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Volume 2, Issue 7

Making Girandola Frames

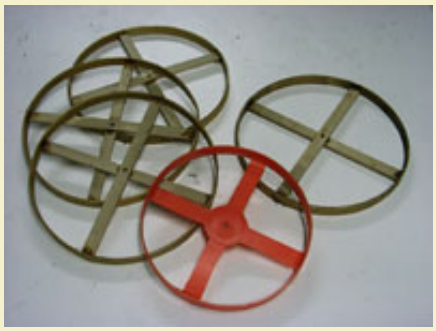

Figure 1: Assorted girandola frames.

Figure 2: Sacrificing a 5 gallon bucket.

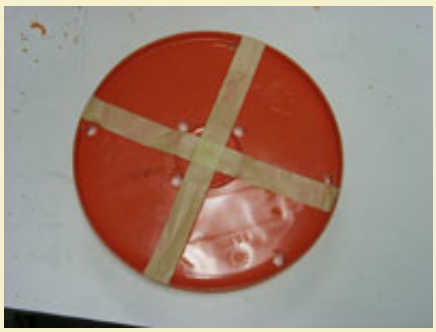

Figure 3: Holes and tape for aid in cutting out quarter panels.

Introduction:
When setting out to build your first girandola, the first problem most people run into is finding a suitable frame. The frame needs to be light, fire resistant, the desired size and ideally able to withstand the drop from several hundred feet without breaking.

Three methods of building simple single-ring girandola frames are presented here. These are suitable for small girandolas in the 8" to 16" range that do not require two rings in order to support the drivers. As girandolas become larger, it becomes necessary to use a more sturdy frame design that allows the drivers to be fastened at two points instead of just one.

Method 1:
The quickest and easiest method to fabricate a durable and reusable girandola frame is to make one from the bottom of a five gallon plastic bucket. I am not sure who first conceived of this idea, but Tom Perigrin also mentions this method in his book Introductory Practical Pyrotechnics.

Plastic bucket frames have the advantage of being very durable, easy to make and cheap (assuming you have a supply of free buckets). The disadvantages are that the plastic is not as fire resistant as wood, nor is the plastic as sturdy as wood. Another disadvantage is the size limitation, as the material is too flimsy to ever be used for larger frames (assuming you could ever even find larger buckets).

Begin by cutting the bottom off of a five gallon bucket as shown in Figure 2. The cut is made at least an inch from the bottom, this way you will have a plastic rim to increase the rigidity and provide a surface for attaching drivers to. I find that the best tool for making the cut is a thin kerf Japanese type hand saw.

Once the bottom is cut out and the edges are deburred and cleaned up, make an X across the center of the bottom using one inch wide masking tape, as seen in Figure 3. This will be your guidelines for cutting out the excess plastic from the frame.

The four quadrants must now be removed, since the wheel must be made as light as possible. This can be done using a sharp utility knife, but it is easier to use a saber saw if you have one. Note the half inch holes drilled at various spots to allow a saber saw blade through the plastic when beginning each cut (see Figure 3).

Once the plastic is removed, the wheel is basically done. Remove the tape, clean up the burrs on the edges with a utility knife and finally drill the desired

Figure 4: Completed frame ready for deburring.

size hole for your launch pin in the center.

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Figure 5: Cutting thin strips of poplar with a bandsaw.

Figure 6: Two thin strips ready to be stapled onto former.

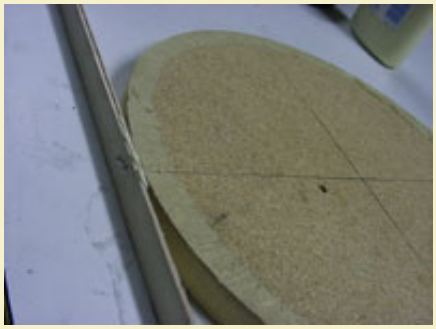

Figure 7: Stapeling halfway overlapped strips to frame at midpoint.

Method 2:
If you are brave enough to attempt making your own hoops, then the first thing you will need is a band saw to cut the thin strips (unless you can find thin strips already cut). The strips need to be about 1/16" thick and made from a light yet flexible wood such as poplar. Using pine or cedar can be frustrating, since these woods tend to break when bending them around the former. Oak bends well, but is also rather heavy. Poplar seems to be a good tradeoff between weight and strength.

Caution: cutting thin strips on a band saw can result in severe profanity! The slightest bit of blade walking can ruin your strip mid cut, which will then require you to reface your board on a table saw or planer to get the edge straight again. I didn't say this was going to be easy! Just make sure your stop blocks are in good shape and butted right up against each side of the band saw blade. It also helps to be using a wider blade, which tends to walk less.

A circular form made from something like particleboard is used to bend the strips around. The edges of the form should be covered with masking tape to prevent the hoop from accidentally getting glued to the former. The form used in Figure 6 is one foot in diameter.

