

Al & Gary's Illusionist Heart



Plans and Instructions by:

Albert Herwig and Gary A. Emerich

AI & Gary's Illusionist Heart



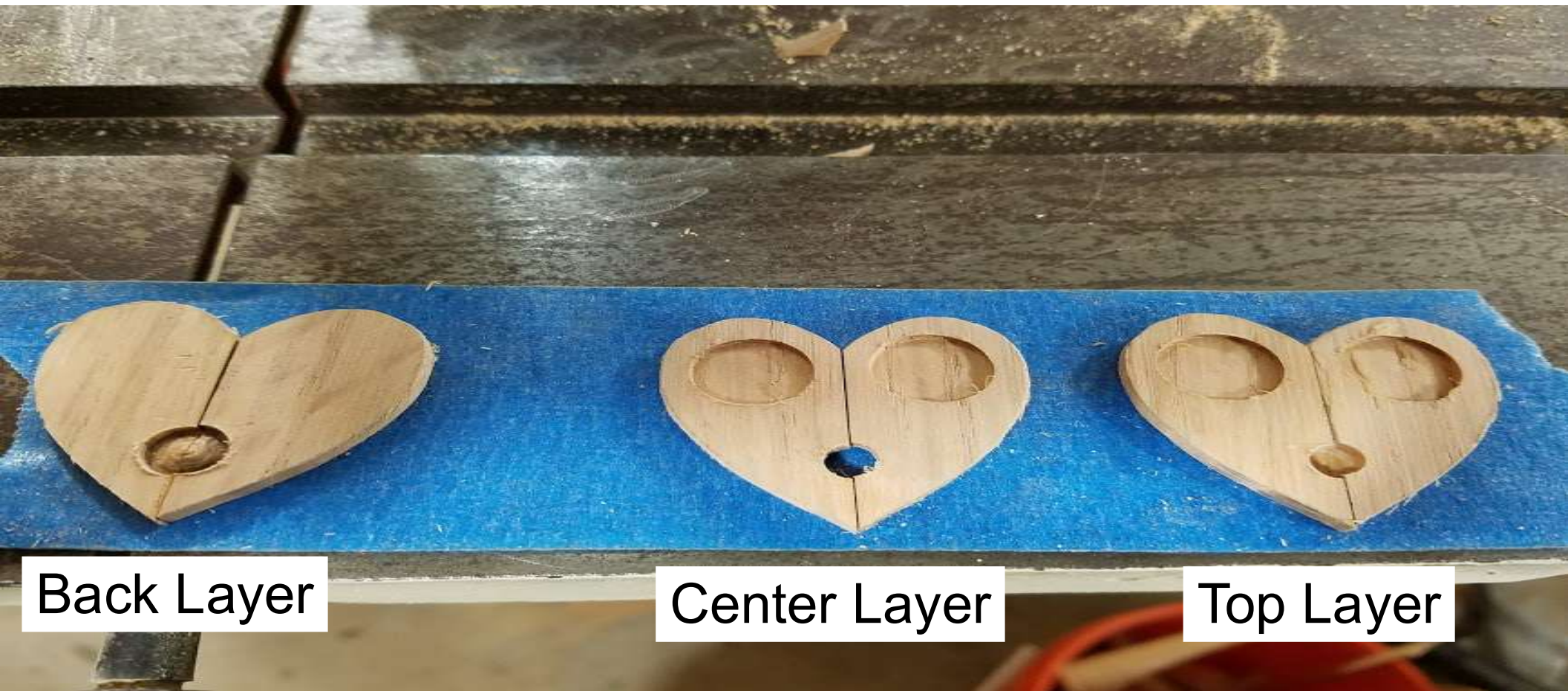
As AI Would Say:

“It's a pendant” “Now it's a heart” “Our pictures are in there” “My children' s pictures are in there”
Now watch the pivot point, see that disappears ...

The Illusionist Heart Overview

OVERVIEW: Is my attempt to show you in photographs what I'm trying to describe in words.

Here are the 6 pieces which makeup the 3 layers needed to construct the heart.



Back Layer

Center Layer

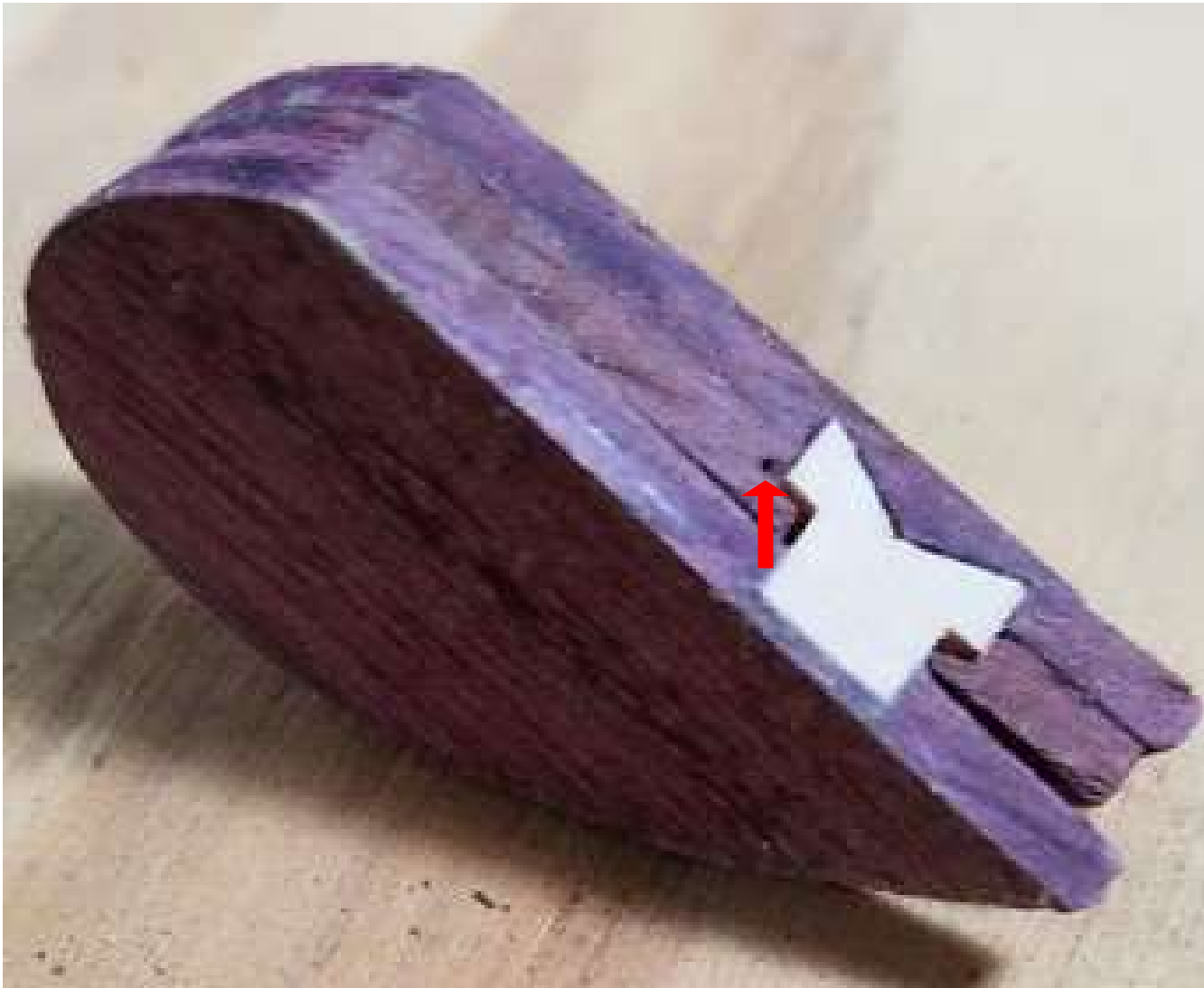
Top Layer

The Illusionist Heart Overview



Here are the 6 pieces glued and assembled. If you look closely you can see how the back and center layers hold the top layer. The wooden pin (white in this picture) slides into the back and center layer and holds it in place.

The Illusionist Heart Overview



Here the wooden pin holds the top layer to the other 2 layers allowing the top layer to turn. If you look at the center layer you can see a hole for the steel pin that allows the heart to rotate from a pendant to a heart.

