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Making Screens

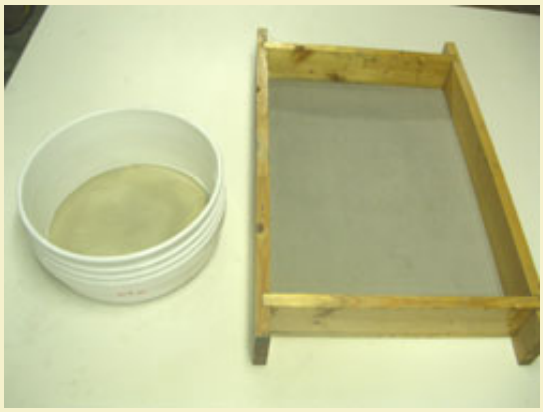

Figure 1: Two types of screens described here.

Introduction:
One can not get very far in pyrotechnics manufacture without a good set of mixing screens. The most effective way to integrate the various powdered chemicals in a pyrotechnic formula is by passing them repeatedly through a metal wire screen. This not only breaks up clumps frequently found in the chemicals, it also helps the individual chemicals become intimately combined into a homogeneous mixture.

Mixing screens are typically made from a non sparking metal that is resistant to corrosion, such as brass, aluminum or stainless steel. The stainless screens have the best corrosion resistance and also tend to deform less than the brass variety.

Figure 2: Using a band of paper as a guide when drawing the cutoff line.

The mesh size of the screen will depend on what it is used for. For mixing purposes, screens in the 20 to 30 mesh size work well. This is large enough to allow an easy flow through the screen without clogging, while still small enough to break up clumps into small enough particles. Most chemicals are already pulverized into a fine particle size and the clumps are usually groups of small particles rather than solid chunks. Screens above 50 mesh start to clog when passing certain chemicals, and the mixing process goes much slower. The screens described in this article use a 24 mesh brass screen, which is good for most general mixing purposes.

It is sometimes necessary to have larger mesh sizes for the purpose of extracting large particles from a mixed range of particles. This is most commonly used for sifting out specific mesh ranges of charcoal or aluminum flake required for long tails or other special effects. It is a good idea to examine the formulas you plan to use and pick three or four mesh sizes that they have in common. A screen set might have something like a 10 m, 15 m, 20 m and 30 m. The sizes do not need to be exact in most cases, for example using a 24 m where 20 m is called for. If you make your own BP, you will also need a set of screens for giving you the powder grain sizes you

Figure 3: Using a pull saw to cut the bucket in half.

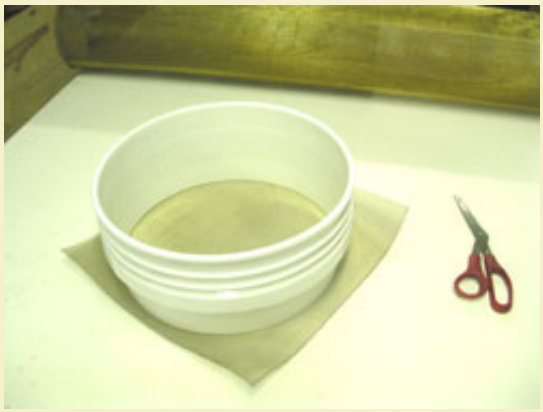

Figure 4: Cutting the screen a bit larger than the bucket.

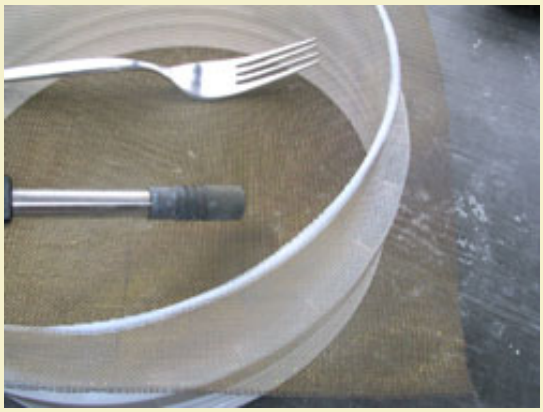

Figure 5: Using a blowtorch to heat the screen and sink it into molten plastic.

want to make. It is not uncommon for a pyro to accumulate over a half dozen screens for various tasks.

