the fundamentals of face driving

Depending on the type of tooling, a **SINGLE FACE DRIVER** may replace several solid ring drivers. Read on to learn more.

by Mitchell Kirby

Ever-increasing demands on manufacturers to improve productivity and quality have led to the need for faster and more accurate machine techniques. Face driving arose to help meet these demands. Originally developed in Europe, it has become increasingly popular in the United States in the last decade.

With chucks and grinding dogs the part must be released after the first operation, reversed, and re-chucked before subsequent operations can be performed. Traditional machining requires multiple operations and multiple setups, increasing both costs and cycle times. Work in process accumulates as parts are queued waiting for subsequent operations.

Unlike a chuck or grinding dog, a face driver grips and turns the work piece by locating only on the face of the part. The face driver's center point centers the part establishing the axis of rotation, while the drive pins penetrate the face of the work piece. Since the part is machined between centers, radial runout is largely eliminated, resulting in a higher quality part at a reduced cost. Basically, face driving allows the complete turning or grinding of the entire outside diameter of a work piece in a single operation. Higher part quality is achieved while reducing queue times and work in process inventories.

How a Face Driver Works

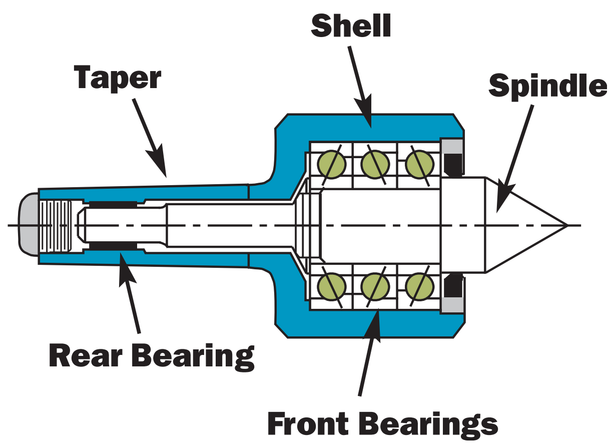
A face driver has two main components, the drive head and the mounting mechanism. The drive head contains a compensating medium; drive pins and a spring loaded center point. The most common mountings are Morse Taper shank mounts, chuck mounts, or flange mounts. Custom mountings are readily available to fit a variety of special applications.

Face driving is a simple, two-step operation; centering followed by clamping. Under tailstock pressure the work piece engages the center point, locating the part and providing a consistent axis of rotation. As the tailstock continues to drive the work piece against the center point, the axial pressure forces the spring-loaded center point back into the drive head until the drive pins engage the face of the work piece. Each pin individually compensates for any irregularities in the face until all of the pins are fully engaged. Under the increasing axial load, the drive pins penetrate the work piece, completing the clamping operation, while the center point maintains the axis of rotation. The compensating medium in the face driver assures equal penetration of the drive pins despite surface imperfections or variations in the squareness of the face.

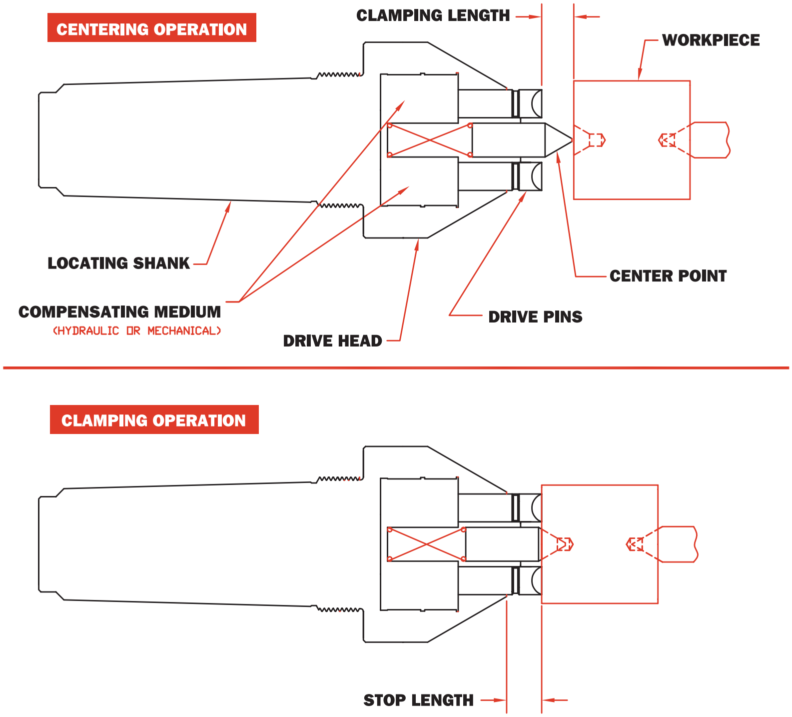
Face Driver Designs and Mounting Methods