The Illusionist Heart

Step #1

Making Wooden Strips

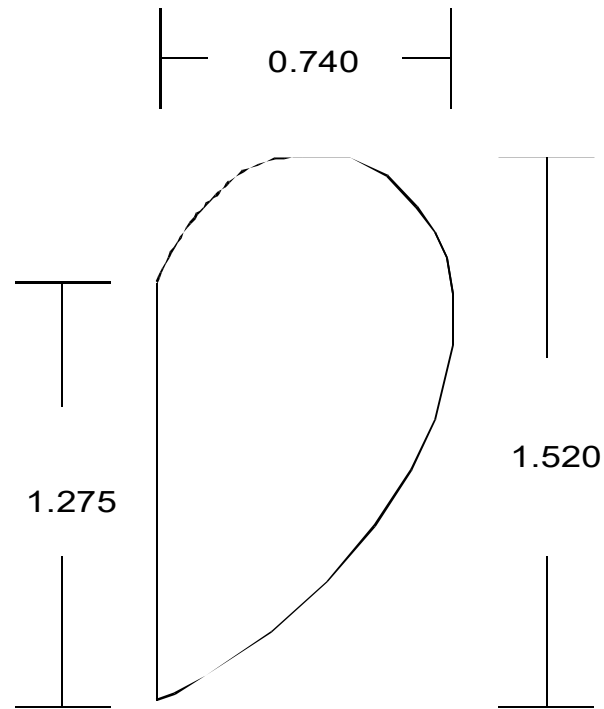


Start by cutting and planing or sanding a piece of wood to these dimensions:
Width 0.800, Thickness 0.125, Length is up to you

The Illusionist Heart

Step # 2

Making Heart Halves

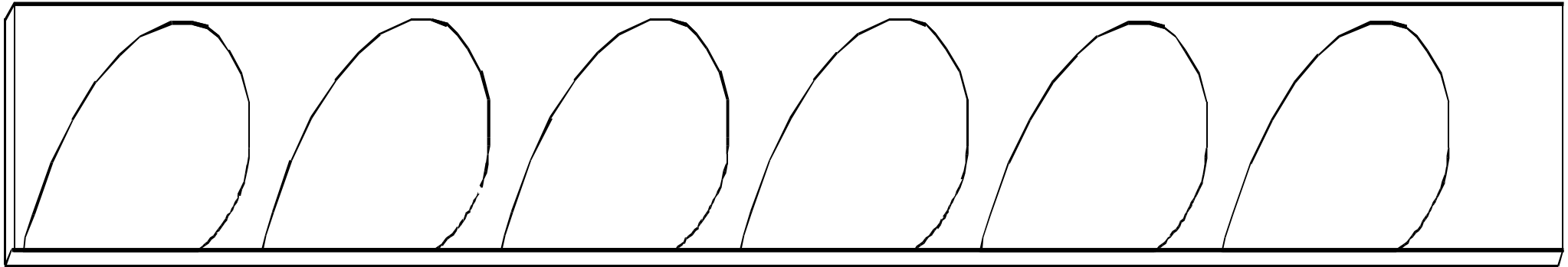


From that piece of wood cut out a half heart with these dimensions to create a pattern.

The Illusionist Heart

Step # 3

Laying Out Heart Halves



Next use the pattern to layout the half hearts and on your piece of wood and cut them out. You will need 6 halves to make the complete heart but my advice is cut out at least 18 or more.

The Illusionist Heart Overview Step # 3

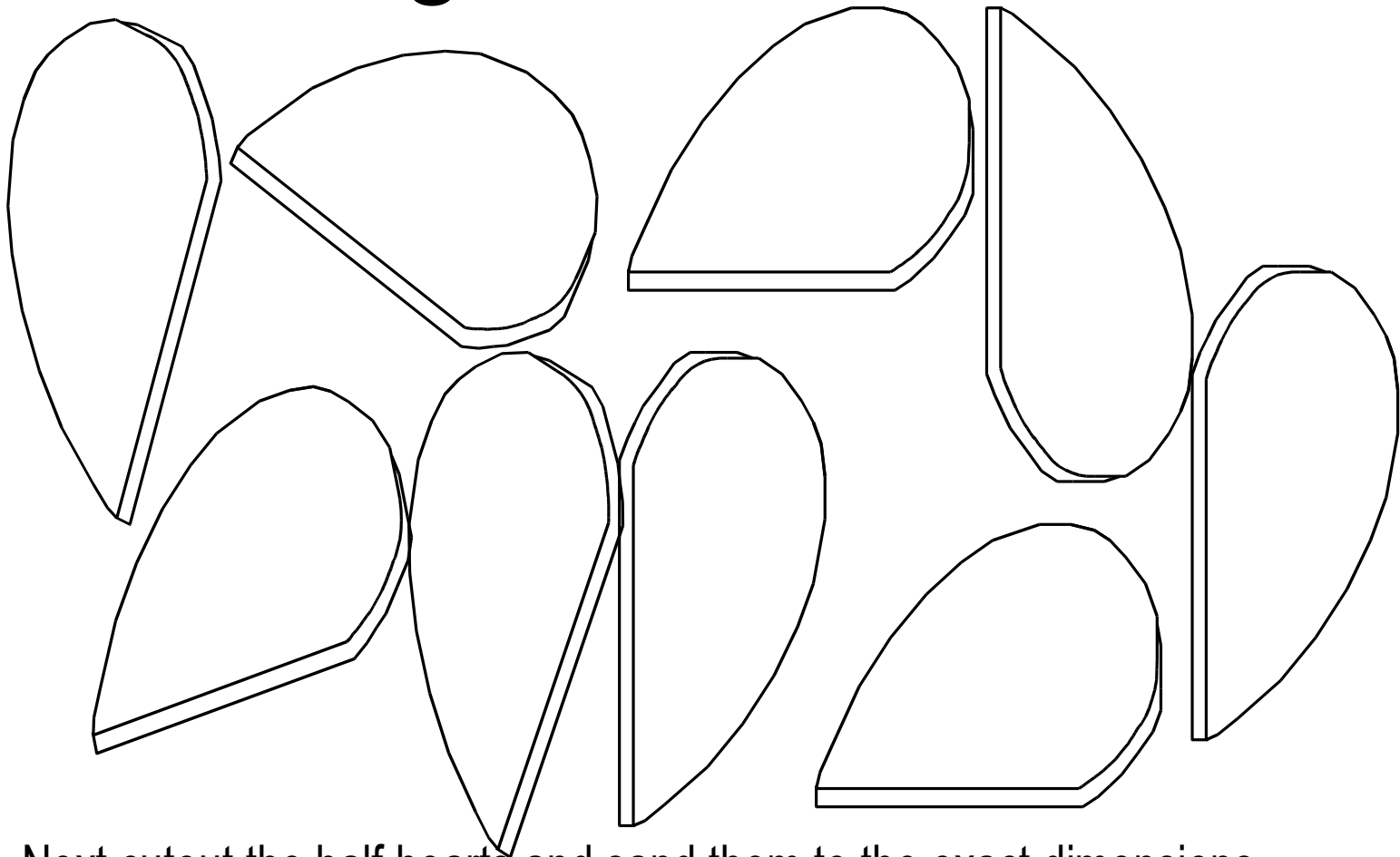


These pieces are rough cut on the bandsaw. Above you can see we only cut close to the line. The next step will make the pieces identical.

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Step # 4

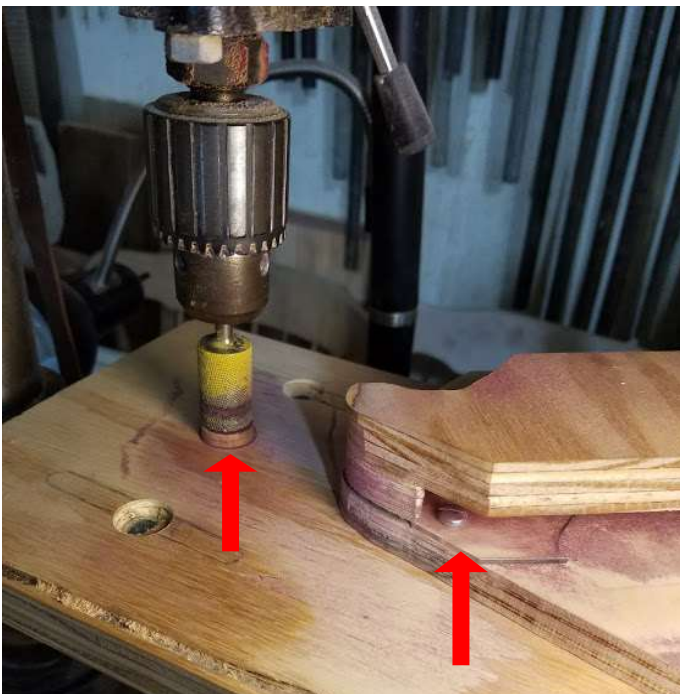
Sanding Halves To Size



Next cutout the half hearts and sand them to the exact dimensions.

The Illusionist Heart

Overview ½ Heart Clamp Jig



See the plexiglass in this picture. It acts as a stop against the flat edge of the half heart piece.



The half heart piece is clamped in place in the gap above.



Then the half heart piece is sanded to size. The size is consistent because the bottom of the Clamp Jig hits a pin the same size as the bit. This makes every piece the same. Look at the pin under the bit. (Far Left)

Al devised the Clamp Jig above to hold 1 half heart piece at a time. If the piece is clamped the same each time, each piece will be identical and fits tightly into the Master Jig.

The Master Jig is explained later in this presentation.

The Illusionist Heart Tooling



Grinding the router bit.

