A Figure Skate Sharpening Machine, version 1.1

By R. G. Sparber

This article provides a high level view of a figure skate sharpening machine I recently built. No plans are provided.

The basic idea of the machine was taken from existing commercial machines but with one major difference. The commercial machines rely on free hand sharpening when figure skates are involved. This is because the profile of these skates can be rather complex and varies with manufacturer, model, and size.

My machine only sharpens a John Wilson Pattern 99®, 9-1/4" blade. Its profile consists of a section with a radius of 96", a section with a radius of 27", and a section with a radius of 12". Many hours were spent carefully measuring the skate in order to develop the exact position of each radii. The data was then used to CNC mill a pattern.

Additionally, the skate blade has two edges separated by a hollow. The skater has many choices for the radius of this hollow and has chosen 7/16". This further specializes the machine.

Most of the critical elements of this machine were suggested by my friend John Herrmann. The pattern was CNC milled by my friend Dan Benoit. Both are members of the Phoenix Valley Metal Club.

Why build the machine? Because my wife, Donna, is a figure skater.

The motor is a ½ HP Baldor®, sealed 3 phase motor with a fan on top. Thanks to Brian Lamb for helping me select the correct HP. Thanks to Dealers Industrial Equipment for helping me select the exact motor and speed control.

The motor is driven by a TEC® variable frequency drive. The motor speed is set as a function of the diameter of the grinding wheel. A new wheel is 8" is diameter and runs at 4000 RPM. This is 8,380 surface feet per minute (SFM). As the wheel's diameter is reduced due to wear and dressing, the speed is adjusted to a maximum of 4400 RPM in order to maintain the same SFM. When we reach a wheel diameter of 7.3", it is time to replace the grinding wheel.

The grinding wheel comes from Blackstone® who makes commercial figure skate sharpening machines. This wheel is 100 grit and specifically designed for figure skate sharpening. I dress the wheel with a diamond coated bobbin also sold by Blackstone. This is how I form the 7/16" radius of hollow.

Under the grinding wheel is my follower wheel. It is 7.6" in diameter which is roughly half way between the maximum and minimum diameter of the grinding wheel. The follower can slide in and out on a dovetail and be locked in any position.

You can see two of the three motor support feet. Each foot can be adjustable for height. A hardened 3/8" diameter ball bearing is fitted into the end of each leg. The leg on the right rests on a button of drill rod with a cone drilled into it. The button on the left has a V grove cut into it. The back button is flat. In this way I can tram the grinding wheel and roughly set the height without having anything bind up. Loosely fit bolts hold the legs down to the base plate.

Having the front two legs in line makes it very easy to set the side to side level. The single back leg makes it equally easy to set the front to back level.

Final grinding wheel height adjustment is set by sliding the grinding wheel hub up and down on the motor shaft.

The skate is secured to the carriage with two clamps. This is necessary because often the skate blade has a slight bow in it due to less than perfect mounting. The clamps force the blade flat so the sharpening is uniform. When the clamps are removed, the bowed blade will have a congruent sharpening which is essential for proper operation.

The carriage precisely sets the height of the skate blade at the same altitude as the bobbin. This insures that the two edges are within 0.002" of each other. If the skate is not bowed, the edges are within 0.001" of each other. Failure to grind the edges to this precision causes a difference in edge angle which can cause the skater to skid when applying side force.

The carriage is guided by a length of ½" drill rod.

The rod is clamped into a block on the right. This block is connected to a pivot block by a short length of rod. Set screws enable me to adjust the distance from the guide rod's major axis and the pivot point and lock the position. The goal is to have the pivot point line up with the edge of the skate.

The pattern is locked into a slot on the face of the carriage and faces the follower wheel.

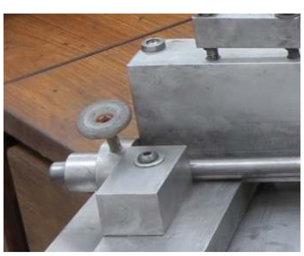
A light coating of way oil is used on all moving parts.

I will spare you the math, but the combination of the size of the follower wheel, its position, the position of the pivot point, and the position of the pattern generate an error of less than 0.0003". Having this simple pivot arrangement is far simpler than using linear bearings to guide the carriage in a near perfect XY orientation.

I will next walk you through how the machine is set up to sharpen the skate.

The first step is to dress the wheel using the bobbin. The motor is then turned off.

Then the skate is placed against the 3 alignment buttons on top of the carriage, it is clamped down. You can see one of the buttons here. I used these buttons to set the position of the skate while taking profile data so the pattern generated from this data depends on the skate being in this same position.



It is essential that the grinding wheel not touch the front pick so that gap is set next. A stop clamped to the far end of the guide bar prevents the user from sliding the pick into the grinding wheel.

The follower wheel is supported by the follower wheel support block. Behind it is the depth of grind (DOG) support block. Both are captured by dovetails and can be individually locked.

The DOG support block has a lever on top that lets me move the follower wheel forward. It also has a square notch in the top front to accept my spacer block. This block is 0.250" wide by 0.249" tall. With it I set my 0.001" DOG.

Here is a close up of the ground blade. I have a pair of worn out blades for all testing. New blades cost over $400. You can imaging the tension in the room when I started to sharpen the good blades!

Rick Sparber
Rgsparber@aol.com
Rick.Sparber.org