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## Project: Combination Lock

**Overview:** How many times a day does the average student open and shut their locker? Each time they have to turn their combination lock back and forth to open their locker. This project helps understand the mechanics that go into basic locksmithing.

**Materials:** 1/2" plywood, 96" of 1/2" dowel and 2' of 5/16" dowel

**Minimum Cutting Area:** 31" x 34"

**Bit Size:** 1/4"

**Finishing:** Finish all of the outside parts with a polyurethane and grease all of the internal moving parts



*\*\*Always read the entire project details before starting to cut the file yourself\*\**

*\*\*Account for the thickness of the physical material on hand and the material thickness in the file\*\**

*\*\*This file is zeroed to the tables surface, Zero your bit to the tables surface\*\**



Included with the cut file is a hold down tool path that shows where it is safe to put screws. Run this file separately from the cut file so you can screw down the work piece, or if you have a different size board or different type of hold down disregard the file.



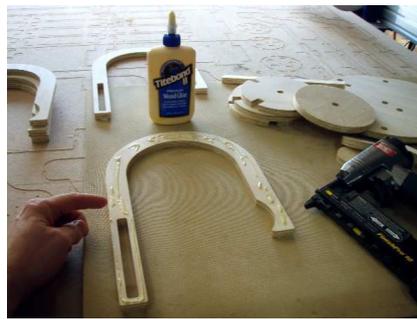
As the file starts cutting the profile of the parts make sure the cut is going all the way through the work piece and into the table surface. If you need to adjust any part of the file make sure you do not remove the hold down or you will lose position.



Tabs are used to hold all the pieces to the scrap wood attached to them. Use a utility knife to score these edges. Never try to push a piece out without cutting the tab, it will tear the grain on your project. Sand remaining tab flat.



Sand all of the parts as they lie in the flat with a random orbital sander.



The first assembly is gluing all of the "U" shaped parts one on top of the next.



A pin nailer helps align each piece to its exact position.



Once all of the "U" shaped parts are together apply clamps and allow the glue to dry for at least one hour.



All of the exterior edges can be routed with an 1/8" round over. This will help keep the project each to handle and avoid any sharp edges.



Install 10 pieces of dowel that are appx. 4" long. Also install the two lengths dowel that are 3/4" long, one into the back and one into the face.



Four pieces of 5/16" dowel that are 4" long can be installed at this time.



The remaining hole calls for a 5/16" dowel; however, it should be sanded down so that it fits through the "U" slots without any friction.



Test this dowel in the "U" fixture and keep sanding until it moves at ease and there is no friction.



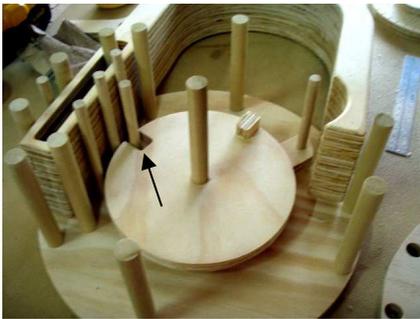
Drop in the "U" assembly with all of the dowels in place on the back side.



Install the lock over the 1/2" stub dowel and install a length of 3 1/4" dowel that is 5/16" dia. Into each end.



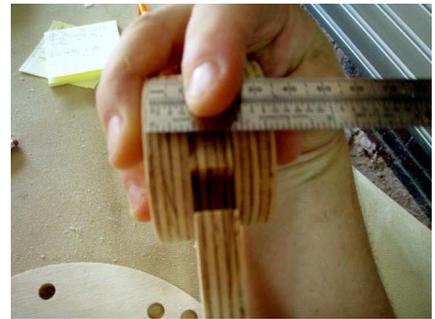
Using the long rectangular piece cut one section 1/4" longer than the depth of the plywood being used.



Set this first circle into place and align with the dropping point of the lock.



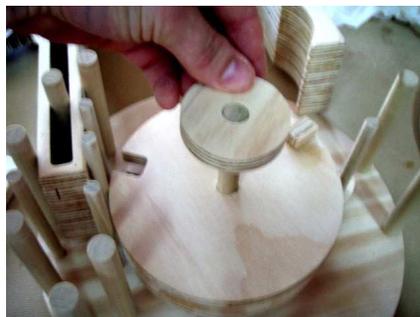
Install one of the smaller spacers over the center dowel.



Cut a section of the long rectangular piece so it extends 1/4" past on each side of the center circle.



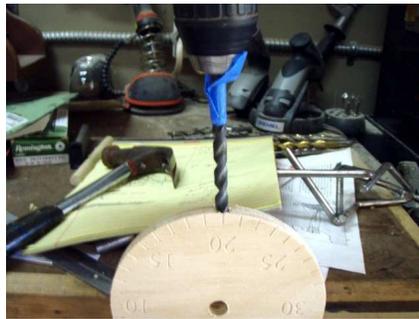
Glue and pin nail these rectangular pieces into place.



Install the other spacer.



Finally repeat the first step and glue a piece of the rectangular stock into the third wheel, having the rectangular piece face down and be flush on top.



The first wheel needs to be permanently attached to the center dowel. Drill down into the first wheel and attach to the center 1/2" dowel with a screw and glue.

The front dial also needs to be attached so drill a hole down through it that matches the screw head diameter.

After the screws have been tightened fill them with a wood putty or filler. At this point make sure all of the center parts turn individually without any strain, if so, sand them to better fit.



Pull the project pack apart from the back side and grease up each individual layer.

Once all of the moving parts have been greased, glue the ends of all of the dowels except for the center one which needs to spin in place.

Tape off the interior of the lock, it is time to spray polyurethane the project and this sticky mess is not needed in the interior guts of the project.



Minwax spray polyurethane works for this project and multiple coats should be applied to seal up the wood.



Twist the knob and make sure all three circles catch each other like above. This catching mechanism is what will be done and undone throughout the dialing of the combination.



Twist the knob to the right several times to get a lock like the previous picture. Twist until pictured above with the rear wheel. Then counter twist until the second wheel lines up like pictured above.



Finally twist the knob again until the third knob lines up. Pay attention to your own personal combination on the front of the lock.



With the three lined up pull on the upper "U" shaped part of the lock.



The lock arm will rotate down and allow the arm to come out of the base.



Pull the "U" shaped arm all the way out.



The upper portion will rotate on the dowel that holds it in place.



Simply push the "U" arm back down and rotate the dial, this will reset the lock and it will not open until the three proper numbers are reentered into the combination.



At first the wheels can stick to one another. Wedging in a piece of foam, rubber, etc. will apply just a little bit of tension on the center wheels.



This helps the wheels stay in place since both clockwise and counterclockwise motions are being applied.



To help locate the front marker point, a decorative screw can be installed here. This is a good idea so the user has a reference point while twisting the knob.



Remember each padlock will have a different combination. It all depends on how the user fastens the front dial and first inner circle to the center dowel. The lock has to be pretty dead on for the counter arm to open and the lock to open. However after a few times of testing your numbers you will know your exact combination that works every time.