TECHNOTES 2

A TECHNICAL SUPPLEMENT FROM BULLSEYE GLASS CO.

THE VITRIGRAPH KILN:

Creating a New Vocabulary in Fused Glass

BACKGROUND

Fused glass is frequently characterized by a "cut-and-paste" approach to design. Various shapes of colored glass are cut and fired to a base blank, often a tile or plate. While this is a valid method of working the material, it comes more from a collage or mosaic than from a painterly tradition.

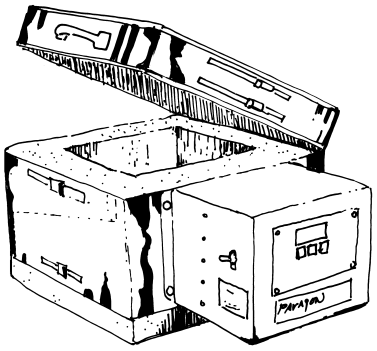
Narcissus Quagliata has worked in stained glass since the early 1970s. Originally trained as a painter, he—probably more than any other modern flat glass artist—succeeded in imparting a fluidity and painter's sensibility to the essentially mosaic methods of leaded glass by both painstaking selection of unique glasses and a highly expressive usage of the lead line. When we invited Narcissus to take part in the Connections program of artist exchanges at the Bullseye factory he quickly enlisted the assistance of Rudi Gritsch, Bullseye's then kilnworking director and equipment builder extraordinaire to help him in generating lines in hot glass that could approximate the spontaneity of the pen or the brush stroke. These glass lines and the techniques of shading and modeling with frits became the core of a methodology of fusing that Narcissus came to call "light paintings" — a revolutionary approach to working glass in the kiln that combines the expressiveness of paint with the vibrancy of light.

The key tool in creating these lines is a small but ingenious little kiln that Rudi designed. We have since dubbed it The Vitrigraph,* built and used numbers of them, and sent replicas off to workshops in Italy, Switzerland and France for use in Narcissus' workshops. In this issue of TechNotes we will introduce you to the equipment and processes that Rudi and Narcissus developed in creating a whole new vocabulary in fused glass.

Narcissus Quagliata during the creation of "Summer Buddha," fused panels employing hot drawn glass lines.

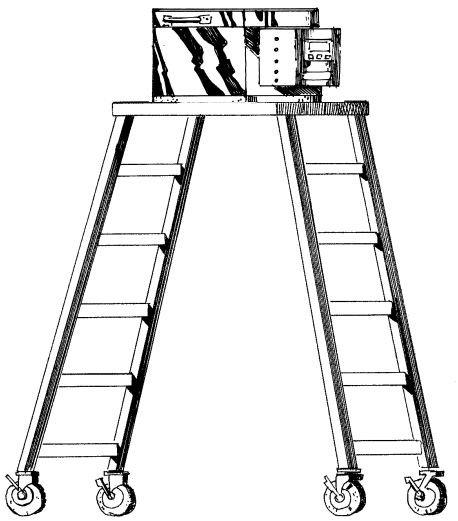
**From the Latin root for glass ("vitri–") and Greek root for writing ("–graph"), the Vitrigraph kiln has only an etymological relationship to "vitreography," the process of making prints from glass plates.*

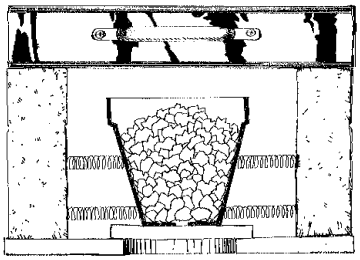
CONSTRUCTION OF A LINEMAKING MINI-KILN



Originally, the Vitrigraph kiln was constructed of three component kiln rings stacked one atop the next. We now use the Paragon Caldera because it has a programmable controller (the original did not), requires less power than the original, and is a more versatile piece of equipment.

The Caldera is rated at 120 volts and 14 amps. The entire unit stands about 10.5″ high and is 13″ by 21″ with the control box. To be used as a Vitrigraph, it is set on top of a panel of 1″ thick rigidized fiberboard that replaces the bottom of the kiln. This 12″ square panel has had a 2.5″ diameter circle cut out of its center. The entire unit is mounted overhead either to a wall or on a sturdy ladder-like structure. Our Vitrigraph is mounted with the bottom about 5′ 9″ off the floor. It is in essence a miniature bottom-draw glass furnace.





