



Lock Making and Picking

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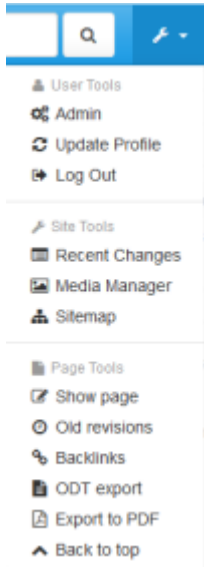


This workshop was developed at The Edge by Phil Gullberg and this version is from the second delivery at Woodford. 2016.

Summary

During this workshop you will learn how to make and pick a lock.

While at Woodford, you can follow along and download a pdf of this Workshop by connecting to our wifi network: TheEdgeWorkshop and downloading from the admin menu at the top right.

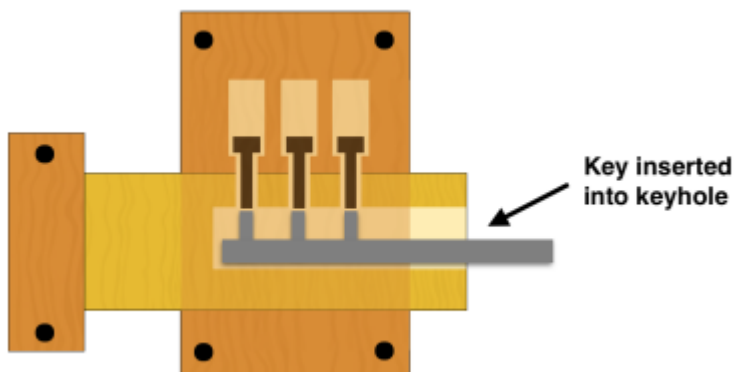


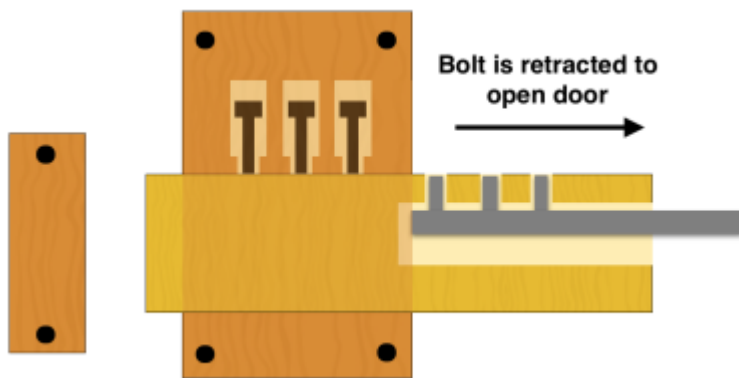
Step Zero: The Pin Tumbler Lock and Your Kit

Basic principles of the pin tumbler lock may date as far back as 4000 BC in Egypt.

The lock consisted of a wooden post affixed to the door, and a horizontal bolt that slid into the post. The bolt had vertical openings into which a set of pins fitted.

These could be lifted, using a key, to a sufficient height to allow the bolt to move and unlock the door.





In 1848, Linus Yale, Sr. invented the modern pin-tumbler lock.

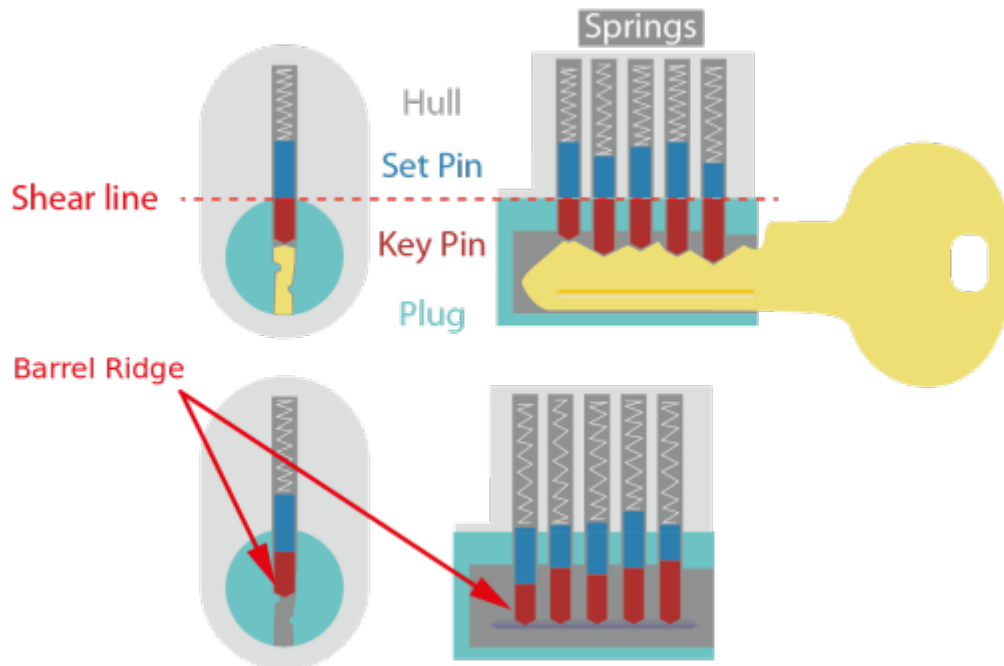
In 1861, Linus Yale, Jr. was inspired by the original designed by his father.

He invented and patented a smaller flat key with serrated edges as well as pins of varying lengths within the lock itself.

The same design of the pin-tumbler lock is in use today.

How a Modern Pin Tumbler lock Works

The **set pins** keep the lock shut. They rest on top of the **key pins** which are kept in place by the **barrel ridge**. The key lifts the **set pins** above the **shear line**, allowing the lock to turn.



Your Lock

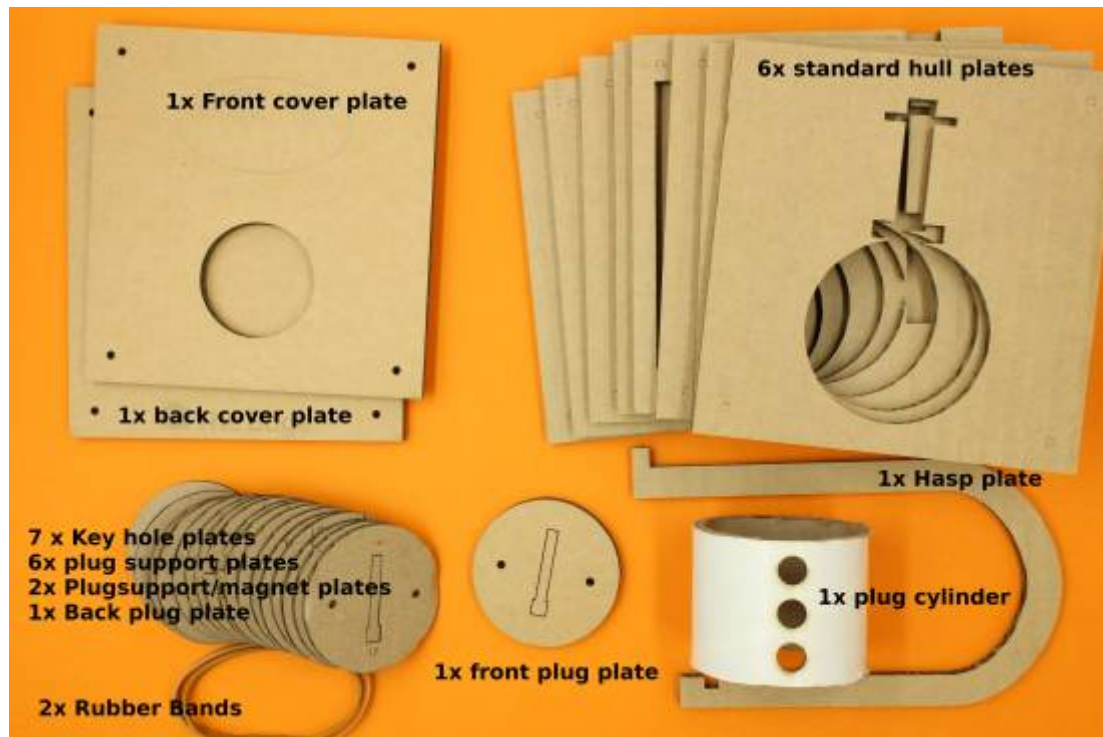
Your lock kit contains a pin tumbler lock set in a padlock. The padlock is held shut with magnets when locked.