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Truing The Drill Presses

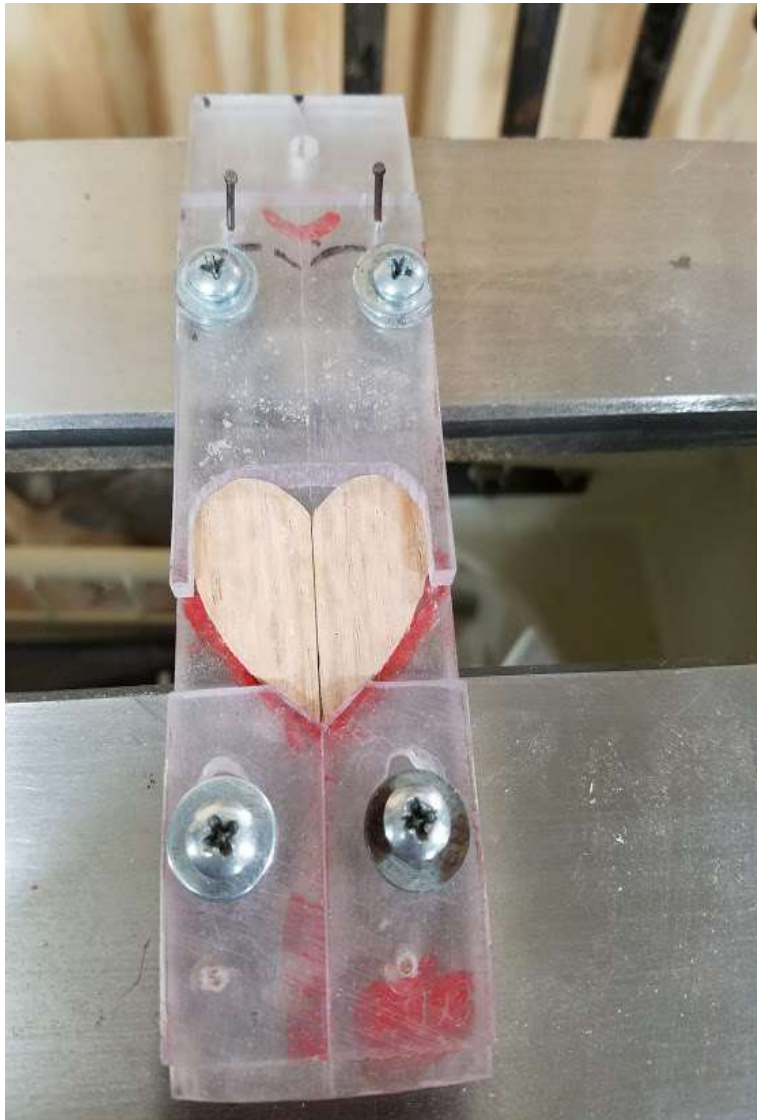


Before we began machining the tables and jig guides had to be level and perfectly centered. This step took a long time to complete but without it our machining would have been off. The heart's pieces wouldn't fit together the way they need to in order for the heart to work. We used a board with a centered wooden pin. Each of 4 drill presses were setup like this allowing perfect placement for the Master



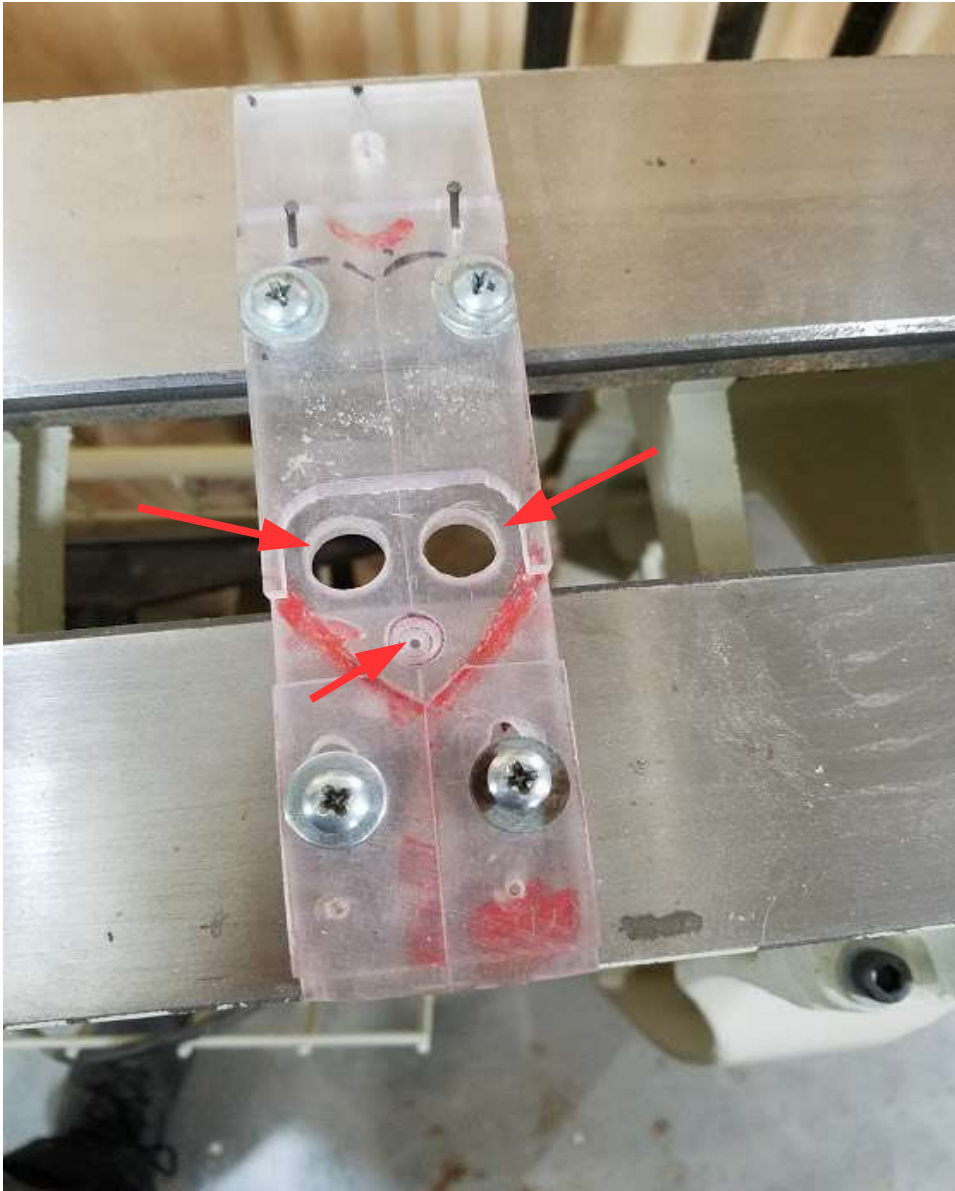
Jig. This allows us to move the Master Jig from drill press to drill press for each step of our machining process.

The Illusionist Heart Master Jig



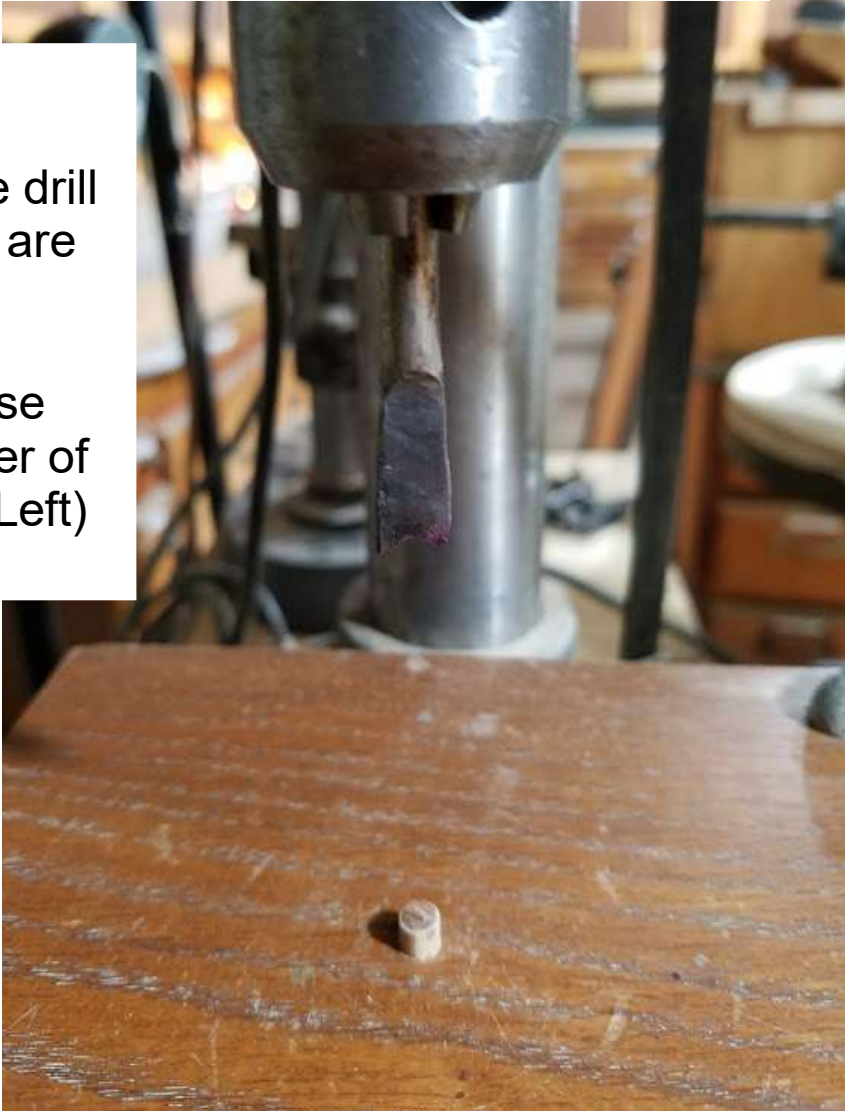
This is our Master Jig. It is constructed of 3 layers of 1/4" (0.250) Plexiglass. This jig holds 2 pieces or 1 layer tightly in place so our machining steps can be accurately preformed on each layer. Because of this jig multiple hearts can be machined accurately.