Two of the most common screen construction techniques are described here, as well as a few pictures of some uncommon techniques.

Bucket Screen:
This type of screen is the most elegant, rugged, easy to make and easy to use of any I have seen. I don't know who to credit for coming up with this idea, but I consider it one of the classic "best practices" pyro tool techniques.

The idea is quite simple: cut the top off a 5 gallon bucket and use heat to melt a screen solidly into the plastic edges. The advantage to bucket screens is that they are cheap to make, require no special tools, can be made in 15 minutes, can nest inside of each other for easy storage, they are water proof and best of all, they fit into the top of another 5 gallon bucket to catch the screened material during use! This feature eliminates the need to make a seperate screening box, which is required for the wooden screen shown in figure 1.

The melted plastic holds the screen so well that deformation from pushing against the screen is much less than wooden box screens. The only down side is that they hold less volume than the larger wood screens, and the working angle when screening is a little steeper and not as comfortable as with a larger screen. They still have plenty of capacity for mixing five and ten pound batches though, more than most hobbyists need in many cases.

The first step is to remove the metal handle from the bucket and then cut about 4 inches down from the top. Do not make it too deep or you will have a hard time getting your hand down into it when mixing. Figure 2 shows how a band of paper can be used as a guide when marking the cut line, thus avoiding the potential for an uneven cut. Figure 3 shows a thin pull saw that makes cutting the bucket just as quick and easy as attempting to use a jig saw or other power tool. The bottom of the bucket can also be put to good use as a girandola frame as shown here.

Next you will want to prepare a square sheet of screen that has at least an inch of overhang around the edges. The screen shown here is 24 mesh brass cut from a roll, but any type of screen can be used including window screen (although window screen is a little too coarse for good mixing).

Working out doors, use a blow torch to heat the

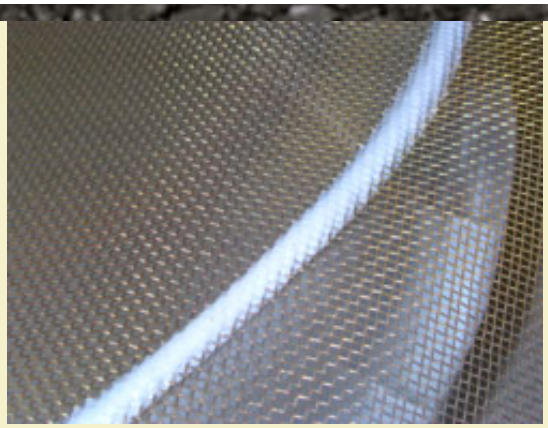

Figure 6: A closeup of the embedded screen.

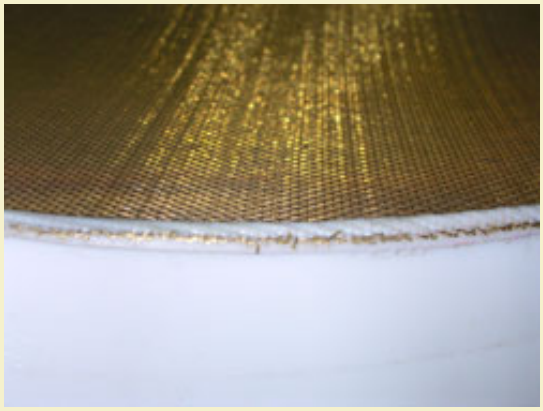

Figure 7: Closeup of screen edge after trimming and sanding.

