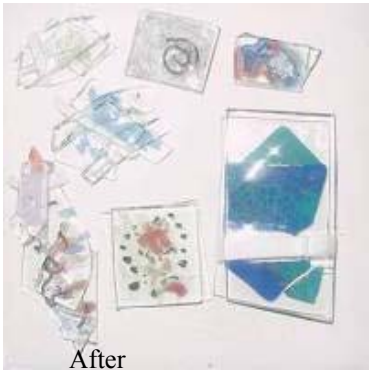

Before


After

FUN FUSING
FUSING FUN

Sue Hinkel
2236 Highway N
Pacific, MO 63069 5402

ART HISTORY: Glass has been around since lightning first struck a patch of sand, forming what we today would call "FULGURITE."
Mesopotamia 2000 BCE. first glass fused in a kiln.
Egyptians continues the development of warm glass processes.
Greeks and Romans adapted and improved the art of forming glass from 300 B.C.E until the birth of Christ. The Roman became some of the best glass workers the world has ever seen.
By the fourth or fifth century CE, warm glass techniques were virtually forgotten and lay dormant until the 19th century when they were rediscovered in Europe.

CAUTION! You are working with very high temperatures - Up to 2000F

MATERIALS
Glass (fusible glass)
Glass Cutters/cutting oil
Glass running pliers
Kiln
Kiln Wash/Brush
Kiln titles or shelf
Safety eye ware
Under glaze
White glue
Fuse paper

PROCESS
1. Cut glass
2. Clean glass
3. Arrange glass
4. Secure glass with a very little amount of white glue
5. Place glass design on a kiln wash covered surface
6. Place the glass design in the kiln
7. Leave the kiln ajar to allow the gases and moisture to escape, heat to 1000 degrees F.
8. Close kiln and heat to 1300 - 1400 degrees F.
9. Turn off kiln.
10. Let cool completely

WORKING WITH GLASS

Firing sheet glass into shapes has been known as glass slumping or bending. Since objects can be fired in a kiln, "kiln-fired glass" has become the term to describe this medium.

THE GLASS BLANK

"Glass blank" is a term to identify glass that has been cut to the shape and size desired for a

finished piece. If it is to be slumped it is determined by the mold on which it is to be fired.

SELECTING THE GLASS

Glass is available in a number of thicknesses (Strengths). Strength in relation to the size of the glass is important. There are limitations to be observed.

The following are maximum sizes for objects which would be handled frequently and refer to square, round or free-form blanks.

One blank:
- Single strength.....6 inches
- Double strength.....9 inches
- Plate or crystal.....15 inches

Two blanks laminated:
- Two single strength.....15 inches
- One single and one double-strength.....15 inches

Blanks to be combined for laminating should be from the same manufacturer. Unless a box of glass is purchased or if the sheet glass is unmarked it is advisable to run a test by laminating two small blanks. Fractures will occur if they are not compatible. Unlike stained glass in which there is stress resulting from non-compatible materials a fracture will be evident after a period of time rather than immediately after firing.

CUTTING

Glass is not actually cut. It is scored and severed. The cutting wheel will remain sharp after much usage if it is frequently lubricated with kerosene. The straight cutter can be stored in a jar with enough lubricant to cover the wheel.

The path of the circle cutter can be estimated and painted directly on the glass with kerosene.
Allow a minimum of one-half inch between the score and the edge of the glass for single and double strength glass. At least one inch is required between the edges of the glass and the score of a circle or a line when cutting plate glass.

A cutting board is recommended. Prepare the surface of a two by four foot plywood board one-half inch thick covered with several layers of flannel and topped with sheeting.

Smooth the layers and staple to the wood or use small tacks. Since the surface will become soiled in time, tape a sheet of brown wrapping paper over this. It can be easily replaced and will be a convenient surface to make notes on as work proceeds.

When scoring a straight line position the ruler to allow for the distance between it and the cutting wheel. Mark the place you wish to score using a plastic tipped pen or marking pencil. Hold the cutter at that mark and bring the ruler or guide to the cutter.

CUTTING CIRCLES

To cut a circle, position the cutter the recommended distance from the edge of the sheet depending upon the thickness of the glass. Score the circle. Turn the glass and press or tap along the scored line. Fissure will be noticeable. Turn the glass back so that the scored side is up and score straight lines from the edge of the glass to near the circle without touching it.

