Build This...

Insert Shells

May, 2002 Issue

Build This:
Insert Shells

Technique:
Making Black Match

Tool Tip:
Build a Black Match Frame

Technique:
Rolling Quickmatch Pipes

NEW! Glitter Simulator

Summary:
Small shells that are packaged inside larger shells, also called pupadelles or granatine by some Italian writers, open up a wide range of effects to the pyrotechnist. The 1-1/2" variety described here will fit snugly as rings of seven inside five inch shells. They may also be fired singly or in cakes much the same way as film canister shells are. The method of construction shown here is a variation of the traditional method described in the Fulcanelli article of Pyrotechnica XI.

Materials:

- (1) 5" x 8-1/2" 70lb virgin kraft, grain short
- (1) 2-1/2" x 8-1/2" manila folder paper
- (1) 4-1/2" x 9-1/2" 30 lb kraft
- (1) 1" piece of cross match
- (1) 1-1/2" piece of cross match

Tools:

- 1-1/4" x 6" long dowel
- Cross match punch or awl
- Rubber mallet
- Anvil cutters

Unmeasured Materials:
Coil of chinese time fuse, 4FA, 1/4" stars, white glue, flax twine, wheat paste

1-1/2" Insert Shells...

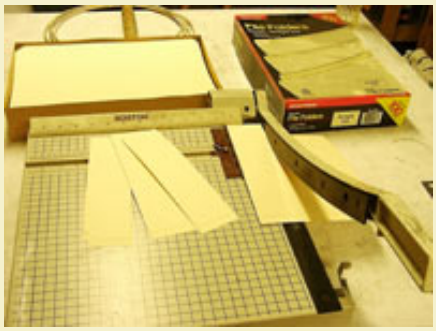

Figure 3: Cutting file folders with a paper cutter.

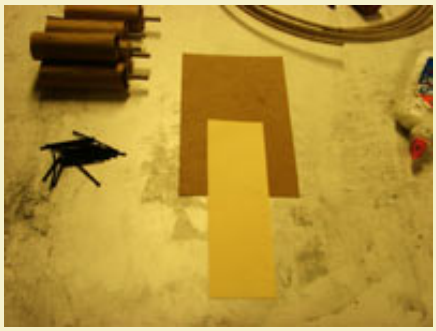

Figure 4: Paper placement for rolling the cans.

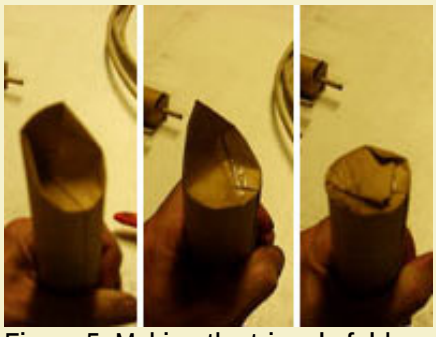

Figure 5: Making the triangle fold.

Introduction:
Small insert shells, as the name implies, are typically inserted as a component of larger shells. When the primary shell breaks, the smaller shells are thrown out in a circle where they produce a striking ring of secondary smaller breaks. These miniature shells, often called pupadelles (pronounced "poop-a-dell", a word derived from the Italian word for puppet), must fit snugly in the ring in order to be dispersed symmetrically.

The method shown here for making these shells does not require prefabricated tubes of any sort, which allows the builder to adjust their diameter to fit the desired shell they will be used in. There is another method that employs small paper cans with end caps that are much quicker to produce, but you must have a source for the right sized cans with matching caps. Even quicker to produce are the small plastic canister shells made for this purpose, but again you must have the right size for your application. If nothing else, the traditional method shown here allows you to whip up a batch of inserts in a pinch in case you don't have any plastic shells on hand.

