

Titanium Serpents

By Robert Westfall

At the Florida Pyrotechnics Arts Guild (FPAG), Florida Fall Fireworks Festival (4F), I entered the 2021 competition with two mines containing Titanium Serpents. The photo on the right is my 4-inch mine that contained 56 Titanium Serpents (two layers of 28 Serpents per layer). The photo on the left is my 6-inch mine, also containing about 56 Titanium Serpents in one layer on top of silver glitter stars.



These two mines raised a lot of buzz. People wanted to know how I made the Titanium Serpents inserts used in these mines. This article explains my process. The photo on the left shows everything I used to make these Titanium Serpents, except the rocket fuel.

I used standard whistle mix 76-23-1 (76% potassium perchlorate, 23% sodium salicylate and 1% iron oxide by weight with 3%t hard wax). I prefer wax over oil because it takes a firmer set. If you use oil, it may not take a good set. The finished whistle fuel is mixed with 10 percent Titanium, 40-80 mesh, granular or sponge.

These inserts are made using 5/16-inch inside diameter by 1/2-inch outside diameter New England Paper Tubes spollette tubes (see



www.woodysrocks.com). I cut these tubes into pieces that are 3 and 1/8-inch long. Each spolette tube makes three serpents with a bit of tube leftover.



One of these tubes is placed on the rocket tooling base. The base is a 5/16-inch diameter pin embedded in a one-inch or larger base. The pin is 1/2-inch tall above the base.



The funnel is made from Delrin Plastic and makes it easy to load the whistle mix fuel into the tube. The funnel is one-inch in diameter and one inch tall. There is a 1/2 inch hole through the middle slips onto the tube. The opposite end is a funnel that was cut with a countersink.

The rammer is a 5/16-inch rod. I added an optional tool holder that allows the rod to be attached to a press.

The fuel scoop was made from a 1/8-inch copper plumbing pipe cap that was silver soldered to a piece of stainless steel rod for a handle. The scoop loads about a 1/2-gram of fuel into the tube between each press.

Multiple types of light presses can be used. I use a light hydraulic press and press the fuel to 1000-psi with translates to about 80-pounds on the ram. Since the tube has no sleeve, you do not want to use more pressure than this, or it may bulge the tube.

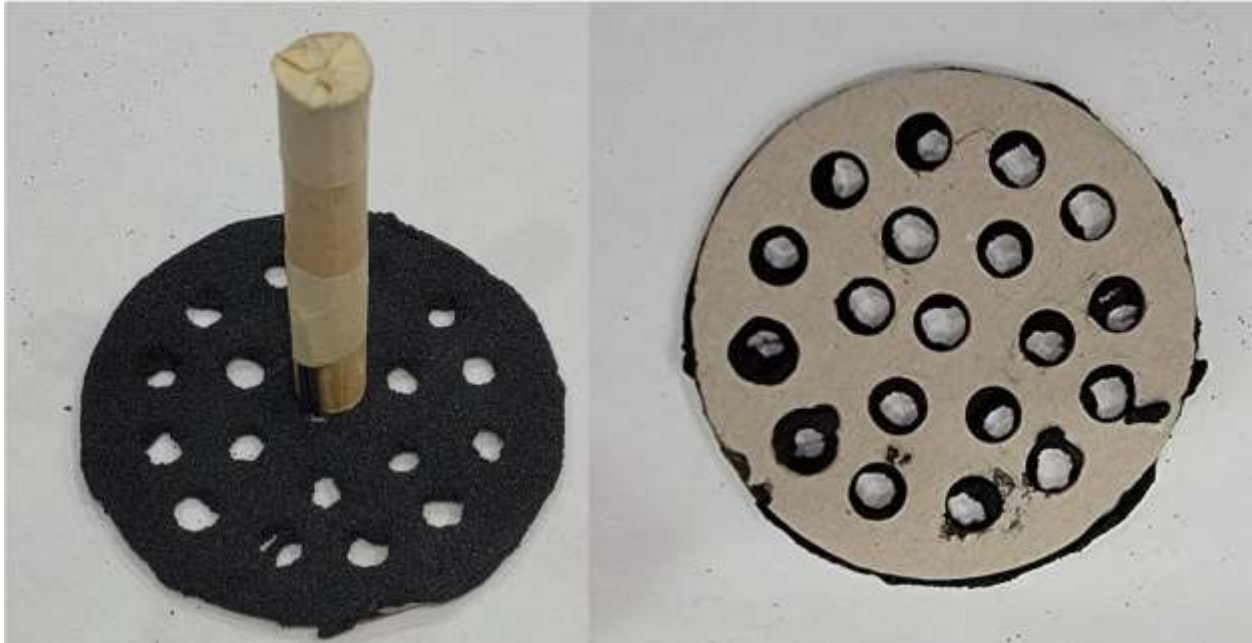
The serpent is made by pressing each scoop separately. You will have pressed between 8-10 scoops when you are done. The finish serpent will have about 5 grams of whistle mix in it. There should be about a 1-inch empty space left on the top of the tube (where the funnel is) and a 1/2-inch of empty space on the other end where the pin was.

Load the 1/2-inch empty end of the tube about 1/2 to 3/4 full of flash if you want a salute ending. Fill the rest of the space with sawdust, being careful not to pack the sawdust. Close that end of the tube by gluing on a heavy 1/2 inch cardboard disk. Once the disk is on, tape it over with masking tape to improve fire integrity.

The tube end with the one-inch space is fused with two strands of thin black match approximately three inches long. The match is J-hooked into the end, ensuring it touches the rocket fuel. The match that sticks out is bent over, being careful not to pull them away from the whistle and taped to the side of the tube with a piece of masking tape.



A separator between the serpents and the lift is created by taking a 3 ½-inch heavy circular cardboard. Multiple 5/16-inch holes are punched in this disc to allow fire through. The side of this disk that is loaded next to the serpents is primed with fine gunpowder to ensure the spread of fire to all the serpent fuses.



I found it takes 10-15 minutes per serpent to make a single serpent but the effect of having 56 of these in a single mine was worth the effort.