Heinrich Company (Racine, Wisconsin) has helped pedal Waterford Precision Cycles, Inc. to the head of the *peloton* when it comes to bicycles. The Waterford, Wisconsin based company manufactures the frame, fork and handlebar stem of high-end, custom-built Waterford and Gunnar brand bicycles. It also builds bikes and other cycling-related components as an original equipment (O.E.) manufacturer for Standard Byke Co., Heron Cycles, and numerous other companies.

Jeff James, Plant Manager, credits Heinrich's DA-2200-SC pneumatic double-acting self-centering vise with enabling his machinists to quickly change tube size and cutting tool with little effort and virtually no downtime. The vise automatically centers the tubing and holds it in place for precise mitering. Both of two opposing jaws are actuated by a cylinder on each end of the vise. The jaws are tied together by a rack and pinion gear system that allows the vise to be self-centering with an accuracy of 0.001". It is mounted on a movable table with a spindle situated above which descends to provide a clean curved cut. (See Figures 1 and 2.) A four-way foot treadle valve (45-12CI) activates the vise.

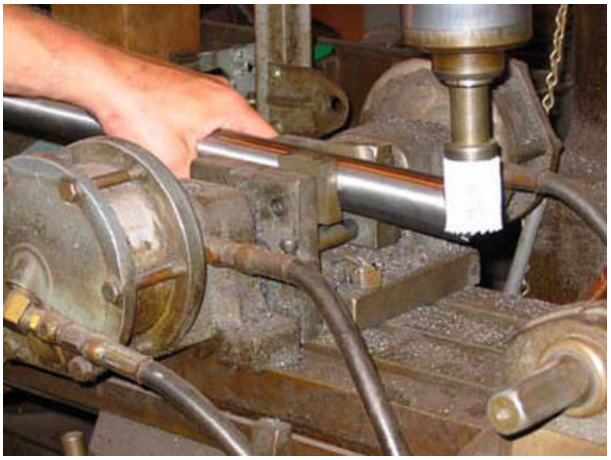

Figure 1: Heinrich Company's DA-2200-SC Automatic Self-Centering Production Vise. Jaws are connected by a concealed gear and rack so that they move together equally on both sides of center, within an accuracy of 0.001".

Waterford Precision Cycles was founded in 1993 by Richard Schwinn (great-grandson of the founder of the company with the same name) and Marc Muller (the former head of engineering for the Schwinn Bicycle Company). Mr. James was asked to become a partner when he took over management of the factory in 1995.

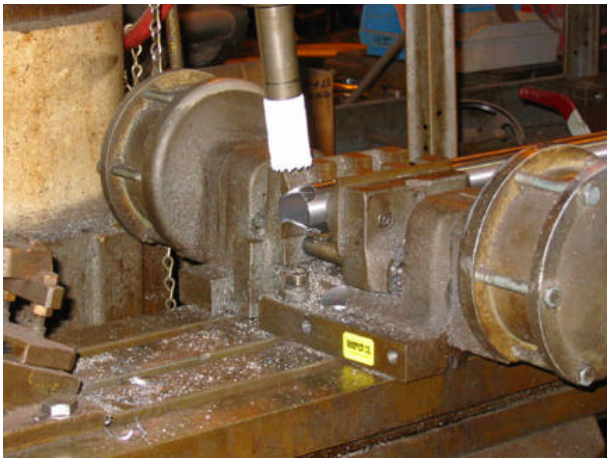

Figure 2: DA-2200-SC Automatic Self-Centering Production Vise.

Mr. James recalled, when the Heinrich vise they inherited from Schwinn broke down several years ago, production ground to a halt and he frantically phoned Heinrich to see what could be done. After learning firsthand the ease with which these vises could be rebuilt, and recognizing their value to the company, he quickly went out and bought another one. The two self-centering Heinrich vises are heavily used and are an integral part of the custom-bike production process, according to machinist Brian Blank.

As one of the nation's leading manufacturers of custom bicycles, Waterford Precision Cycles offers world-class craftsmanship, a practically infinite number of option combinations, unparalleled customer service, and the ability to handle small batch sizes, along with color flexibility.

Frames are made of either chromoly steel (chromium-molybdenum) or the new air-hardened alloy steels available from True Temper USA (Memphis, TN) or Reynolds Cycling Technologies (Birmingham, UK). While a weld will weaken chromoly by almost 45%, welding actually *adds* 20% strength to the high-yield, air-hardened type steel. Low-temperature silver brazing has been used by Waterford and its predecessors for over 40 years, and is used exclusively on the high-end Waterford models, which can retail for up to $1,750 for the frameset only. The nature of the air-hardened steels allows Waterford to very successfully employ T.I.G. welding on its Gunnar line of frames.

