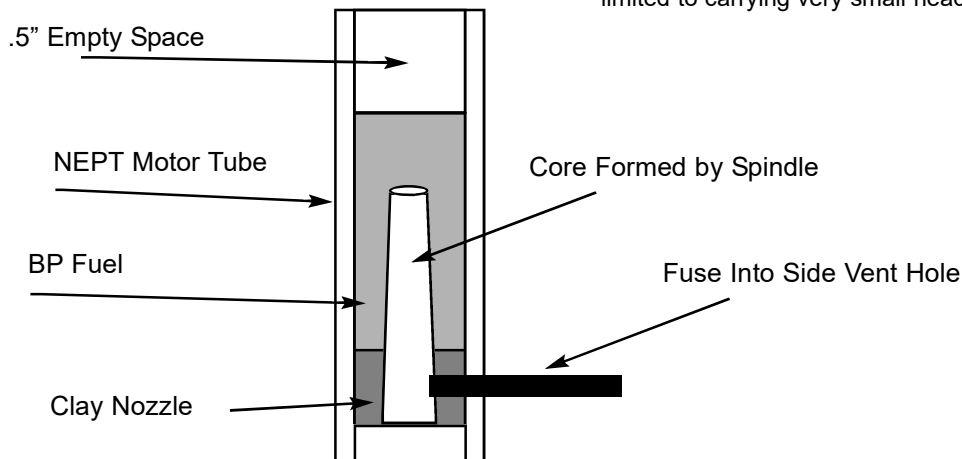


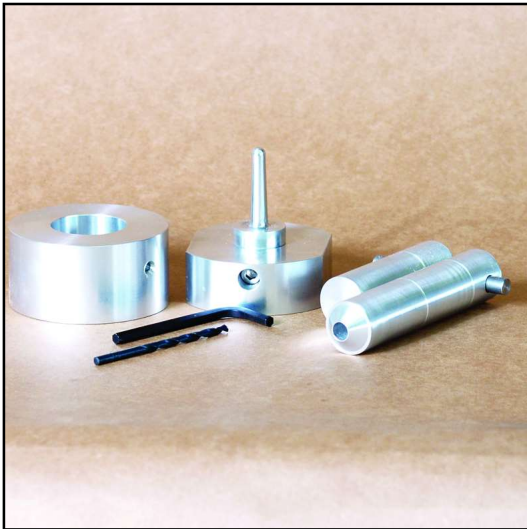
## How to Build BP Stingers

### CAUTION!!

Working with pyrotechnic devices is a very rewarding endeavor that can become a lifetime passion. To ensure continued enjoyment of this hobby, please follow appropriate safety guidelines. Work in an open area outdoors, keep all pyrotechnic mixtures in closed containers, limit any compositions to only the amount needed for a particular item, store finished items in an appropriate day box or magazine, be sure to wear appropriate non-synthetic clothing, wear eye protection and keep a source of water nearby. FireSmith cannot be held responsible for any accidents or incidents resulting from the construction and use of any pyrotechnic devices. It is highly recommended to check and adhere to all local, state and federal regulations. Please consider joining the PGI and any pyro clubs in your area so that you may construct pyrotechnic items in a safe and legal environment. Additional information can be found at [www.pgi.org](http://www.pgi.org).

Stingers are tremendously fun pyro devices. They are spin-stabilized rockets (they use no stick) that can be constructed quickly and with very simple fuels and techniques. In fact, it is quicker to build a stinger than it is to read this tutorial. Though they will lift light payloads, they can become quite off-balance when doing so. To prevent the erratic flight that typically results, it is recommended to keep these devices limited to carrying very small headings.