The Illusionist Heart Master Jig




The 3 holes in the Master Jig (red arrows) align the layers of the heart to each drill press. Because of this each layer can be machined very quickly with the accuracy necessary.

The Illusionist Heart Master Jig / Drill-Press Connection



Each drill press has an alignment pin in a board clamped to the table of the drill press. (Right) These pins are centered within 0.005.



The Master Jig sits on these pins with 2 pieces or 1 layer of the heart for machining. (Left)

The Illusionist Heart Master Jig / Drill Press Connection

We use the depth stops on the drill presses to achieve the desired depth.



Setup took us quite a few hours .



The Illusionist Heart

Setup The Drill Presses



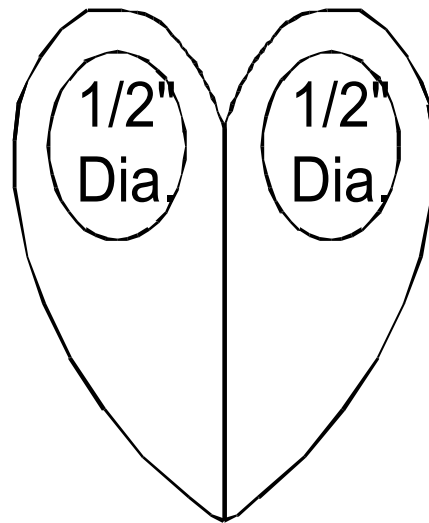
We setup the pins on 4 drill presses. Each to aligned within 0.005 of center. Then using the Master Jig, depths were set. After quite a pile of messed up pieces we got it right! Now this part of production can move forward.

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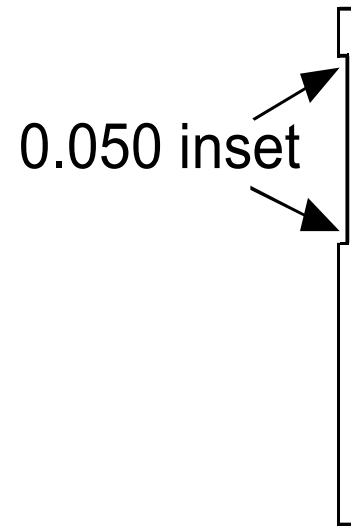
Step # 5

Center Layer Picture Insert Dimensions

Heart Front View



Heart Side View



Next using a 1/2" end mill cut out 2 areas 0.050 deep.

Center Layer

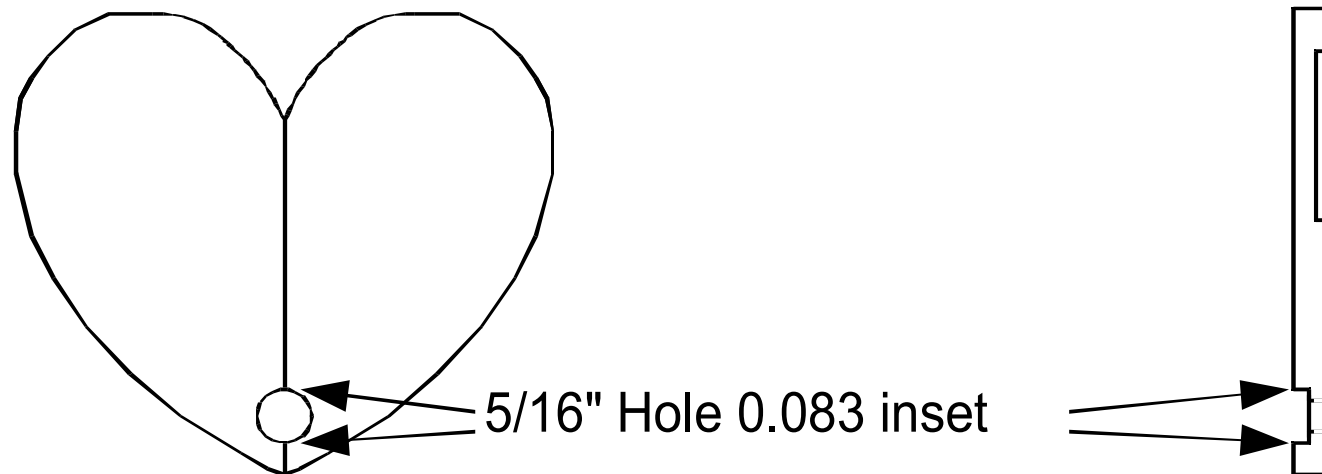
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Step # 6

Center Layer Back Insert Dimensions

Heart Back View

Heart Side View



Next using a $5/16$ " drill bit (ground flat) drill an inset 0.083 deep.
This creates a shoulder on the back side of the heart.

Center Layer

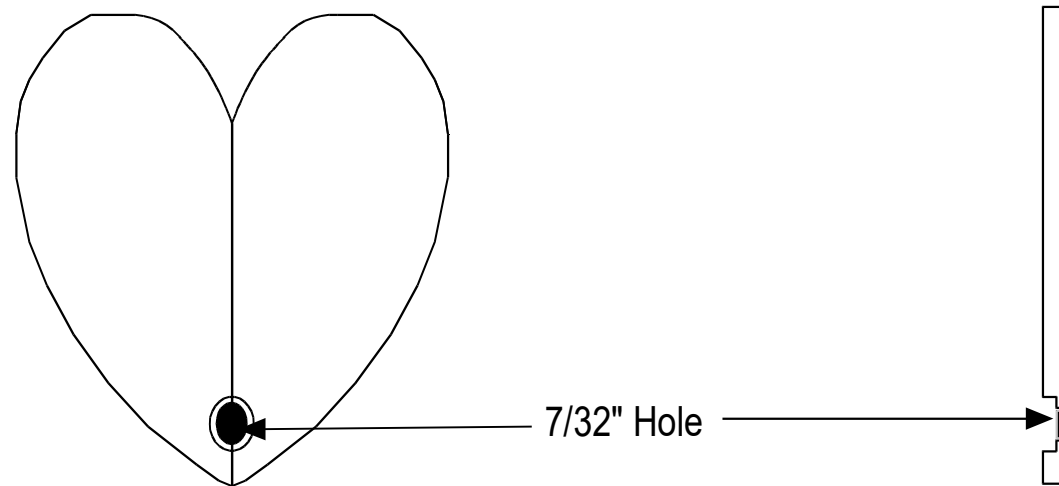
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Step # 7

Center Layer Hole Dimensions

Heart Back View

Heart Side View



Next using a $7/32$ " drillbit drill a hole through the Center Layer .
This creates the hole for the wooden pin of the heart.

Center Layer

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Step # 7 Overview

Center Layer Hole Dimensions

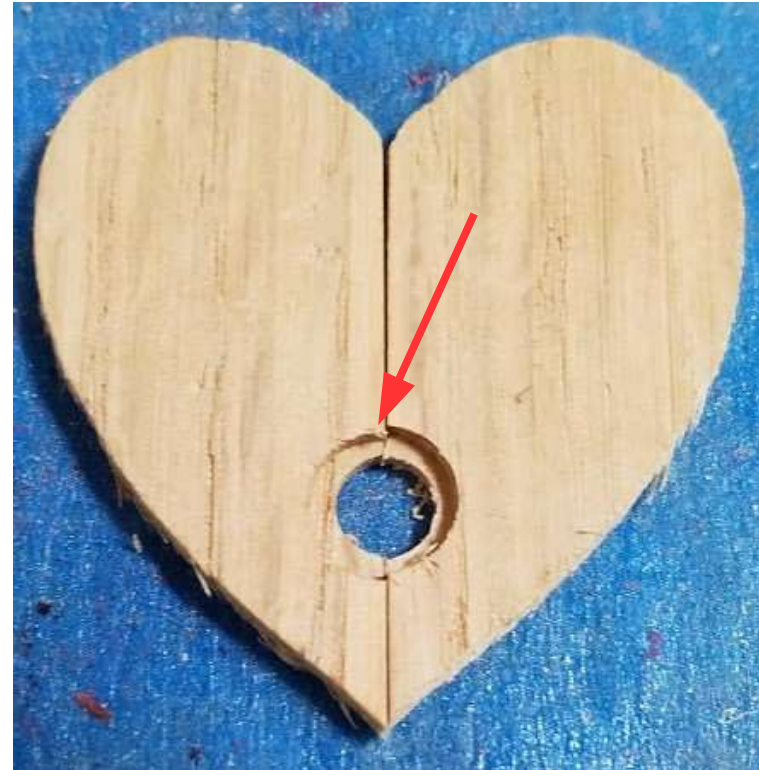
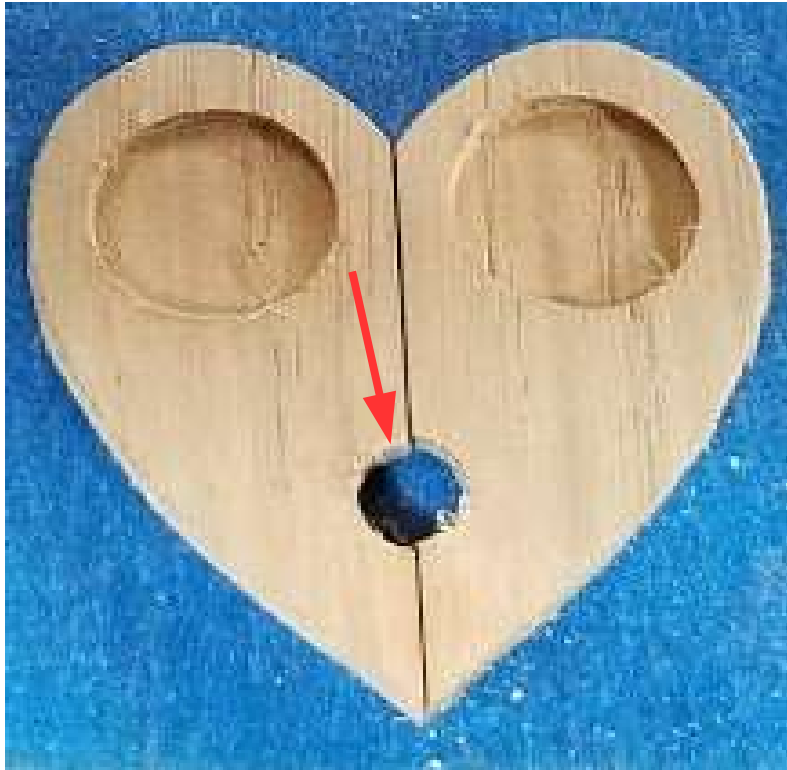


