
El Cheapo Tooling for Curve Generating

by Peter John Smith.

A simple method to utilize cheap diamond saw blades for

generation of spherical surfaces on glass.

A normal milling machine is used, but with enterprise the

principles could be applied to simpler homebrew machines.

NOTE

Since this was written the position with respect to diamond tooling has changed dramatically.

Small diamond Hole Saws or Trepans are readily available quite cheaply.

See hardware stores or eBay. Many are from China.

While not the very best quality, and maybe a bit course, they are quite suitable for rough diamond curve generation.

Be careful about edge chipping. Try to have the blade edge moving from edge to centre and allow enough for some edge chipping.

The life of these blades may not be up to a good Copper Diamond sintered blade but replacement is cheap.

It is ironic that the cost of diamond generating is often cheaper than using grit. And a lot faster.

Also, the thickness of the resulting lens is under better control.

The article, while in many respects out of date, still may be of use to somebody.

Background.

People with close connections to commercial glass working facilities and suppliers take for granted the availability of curve generating machines and more importantly the diamond tooling that goes with them.

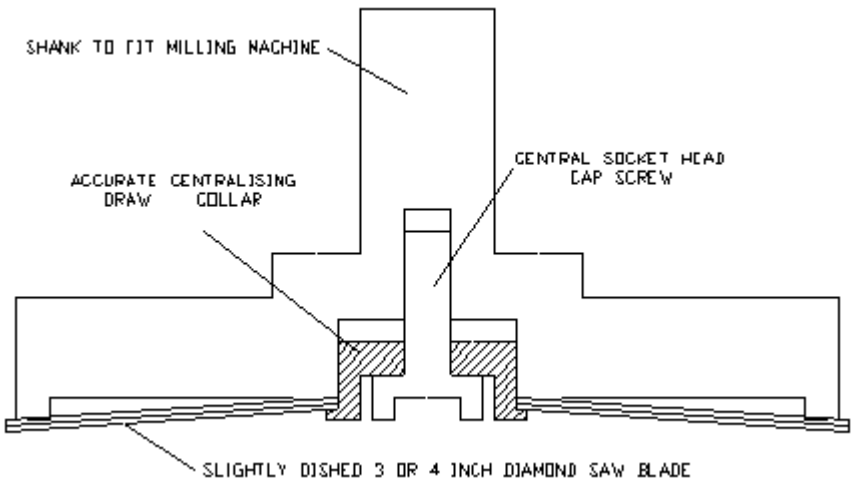
The attractiveness of diamond tooling for curve generation has been considerably increased because of the price of coarse Silicon Carbide grit. We now have a situation where the diamond tooling is far more cost effective, even without considering time saved and better thickness control.

Tooling.

Although by no means the best blade available, cheap Chinese diamond saw blades of 4 inch diameter are available for $9 Australian. They are intended for cutting concrete blocks and the like. One source is the 'Overflow' chain of stores. They can be turned into very effective 'cup' wheels of very shallow depth by simply dishing the blade slightly. These can be used for concaves, flats, and very slight convex surfaces.

These blades are available in either segmented or continuous rim. The continuous rim type is the best and chips least. It is also much safer, as it will not draw in fingers if contacted while running.

A carefully constructed holder for these diamond blades is worth while. In fact, I consider it a necessity. Accuracy of diamond tooling is important to minimise chipping and prolong tool life.



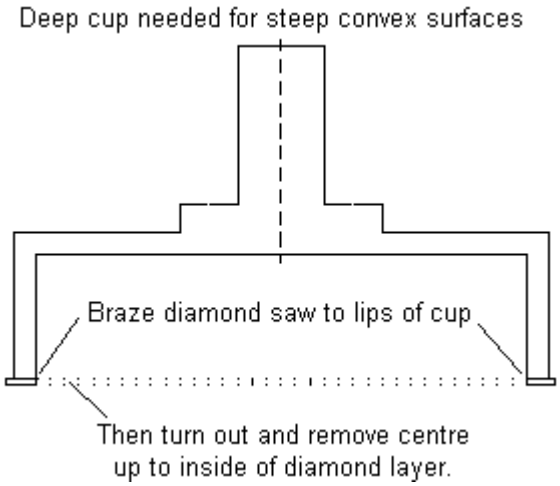
The main advantage of this generating tool is the ease of blade changing. You will be surprised, however, how long a blade lasts and the quantity of glass it will shift. A photograph is included later.

It is possible to turn a 45 degree chamfer on the inner edge of the blade, with a mating chamfer on the draw collar. This deepens the cup slightly. The holder photographed is made like this.

A deep cup may be made by brazing a diamond saw blade onto the edge of a cylinder and turning out the centre.

This is a lot more work. But if the materials and machining equipment are on hand, a little time will produce a useable cup wheel for $9. I estimate it will generate hundreds of surfaces and is of course useable on deeper convex surfaces. A photograph is given later. Diamond tooling will last much longer if used with the best lubricant/coolant. While it hardly seems worth worrying much about very cheap diamond blades, a reasonable, easily obtainable material is ethylene glycol.