#### **Step 1**

**Gather the stinger spindle, rammers, drill jig, Allen key and drill bit.**

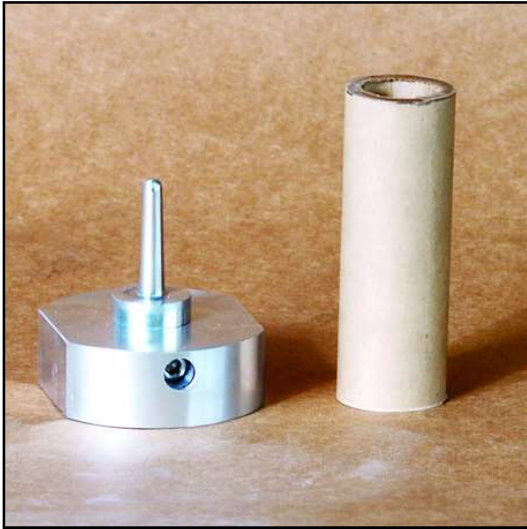


#### **Step 2**

**Gather all tools and supplies. These include a dead-blow mallet (1-2lbs), a sturdy work bench, an NEPT tube of appropriate length, paper cap or plug to fit the tube, a 3" length of Visco fuse, teaspoon, funnel, BP fuel and powdered clay. A cordless drill is also handy but not pictured.**

\*Clay used for the nozzle is typically dry bentonite powder. It can be found at just about any pyro supplier. Oil Dry or generic kitty litter run through a coffee grinder or ball mill also works quite well.

\*The BP fuel used for stingers needs to be fairly quick. A standard mix of 75%  $\text{KNO}_3$  - 15% Charcoal - 10% Sulfur works very well. Using a softwood charcoal (I use pine 2x4 scraps) vs. a hardwood charcoal will increase the speed of the fuel. Additionally, ball milling vs. simply screening the BP will also increase its performance. Because these rockets are hand rammed it is important to keep fuel grains "soft". As such, avoid using any binders (such as dextrin or red gum) when making BP.



### Step 3

FireSmith Stinger tools are designed to be used with NEPT tube. Common sizes are as follows:

- 1lb = (.75" ID) tubes 3" long.
- 2lb = (.875" ID) tubes 3.5" long.
- 3lb = (1" ID) tubes 4" long.
- 4lb = (1.25" ID) tubes 5" long.
- 6lb = (1.5" ID) tubes 6" long.



### Step 4

Place the tube onto the spindle. Using a funnel dump one increment of clay into the tube.

\*An appropriate increment size for stingers is about 1/2 the ID (inside diameter) of the motor tube depending on arm strength and building technique. A good starting point is as follows:

- 1lb = 1-2 teaspoons
- 3lb = 2-3 teaspoons
- 6lb = 4-5 teaspoons



### Step 5

Using a dead blow mallet and the #1 rammer (the longer rammer with the cone shaped tip), give the rammer a couple light whacks to consolidate the clay. Once the clay is consolidated, give the rammer a couple heavy whacks to really compress the clay. A 4x4 timber stood upright makes a nice sturdy work surface should a heavy work bench be unavailable.

\*Do note the location of the line machined into the top of the rammer. If that dips below the top of the tube, tooling damage may result. This line will also provide an indication of the height of the nozzle. The nozzle is at the proper height when this line is 1/2 the ID of the tube above the top of the tube (i.e. for a 1" ID rocket the line should be 1/2" above the top of the tube). Depending on the size of the Stinger being built, it may be necessary to add another increment of clay followed by a few more whacks with the mallet to reach the desired height of the nozzle.



**Step 6**

Slide the drill jig over the motor. This is to be done while the motor is still on the spindle. The drill jig is marked to indicate the proper orientation.



**Step 7**

Drill the vent hole through one wall of the tube. Using a small cordless drill makes this task very easy. To ensure the long life of the drill jig, do not start the rotation of the drill bit while it is being inserted into the jig. Wait until the drill bit has contacted the tube before starting the drill. Be careful to avoid drilling through both walls of the tube.



**Step 8**

Remove the drill jig. Do not remove the motor from the spindle.



**Step 9**

Insert the 3" length of Visco fuse into the vent hole.



**Step 10**

Using a small funnel, load one increment of BP fuel into the motor tube.



**Step 11**

Still using the #1 rammer and following the same procedure used when ramming the nozzle, give the rammer a couple light whacks followed by a couple heavy whacks to fully consolidate the BP fuel. It will be necessary to repeat this loading and ramming procedure a few additional times. This operation is complete when the lower line machined into the rammer is visible above the tube.