The custom manufacturing process begins when a bike dealer calls Waterford with the rider's specifications. In-house design takes roughly two hours to convert this information to tubing geometry, frame dimensions, and correct tubing type. The wall of the tube is thickest on the ends, and gets thinner towards the middle. "The purpose of this is to make sure that the bike is as strong as possible, while still remaining as lightweight as possible. The frameset tubing is highly engineered to strict tolerances," explained Mr. James. Every custom-made bike carries with it throughout the manufacturing process a complete engineering drawing describing every detail of the bike's geometry, in addition to the paint scheme and which decals the rider has chosen.

The tubing is mitered using Heinrich's double-acting, self-centering vise. These mitered pieces then follow different paths, depending on the type of bike and the welding process selected. Some frames are mounted on a versatile welding fixture designed for ease of set up, and the ability to handle a wide range of bike sizes and types. This fixture allows different frame angles to be set up quite easily.

Following the welding process, the frame is aligned. It is set in a machine resembling a medieval torture device. After "the rack," Waterford bikes are subjected to even further testing by being inspected on a large surface plate. Here, a bike's dimensions are ensured to within 0.003", thus maintaining the company's stellar reputation for precision.

Once the frame has been properly aligned, it is ready to be transferred to the paint department. There it is hung and dipped into several solutions, which clean and prepare the steel for paint. Waterford is equipped to paint any color or design. "A customer once walked in wanting a bike the same color as his yellow Labrador retriever. We had him wait while we created and matched the color," boasts Mr. James.

After painting, a bike is ready to be shipped. The bright fluorescent lighting in the shipping department allows the final product to be visibly inspected for any surface irregularities. Mr. James states that a key foundation of the company's quality is extreme road testing of new designs. "It is not uncommon to put over 25,000 miles on an experimental frame before we even consider it for production." (He then asked how many miles we put on our cars in one year.)

The cycling company recently started using a distinct, blue shipping carton, simply labeled, "American Dream Bike, Waterford USA" so that its bikes can be readily identified when received. By not advertising a specific brand name, they anticipate expanding OE business.

Mr. Blank points out that another vise, Heinrich's double action DA-3301 (See Figure 3.) is used exclusively to crimp

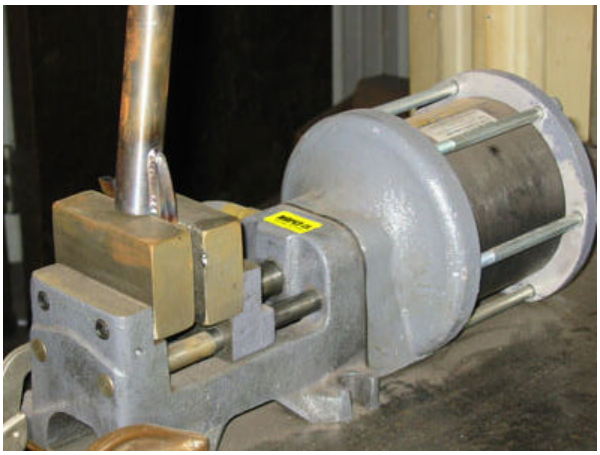

Figure 3: "The Cashius Cruncher" in action, Heinrich's DA-3301 Double-Acting Vise. Piston-type air cylinders provide up to 1500 lbs. of clamping force to collapse and flatten tube ends.

the end of one particular frameset. "It's fondly referred to in the shop as the 'Cashius Cruncher,' after the Cashius BMX model it's used for," he added.

Waterford manufactures just about any bike one can dream of…downhill racers, touring and mountain bikes, bikes that people can fold up and throw in the trunk of their car, even an Iditabike (named after the Iditarod), with 3½" tires used for cycling in the snow. Waterford also offers standard bicycle designs for virtually every form of cycling found today. Constantly striving for perfection, Waterford depends on Heinrich's production vises to help them measure up to the precise engineering and technology demanded in today's rigorous cycling circles. Heinrich Company has been instrumental in helping Waterford Precision Cycles get a grip on the competition and set the standard for custom-built, American-made bicycles. You can bet they won't be content to just sit around, spinning their wheels.