We found that the $7/32$ " hole in the center layer would vary by several thousandths because the drill bit would travel. So we made a drill bit guide that perfectly centered the bit each time (picture on the left is a top view). This guide we made of a $5/16$ " bolt head and body. We drilled a $7/32$ " hole through the head and body of the bolt (picture on the right is a bottom view). Then we brazed a handle on it to make it easier to use.



The Illusionist Heart

Step # 6 & 7 Overview



This is the front and this is the back of the same 2 pieces that make up the center layer. You can see the machining that was done on both sides of this, the center layer. But if you look closely you will see flaws in the machining which had to be corrected before these pieces could be used. We found that rotating the Master Jig while machining the shoulder helped. The drill guide corrected the other flaw.

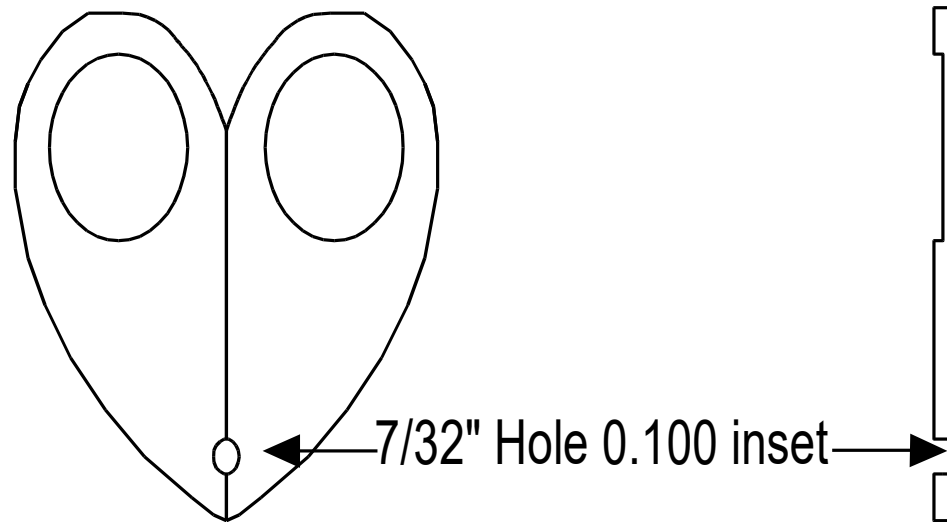
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Step # 8

Top Layer Hole Insert Dimensions

Heart Front View

Heart Side View



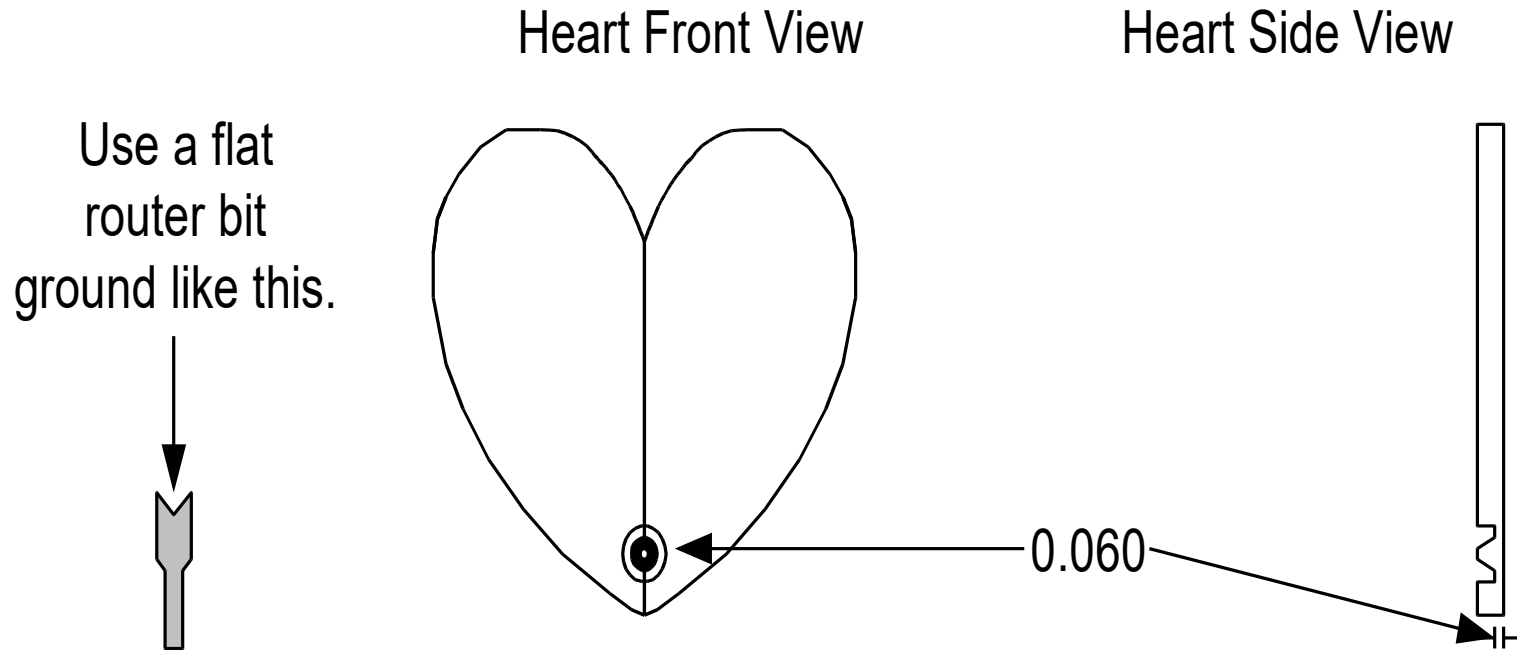
Next using a $7/32$ " drillbit (around flat) drill an inset 0.100 deep.

Top Layer

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Step # 9

Back Layer Insert Dimensions



Next using a flat router bit (ground like the drawing) drill an inset leaving 0.060 of wood. This creates a cone shape for the wooden pin to seat.

Back Layer

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So now we machined 48 pieces or enough to do 8 hearts. Then we begin assembling and debugging our setups. Dimensions are adjusted by thousands and flaws were corrected until the pieces all fit together the way they are suppose to. Small adjustments are made with the Dremel Tool and a small burr. Then it's time to make the wooden pins.



The Illusionist Heart Wooden Pin Overview

Making The Wooden Pin



We start with axle pins 1/4"; 7/32 shank

The Illusionist Heart Wooden Pin Overview

Making The Wooden Pin



We make our wooden pins on the lathe with 2 chucks setup like this.