\*Be sure to keep the bore in the bottom of the rammer clean. This is incredibly important! After ramming each increment of clay or fuel, use a small wood or brass rod to clean out any residue left inside the bore. Do not use a drill bit or power tools of any kind for this operation.



#### Step 12

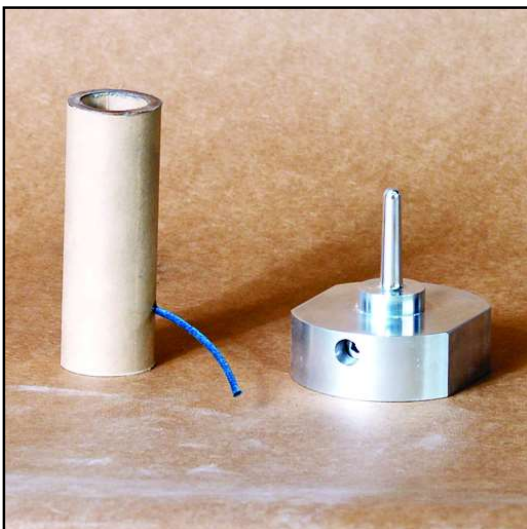
Switch to the #2 rammer (the shorter solid rammer with a flat face) and continue loading and ramming BP fuel one increment at a time. Be sure to note the location of the line machined into the top of the rammer. Should this line fall below the top of the tube, tooling damage may result.

\*Many pyros like to see a nice trail of sparks flying into the air when their rockets take flight. This is fairly easy to accomplish using 5-10% of 100 mesh and smaller titanium, aluminum or charcoal. These metals can simply be added to BP fuel by tumbling in a small plastic container with a bit of plain BP. However, use fuels containing metals only when using the #2 (solid) rammer. Do not use fuel containing any metals when using the #1 (cored) rammer. Accidents and tooling damage may result.



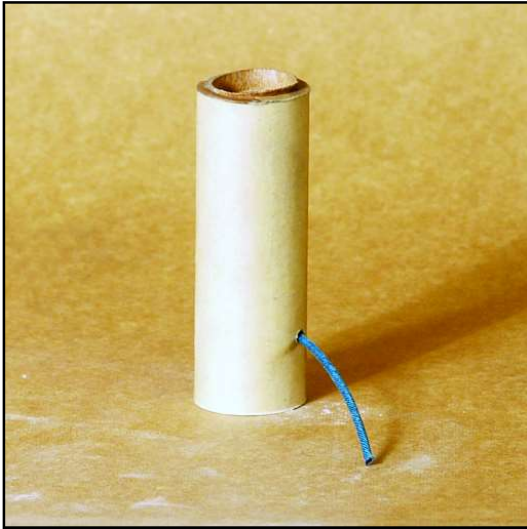
#### Step 13

The final increment of fuel is rammed leaving about 1/2" of empty space between the top of the fuel grain and the top of the tube.



#### Step 14

Remove the completed motor from the spindle. This is easily done by holding the motor in one hand and the base in the other. A slight twist and pull will remove the motor.



#### Step 15

A simple effect for the end of rocket flight can be created by sprinkling a few stars or a bit of loose BP into the cavity at the top of the motor. After the effect has been added, cap the motor by gluing a paper plug or disc to the top of the motor tube. A wrap of masking tape around the top of the tube and folded over the cap will help ensure a tight seal.

\*Experienced pyros may wish to sprinkle on a small amount of flash powder to produce a nice report at the end of flight. Flash is a very sensitive, yet powerful composition. If handled improperly it can cause serious injury. It should only be handled by those with experience. The absolute safest way to produce a report heading for stingers is to sprinkle 1/4 teaspoon of KClO<sub>4</sub> and dark aluminum separately into the cavity at the top of the motor. Only after the motor is capped with a glue and a paper disc should the motor be shaken to fully mix the flash.



#### Step 16

The safest method of launching stingers is to shoot them out of a small tube. Doing so keeps them going "mostly" straight up. A 1.75"-2" diameter tube will work just fine for 1lb and 3lb versions. Place the stinger into the top of the tube, sliding it down until just the tip of the fuse is exposed. When the fuse is lit the stinger will drop to the bottom of the tube and launch into the sky.