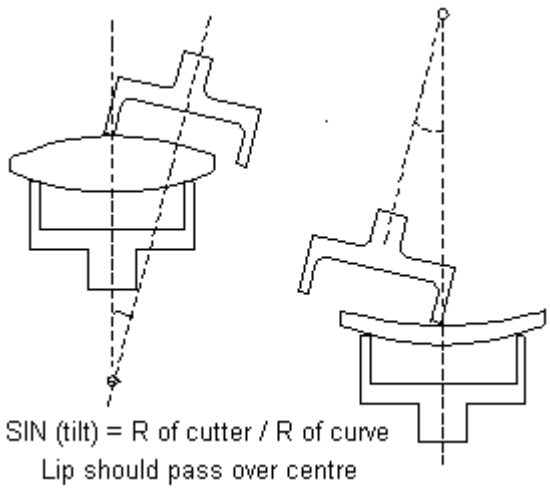
Water offers easier cleanup and disposal at the cost of more diamond wear.



Turning out the centre can be interesting. Apart from unbearable singing of the blade, the diamond chips make mincemeat of a lathe tool if the cut is taken too far. But a HS tool is quick to sharpen so it's no big deal. Singing may be reduced by placing putty or plasticene on the blade.

Diamond Trepanning cutters (Core drills) may also be used for small lens surface generation if you already have them.

Method.



The principle of generation using this method is illustrated above. The setup may be accomplished by

angle setting of the tool axis. In practice it is impossible to attain perfection this way as the pitch circle is ill defined and changes with wear. Some trial and error may be needed for perfect setting.

It is important that the lip of the diamond generating tool passes directly over the centre or a pip results. A slight pip is, however, immaterial as it soon grinds away.

Another method of setting is to simply place a sample lens in place and adjust until good contact results.

A method of slowly turning the glass surface is required. One solution readily available in many machine shops is a rotary table. Preferably this could be power driven, but I have found turning by hand is a viable option. The table is raised slightly and the rotary table turned for one revolution. Then repeated until the generation is complete.

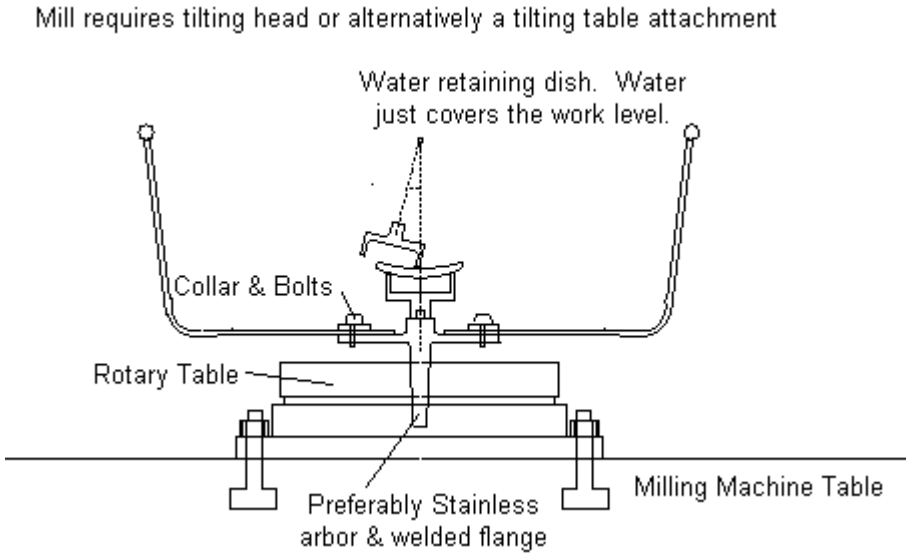
A vertical mill with tilting head is perfect but it would be easy to tilt the rotating table on a normal vertical mill. A mill has the advantage of rigidity.

A drill press could be, and has been, adapted. But its rigidity for large surfaces may be in question.

Wax and rosin mix can be used to attach the glass to the bottom flange for smaller lenses. Large mirrors (I have not tried this) will need some good clamping system. Lateral movement during generating is a disaster with danger of glass chips flying.

Warning.

Some method must be found to safely control glass dust in the air. I have used the principle of generating in a bowl with water just covering the glass surface. Some experiment is needed to find the ideal level when swirled by the rotating tool. Too much reduces the view of the process and splashes badly.



This is the method I have settled on. Obviously it was determined by what was at hand. A friend has made a similar setup which uses a power driven table. A cup wheel made from a diamond blade is in place in the photograph.

All the elements previously described are evident in the above photograph. The table has been deliberately lowered to expose the cutter.

When adjusting the water level, it is handy to have on hand a bucket of water, a small tin can, and a sponge. The water, apart from controlling glass dust, also precludes heating which would weaken the wax holding the glass blank.

Glass sludge must be removed occasionally as a lot is produced. It is amazing how much collects. The thought of this dispersed as a powder in air or a water mist entering the lungs is horrible. Be very careful when scraping out as some larger glass chips will be present. Sharp sharp sharp.

When the cutter is lowered deep inside the bowl, eye protection may not be needed but would never go amiss.

Visible is a disk of Aluminium to which the lens has been waxed. Wax alone is not strong enough. Beeswax and Rosin mined works. The centre of the disk has been relieved to form a cup.

In this case, these holders screw onto the rotary table spindle. This is not a very satisfactory system as the cut has to be arranged so it does not unscrew during generating. This requires some thought and a slight decentering of the cutter. A better system would be advantageous.

Small Convex Lens Generator.

The main problem with the previous generation method is the inability to handle deep convex surfaces using a diamond saw blade.

Experiments are at present being made with a smaller diamond blade donated by Chuck Hards. The method is entirely different. One of the main problems is disposal of glass dust. And too many commitments to finish the work.

When I consider the method has been developed into a useable and safe system I will add it here. Hopefully before long.