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Step # 10

Making The Wooden Pin

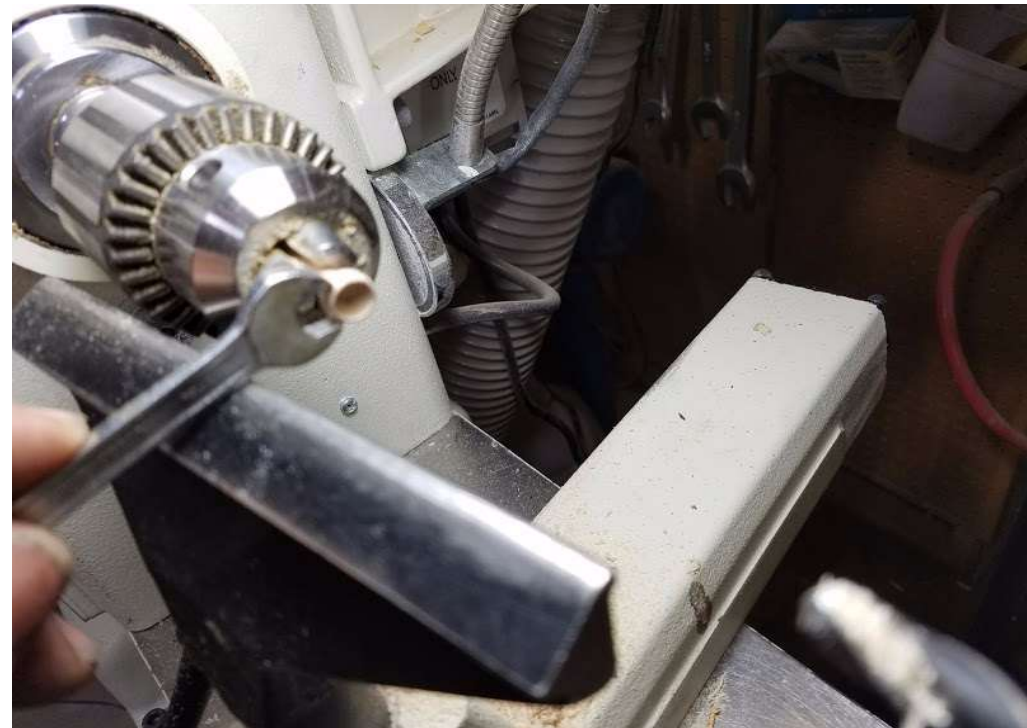


The wooden pin is chucked and the head is shortened to 0.135.

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Step # 11

Making The Wooden Pin



The wooden pin is advanced out of the chuck and with a sharpened wrench is sized to 0.300 or 5/16".

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Step # 12

Making The Wooden Pin



The wooden pin is chucked and drilled with a 5/16" bit to a depth of 0.080.
We use the lathe's tool rest as a stop.

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Wooden Pin Overview

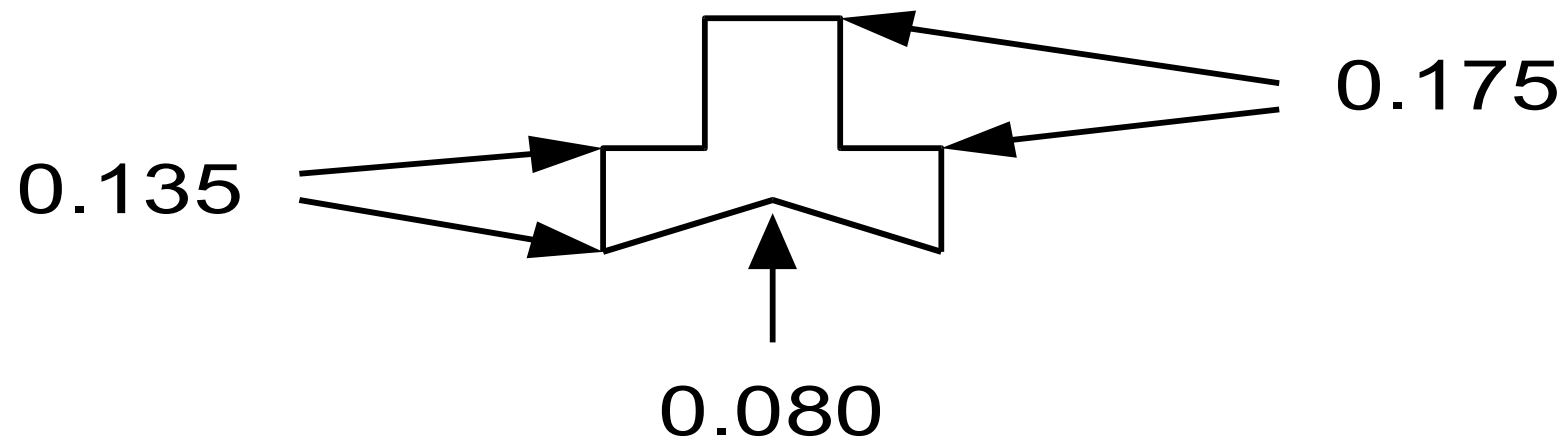
Making The Wooden Pin



The wooden pin's dimensions must be accurate so check them after every step.

The Illusionist Heart Wooden Pin Overview

Making The Wooden Pin

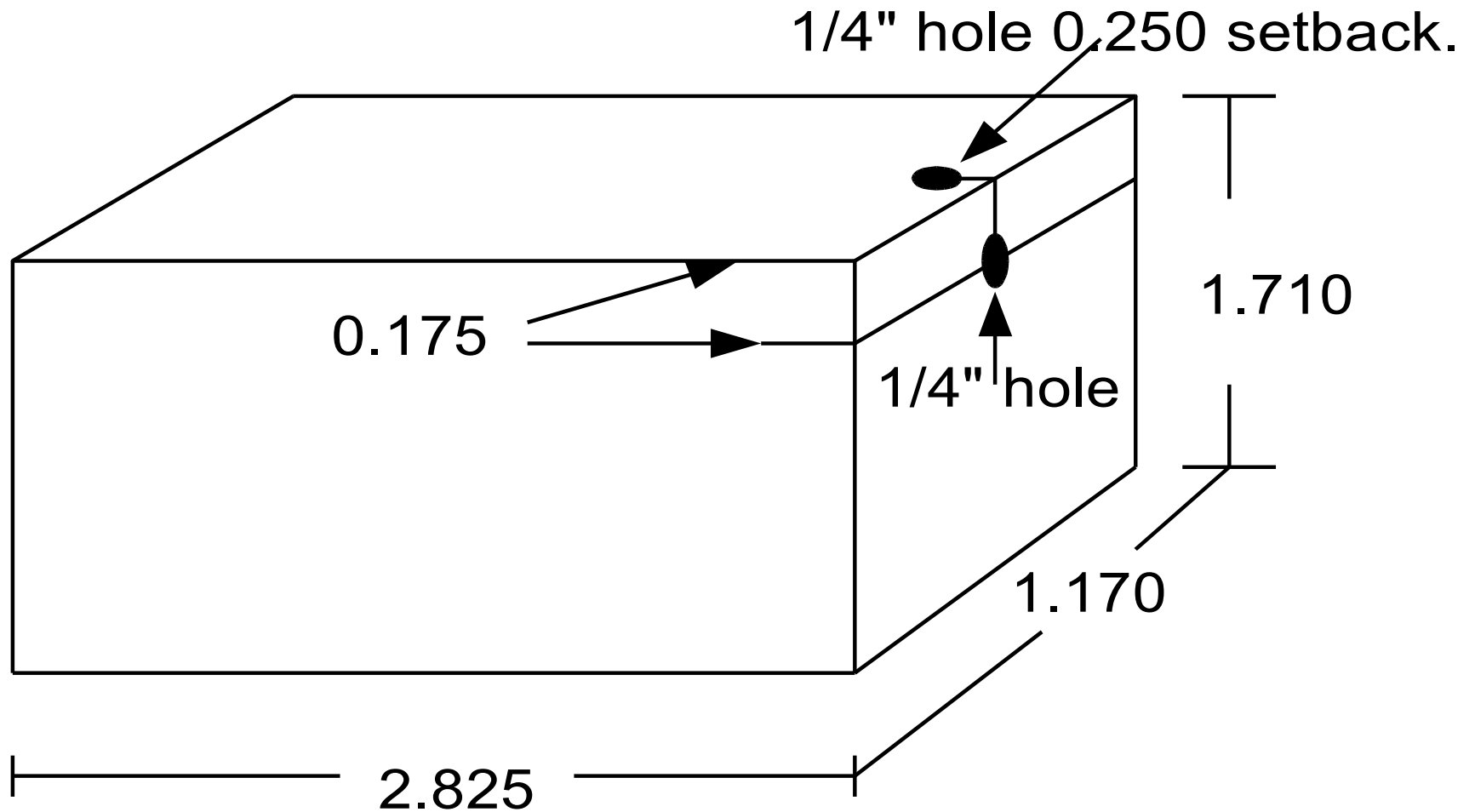


The wooden pin dimensions.

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Wooden Pin Cutting Jig

Making The Wooden Pin



The jig for cutting the wooden pin. Made from hardwood.

