COMMON WAX PREVENTS CATOS

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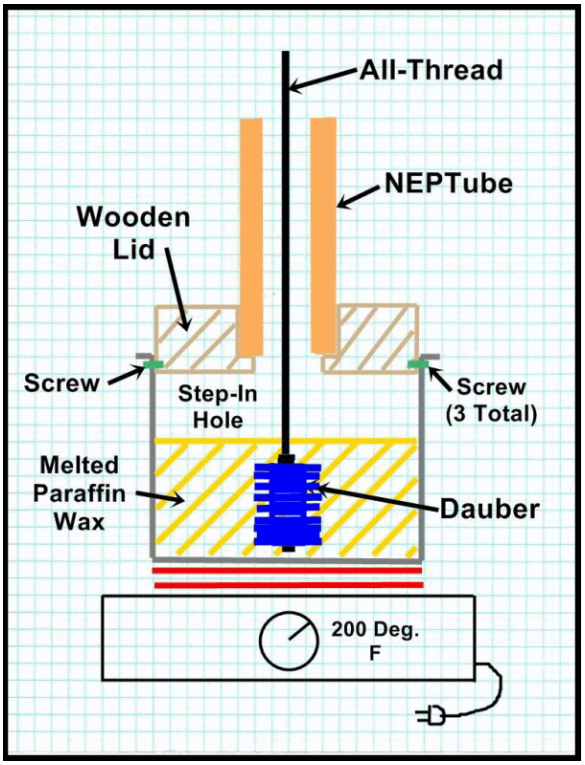
That's right! Read on, and I will tell you how I made this amazing discovery. I will also tell you how any rocket maker can easily apply this foolproof method. In addition to preventing CATOs, rockets will be easier and less noisy to press. As if that isn't enough, using my method will allow rocket makers to achieve thrusts never before seen in black powder rockets. The benefits of the wax treatment are not confined to black powder rockets, but increases in thrust for whistle rockets have not yet been quantified.

This is not a "flash in the pan" idea. It has already been tested and validated by many rocket makers, including well-known icons in the field of pyrotechnics. I challenged Steve LaDuke, a 40-year veteran rocket maker and mentor of the famous universal tooling, to try my method. I asked him to use it on rockets he was sure would CATO. They did not. **They were about the fastest rockets he'd ever seen though.** Ned Gorski, past PGI Grand Master and host of Fireworking.com has done extensive testing with different types of black powder rockets using the wax treatment. He has produced pages and pages of data that confirm the value of this technique, ultimately achieving almost 100 pounds of peak thrust on a 1 pound black powder rocket!



Okay, enough name-dropping and buildup already! Let me explain how this discovery came about. I set out to find out what the maximum thrust was that I could squeeze out of a 1 pound nozzleless black powder rocket. These require pretty hot black powder for fuel. I had been using 2% wax in my fuel to facilitate pressing. To squeeze out more power still, I decided to leave out the wax and use straight ball-milled black powder. Every rocket I tried blew up! I really didn't think eliminating the 2% wax could make the fuel that much more powerful. I concluded that it was not a matter of sheer power. It was the relationship between the fuel grain and the tube wall that had changed. Well, I didn't want to add the wax back in and weaken the fuel, so I painted it on the tube walls instead. Bingo, no CATO! So I did it again with a longer spindle. Same thing. I was now close to doubling the maximum power Ned had achieved thus far, so it was time to do some bragging. The rest is history.

After I reported my initial results to the gang on Fireworking.com a flurry of tests were done by too many pyros to mention. All came to the same conclusion: Coating the inside of rocket tubes with regular paraffin canning wax has great value. Lloyd Sponenburgh, a professional pyrotechnics man, said: "You've solved a problem that has been plaguing rocket guys for decades - how to get the fuel to seal to the tube walls so that no fire can pass. NICE concept, Dave; and an easy one too! This one will change pyro rockets. I'll even venture to guess that if the tube expands away from the pressed grain, the wax inhibitor still prevents fire passage, by inerting the surface of the grain past the expansion point." I don't pretend to understand the details like Lloyd does. I just know it works.

Here's how it is done: regular paraffin wax is melted and applied to the inside of a rocket motor tube with a dauber similar to a bottle brush, but 'bushier'. The diagram on page **Error! Bookmark not defined.** shows my apparatus. Others use different methods, but the goal is to apply a thin even coating to the entire inside of the tube.

A dauber made from a 12-gauge gun cleaning swab works well for 1 pound tubes. Ideally, the dauber has a gentle friction fit as the wax is applied. For 3 pound (1" I.D.) tubes I fashioned a dauber from Scotchbrite cleaning pads by punching out donut-shaped pieces and stacking 10 or 11 of them on a piece of allthread with nuts and washers on both sides. The dauber is put into the hot wax, and a tube is slid down over it and seated on the step in the bottom of the hole in the lid.

I added a small hole in my lid so that I could insert a meat thermometer to monitor the temperature of the wax. The dauber is brought up through the tube all the way to the top and then lowered back into the hot wax. I repeat this 3 times in fairly quick succession to coat each tube. One or two dips would probably do. Then the tube is twisted loose and lifted off of the rod, being careful not to rub it too much on the rod on the way up. Done! I can coat a lot of tubes in a very short time this way. The tubes are inspected for damage, deburred and cleaned before coating. This allows for a smooth coating without dust in it. Each 1 pound tube gains around a half a gram of wax during coating. The idea is to coat the tube with a layer of wax, rather than impregnating the paper. I find that 200 degrees Fahrenheit is a nice temperature for the melted wax. If it just barely melted, or if the tubes are ice cold, the layer may become too thick and interfere with the fit of the drifts. The hotter the wax is the thinner it gets, like cooking oil. And as with hot oil, care must be taken to avoid possible burns and risk of fire. I have not tried anything but regular canning wax for coating the tubes.

When a rocket is pressed using one of these waxed tubes, the operator will notice one thing right off the bat—the pressing is smooth, and the creaking, groaning, snapping sounds of dry pressing are all but completely gone! The tube does not get shorter during pressing either, since the wax acts as a lubricant. Dr. Shimizu mentions coating of pyro tubes for that purpose in F.A.S.T. High power nozzled rockets have been made with coated tubes too, and the wax does not seem to interfere with the grip of the nozzle on the tube. The bulkheads don't blow out either. There are too many potential applications to name for this new discovery. There are others that use alternative methods for coating the tubes with success. It seems to me that this technique allows for lots of flexibility.

Here are a few examples of what wax-coating rocket tubes can achieve, besides the obvious. Straight salicylate whistle can be used in an end burner, or on universal tooling, and even on standard black powder tooling! I have personally lifted a 6” ball shell with straight black powder in a 1 pound nozzled rocket using a waxed tube. To be sure, it was no high flyer. But it went straight up and no embers hit the ground. Longer spindles can now be used with hot fuels to achieve power never before thought possible with pyrotechnic rockets. As this simple method spreads, other possibilities are sure to present themselves. This article was meant as an introduction to a new concept. As the method gains traction a follow-up article with more specific details can be added as time and space permit. The only negative thing I’ve heard about this idea so far is that it’s too bad our high quality NEPT rocket tubes don’t come pre-waxed. Yeah, not yet! DWF