

All About Boxes

SWAT 2006

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Turned boxes are a great form for expressing your creativity. There are endless combinations of design, material and finish that make each box unique. The purpose of boxes can range from a utility item to pure art form. Boxes provide an excellent canvas for experimentation with surface decoration. Below are some factors to consider when planning a box:

Box Design Factors

- I. Purpose of box
- II. Type of wood
- III. Size and Shape
- IV. Grain Orientation
- V. Fit of the lid
- VI. Surface enhancement (Texturing and adding other materials)
- VII. Finishing

I. Purpose of Box:

Deciding the purpose of a box is an important design factor because this affects everything else. Do you want a utility box, a purely artistic box or some combination of both? Do you want the box to be handled or left on the shelf?

I believe that turned boxes should be made to be handled. Part the fun of a turned box is opening the lid and looking inside – even if it is empty. Think about how this one factor might affect the size, shape, lid fit and surface enhancement of a box.

Purpose has a direct impact of the fit of the lid (or visa-versa). Since boxes are usually picked up by the lid first, the lid of a utility box should either come off easily or be securely fastened.

Probably most of the boxes we make are intended to be somewhere between purely utility or artistic so we might call them “functional art”. We would like them to look nice even if we chuck them full of pennies. These kinds of boxes will be the focus of this demo.

II. Type of Wood:

As with all turnings there are many types of wood that can be used to make boxes. Materials other than wood can also be used but this demo will focus on wood only. Generally, close grain hardwoods make the best boxes. We are blessed in the Southwest USA with many excellent woods for box making such as Maple, Cherry, Mesquite, Texas Ebony, Ash, Boxwood, most fruitwoods and Walnut.

There are also many imported woods that are excellent for turning boxes such as Bocote, Mahogany, Ebony, Rosewoods, Cocobolo and Lignum Vitae.

Soft woods come from faster growing trees and hence have wide growth rings. These woods tend to have a lot of grain tear out and are not very suitable for box making. These can be used but they take a lot of extra time (and often CA glue) so why bother. Stick with the best woods for the task and you will have less frustration.

III. Size & Shape:

For boxes that are intended to be handled, a diameter between 2"-3" works well. The length can vary but a result that is pleasing to the eye can always be obtained by applying the "Golden Ratio". Make the diameter about $\frac{3}{5}$ to $\frac{2}{3}$ of the length.

The proportion of the lid to the base is also important for an aesthetic result. Again the "Golden Ratio" is useful. Make the height of the lid about $\frac{2}{5}$ to $\frac{1}{3}$ of the total height of the box.

While these proportions are attractive, they are by no means a limiting factor. The only limit to shaping a box is one's imagination. A good way to experiment with shape is to turn and carve solid forms using a cheap wood.

IV. Grain Orientation:

We all know that wood moves with changes in humidity. The main concern with box making is to have a stable fit for the lid. Mount the stock with the grain parallel to the lathe axis and this will provide the most consistent fit for the lid over time.

Boxes can be made with the grain oriented radially (at 90 degrees to the lathe axis) but one must take care to use stable woods. Also, the wood must be dry when finish turned so rough turn the box and let it stabilize before final turning. Finally, a loose fit lid works best when the grain is oriented radially.

V. Fit of the Lid:

In many ways, the fit of the lid defines a turned box. There are at least 7 ways to fit a box lid to its base.

Sliding (or mortise and tenon) Fit – A sliding fit is achieved entirely by turning and is the most common style of lid fit. A tenon flange is cut on either the lid or the base and it slides inside the mortise flange cut on the other part of the box. This process will produce one of three types of fit.

1. Loose fit – A loose fit lid lifts off of the base easily. There is no suction or resistance felt when the lid is removed. Use this type of fit for utility boxes because it allows the lid to be removed with one hand and without lifting the base.

2. Snap (or tight) fit – This type of fit requires two hands to remove the lid. It can be used for utility boxes but the lid must fit tight enough to stay on the base until it is pulled off. If the lid is too loose, the base may be lifted momentarily with the lid and then drop spilling the contents of the box. The challenge is to get a fit that is not too loose and not too tight.
3. Suction fit – This is perhaps the most difficult lid to turn but is a work of art when done right. The suction fit lid will lift off easily but with some drag. For this reason, don't use a suction fit for utility boxes. When the lid is placed on the box, it should settle down as air slowly bleeds out between the flanges

Mechanical Fit Lids – These lids make for a very secure fit and can be used for any purpose box.

4. Hand chased threads – It takes a commitment to develop the skill to hand chase threads. Alan Batty is no doubt the best known turner for hand chased threads and he has produced an excellent video on the subject.
5. Threading fixtures – This is the most preferred choice for those who want to thread their box lids. The most popular threading systems are sold by Bonnie Klein and Best Wood Tools both of which can be found on the Internet.
6. Metal threaded rings – Packard Supply sells sets of threaded rings that can be glued on a box lid and base. The box diameter must be cut exactly to fit the flange.
7. Hinged lids – The Internet woodturning suppliers sell a metal hinge that can be glued on a box lid and base. This device has two flanges joined by the hinge. Like the metal threaded rings, one must cut the box diameter precisely to fit the flange.

VI. Surface Enhancement (Texturing and adding other materials)

Boxes make an excellent canvas to try various surface treatments. One easy method is to texture the lid and/or the sides of the box. Texturing can be as easy as cutting grooves with the point of a skew on its side. The end grain on the lid can be textured with a Chatter Tool but this does not work well on side grain. Side grain can be textured with carving tools or the Sorby Spiraling and Texturing Tool. Also common objects like a piece of a hacksaw blade will provide an interesting texture. Use colored markers to enhance the textured surface.