The Illusionist Heart Wooden Pin Cutting Jig Overview

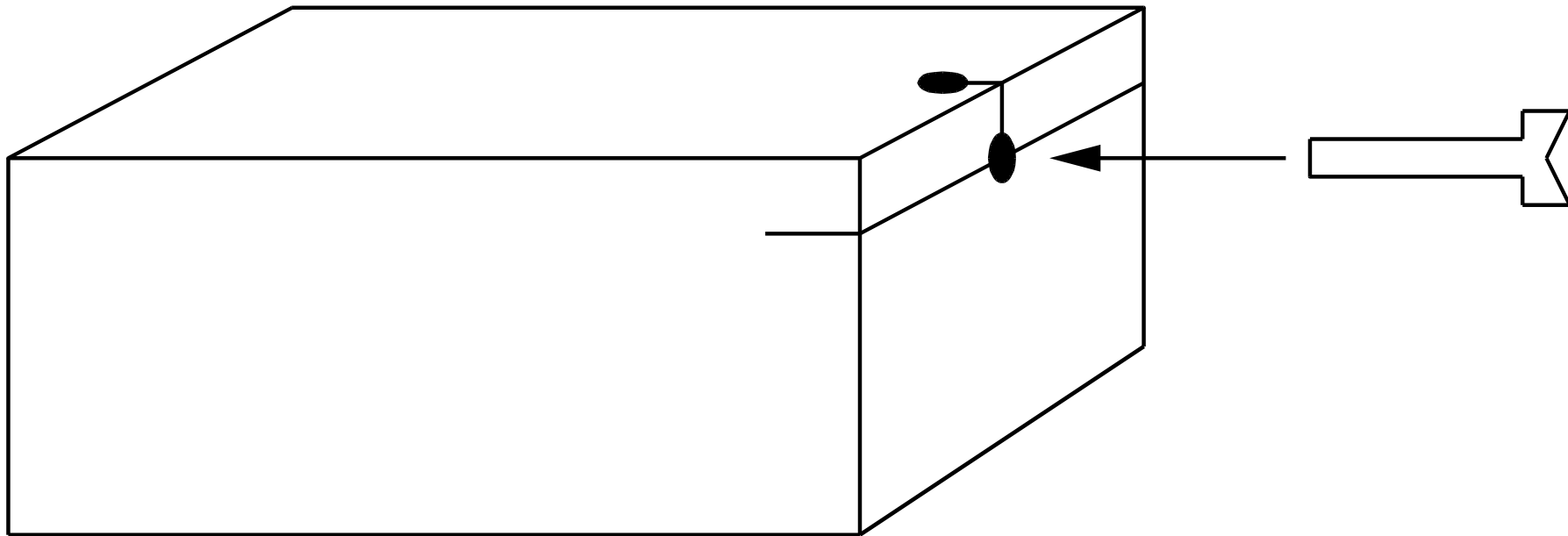


Here's Our Jig.

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Step # 13

Making The Wooden Pin



First cut the wooden pin in half (just the top end) by placing it in the side hole.

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Cutting The Wooden Pin Overview



The saw we use is the medium size from a set purchased at Menards (0.029 thick and about 0.960 round). The drill-press is setup so that the saw passes through the slot in the hardwood jig.

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Step # 13 Overview

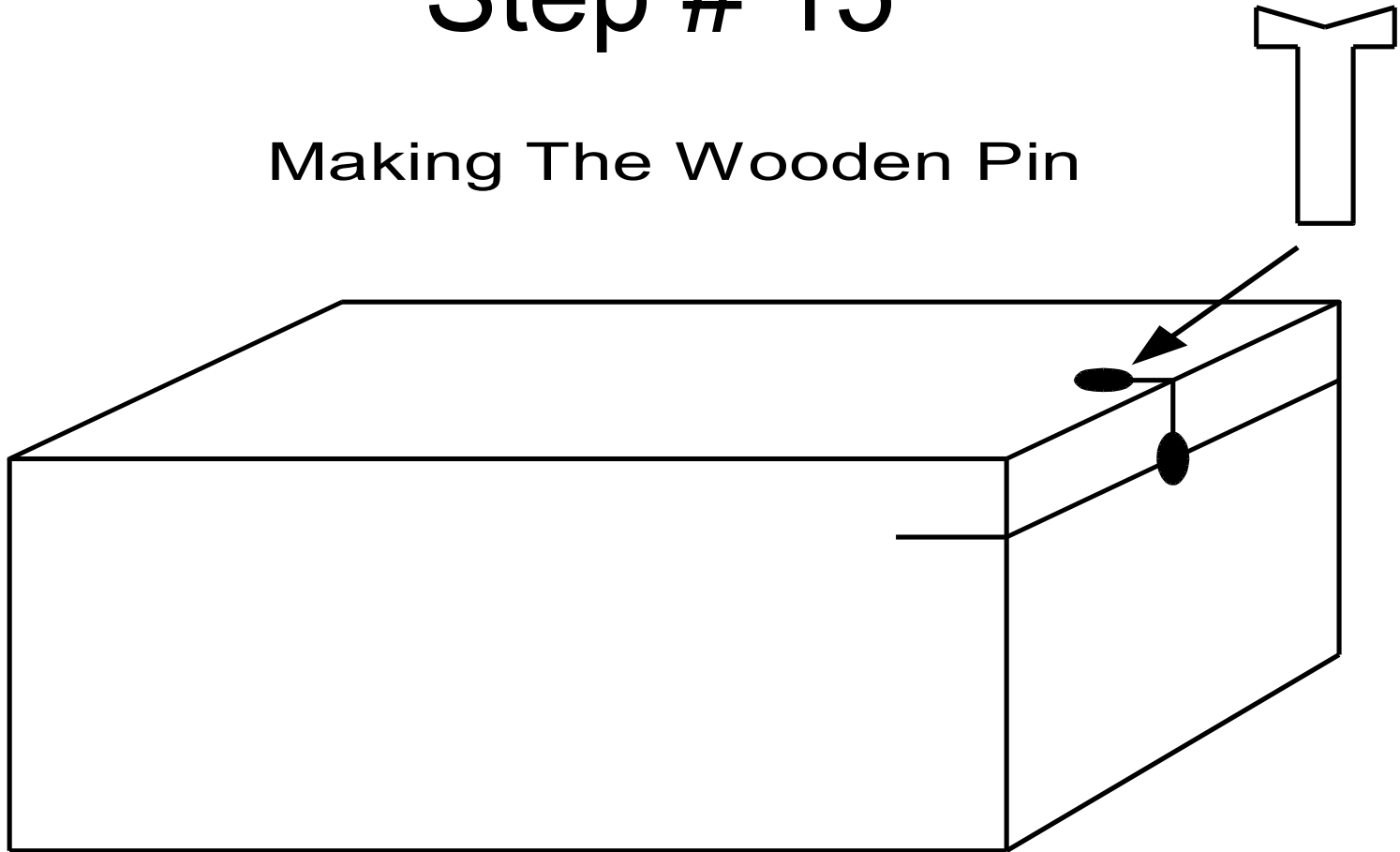


Here the wooden pin is in the jig and the saw is in the slot of the jig cutting the top of the wooden pin in half.

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Step # 15

Making The Wooden Pin



Second cut the length of the wooden pin by placing it in the top hole.

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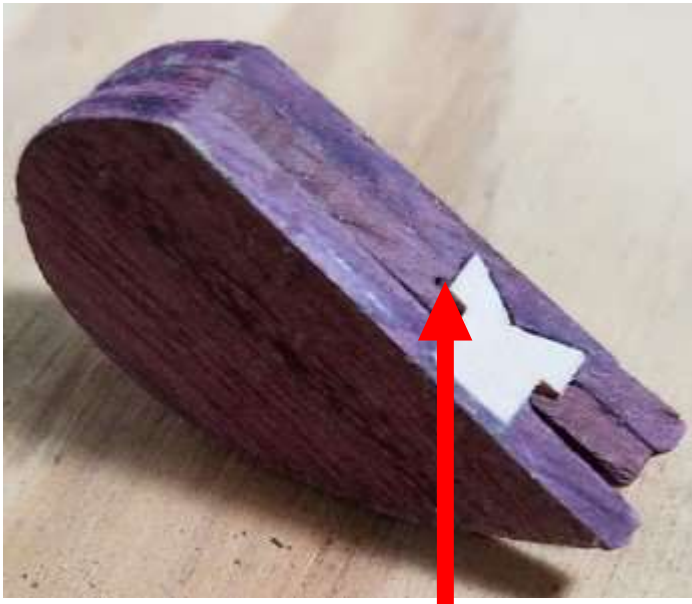
Step # 15 Overview



Here the wooden pin has been placed in the top hole and again the saw is using the same slot of the hardwood jig to cut the wooden pin's length. (This length usually needs to be adjusted by sanding in order to get a tight fit during the heart's assembly. Often several passes on sandpaper is necessary until the fit is right.) Or if the pin needs to be longer than 0.175, you can punch a hole in printer paper and use it like a washer between the jig block and the wooden pin's head. Each paper washer adds about 0.003 to the length of the pin. Be sure to measure the thickness of your paper if you do this.

The Illusionist Heart

Making It Change From A Pendant To A Heart



Remember the hole in the center layer? A steel pin is placed in this hole and is used to pivot the Illusionist Heart from a pendant to a heart and back again. Placement of this hole has to be exact for the pivot to work and look correctly.



We use a steel pin 0.024 thick and 0.850 long (basically cut the head off notice the blue head).

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Step # 16 Overview



To drill the starter hole in the center layer. Al made this jig. It holds one piece of heart in exactly in the correct orientation for drilling the pivot hole.

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Step # 16



After the starter hole is marked on each half of the center layer the piece is clamped and drilled to full depth. We use a Dremel setup in a drill press stand for this step because of the size of our drill bit. We use a #72 bit which is 0.023 diameter. The drill press stand's stop is used to determine the depth which is approximately 0.425. We purchased the #72 drill bit in a set of bits from Rockler for around \$7.

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Step # 17

Gluing Center & Back Layers



We glue the Center and Back Layers together using Titebond III Ultimate. The area inside the layers (Red Arrow) is cleaned out with a paper towel and tweezers to remove any squeeze out. A Dremel and small burr is used after the glue is dry for any needed clean up. Usually these pieces are clamped for at least 24 hours. After it's cleaned the split wooden pin is tested for fit. Once we are satisfied with the fit it is checked for length by placing a piece of wax paper 0.001 thick between the Center and Top Layer. The split pin's narrow end is sanded until the fit is correct. Meaning that the split pin just fits and all three Layers are tight together with the wax paper in place.