The bulk of your kit is made from cardboard to keep costs as low as possible.

This means that we can't make a barrel ridge that will stand up to the test of picking. So we've modified the the mechanism, with Orings on the **key pins** to keep them in place when locked.

Kit Parts

Please check you have all your cardboard parts



And all your other parts



Shared Tools

Some simple tools required during the workshop, these are shared.

1. Side cutters (for biting off skewers)
2. electrical tape
3. Scissors (for cutting tape)

Step One: The Plug

We'll start by putting our plug together. Before we start, make sure that the skewer holes in your cardboard segments are punched out, and note each plate has a number on the bottom front side.

Assemble the first five plates of the plug



Add the plastic plug supports. Carefully use the pointy end of a skewer to nudge the plastic plug supports into place

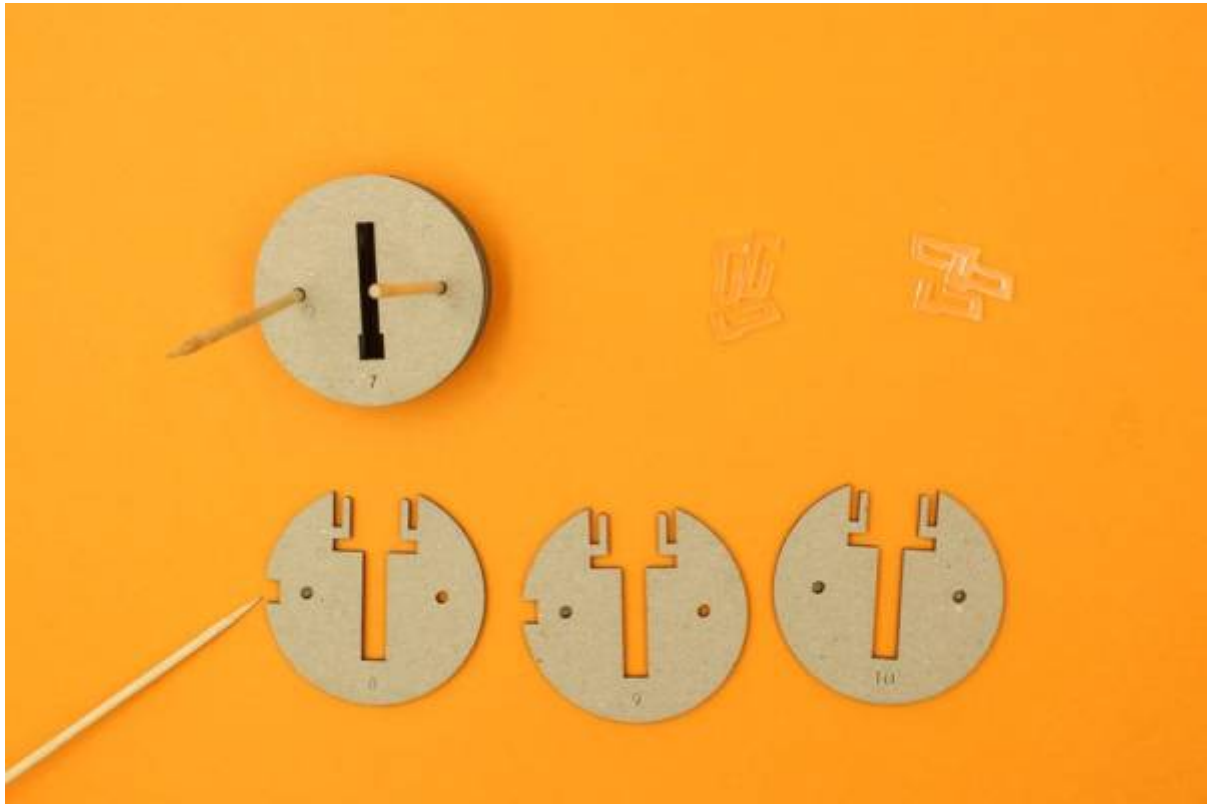


Then add two cover plates to hold it all together - plug plates #6 & #7



Now we will add another three plates.

(Note the notch in the left hand side of plates #8 & #9.) This is where one of our magnets will go... but we'll come to that in a moment



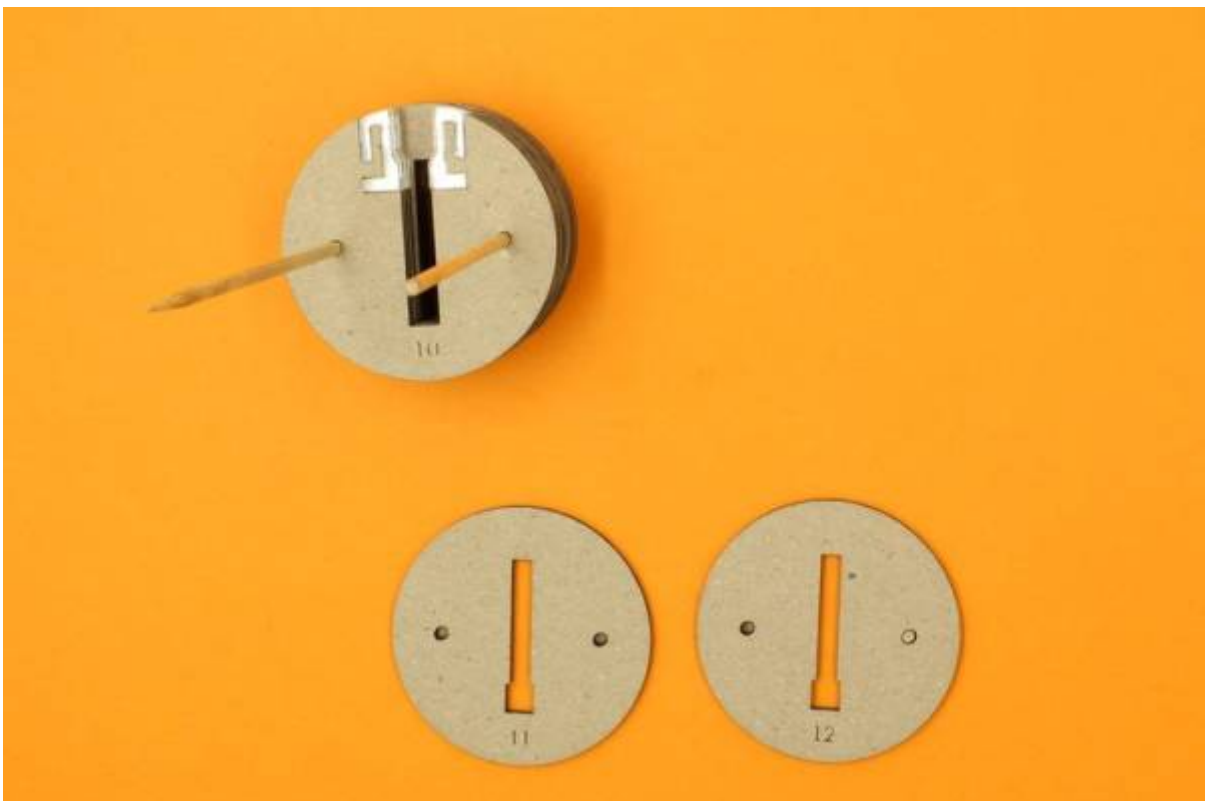
And again we add the plastic plug supports to these three layers