One you have the strips made, mark the center of one and apply wood glue down half its length. The second strip is now placed on top of the glue such that it overlaps the first strip by half. This assembly is now stapled to the form right at the midpoint, as seen in Figure 7. The staples should be about 1/2" so that they penetrate both strips and far enough into the form to hold things together.

Next the form is placed on end to that it pins the stapled joint down onto the table. The two strips are bent half way around and held down with more staples, as shown in Figure 8. While holding the strips in this position, apply some glue along the remaining length of the bottom strip.

Now comes the hard part (as if it hasn't been hard enough up till now). The top strip needs to be curved down around the form until it meets itself at the joint. If the strip is too long, it may be trimmed with scissors. Once it is butted up against where it started, the other strip is pulled up over it and stapled into place. The second strip should form another butt joint at the top. Trim as necessary to minimize any gap or eliminate overlaps.

If you have not thrown the entire assembly across the room by now,

Figure 8: Strips are bent and stapled around former so that the seam for each strip lies directly accross from each other.

Figure 9: Strips allowed to dry on former, then staples are removed.

then your patience is admirable and the results should look like Figure 9.

Once the glue dries on the laminated hoop, the staples are pried out with a screwdriver and the hoop is removed. It helps to have guidelines on your form so that you can mark the four points on the hoop where the cross members will connect.

You will need to drill a 1/4" hole through the frame where the spokes will attach. Due to the two weak points in the hoop where the strip seams are, it is best to make the cross members connect where these seams are located in order to strengthen them. The frame will not flex at the points where the cross members attach, so this is the best place to locate any weak spots.

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Figure 10: Fitting out the cross members.

The cross members are made by shaving 1/8" or 3/16" strips from 3/4" thick material using the band saw again. These are then cut to the length of the outside diameter of the hoop. Each end of the two cross members must then be notched and trimmed with a utility knife so that you get a round tendon that will fit into the holes you drilled in the hoop. The length of this tendon should be equal to the thickness of the hoop, which should be a little over 1/8".

Finally, the ends of the cross members are glued and the point where they cross over each other at the center is also glued. The pieces are now snapped into place and allowed to dry. The pivot hole at the center is drilled after all the glue is dry.

Figure 11: Finished wheel.

Method 3:
If the previous method of making frames seems too difficult, then it probably is. Another method for making high quality wooden frames uses wooden hoops that may be purchased from art supply stores and are usually found in the knitting section. The hoops are sold in pairs, with one being adjustable and the other being solid. You really just want the solid one but you have to buy both. This is a more expensive way to make the girandola frames, and they are slightly heavier, but it saves you the trouble of having to make your own hoop. The hoops also come in a variety of sizes, so you are not limited to just one size as in the case of the five gallon bucket method.

Figure 12: Stitching frame and dowel rods with 2x2 hub.

One you have your hoop, you will need to get some dowel rods to use as the spokes. The diameter of the dowel rods should be half the height of the hoop frame. Thus if your hoop is 3/4" tall, you will need four 3/8" dowel rods equal to the radius of your hoop.

You will also need a central hub for the dowel rod spokes to plug into. This can be made by cutting off a 1" section of spruce 2x2 material. You can leave the hub square, or you can shave down the corners to reduce the weight. It is easier to drill all the holes while the hub is still square. You will need holes in four adjacent sides where the dowel rods get glued in, and one down the middle that will loosely slip over your launch pin. You will also need to drill holes through your hoop at the four points where the spokes connect. A drill press is the ideal tool for making these holes, since they need to be very straight.

Figure 13: Finished wheel using store-bought components.

If you are using a large hoop, you may need more than four spokes, which will require you to fabricate a pentagon or hexagon shaped hub. If this sounds like too much work, a segment of 1-1/2" round dowel rod can also be used in cases where more than four spokes are needed. More skill in marking and drilling each hole will be required when using a dowel rod as the hub.

Figure 12 shows all the components ready to be glued together. The dowel rods can stick out beyond the frame when glued and then sanded down later. Note that a stronger joint is made by not drilling the spoke holes all the way into the center of the hub, such that the launch pin hole is not intersected by the spoke holes. This also helps reduce problems of glue spilling down into the center hole and decreasing it's diameter. Another method to prevent this problem is to drill the center hole only after the entire assembly has been glued together.

Summary:
The three methods shown here have different tradeoffs between cost, ease of fabrication, resistance to fire and weight. The second method produces the lightest wheel, weighing in at about 80 grams if material is minimized, but requires the most tools and skill to make. The bucket wheel is slightly heavier, but is easily made and will withstand a fall from any height. The wheel made using method three is the most expensive and heaviest method, but is the strongest wheel of the three. Hopefully the reader will find a workable design based on his requirements, woodworking skills and available materials.