Figure 8: Screen nests conveniently into another 5 gallon catch-bucket when mixing.

screen and the bucket edge at the same time, allowing the screen to push down into the melted plastic so that it becomes fully submerged. The plastic should completely seal off the screen as seen in Figure 6. It helps to work in sections and let them solidify before moving to the next section. This lets you pull the screen tight as you work without pulling it out of the soft plastic. Be careful not to grab the screen with your fingers near the hot spots, rather use a fork or other object for pushing on the screen when sinking it. Otherwise you will have a grid pattern burned into your finger like I have right now. Ouch!

Once the screen is completely melted in place, scissors or a knife can be used to trim it flush with the edge of the bucket. You will also need to sand it further to get rid of all the sharp little wires left sticking out, otherwise you will pay the price later with stuck fingers! Figure 7 shows the trimmed and sanded edge. This completes your screen and it is ready for use.

Usage Notes:
Figure 8 shows how this bucket screen conveniently fits into another 5 gallon catch-bucket when screening. It helps to have two 5 gallon buckets on hand when screening, such that you are feeding the screen from one bucket while the other is used to catch the screened material. You then move the screen to the other bucket when it is empty and feed from the previous catch bucket for the next screening.

More...

Mixing Screens...

Figure 9: A simple box screen ready to be assembled.

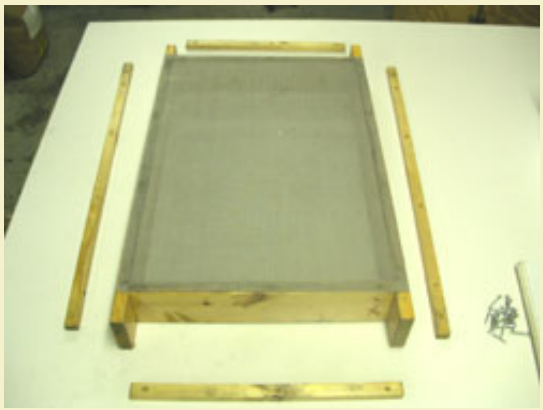

Figure 10: The screen in place (already trimmed).

Wood Box Screens:
This type of screen is probably more commonly used in industry for its higher capacity, but it is not all that difficult to build one. The basic concept is a wooden box frame with a screen attached to the bottom of it. There are various ways to make these, depending on what type of tools you have. I make all my screen frames using interlocking "dado" joints to make alignment easy and eliminate the need for using screws or nails. Dove-tail joints would be even stronger and cleaner, but considerably more trouble.

Figure 9 shows a typical frame made from 1x4 pine boards. Before the board is cut into the four segments, a 1/2" strip is ripped from one edge, which will be used to make the clamping bars that hold the screen to the bottom. This gives you a 3" wide board to use for the box, which is deep enough to easily mix five to ten pound batches (depending on the comp density). Two 26" long boards are cut for the long sides, then two 15-1/4" boards for the short sides. A 3/8" deep dado channel is cut 1-3/4" in from each end of the 26" boards. The short sides are then fit into these channels and the frame is glued together and clamped until dry.

The 1/2" strip is then cut into two 26" long strips and two 14-1/2" long strips. I use 1-1/4" long #6 wood screws to hold these clamps to the box frame, with three on the short side and six on the long sides. The clamps are put in position on the edges of the screen box and pre-drilled with #6 countersink bits, fastening each screw as you go to keep things from sliding out of position. The screws are then removed and the clamp bars are set to the sides of the frame prior to installing the screen.

All the parts are ready for assembly in Figure 9. At this point you need to water proof all the pieces before installing the screen, because your screens will be frequently hosed off when cleaning them. Polyurethane or clear acrylic spray can be used for this purpose as long as the screens are not submerged in water for any length of time. Any kind of outdoor paint will work as well.

Once water proofed, the frame is ready for installing the screen. The screen material is laid over the box and rough cut with a few inches of overhang, which will be trimmed off later. Figure 10 shows a piece that has already been trimmed because I took apart an existing screen, but normally the screen would be oversized to allow for exact trimming after assembly.

Start by screwing one of the short bars completely down over the

Figure 11: Clamp strips used to fasten screen to frame.

Figure 12: A mixing box used to support the screen during use.