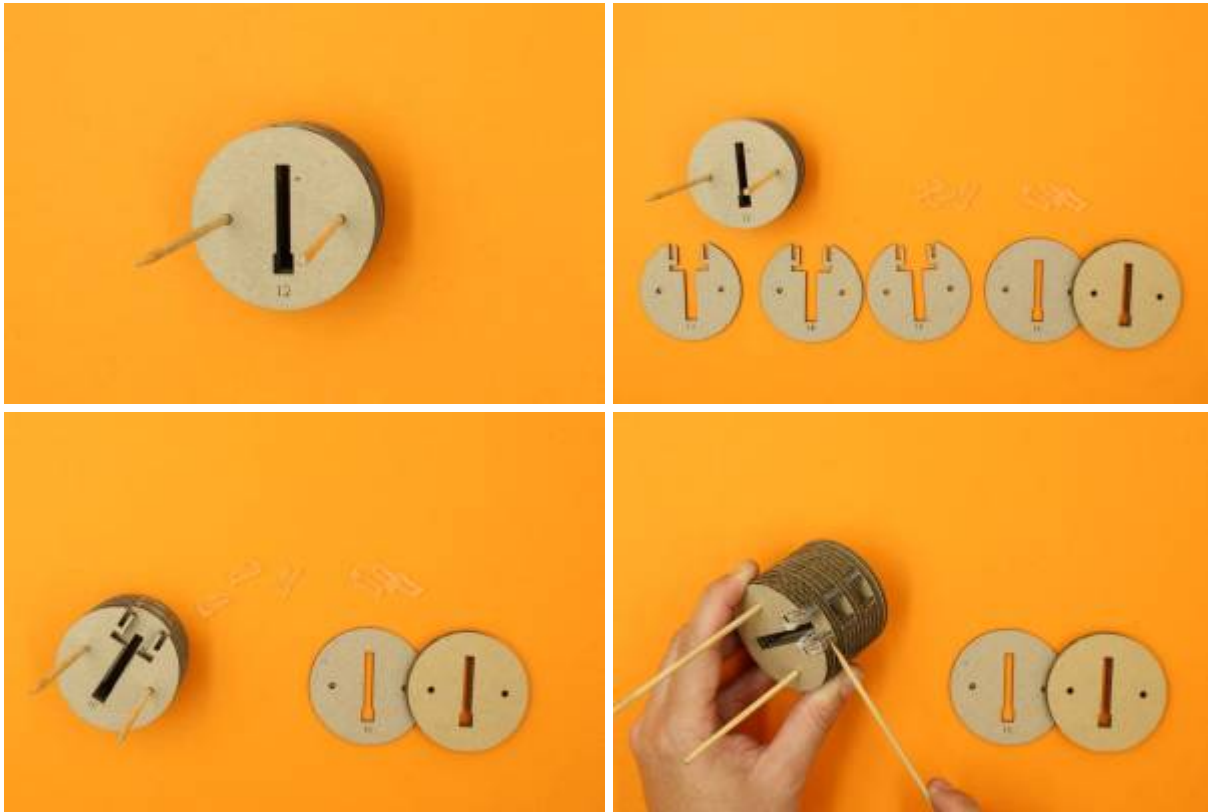
And then two more cover plates



You should be up to plug plate #12



Now add the last three layers of plug plates and the two plastic plug supports for each layer



And now get plug plate #16 on top to hold it all in place. You don't want it to fall apart



Step Two: Tape in Plug Magnet

Now we are going to add the magnet and tape it all together



Can you see the magnet in its notch on the left hand side (if you are looking at it from the front)?

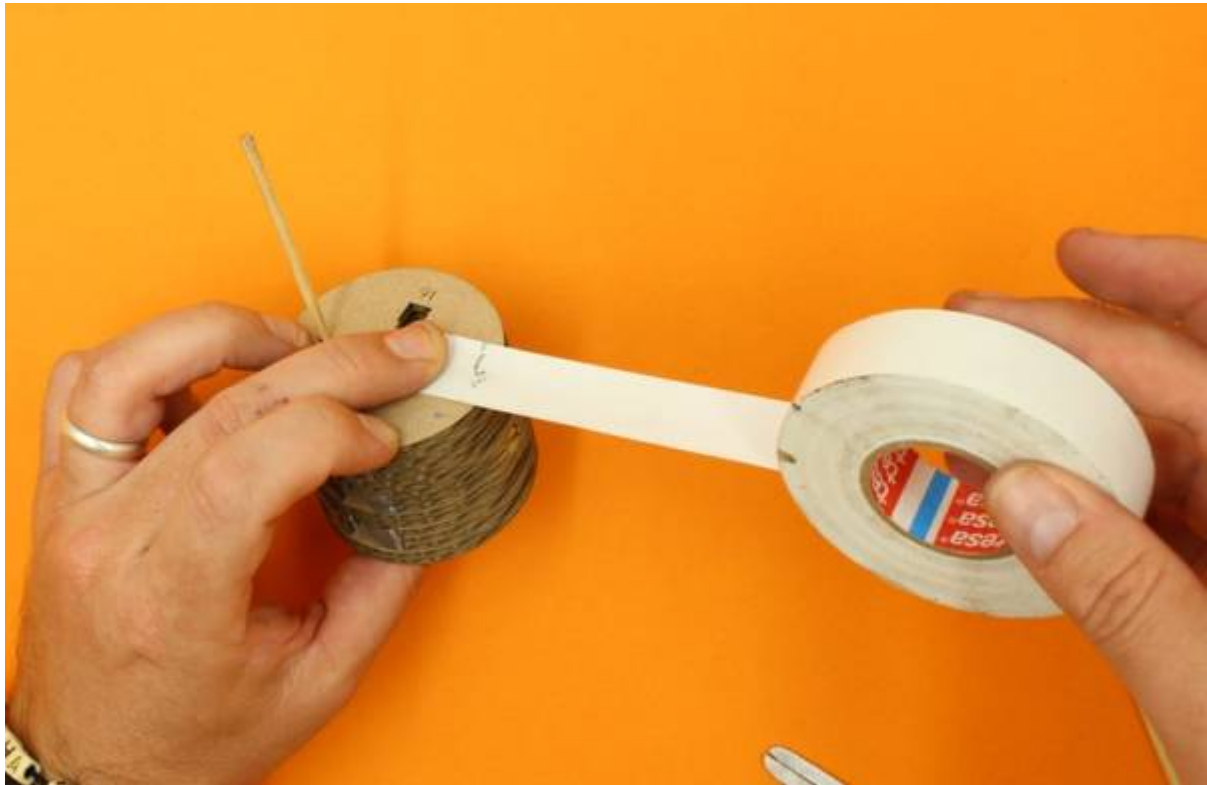
Carefully remove the skewer on the left hand side of the assembled plug ...