Within the heating chamber a pair of mullite clay strips (sawn up kiln shelves) are bridged across the center opening in the fiberboard in order to support a clay flowerpot. This pot is about 5″ high with a 6″ diameter rim. Avoid pots with hairline (or larger) cracks as these will widen as they reach molten glass temperatures. In our experience Italian pots seemed more durable than those from Mexico.

A Sentry Xpress digital temperature controller mounted on the outside of the kiln controls heating to the kiln chamber. Instructions for programming this controller come with the kiln upon purchase.

GLASS FEEDSTOCK

Any scrap pieces of Bullseye Compatible sheet glass or larger grain size -03 frit can be melted down to make lines or "stringers". Glass granules smaller than -03 frit should be avoided because they produce a seedier stringer due to the greater amount of air trapped between the smaller particles.

LOADING THE GLASS

We typically load the glass into the pot outside of the kiln, while it is at room temperature, and then place the loaded pot into the kiln so that it is supported on the bottom perimeter by the mullite strips. When working with frits and extremely small pieces of scrap sheet glass, you will need to take some measures to prevent the glass from falling out of the hole in the flowerpot when loading. We place a small square of Bullseye Compatible sheet glass of the same color as the feedstock over the hole, and then fill the pot with the required color.

FIRING THE KILN

Before firing the Vitrigraph read the safety notes on page 4, make sure that all electrical cords are secured out of your way, and that whatever platform you have selected for the kiln is stable. If your platform does not include some ladder system (as ours does) you will need a sturdy ladder adjacent to the kiln in order to access the top lid for charging.

Charging. We try to load the amount of glass that we will need for a run of stringer while the pot is cold, and then cool between runs. If time forces you to do continuous melts, or if during the melt it becomes necessary to add more glass to the pot, there are a few things that you will need to keep in mind. Use extreme care in filling the pot. Glass scraps or frits which miss the pot and land on the electrical elements can damage the elements. Those which melt against the refractory brick will soon eat it out. Power to the kiln should be turned off during charging.

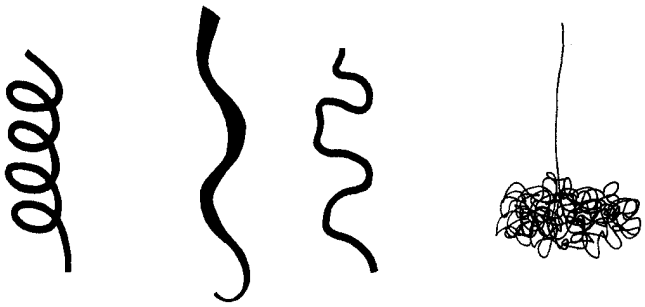
Firing cycles and process temperatures for various glasses. All glasses will not behave identically in the melting and forming process. Those with lower melting temperatures (like black #0100) will need to be heated more slowly and to a lower process temperature to avoid their running too freely. Certain glasses (like white #0113) will cool more quickly than others and have what is termed a narrower "working range." Transparent cadmium/selenium glasses such as 1120, 1122, and 1125 will have a tendency to opalize in this remelting process. Only by working with the various glasses will you come to understand their various idiosyncrasies.

Firing the vitrigraph too rapidly may result in a very seedy melt, with lots of air bubbles trapped in the resulting stringers. It may also cause the feedstock to thermal shock, sending chips and shards into the elements and refractory bricks. Firing too quickly can also result in an extremely uneven melt, with the glass in the top of the pot extremely hot and the glass in the bottom still relatively cold. The result is that the glass begins to flow very slowly, but then very suddenly flows at an uncontrollable rate. The following cycle works well to achieve a very controlled line for most glasses:

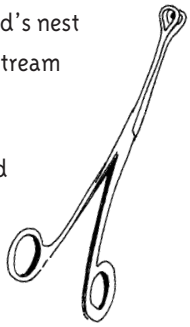
RATE	TEMPERATURE	HOLD
450 dph	1680-1725F*	2:00

Forming. During the forming stage the temperature will determine the quality of line produced. Setting the kiln at 1680 while melting 0100 should produce a thick, fairly slow-moving stream. At this temperature it is very easy to manipulate the glass by hand-pulling and using the simple tools explained below. Fine-tune the quality of the stream by starting at a low melting temperature and then slowly increasing it. If the glass stream is moving so fast that it becomes impossible to control, turn the kiln off and lift the kiln lid to allow heat to escape. When the glass is back under control, close the lid and restart the kiln.

