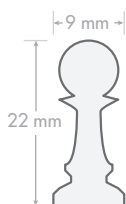


How to make acrylic chess pieces with a laser cutter

by Steve Kranz

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pawn



bishop



queen



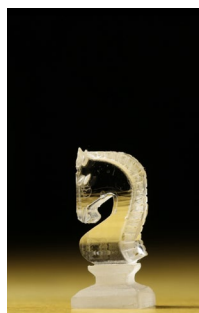
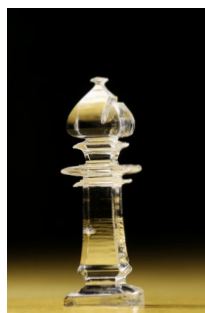
king



rook



knight



Required equipment

Laser cutter

Cast acrylic sheet/bar

Vector drawing software

What I used

Epilog Mini 18 (30 W) with 2" lens

3/8" x 2" x 8" (9 mm x 50 mm x 200 mm)
McMaster-Carr, #1227T339

Adobe Illustrator

Time to make one piece

between 5 and 20 minutes
practice not included

Pawn

1. Cut the profile of the pawn piece.

For a 30 W laser cutting through acrylic
~9 mm thick, I used settings of:

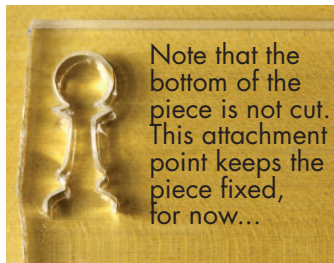
Power: 100%

Speed: 3%

Frequency: 5000 Hz



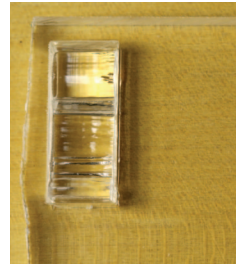
pawn Carve.pdf



Note that the bottom of the piece is not cut. This attachment point keeps the piece fixed, for now...

4. Rotate the part 90° and place it back into the rectangular hole so that the top and bottom sides are now on the left and right.

At this point, we see that the piece should be as wide the material is thick.

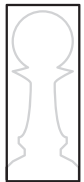


Use half of the padding on the bottom to help the piece nest in the hole.

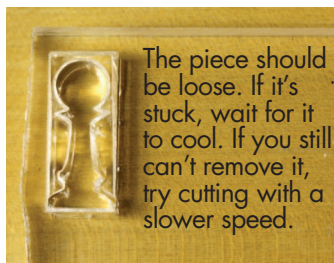


2. Cut a rectangle surrounding the piece.

All vector cuts will use the same power/speed/frequency settings as above.



pawn Rect.pdf

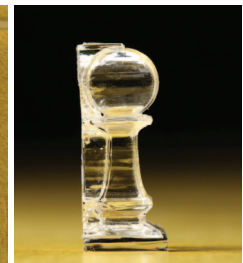


The piece should be loose. If it's stuck, wait for it to cool. If you still can't remove it, try cutting with a slower speed.

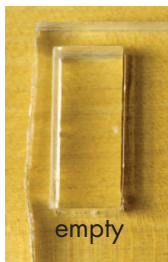
5. Cut the profile a second time.



pawn Carve.pdf



3. Eject the piece along with the surrounding "padding."



empty



with "padding"



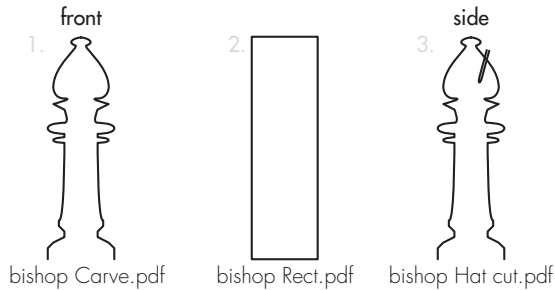
without

6. Remove the rest of the padding and enjoy your completed pawn!



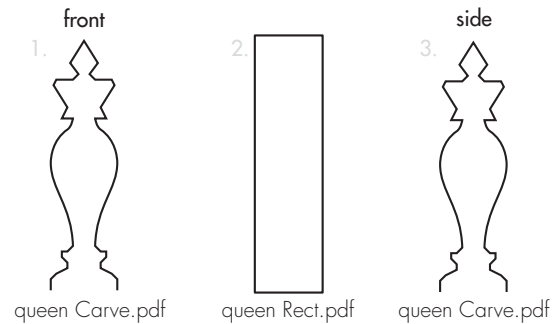
Bishop

This bishop is made similar to the pawn. When cutting the side profile, cut a notch to help define the bishop's hat.