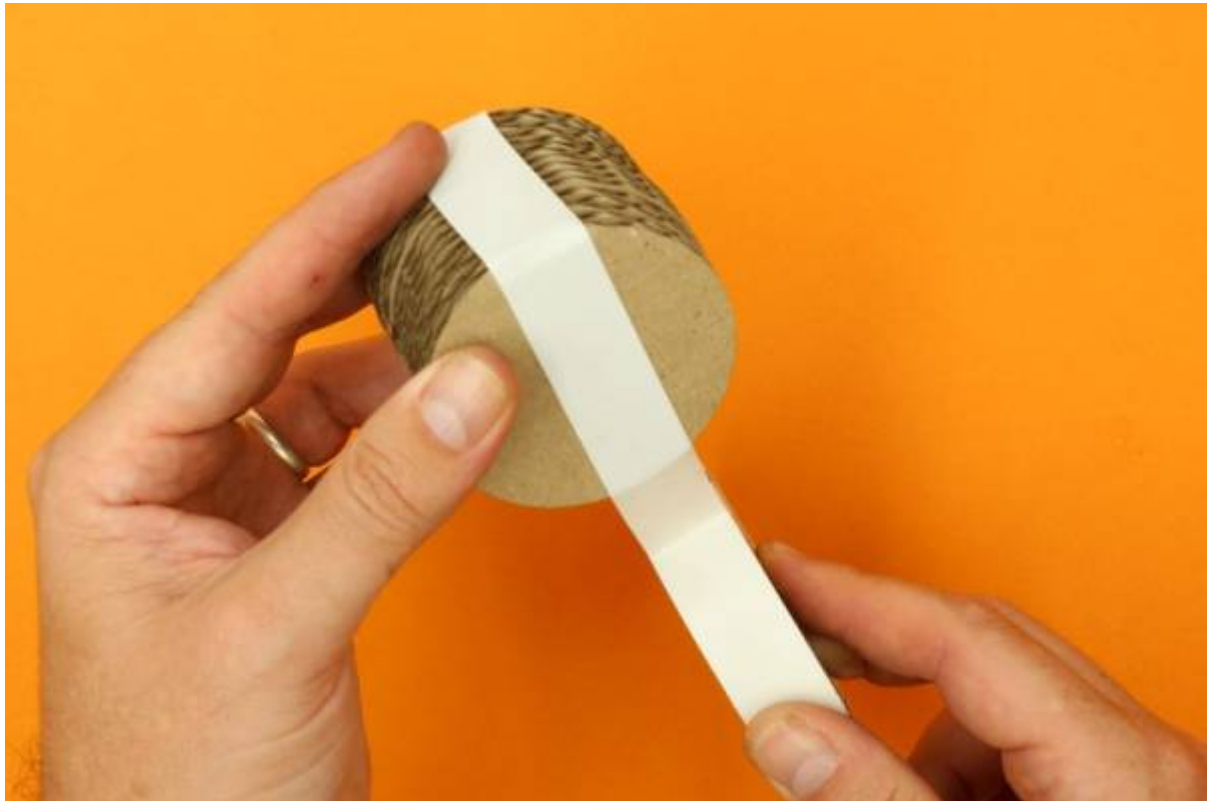
and starting here, tape around the “equator” of your plug...



Tape over the magnet...



Around the back...



Carefully remove the second skewer without disturbing the alignment of the layers

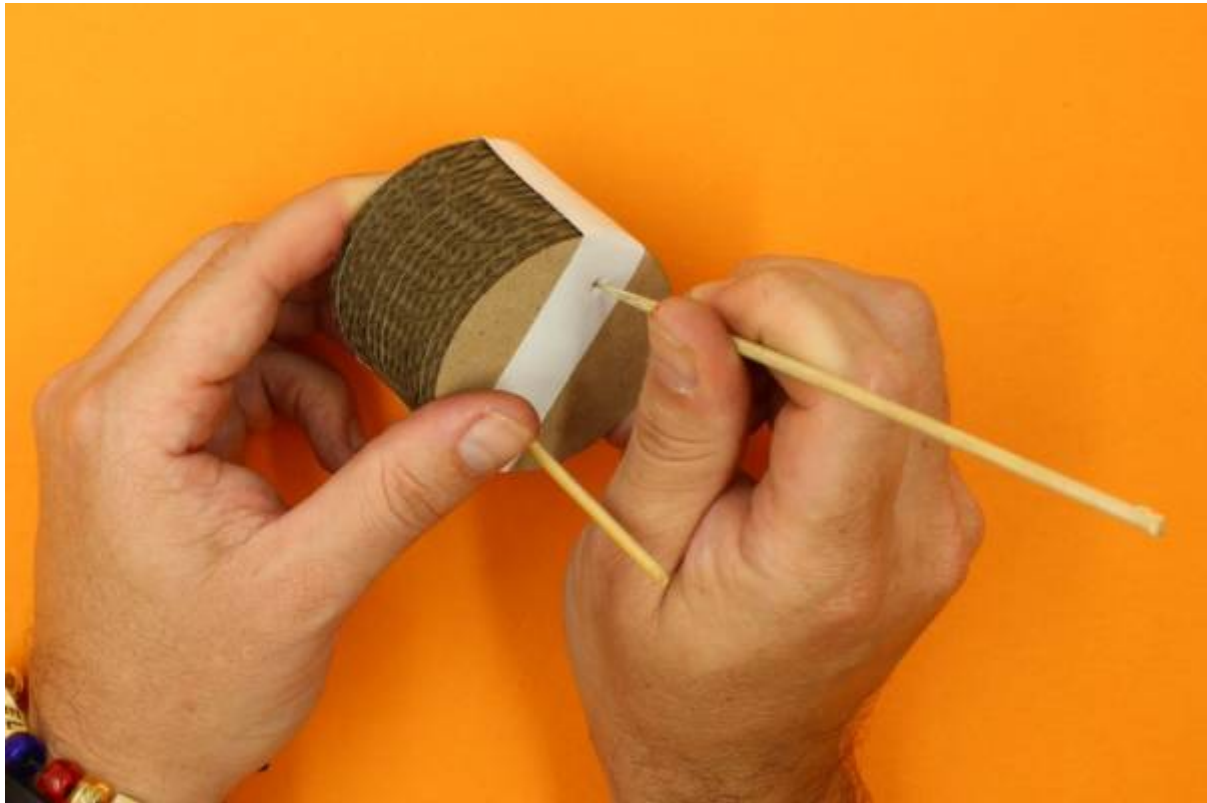


Trim the tape to the required length.

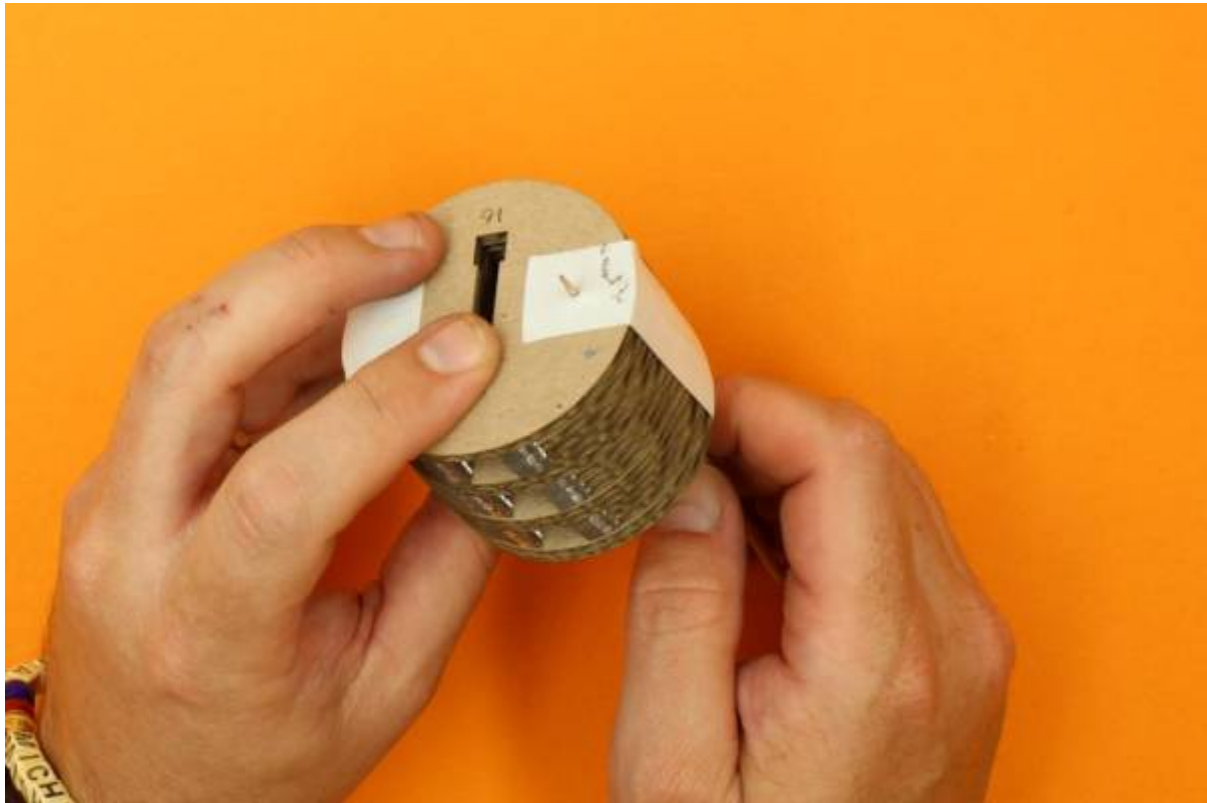
Make sure you are not compressing the cardboard too much but also that there isn't any space between the layers