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Step # 18

Gluing The Split Pin

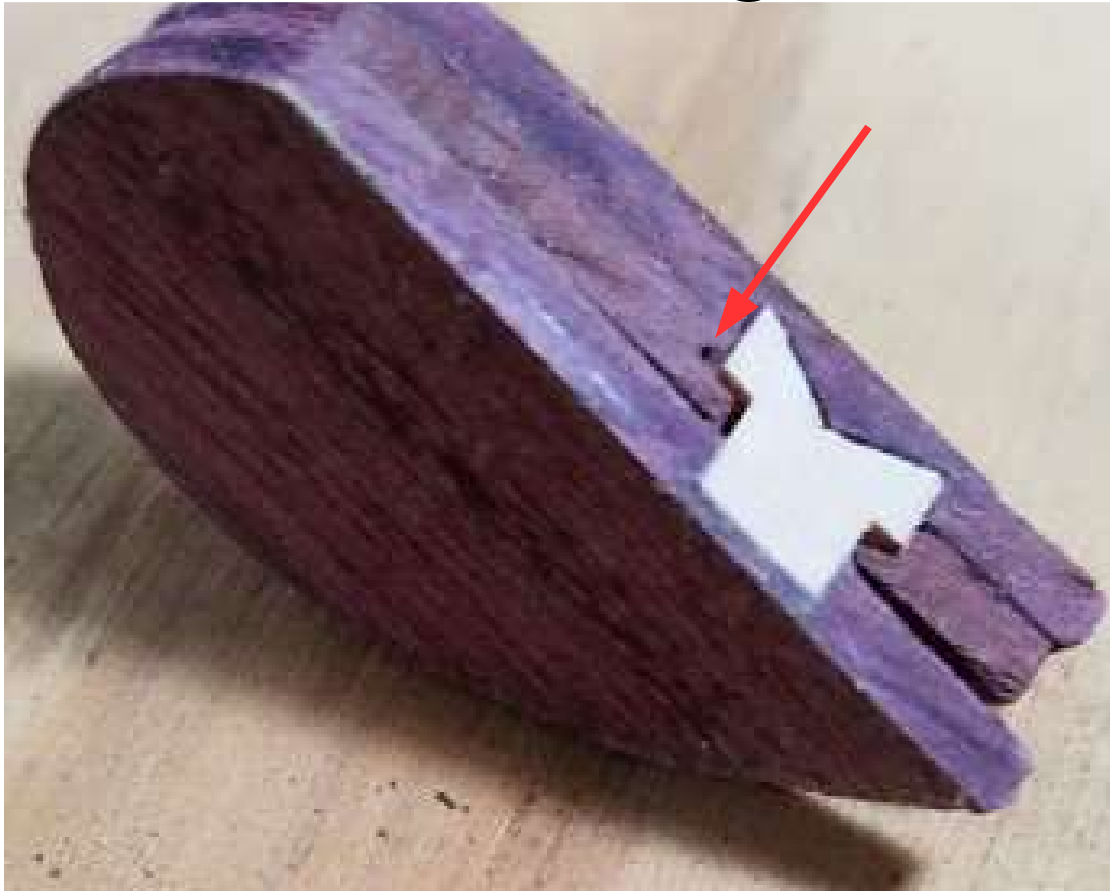
Once it fits well the split pin is glued into the Top Layer. (Left) Again Titebond III Ultimate is used. The split pin's alignment is very important. We use a piece of aluminum angle and table top to achieve the alignment. (below)



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Step # 19

Inserting The Metal Pin

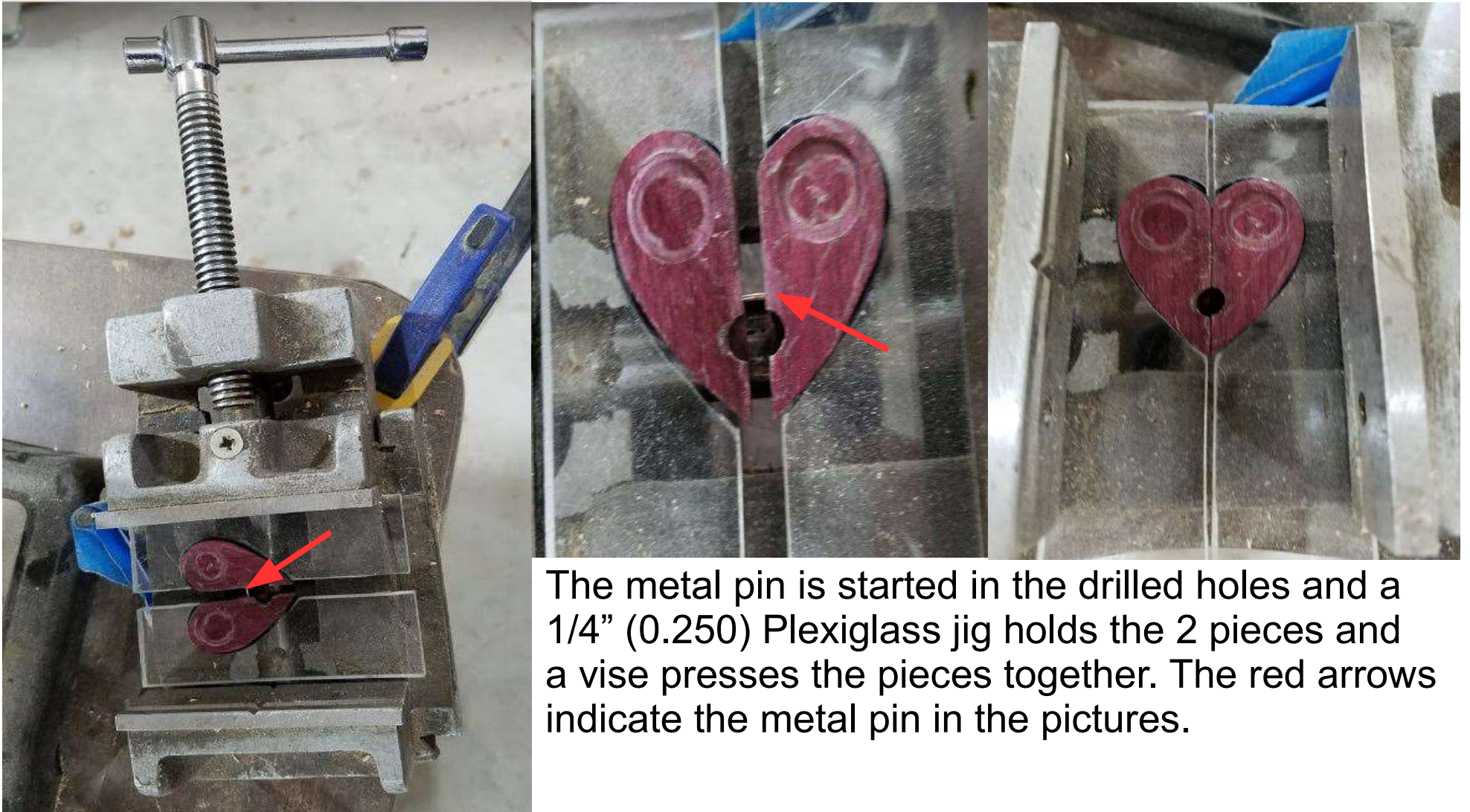


Now the metal pin is inserted into the holes of both Center Layers and the two sides are pressed together being very careful not to bend the metal pin. (Left) The result is shown below.



The Illusionist Heart

Step # 19 Overview



The metal pin is started in the drilled holes and a 1/4" (0.250) Plexiglass jig holds the 2 pieces and a vise presses the pieces together. The red arrows indicate the metal pin in the pictures.

The Illusionist Heart

Step # 20

Sanding & Shaping

After the pieces are all fit together and the heart moves freely, the sanding and shaping begins. We clamp it in the vise and then with a rasp and sandpaper it receives its final shape. We are very careful not to be too aggressive as it is very fragile. Also while shaping we watch not to remove too much wood and exposing the ½ inch picture insets of the Top Layer.



We always clamp the heart in the vise and we are very careful of the direction we are rasping and sanding. We start sanding with 80 grit and finish with 120 grit.

The Illusionist Heart

Step #21 Waxing



After shaping and sanding we apply a coat of Carnauba wax to the interior faces of the Center and Top Layers. We also apply Carnauba wax to the split wooden pins. We use a buffing wheel on a Dremel Tool to apply the wax. This allows the surfaces to move easily.

The Illusionist Heart

Step #22

Finishing The Exterior



The exterior surfaces get three coats of clear coat. We prefer a gloss finish.

The Illusionist Heart



Well that's how we create our Illusionist Hearts. From the previous slides you can see we have used several different woods. So far we have had success with every wood we've tried. After Al was shown the design for this heart online at the library he went home without plans and made the one he carries with him. That heart took him a year and as he says lots of scrap to complete. As of Christmas 2016 we have completed 32 hearts. Of course I have 8 drill presses setup each for a different machining step. Al did it with 1 drill press! We hope you found this helpful. Good luck with your adventure making the Illusionist Heart and remember to be safe in your woodworking.

Best wishes Al Herwig and Gary A. Emerich