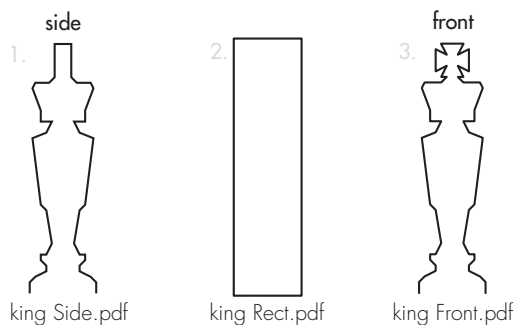
Queen

Like the pawn, the queen's front and side profiles are the same.



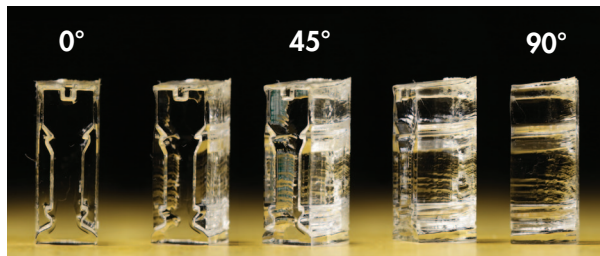
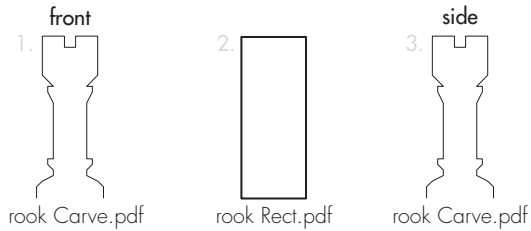
King

To form the cross on the king's crown, the side and front profiles are different. Theoretically, it doesn't matter which profile is cut first, but I found it easier to cut the side first.

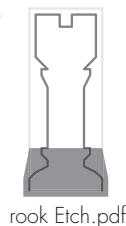


Rook

The rook is about as easy as the pawn to make. Both the front and side have the same profile.



Instead of vector cutting, the piece can be etched to give the acrylic a frosted look.

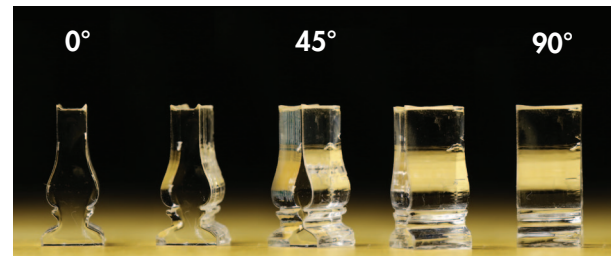
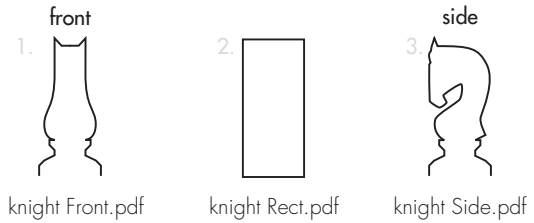


The same process can be used to make decorations.

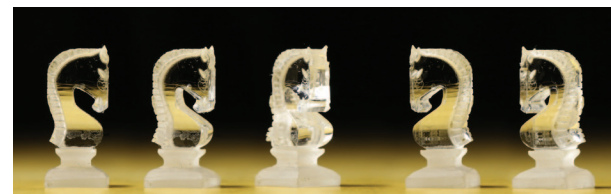


Knight

I think the knight is the most challenging, but most fun piece. The front and side profile are very different.



To help define the knight, etch eyes, nose, ears, mouth and a mane.



Notes

Sometimes the “padding” sticks to the piece after a profile is cut. The vaporized acrylic can condense as a liquid and solidify between the piece and the padding. The edge of a razor blade or knife can pry the two apart.

Keep in mind that the laser beam has a finite width. In my case, around 0.2 mm. This means that if a laser cuts along a rectangle 9 mm wide and 30 mm tall, it yields a block that is 8.8 mm wide and 29.8 mm tall, and a hole that is 9.2 mm wide and 30.2 mm tall. Since the part is slightly smaller than the hole, it can wobble around and become misaligned when cutting the second profile (*pawn, step 5*). To fix this, you could cut a separate slightly smaller hole to fit the piece more snugly.

The laser beam cross-section is gaussian—it is most intense in the center and drops off as it moves radially outward. As a result edges cut by the beam have a slight angle. This can make the pieces stand not quite upright.

What if you made V-blocks that held the piece at 45° angles in the hole? Could you make an 8-sided chess piece?

Acknowledgements

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