Figure 13: Screen in place atop the mixing box.

screen on one end. This allows you to pull the screen tight while clamping the remaining bars. Screw down the two long side bars next, making sure to pull the screen tight the whole time. The remaining short bar is last to be screwed down.

Any overhanging screen is now trimmed with a utility knife. Be sure to angle the blade up under the wood to trim the screen off as close as possible, otherwise you will have pointy wires sticking out that will stick your fingers later. Figure 11 shows the finished screen after trimming.

In order to use this type of screen, you will need to build a screen box to hold it up off the working surface. Figure 12 shows a simple screen box built to fit this frame. The box is constructed to hold a 16" wide screen about 6" above the table. Six inches is about the minimum height you would want, otherwise large batches of comp will pile up and touch the screen during use. Taller boxes also allow better mixing during screening, since there is a longer distance for the screened material to fall and intermix on the way down.

Figure 13 shows the screen placed on top of the mixing box. Note the two shorter sides of the box allow the screen to nest inside of two taller walls, which keep it from sliding off. An alternate method is to build a box with all four walls the same height, then fasten an inner shelf along the top edge to support a screen designed to fit snugly inside the box. You want to avoid air gaps between the screen and the box walls, otherwise a lot of dust will come up through the cracks.

Fancy Screens:

Figure 14 and 15 shows a rather fancy screen that is perhaps more trouble than it is worth for most people to make. The screen has a rounded bottom, with the idea of keeping the material to be screened at the center of the screen. Because of this rounded bottom, it can not sit on the screen box directly and special rails had to be installed on the sides, which rest on the screen box during use. This screen also features dove-tail joints for a strong box, oak clamping bars that are thin enough to be bent over the rounded bottom, and a handle for sliding the screen back and forth and banging it up and down to dislodge clogged screen holes while mixing.

Figure 16 shows an even more elaborate screen system. A desktop with a hole that drops down into a removable drawer serves as a built-in screen box. Screens are inserted as seen in Figure 17, then the material is collected in the paper lined drawer. The drawer is then removed and replaced with another identical drawer from two rows of drawers on each side. This concept was taken from commercial industry, but is really not that practical for hobby pyro. The screens shown here really do not have a good frame for containing much powder, and the capacity is rather small. But the real problem is that all screening should be done out doors, and lugging a large desk outside just to mix chemicals is not very desirable! This setup is really more practical for small scale indoor chemistry experiments using a vented hood above the screen hole, and was designed for such operations.

There are dozens of ways to make screens, and some people even use simple kitchen sieves to do their mixing. The bucket screen and

Figure 14: A fancier screen with a rounded bottom and handle.

Figure 15: Top view of deluxe screen.

Figure 16: A screening bench that uses a drawer for the screen box.

the wood frame screen illustrate the two most common types and give a good starting point for fabricating your own screens. Obtaining the screen material itself is usually the hardest task. Screen material can often be found at hobby pyro conventions, and McMaster Carr is a good place to find a large variety of mail-order screens online. I prefer the milling grade stainless steel screens, which are located in the Woven Wire Cloth catagory. Avoid screens made from wires much thicker than .015, since powder has a hard time dropping through the thicker screens.

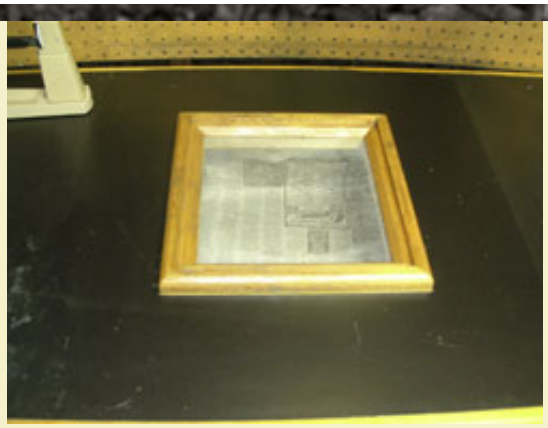

Figure 17: Interchangeable screens drop into the table top.