Construction:
This type of insert shell resembles a stripped down version of full sized canister shells. There is a case, a liner, time fuse, spiking and a paste wrap. About the only thing they don't have are end disks. The inner liner material is much thinner than the chip board used for typical canister shells. Manila file folders are the ideal thickness. Poster board can also be used, although the resulting shell will be slightly larger than if file folder paper is used. Figure 3 shows how a paper cutter can be efficiently used to make short work of file folders. The folders are cut into 2-1/2" wide strips, which are then cut to 8-1/2" lengths.

The file folder liners are placed on a strip of 70lb kraft that measures 5" by 8-1/2" long, with the grain running in the short direction, as shown in Figure 4. It helps to put a little white glue under the liner where it overlaps the kraft paper, which prevents the liner from sliding off center when the case is on the former. A 1-1/4" dowel rod with a 5/16" hole drilled in one end is used to roll up the case.

With the case still on the former, slide it so that the end of the dowel containing the hole is level with the edge of the inner liner. The kraft paper that overhangs beyond the edge of the dowel is now crimped closed using what is called the "triangle fold," illustrated in Figure 5. I prefer to apply a little white glue between the folds to help reduce the ability of the ends to blow out instead of the sides, although many builders skip this step.

Next a center punch is used to punch through the folded paper and into the hole in the dowel rod. The time fuse should fit snugly into this hole when it is

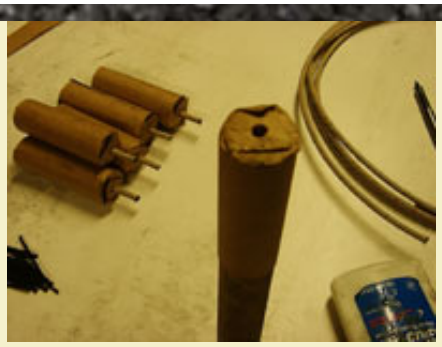

Figure 6: Fuse hole punched.

removed from the former. Before sliding the case off the former, the end can be flattened down by inverting the dowel onto your workbench and giving it a couple whacks with a rubber mallet. The case is now ready for fusing.

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1-1/2" Insert Shells...

Figure 7: Using a length gauge to mark time fuse.

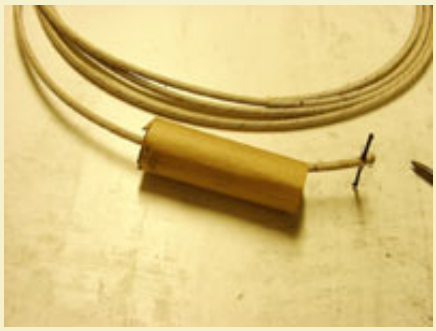

Figure 8: Case threaded onto time fuse coil and crossmatched.

Figure 9: Time fuse is pulled through and cut where marked.

Due to the small size of this shell, it would be difficult to insert a piece of cross matched time fuse down into the casing from the inside. The clever solution devised to get around this problem is shown in Figure 8. Working from a full roll of time fuse, a mark is made 1-3/4" from the end where it is to be cut (this assumes 1-1/4" between cross match centers and should be altered to produce the desired timing for your application). One time saving trick is to have the 5/16" hole in the dowel rod bored to the same length as the time fuse length. This gives you a simple gauge for quickly and consistently marking you time fuse, as shown in Figure 7. Several dowels could be prepared with various length holes corresponding to your most commonly used insert shell timings.

The casing is now slipped onto your time fuse coil so that the fuse runs all the way through it. The end is now punched and cross matched 1/4" from the end, as shown in Figure 8. After the cross match is secured, the time fuse is simply pulled back into the case until the cross match hits the end. The fused assembly is then cut free at the mark you made, as pictured in Figure 9.

You should now have a fused casing that is ready for loading, as shown in Figure 10. It is a good idea to run a bead of white glue or woodworkers glue around the joint between the time fuse and case in order to help prevent gas leaks in this area. The glue should be allowed to dry before proceeding further.

A wooden block with a hole drilled through it to accommodate the time fuse makes a handy fixture to rest the shell on during the loading process.