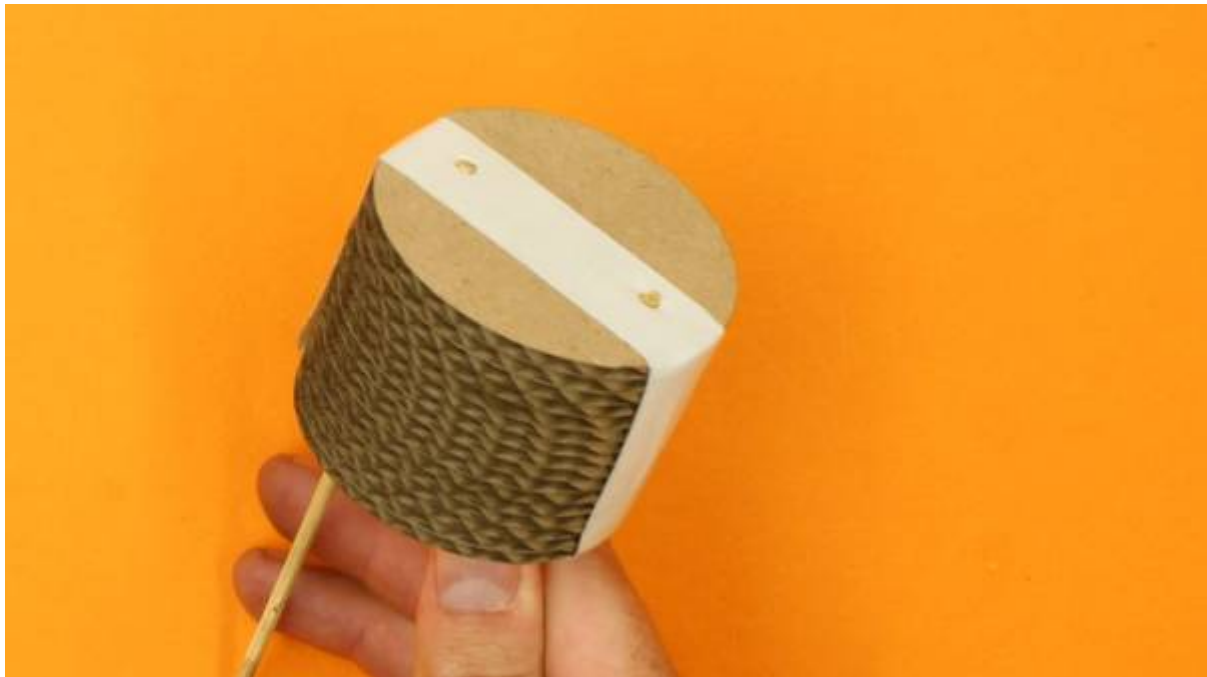
Now we are going to push the pointy ends of the skewers through the tape and back into their holes



All the way through the plug and out through the tape on the front



Make sure the two skewers are flush on the back of the plug...



Now we are going to add the front cover for the plug



This front cover is 6mm, a bit thicker than the other layers, cut out of the double-ply corrugated cardboard that the hull parts are cut from



When you have this front cover in place, trim the skewers to the required length with the side cutters. *Make sure you hold on to the bit you're cutting so it doesn't fly off and take out an eye!*



Step Three: Fit Plug Sleeve

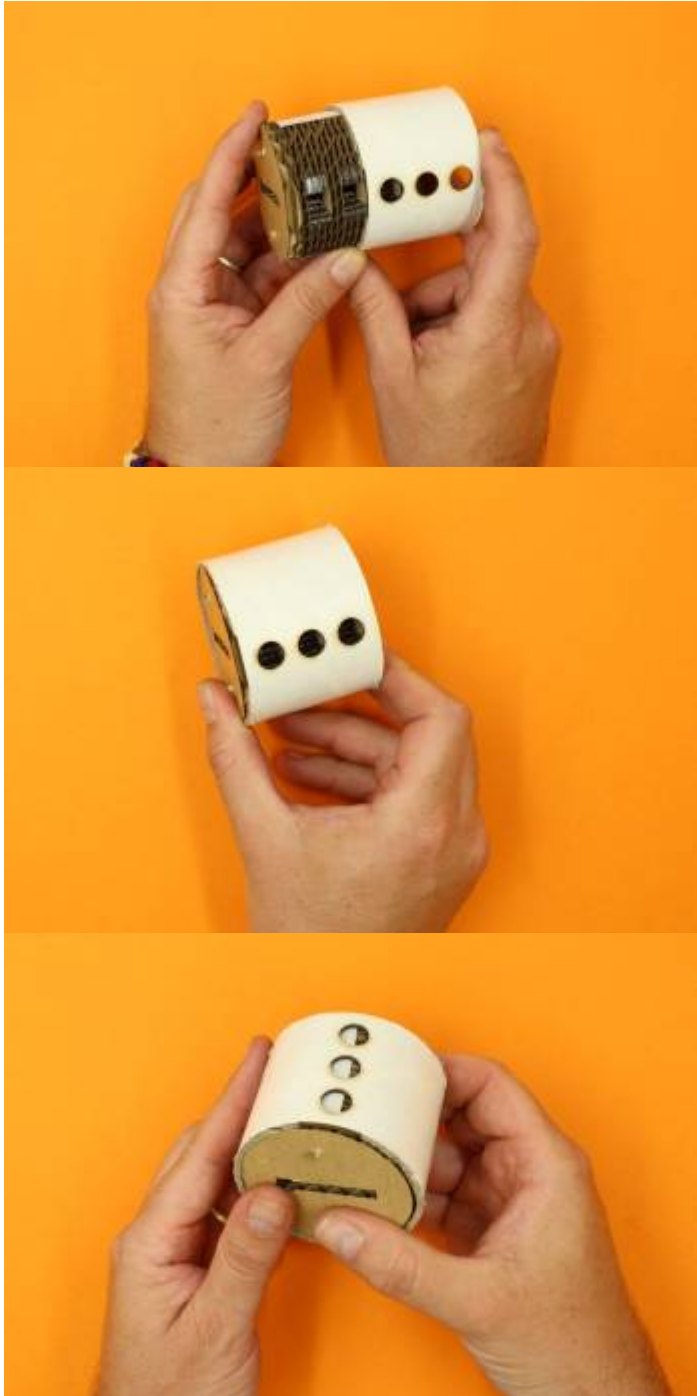
Now we are going to get our plug sleeve ready and test that the plug will spin smoothly inside it



Take your little piece of sandpaper and smooth off the rough edges on the plug sleeve



