

QUEEN CITY FORGES AHEAD WITH TECHNOLOGY

Queen City Forging began operations in about 1880, taking over a vacant icehouse along the banks of the Ohio River, to produce metal component parts for horse-drawn carriages, required by the large number of carriage builders in the Cincinnati area. In 1881, The Queen City Forging Co. was incorporated, having grown quickly to meet the demands of the local market.

By 1900, Queen City Forging was producing forged components for the infant automobile industry. As the transportation market shifted, Queen City shifted production away from vehicle components to more generalized production for many industries. Most of the customers were Cincinnati-area manufacturers.

During and after World War II, Queen City engaged in volume production of ordnance materials for the U.S. military. Subsequently, the company fell into decline as the second-generation owner reached re-

tirement age with no plan for succession.

Howard Mayer and John Roth, business partners after leaving the U.S. Army following World War II, began as manufacturer's representatives based in Cincinnati. They quickly focused their sales efforts, serving manufacturers of forgings and castings and in 1958, purchased Queen City. Over the next 30 years, the company grew thanks to the variety of job shop work performed by the facility. In 1980, Mayer, along with his sons Rob and John, purchased Roth's shares of the company, and set in place a succession plan that has resulted now in the two brothers owning Queen City Forging.

Today, Queen City produces impression-die hammer forgings up to 8 lb. and upset and open-end die forgings up to 15 lb. and performs industrial blacksmithing of tools and special shapes up to 50 lb.

A Chambersburg die forger was acquired in 1996. This hammer, with com-

puter controls to program blow pattern, timing, and blow energy, employs "state of the art" forging hammer technology. It is a significant upgrade from the capabilities of the company's board drop hammers, and allows Queen City to produce a greater variety of forgings to closer tolerances, efficiently. A reconditioned 650-ton, long-stroke National Maxi press was installed in 1998, complete with new PLC controls, and improved the company's capabilities in aluminum forging. In 1999, the company installed an Arrow 500 machining center. It allows Queen City to offer one-stop shopping because it can effectively finish parts, ready for assembly or for sale. The machining center also allows it to undertake tool machining with greater accuracy.

Induction heating is available on all forging units for improved quality and efficiency. Gas fired forging furnaces are also available, increasing flexibility, and

However, low rates of heat-transfer to the workpiece, and the need to heat both the furnace structure and the workpiece, require relatively long cycle times. That makes gas-fired preheating thermally inefficient.

Heating techniques have been developed that use high-speed convection furnaces and induction furnaces, and these have higher heat transfer rates that indicate some improvement for the billet-heating process. Induction furnaces, for example, can heat more efficiently, but the equipment is expensive and the geometry of the metal being heated must be carefully considered. Finally, in Queen City's experience, induction furnaces had problems coupling with aluminum alloys, and they proved to be unsuitable when reheating forgings that require multiple forging cycles.

To address these issues, Oak Ridge National Laboratory and industrial and university partners, including Queen City Forging, developed a hybrid infrared heating system. Rapid Infrared (RI) heating permits fast and uniform heating of aluminum alloy billets prior to forging, and the system also can be used for subsequent reheating of forgings that require additional processing.

At the Ohio Technology Showcase, held in Cleveland, September 27-29, Dr. Craig Blue, group leader, Materials Processing, and Puja Kadolkar, research associate, both from ORNL, joined Rob Meyer, president of Queen City

Forging, to present results of their development work.

They noted that RI heating has been proven to reduce the heating times by an order of magnitude, decrease energy consumption by factor of three, and produce forgings with enhanced metallurgical and mechanical properties. Testing of this hybrid infrared system in full-scale production demonstrated cost savings of up to 40-50% through reduced energy consumption, increased throughput, and improved consistency in the process and quality of the product.

More specifically, aluminum forging-blank heating time has been reduced from three hours to 15 minutes, using a continuous belt setup for higher throughputs and more efficient production.

RI processing provides fine-grained metallurgy, offering the potential for design changes and extended component service life based on improved fatigue properties.

Queen City is commercializing RI for forging preheating. It also expects to offer RI for heat-treating aluminum forgings, castings, and other aluminum products upon installation of new equipment. Evaluation of the heat treatment indicates that cycle times can be reduced from four hours to 40 minutes on 2000 series aluminum alloy.

Currently, this aluminum billet heating and heat treating technology is available exclusively from Queen City Forging. U.S. and international patents are pending. 