Because the walls of the shell are thin and there is not much integrity to the casing, they must be filled solid to avoid being crushed from the pressure that builds up during the break of the parent shell. This requirement, combined with their small size, makes the use of flash bags difficult as a burst mechanism. Thus, they are simply filled with a mixture of 1/4" stars and 4FA black powder. The case is filled half way with stars, then a quantity of 4FA is poured over them and jostled until it fills in the voids between the stars. The shell is then filled the rest of the way with stars and more black powder in the same way, making sure not to fill beyond the edge of the inner liner.

Once the shell is loaded, another triangle fold is used to close the bottom, which should look like Figure 12. At this point the shell is ready for spiking.

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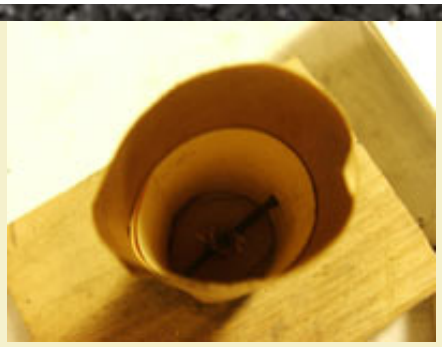

Figure 10: Cross matched end sits flush against bottom of can.

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Figure 11: Filled with 1/4" cut stars.

Figure 12: Bottom is triangle folded.

Figure 13: Spiked with 8 vertical strands of flax twine.

The spiking pattern shown here has been developed to work with the specific type of paper, twine and homemade burst charge I use, and may not be ideal for different materials. The twine used is a good strong flax twine that does not stretch under tension. Eight verticals are used in order to strengthen the shell in its weakest areas, which are the two folded ends. No verticals are used in order to insure that the sides of the shell burst instead of the ends. Adding horizontal spiking with this type of twine also causes the shell to break too hard and blow the stars blind.

Two turns of pasted 30lb kraft are applied to the shell in order to fire proof them and keep out the hot gases generated when the parent shell breaks, which could prematurely set them off. The ends of each time fuse should be protected with a piece of masking tape, which will prevent paste from getting onto the exposed end and absorbing into the powder core.

Figure 14 shows a good method for pasting many shells at once. A stack of kraft sheets are laid out on the table in a stair stepped pile, with paste between each sheet. About 20 sheets can be stacked up in this way, then the entire stack can be broken in at once by crumpling it up and working in the paste. The stack is then flattened out and each shell is rolled off the top of the stack. The feathered edges make each sheet easy to grab, eliminating the hassles of prying apart each single sheet.

When rolling the shell in the pasted paper, the overhanging paper at both ends can be folded down as you go. This will seal the ends without the need to tear and pleat down the paper. The wrap should be twisted around the time fuse to provide a good crown.

Once dry, the time fuses are punched and cross matched 1/4" from the end. The shells are now ready to be loaded into shells or fired from small mortars. When testing shells of this size, it is easiest to bottom fuse the mortar with visco and prepare tiny lift charges of 15g wrapped in a square of tissue paper and twisted closed. To fire the shell, simply insert the visco, drop in a lift packet followed by the shell and you are ready to go.

Shells of this size are difficult to break with a good pattern. If you are not using the exact same materials described for this article, you will have to adjust the spiking pattern until you get a good break. It is not unusual to run a half dozen trials trying to dial in the break on these little shells. If you are blowing out the ends, you can reduce the horizontal spiking or eliminate it altogether as I have done here. If you are using cotton, make sure you paste the string well. If you are looking for a bigger spread, you can try adding whistle mix or flash in with the black powder burst, or increasing the horizontal spiking. It will take some experimentation to find what works best for you. But then that's what makes this hobby fun!

Figure 14: Final paste wrap.

References:

Traditional Cylinder Shell Construction, Part 2 by A. Fulcanelli, Pyrotechnica XI