When you've done this insert the plug and check it turns smoothly in the sleeve



Step Four: Install Key Pins

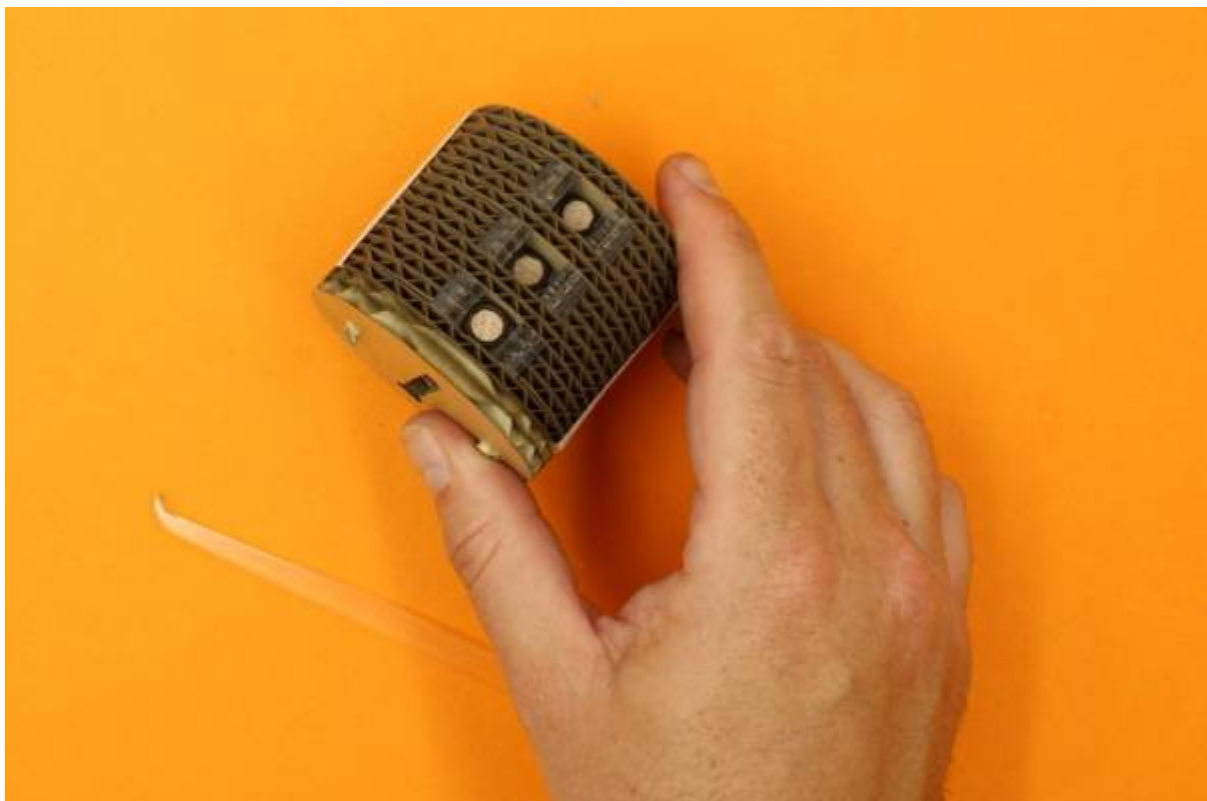
Now we are going to install our key pins and test their function



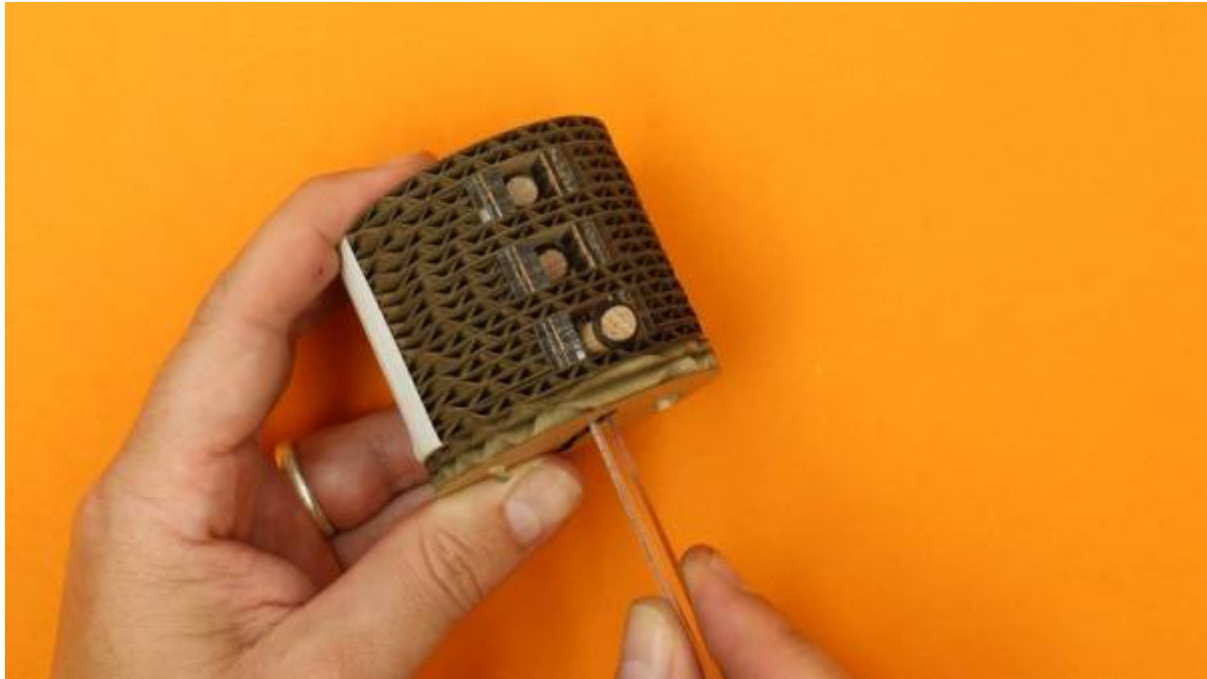
The key pins are the three shorter dowels (24mm long) with a groove cut into them. Seat the Orings on to the three key pins



Insert the pins into each of the chambers...

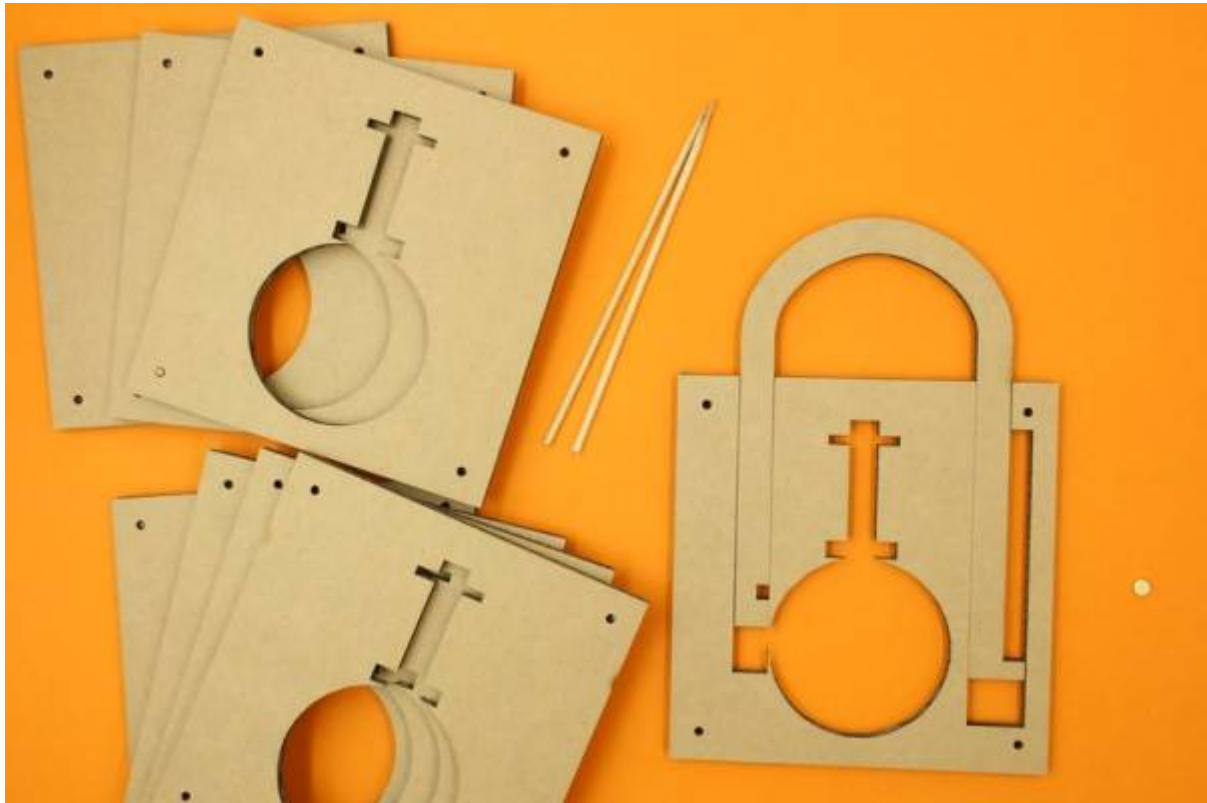


and check their function (i.e. that they move up and down freely) by manipulating them using your pick via the key hole



If you have got this far...Congratulations!

