Connick Windows

Thoughts, news and comments concerning the art and craft of Connick stained glass, published periodically by....

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How Stained-Glass Windows Are Made (Part Two)

Julie L. Sloan, 2007

In the last newsletter Ms. Sloan introduced us to the various types of glass, how it is painted and then held together by cames. In this conclusion she discusses the assembly, waterproofing and support of stained-glass windows.

Cartooning

To make a leaded-glass window, a small-scale drawing is prepared for the architect and patron's approval. When accepted, a full size drawing called a cartoon is generally rendered in charcoal. From the cartoon two sets of tracings of the leadlines are made, one for a glazing guide and one to cut up as patterns for the individual pieces of glass. The original cartoon is kept for reference. In order to cut the patterns, a three-bladed shear is used. This removes a narrow strip of paper from between the pieces to leave room for the heart of the came.

Cutting glass

Colored glass is selected piece by piece. After a piece has been chosen, the paper pattern is placed on top of the glass for cutting. Glass does not cut like paper or wood or other solids. Instead of passing a blade through it, the surface of glass is scratched or scored with a diamond or, more commonly today, a steel-wheel glass cutter. This breaks the surface tension and allows the glass to be divided by pulling away from the score. Burrs, slanted edges, or inaccurate cuts must be adjusted in order for the panel to fit together. This is done by grozing, chipping the edge with flat-jawed grozing pliers today or, in the past, with a grozing iron, a steel tool with a notch cut in the side.

The pieces are then waxed up for painting. On a large sheet of plate glass, the lead line of the window is traced in black paint from the cartoon. Each piece of cut glass is then attached to this plate-glass easel in its correct position, using a beeswax mixture to adhere it in place. The easel is then placed vertically in front of a light source so that color relations can be studied. The main outline of form and design are traced on individual pieces placed over the cartoon. Half tone or mattes are applied to the glass with the monochromatic paint to help control the light. After application of the paint, the pieces of glass are removed from the easel and fired in a kiln permanently fusing the paint to the glass.

When all the decorative processes on the individual pieces of glass are completed, and fired, the panel is ready for glazing. Placing the glazing diagram on the bench, strips of wooden lath are nailed to the bench to form a guide for the corner of the panel. The cames for this corner are cut and placed against the lath, and glazing has begun. Working from one corner across the window, the glass is placed in the came, then another piece of came is cut and placed, then glass, and so on. The glazing guide beneath the panel ensures that the pieces are placed correctly and that the size of the panel is kept accurate. In order to keep the assembly, which is not yet soldered, from coming apart, large nails are tapped into the bench at the edges of each newly placed piece of glass. When the opposite side is reached and all the glass and came are in place, all the nails are removed and laths are nailed in place on the final two sides of the panel. The panel is ready to be soldered.

Soldering

All the joints of the panel must be soldered on both sides. Before soldering, they must be fluxed. Flux cleans the came and assists in the distribution of heat to allow the solder to flow smoothly. Solder is a metal alloy of tin and lead that is melted to hold the came or foil together. Unlike welding, the lead, zinc, brass, or copper of the came or foil is not melted; only the solder is melted. It is melted and applied to the metal with a soldering iron. Flux is wiped on every joint, and a heated soldering iron is touched to the solder and the joint to melt the solder into the joint and connect the cames. When the upper side of the panel is completely soldered, the laths are removed and the panel must be carefully turned over to solder the other side. After soldering, the panel is cleaned to remove all traces of flux. Then a waterproofing compound is forced beneath the flanges of the came to seal and weatherproof the window. Traditionally, this was a putty made of boiled linseed oil, whiting, red or white lead, kerosene, and lampblack.

Support bars

A single window is usually made up of numerous panels or sections. This is done for ease of manufacture, handling, and installation. It is much easier to deal with four 3' x 4' sections than with one that is 12' x 4'. But these panels must be supported so that their weight does not crush the bottom edge of the window, and so that the window will be able to withstand wind pressure. Support bars are necessary, even though they can interfere with the design. Stained-glass designers who understand the necessity of bars work them into the design, [As did the Connick Studio]. To give lateral support, saddle bars span the surface of a panel, usually on the interior of the window where they will not catch rain and snow. Saddles can be of any profile and size. Round is most common, but square, flat, and even oval shapes are used. They are set into or affixed to the frame and fastened to the window. The most ancient and traditional method of fastening a saddle bar to a panel is with copper tie wires soldered to the stained-glass panel and twisted around the saddle bar after installation to hold the panel against the bar. Flat bars are attached by soldering the narrow edge of the bar directly to the panel instead of using tie wires.

To support individual sections T-bars, shaped like a T set on its side, are sometimes used. These bars extend from outside to inside to evenly distribute the weight of whole window to the jambs (the vertical frame elements). Windows that are set without T-bars between sections have stacked or meeting joints between sections. The bottom came of the upper section laps over the upper came of the bottom section to create a water-resistant connection. With this type of joint, the window's whole weight rests on the sill.

Photographs by Orin E. Skinner in the studio of Charles J. Connick

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