The compensating medium distinguishes the two predominate designs of face drivers. Hydraulic designs are generally less accurate than mechanical designs and require some disassembly to change drive pins and center points. Sitting behind every drive pin is a sealed piston assembly that prevents hydraulic fluid leakage. The oil cavities behind the pistons interconnect to a common fluid reservoir. Because the pressure equalization of each drive pin is directly influenced by the hydraulic fluid, each pin "floats" in conjunction with the other pins. The drive pins "react" to accommodate irregular work pieces to a greater degree than that of mechanical designs. However, higher tailstock pressures may be required to drive the work piece when compared to mechanical drivers.

Mechanical face drivers have quick-change center points and drive pins. Both pins and points can be removed from the drive head with moderate pressure without disturbing the accuracy of the driver. Changing from one pin style to another can be accomplished in under a minute. The drive pins in mechanical face drivers sit on a series of male and



female convex and concave washers. The male inner washer is split into segments that move independently against the concave surface of the female washer. Pressure from the drive pins forces the split segments to slide down the concave surface of the female washer until the segments lock around the center point. This locking feature provides a similar effect to that of a collet chuck. The locking center point feature enhances dimensional accuracy and repeatability to a greater degree than that found in hydraulic designs. Since



FACE DRIVING ALLOWS THE COMPLETE TURNING OR GRINDING OF THE ENTIRE OUTSIDE DIAMETER OF A WORK PIECE IN A SINGLE OPERATION, SO HIGHER PART QUALITY IS ACHIEVED WHILE REDUCING QUEUE TIMES AND WORK IN PROCESS INVENTORIES.

the center point and the drive pins both support the work piece, tailstock pressure requirements can be reduced in comparison to hydraulic drivers. This not only saves wear and tear on the machine spindle bearings, but allows mechanical drivers to be used in applications where tailstock pressures are limited.

Morse Taper shank mounts are used when machine spindles will accept a taper shank. They have the benefit of easy changeovers without requiring any tools. Chuck mounts require special soft jaws and grip directly on the drive head or the mounting flange of the face driver. This configuration is not as accurate as taper shank or flange mounts, but does not require the removal of the chuck from the machine spindle. Flange mount face drivers are bolted to a spindle adapter plate, which in turn bolts directly to the machine spindle nose. This mounting is the most rigid and is usually required when holding tighter tolerances. Spindle adapter plates are available for most standard machine spindles. During setup, the driver is “dialed in” on the adapter plate with stirring screws until all runout from the machine spindle has been eliminated.

The Riten Face Driver product line consists of seven hydraulic and 10 mechanical designs. This wide range of models offers a large degree of versatility for large parts such as large rolls, motor shafts, and crankshafts: for small parts such as valve stems, ball studs and automatic transmissions shafts; and for rough castings and forgings such as automotive axles and gears. As a general rule, hydraulic drivers are used for larger shafts and forgings, aggressive roughing applications, and applications where accuracies of .0015 -.0020 inches are acceptable. Mechanical designs are frequently used for smaller parts, families of similar parts where quick-changeovers are important, and applications where accuracies of .0004 - .0008 inches are required. Face drivers are used in many between center operations such as hobbing, milling, shaping, grinding, gear cutting, spline milling, facing, and turning.

The gear industry is somewhat unique in that solid ring face drivers or driving disks are used extensively in hobbing applications. Most of the standard tooling supplied by Liebherr, Gleason, and Pfauter consists of this type of driving mechanism. Standard face drivers can be used in many hobbing and gear cutting applications without difficulty. Depending on the type of tooling, a single face driver may replace several solid ring drivers. As with any new process, customers should consult the factory to determine the best choice of face driver for a given application.

About the author:

Mitchell Kirby is vice president of manufacturing for Riten Industries, Inc. He can be reached at (800) 338-0027, or via e-mail at mitch@riten.com. The company’s Web site is [www.riten.com].