Step Five: The Hull



The hull consists of 10 layers:

- 1x front smaller hole (has etching on it)
- 1x back no hole (has The Edge logo on the back)
- 1x hasp layer
- 7x filler layers

First of all take your hasp layer and carefully remove it. We are attaching the other magnet to the hasp



Make sure the polarity matches the polarity of the magnets in the plug.

An easy way to do this is to put your plug in the white tube (to make the removal of magnets easier) and let the magnets snap together on the outside. This way you'll know which side should point in or out.

Make sure the magnet in the hasp doesn't stick out too much and add a piece of tape to keep it in place





Don't use too much tape as it will add unwanted friction



Put the hasp back into its layer before the next step



Now we start putting our Hull together



Just as we did with the Plug, start by aligning three of the Hull “Filler” plates on two of your skewers. Then add the Hasp layer of your lock.

Step Six : Construct Top Pin Chamber Assembly

The following parts make up the Top Pin Chamber Assembly:

- 3x metal tubes (45mm long)
- 2x plastic supports with regular size holes (same diameter as the tubes)
- 1x plastic support with smaller holes



Start by fitting the middle metal tube into the centre hole of one of the plastic supports



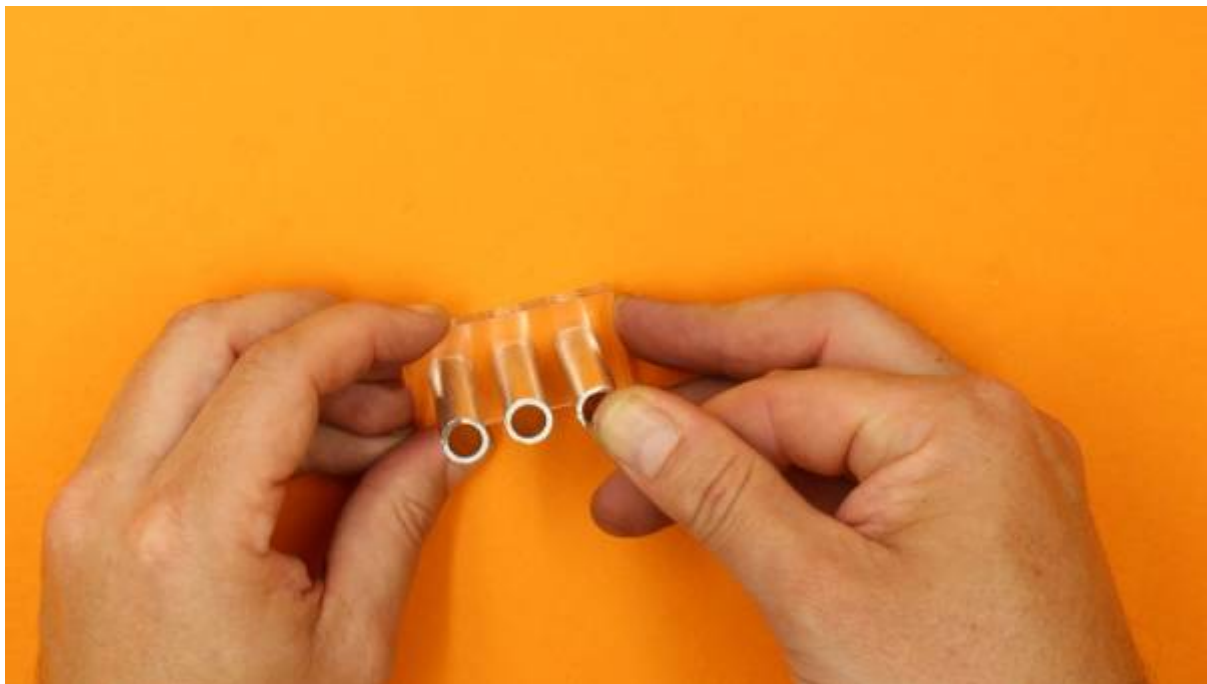
Now add the second plastic support



Align the outside holes of the plastic chambers supports and fit the other two metal chambers

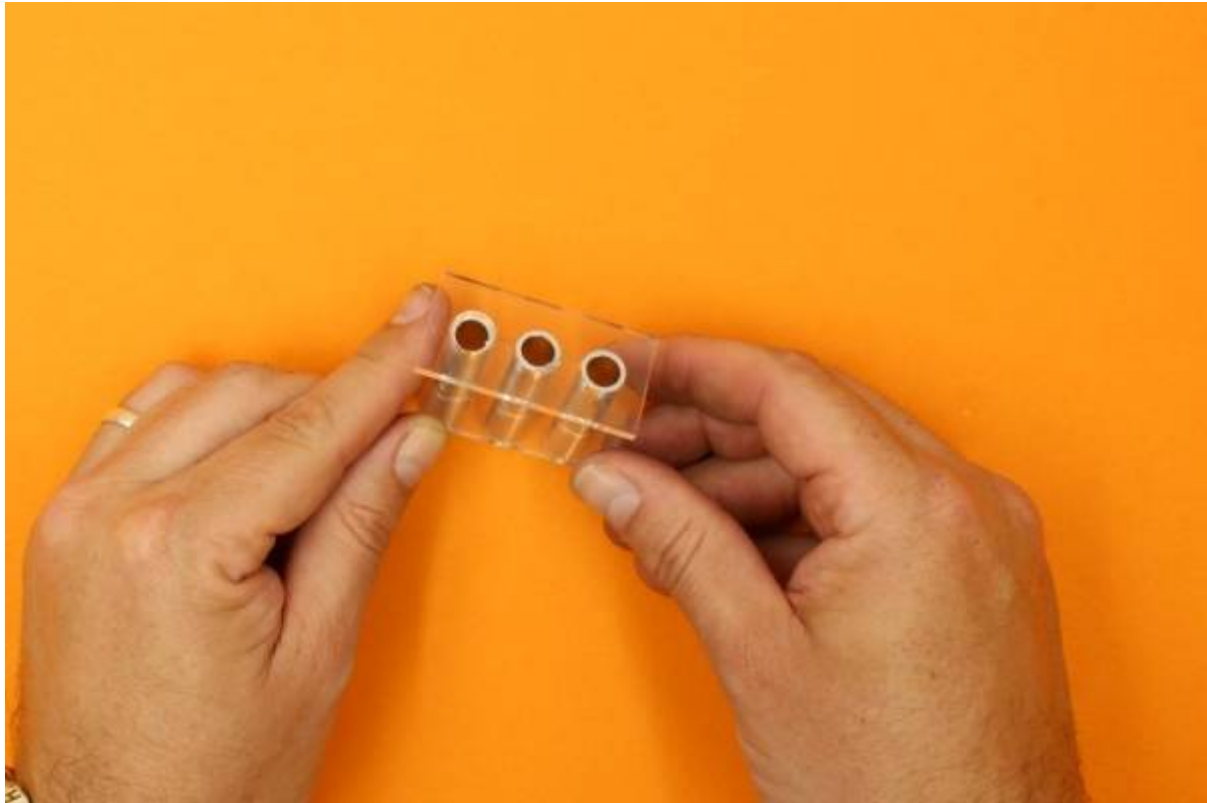


Now *shimmy* the top plastic support up the metal chambers until it is about 5mm from the top of the chamber