Make four straight lines from the edge of the glass to near the circle without touching it. Make four straight lines. Turn again and press or tap over these lines. The circle will release. Unless the glass is thick pressing is preferred because a smooth edge results.

It is important to emphasize not to place the straight lines around the circle until fissure takes place either by pressing or tapping. The straight lines can go through the circle unless stopped by this partial severance. If small pieces remain around the perimeter of the circle they may be removed with wide-nosed pliers scored side up.

If part of a design includes small circles and you do not have a cutter for that purpose, cut squares and score at each of the four corners. Remove the triangles with pliers. While they do not appear to be perfect circles they will be circular when they are fired.

To make small pieces the same size draw lines with a marking pen to guide the upper and lower limits of the shapes. Unless small pieces can be severed easily with pliers, all scoring is done on one side and tapped or pressed on the reverse side.

Proper pressure will become familiar with practice. The sound of the score indicates whether enough pressure has been used. If there is no sound not enough pressure has been made. If there is no sound not enough pressure has been made. If the cutter resists scoring and does not run smoothly too much pressure has been applied.

To sever glass when straight lines have been scored, place the sheet scored side up along the edge of a table and snap it off using a downward stroke. An alternative depending upon the size of the glass is to turn the glass with the scored side down and press along the score. This will work easily for single strength glass. If double strength glass resists severing, tap lightly along the score line scored side down using the end of the cutter. A ball-end cutter works better than a handle which does not have one.

The position that the cutter is held is very important. It must be held perpendicular to the glass. It must not slant to the left or right of the line to be scored. Hold the cutter between the second and third finger with added pressure from your thumb underneath. If another position is more comfortable use it. The slant can be toward you or away from you as long as it is perpendicular to the score being made.

ANNEALING GLASS WHY AND HOW

Annealing is the process of relieving stress in glass. This is done by holding its temperature within the annealing range. A glass manufacturer has been given a range of 1010 degrees R. to 955 degrees F. The top of the annealing range is identified as the annealing point and is the most effective temperature for annealing. However, since there is variation in temperature within the kiln, it is best to use 1000 degrees f. as the optimum point. The lower end of annealing is identified as the strain pint or about 950 degrees F.

Small pieces require less time to anneal than larger pieces. For this reason small projects should be placed on the bottom shelf of the kiln as this area differs in temperature as much as 40 degrees F. lower

than the rest of the kiln. This is a generalization. The kilns used for the tests followed this pattern. If the difference is less so much the better.

To explain what actually takes place when glass is in the process of being annealed, can become very technical but in simple language, when glass enters into the annealing range and the temperature is kept well within that range, the molecules have an opportunity to arrange themselves. Above this range the glass is too soft to hold an arrangement and below it, the viscosity of the glass it too high to allow change.

When 1000 degrees F. or near that temperature has been maintained for 20 minutes unless it is extremely large or heavy, most pieces are satisfactorily annealed. When glass passes through the annealing range quickly as it is cooling, the molecules are unable to change their naturally irregular pattern and the end product may be easily broken.

Annealed glass should not be confused with tempered glass. The tempering of glass is a treatment given to plate glass as it is in the process of cooling. It can be accomplished at the factories. When the glass reaches 1200 degrees F., it is held at this temperature while 100 degree air is blown on the surface which has an affect up on the inner part of the glass. The surface forms a high compression layer and is three times stronger than ordinary plate glass.
High tension is trapped within the surface. Glass that has been tempered cannot be cut and attempting to do so will cause it to break up into tiny pieces. Plate glass is cut and then tempered.

MOLDS

To give a glass object contour, the flat blank is placed on a mold and fired in a kiln. The firing schedule is determined by the type of glass used. When the firing is completed, the glass has taken on the shape of the mold. It has not become truly fluid but only softened enough to slump in to the shape dictated by the mold. The sharp edges of the glass have become smooth in the process.

A mold that has detail, such as one with a fluted pattern, will supply the design, and only the addition of a colorant to the glass is needed. In the case of stained glass, it may be cut to fit the mold without further embellishment, or pieces may be fused on it to give added interest.

Molds manufactured especially for glass are available. In addition, poured greenware, although not made for this purpose, may be used if it complies with the conditions required for any mold used for slumping. Two major requirements for molds that have contour, regardless of the material used, are that the inside bottom of the mold be flat and the walls have a gentle slope. Molds can be make by the artisan by draping clay over a shape that meets the requirement. Also, clay may be shaped by hand to give a freeform effect.