



Glass is Not a Liquid: Information about Early Windows and Glassmaking

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Following a recent lecture on Newport architecture, I felt compelled to do a bit of research to back up my knowledge that glass is not a flowing, “supercooled liquid” at all. The characteristics of historic glass are all due to its methods of manufacture, but the nature of the material itself required confirmation from the experts. I contacted Stephen Koob and Dr. Brill at the Corning Museum of Glass, two renowned scientific experts in the conservation of glass and the nature of the material.

They stated that glass is not really a supercooled liquid at all, since it does not display *any* characteristics of a liquid. It is an amorphous solid, meaning that it does not have the more common crystalline structure of minerals; despite that difference, the material most chemically and physically similar to glass is quartz – definitely a solid also.

As to the notion – often observed to be true – that old window glass is thicker at the bottom than at the top, that quality is due to the original form of the glass, which in turn is due to its method of manufacture. The manufacturing processes will be described first, followed by the construction principles for windows. These generalities apply equally to glass in medieval stained glass as well as to eighteenth-century windows everywhere.

Early glass could be made in three ways: crown, cylinder, and rolled. The latter can be discounted for window glass, because the process was only applied to very costly luxury items. Crown glass was first blown by mouth: a gather of molten glass from the furnace was blown on a blowpipe until it became a proper sized bubble (limited by the glassworker’s breath and arm strength), at which point, the side of the bubble away from the pipe was cut open, and the worker spun the hot glass into a flat disk after transferring the piece from the blowpipe to a pontil rod (stuck to the center of the disk, where the blowpipe had been; this also closed up the hole in the middle). This often entailed a number of steps, mostly to keep the glass hot and malleable. This was the “crown” of glass. The disk tapered from the center to the edges, but if the worker was skilled, at least it was fairly flat; often, curved lines resulting from the spinning may be seen in pieces of crown glass. Cutting usable panes or “quarries” from the disk involved some waste, but cutting small panes, some of them triangular (for a diamond-pattern window) wasted the least. Unusable scraps of glass were returned to the furnace. The center of the disk, called the bull’s eye, was not as transparent as the rest, and was often used in transoms above doorways, where one would not be able to look out anyway, and some light was admitted. Now, of course, bull’s eyes are much sought after.

A type of flat glass that was a bit thicker was produced by the broad or cylinder method. A large bubble of glass was blown, roughly forming a cylinder, which was cut open along its length and ironed flat while still hot and pliable from the furnace. Although cylinder glass could produce larger rectangular pieces than crown glass, it was more difficult to make, and it was not as clear, due to the ironing process; elongated striations may be seen in it.

The first method for making plate glass was developed in the late seventeenth century, but it seldom pertains to window glass. Early plate glass was made by rolling molten glass on metal tables, producing heavy pieces of dull, uneven glass that needed considerable grinding and polishing to be usable in large windows and mirrors. Needless to say, it was much more costly than either crown or cylinder glass. By the mid-nineteenth century, a method for making drawn sheet glass created smooth glass by pressing the molten material between two rollers. By 1923, high quality thick plate glass could be produced, and in 1959 the float glass process was perfected, producing a continuous ribbon of glass floated on molten tin.

As a brief note, there are two common formulas for glass. In the simplest terms, common glass is made of silica, lime, and soda or potash. Its color and clarity depend on the purity of the ingredients; it was frequently green from iron content. Common glass was often known as “bottle glass.” More expensive flint glass was made substituting lead oxide for lime. The resulting material was heavy, sparkling, and somewhat softer than common glass. Flint glass was well suited to cutting and engraving, while common glass was used in creating decorative pressed glass pieces.

As for the construction of windows, the method is straightforward. Panes are cut from the crown, and often display some taper, due to the nature of the crown itself. Logically, the thicker edge of the glass is placed toward the bottom. Sometimes, lines or smears can be seen in the glass, also as a result of the production method. If cylinder glass was used, those lines may be straighter, but not necessarily. Consider that old mirrors, bottles and other vessels do not change shape over time, and we know that window glass does not, either. The glass does not sag over time, nor does its surface become wavy as it ages. It cannot become “less solid” unless it is placed in a furnace and melted.

About the only change that occurs in old glass – and then, only in rare and extreme cases – is sometimes called glass disease. A fault in the original composition of the glass causes it to be vulnerable to attack by moisture. Alkali is leached out of the glass, droplets of moisture might be seen on the surface (hence the expression, weeping glass), and there may be a slight vinegar smell. The glass may take on a hazy appearance, developing over time into a mass of microscopic cracks; this condition is called crizzled glass. Also rarely, old glass with an excess of magnesium in the mix can develop a purple cast, although in modern times this condition is generally regarded as a status symbol rather than a problem. It does not materially affect the glass.

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