Using an inlay of contrasting wood will also enhance the exterior of a box. You can experiment with attaching other materials such as fibers, metal or stone in creative ways.

VII. Finishing

Friction finishes work very well on boxes. These are products that you apply to the wood, turn on the lathe and rub with a paper towel to build up friction heat to cure the finish. There are a number of Shellac based finishes that work well. Lacquer based friction finishes are difficult to work because they tend to streak easily.

Another group of friction finishes are the waxes. I prefer Renaissance wax but Carnauba wax, Beeswax and Briwax also work well.

As with all finishing products, you should take note of the chemical contents and take all needed precaution to avoid contact with you skin.

Preparing blanks:

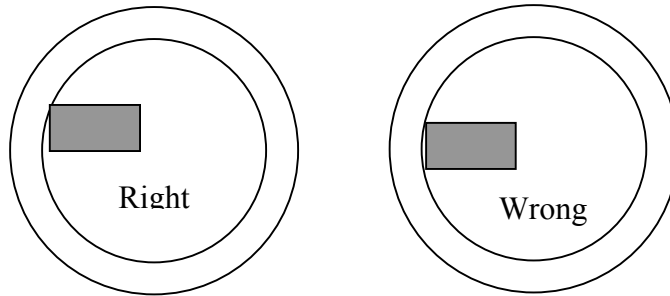
Cut wood blanks to a square 2.5" to 3" on a side. The length should be enough for the finished box plus a tenon on one or both ends (depending on the type of box) plus parting off the lid. I strongly recommend that you rough turn box blanks and allow them to air dry. This will make fit more consistent with time and is more important for suction and snap fit lids.

Making a Simple Box – Solid, tenon lid

This box is about as simple as box making can get because the lid is solid. Therefore, only the base needs to be hollowed. A loose fit lid works best with this style of box.

1. Mount the blank between centers and turn it round. Put a tenon on the base end of the blank.
2. Install a chuck and mount the blank.
3. Shape the lid including the tenon that will fit into the base.
4. Start shaping the base but do not remove too much material near the bottom of the base because this needs to be strong enough for the heavy cuts made during hollowing.
5. Start the parting cut to cut off the lid. Sand the lid and apply the finish.
6. Finish parting off the lid leaving a small part of the tenon (no more than 1/32") on the base to use a guide when sizing the opening of the base. The bottom of the lid can be finished later either by hand or using power sanding.
7. Hollow the inside of the base. Cut the mortise flange for the lid with a constant diameter so it will be parallel to the lathe axis. Stop the lathe and check the fit as needed. The lid should fit loose but not sloppy.

When cutting the mortise flange, use a flat, square end scraper or a skew on its side. Position the tool rest so the cutting edge will be above center high enough to prevent the bottom of the tool from hitting the side of the work.



Tool position for cutting the mortise flange

8. Shape the outside of the box as far down on the side as possible.
9. Sand and finish the inside and outside of the base.
10. At this point you can decide to finish the bottom of the base in one of two ways. You can part of the base and finish in the same manner as the bottom of the lid or you can part it off, reverse chuck the base and finish the bottom on the lathe.

Making a Hollow Lid Box

This style of box requires that the work be mounted more times but is not really any more difficult. The fit of the lid can be loose, suction or a snap fit depending on the final cuts on the tenon flange. I prefer to cut the mortise flange into the lid and cut the tenon flange on the base. I think that this makes for an easier sequence but one could do the reverse.

1. Mount the blank between centers and turn it round. Put a tenon on both ends of the blank.
2. Start a parting cut to separate the lid from the base. DO NOT attempt to complete the part with the work mounted between centers because the parting tool can easily bind and be pulled from your hand. Leave about $\frac{1}{2}$ " diameter of material at the center, stop the lathe and finish the cut with a hand saw.
3. Install a chuck and mount the lid in the chuck and true up the sides.
4. Hollow out the lid and cut the lid flange. Take care to cut the flange a uniform diameter making the sides parallel to the lathe axis. Use inside calipers or a straight edge to check the flange. The flange should be $\frac{1}{4}$ " to $\frac{1}{2}$ " in depth. Cut the bottom of the lid so that it is chamfered inward.
5. Sand and finish the inside of the lid. Sand the lid flange very lightly with a fine grit. If you sand too much you will cause the lid flange to become egg shaped and the lid will not fit well.
6. Begin shaping the outside of the lid staying clear of the chuck jaws.
7. Remove the lid and install the base. True up the sides and end.
8. Using a parting tool and the lid for reference, make a rough at the base flange leaving the diameter larger than the inside diameter of the lid.
9. Hollow out the base taking note of the depth.
10. Cut the flange on the base so that the lid fits tight. Use a parting tool or a skew on its side.

11. Install the lid and finish turning the outside of the lid and shape the outside of the base.
12. Sand and finish the outside of the lid. Remove the lid.
13. Finish turning any details on the outside of the base and finish cut the base tenon flange to achieve the fit you desire.
14. Sand and finish the inside and outside of the base. Sand the base flange very lightly with a fine grit so as not to change the fit of the lid.
15. Part off the base. Cut a tenon the wood left in the chuck (or mount a scrap piece) and jam fit the base on this tenon. Be careful not to split the base.
16. Finish turning the bottom of the base, sand and finish.