Street Medallions - Visions in a fast lane

Arizona State University
Architectural Sculpture Class
May 18 - Aug. 26, 2005
Second Floor Gallery

The Cupola

In design and character, the cupola is essentially a stack furnace, a structural configuration that has existed since the earliest times. It contains solid fuel, at first charcoal and today coke, along with the metal to be melted. An air blast is injected into the burning fuel, bringing it to incandescent heat, and the resultant molten metal is collected in a well at the bottom.

Cupola melting is often used in universities because very few art departments, let alone individual sculptors, can afford induction furnaces. The Arizona State University cupolas are cylindrical and have three parts or zones made of refractory-lined steel. The well at the bottom, where the molten iron collects, features a one-inch tap hole and spout near the bot front, which is sealed with a clay bottom between iron taps. Toward the upper portion of the well is a slag outlet. Directly above the well is the melt zone, an area where the blast air is introduced directly through openings called tuyeres—or is distributed to the tuyeres through a windbox which wraps around the cylinder. The stack is above the melt zone, and accepts and preheats alternating layers of scrap iron pieces and coke fluxed with limestone.

When the furnace is first set up, the large chunks of “bed coke” are stacked up above the windbox and ignited. When the air blast is started (usually with blowers) the red hot coke moves into a white heat and the first charges of metal and coke are tipped into the stack. The iron liquefies in the intense heat of the blast, and within minutes droplets of glowing metal can be seen through the tuyere (which often double as observation ports) racing down through the coke into the well. Subsequent charges continue to move down the stack.

When the well is full, the glassy slag floating on top of the molten iron begins to run out the slag port, signaling that it is time to tap the furnace. The clay bot is broken away with a pointed steel rod and the metal in the well gushes out the hole down the spout at upwards of 2350 to 2600 degrees fahrenheit and into receiving ladles (this incandescent flow is called the cock’s tail when the tap erupts with such force that the metal arches out over the spout without touching it). The ladles, holding 50 to 150 pounds can be taken onto the floor by pouring teams, where waiting molds are filled. When all the molds are poured, the hatch at the bottom of the well is dropped out and the remaining coke charges fall out onto the ground beneath in a glowing rubble.

The cupola, as a metallurgical term, originated in Germany in 1454, and its application to western industrial iron founding is attributed to John Wilkinson, a talented Englishman who was obsessed with all aspects

of the metal. (He was buried in an iron casket.) In 1794 he was granted a patent to produce iron for cannon, using the invention he called a cupola furnace. Its meaning today has narrowed to a furnace for iron re-melting in the foundry. Such devices are economical and extremely productive.

The American Foundry Society, the large service and educational organization serving the foundry industry since 1896 sees cupola melting as a vibrant technology, though there had been predictions of its demise in the face of environmental regulations. The cupola remains the best available technology to assure high quality, low cost iron. About 67 percent of gray and ductile iron in America is cupola produced today. Cupolas in industry have frequently been used to produce pig iron which goes on to further processing.