SOME SIMPLE TOOLS AND THE LINE QUALITIES THEY PRODUCE

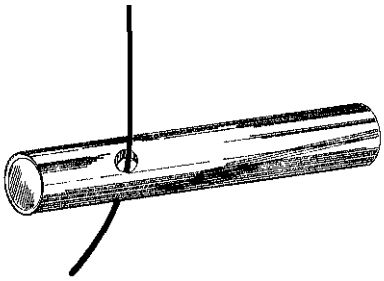


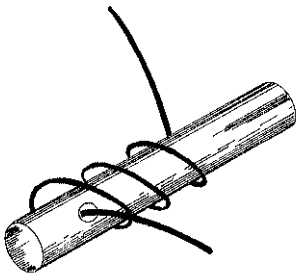
Hand pulling. Many types of lines require only handwork (gloved, of course!). If the glass is viscous enough you can pull it at intervals to create stringers of fluctuating thickness. At these low temperatures the glass can also be pulled into curves. At very high temperatures when the stream is extremely thin and fast-moving you can make delicate bird's nest shapes and meshed globs by allowing the stream to "free fall."



Tongs. Any of a variety of long-handled metal tong-like tools can be used to bend and twist the stream into curves if you do not feel comfortable hand pulling the glass. We used large (9˝ long) hemostats.

*Most transparent glasses and 0100 will work well at process temperatures of 1680F. Most opalescent glasses will work well at process temperatures of 1700F. Stiff glasses such as 0113 and 0137 work well at 1725F. Depending on your experiences and the types of stringers that you are trying to create, you will find process temperatures that suit your specific needs.





Pipes. Stringers in the shape of spring-like coils are made using a 1˝ diameter steel pipe. Ours is 15˝ long with 1/2˝ holes drilled through the wall about 1˝ from the pipe's end. Pull the glass stream through the drilled holes. As the glass flows, twirl it around the pipe and then cut or break it at the end of the pipe.

Tray. A 2-foot square stainless steel tray held at a 45° angle about 16˝ below the bottom of the kiln makes a good working surface for creating flat curly-Qs, S-curves, and other curves. Affixing such a tray in a way that it is both convenient but easily detachable will require some fabricating skills beyond the scope of this TechNotes issue. We're still mucking about with ours.

MELTING CYCLES AND POT LIFE

Because of its long working range and for obvious design reasons black (0100) is a good stock for your initial experiments in line-making. If you wish to work in other colors you will need to cycle through the spectrum, gradually transitioning from lighter to darker colors. Charging white scrap into the flowerpot at the end of a black melt will result in a run of grey stringers.

Rapid cooling of the pot dramatically shortens the pot life. Be wary of refiring a used pot. The risk of it cracking is far greater than the minimal expense of a new pot. As mentioned above, watch out for cracks. They widen and eventually break on firing. Any grey or metallic appearance to the pot after firing is iron in the clay which has migrated to the surface. The presence of iron on the pot's surface indicates that the pot (and presumably the glass in the pot) became much hotter than it needed to be. This is a good way to weaken the pot and shorten its life.

SAFETY NOTES ON OPERATING THE VITRIGRAPH KILN

◎ Keep this (and any) kiln away from flammable surfaces or materials.

◎ Make sure the kiln is on a stable foundation at all times.

◎ Use heavy (12 gauge) electrical extension cords.

◎ Keep all primary electrical and extension cords out of the way by taping them down in such a way as to eliminate the chance that they can be yanked, pulling the kiln off its supports. If cords are on the floor, tape them down!

◎ As noted by the manufacturer: the temperature inside the kiln should never exceed 2350°F. Never leave the kiln unattended and monitor the temperature by watching the viscosity of the glass stream.

◎ You may find yourself charging the kiln using a metal scoop or tool of some sort. Be certain to turn off power to the kiln and to avoid contact with the elements. There is a significant risk of electrical shock when working this close to the kiln elements.

◎ Always wear protective gear:

Safety glasses. A must at all times. Glass will sometimes thermal shock while being loaded into a preheated pot. Bits of glass will also tend to fly when stringer is broken from the glass stream.

Gloves. Zetex or Kevlar gloves are necessary for charging the kiln and for any direct contact with the hot glass. However, the bulkiness of these gloves makes it difficult to manipulate the forming tools. A thinner leather glove on the working hand can let you handle the tool and provides some protection from the heat, while a Kevlar glove on the other hand allows you to break the hot stringer from the glass stream.

Clothes. Wear long-legged cotton pants and long-sleeved cotton shirts, and be sure to wear close-toed shoes. Avoid wearing synthetic materials/fabrics.