pratt Burnerd. In addition to reducing setup time by at least 60 percent, the maker of Ditch Witch construction equipment was able to utilize existing top tooling with its 30 systems.

"We've got several 15" chuck machines and four different sets of master jaws with different serrations for each machine," said Jack Galfetti, the company's capital-equipment buyer for manufacturing process engineering. "They can all share tooling of different serrations on the back of the chuck jaws, and you can just move them around from one place to another. It makes your facility as flexible as possible."

To change a master jaw, the operator needs only an Allen wrench. Each jaw has an Allen screw located around the circumference of the chuck, and to release a jaw, the Allen wrench is turned 180°. Then, the operator removes the jaw, puts in a new jaw with the top tooling already in place and secures it. "It takes 2 to 3 minutes," Galfetti said, "because the jaws should be cleaned and regreased before they are put back into the chuck."

The equipment manufacturer is working on a 24" chuck project. The chuck will come with special sets of master jaws, allowing utilization of its 18" top tooling as well. "We have 239 sets of jaws at \$440 a set that we will be able to reuse," Galfetti noted.

And, because of the chuck's counterbalance feature, the manufacturer didn't have to worry about its primarily mild-steel parts coming loose during machining. "You don't lose grip force as the machine's rpm goes

up," Galfetti said.

### Acceptance

Quick-change chucking systems have been relatively popular with larger manufacturing customers. Job shops are a harder sell.

"For one thing, the new CNC [machine] the shop has just bought comes with a standard chuck, and convincing the owner to pay another \$7,500-plus for a quick-change chuck is hard to do," said SMW Systems' Brown. "It's his money, and though he will gain the most, he also has to bite the bullet and pay up front."

But both Brown and Positrol's Weber agree that once a customer has used a quick-change chuck, the system quickly proves its value; customers often choose to have their other machines retrofitted to gain even more advantage.

Ironically, it is the job shop, with its multiple smaller jobs requiring multiple changeovers, that benefits most from quick-change chuck technology, but which might be locked into more conventional thinking when it comes to workholding. "At most job shops, it hasn't really sunk in yet," said Bock's Cousins. "They need to convert from one job to another very quickly." △

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