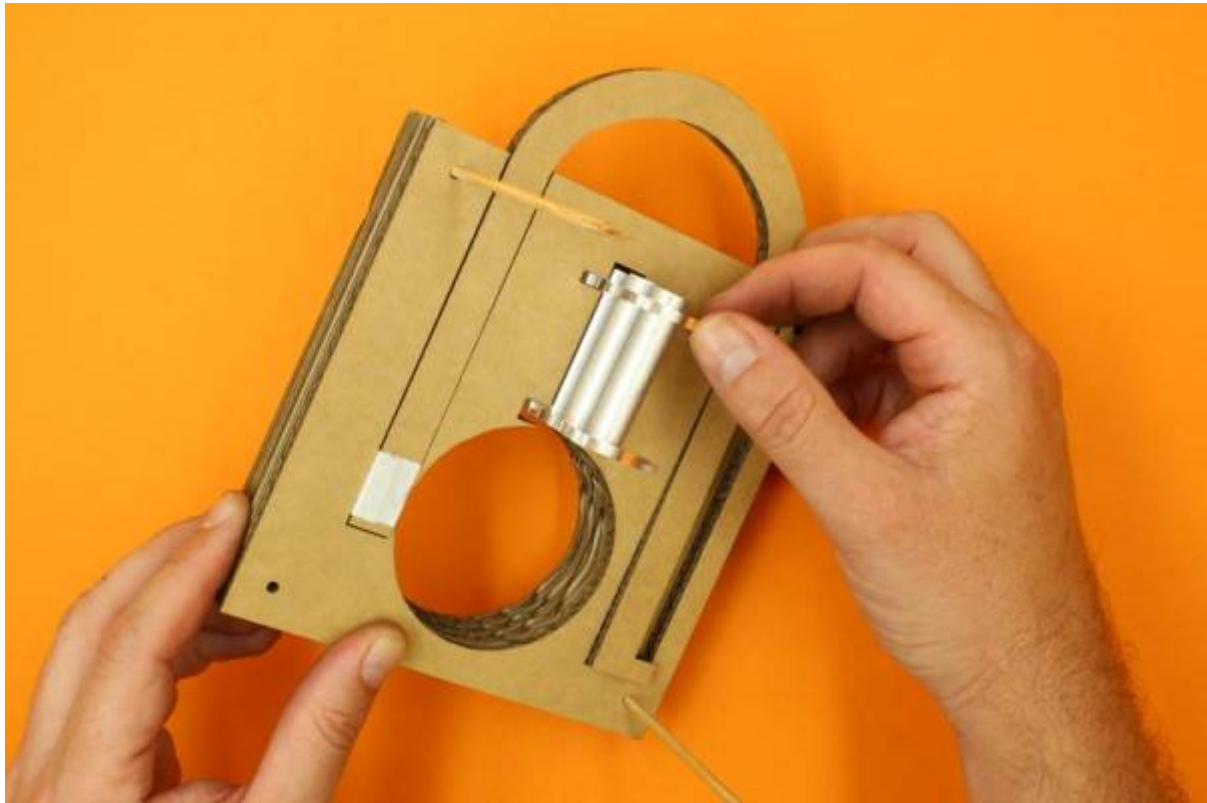


It helps if you keep it as level as possible as you shimmy it

up Make sure the metal chambers stay flush with the bottom surface of the the lower support



We'll now install the Top Pin Chamber Assembly into our half built Hull...



And slide the third of our plastic Chamber Supports (the one with the smaller holes) into the gap between the lower chamber support and the floor of the Chamber Assembly hole in the Hull Plates



This may require more patient shimmying



Step Seven: Complete Hull Assembly



We are now ready to complete the assembly of our Hull



Just add the remaining Hull Filler plates



Step Eight: Fit the Plug into the Hull

We use tape to ensure the sleeve fits snugly inside the hull and won't rotate when we operate the lock.

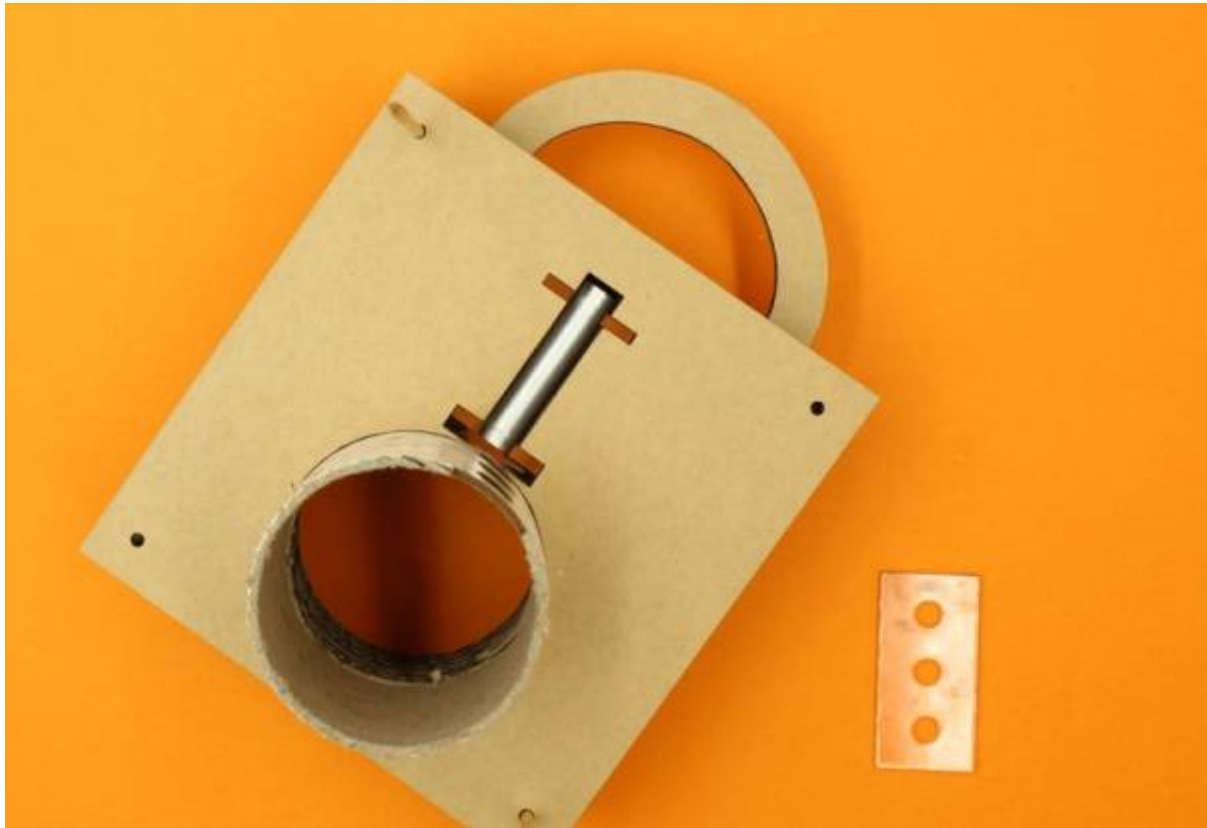
First, add a strip of tape around the circumference of the Sleeve (postal tube).

Start the tape next to the middle hole, wrap it around the sleeve and trim the tape near the other side of the hole



This snug fit also means that if we get the next bit wrong, it can be hard to reposition, so we need to be accurate as we fit the Plug Sleeve in to the Hull.

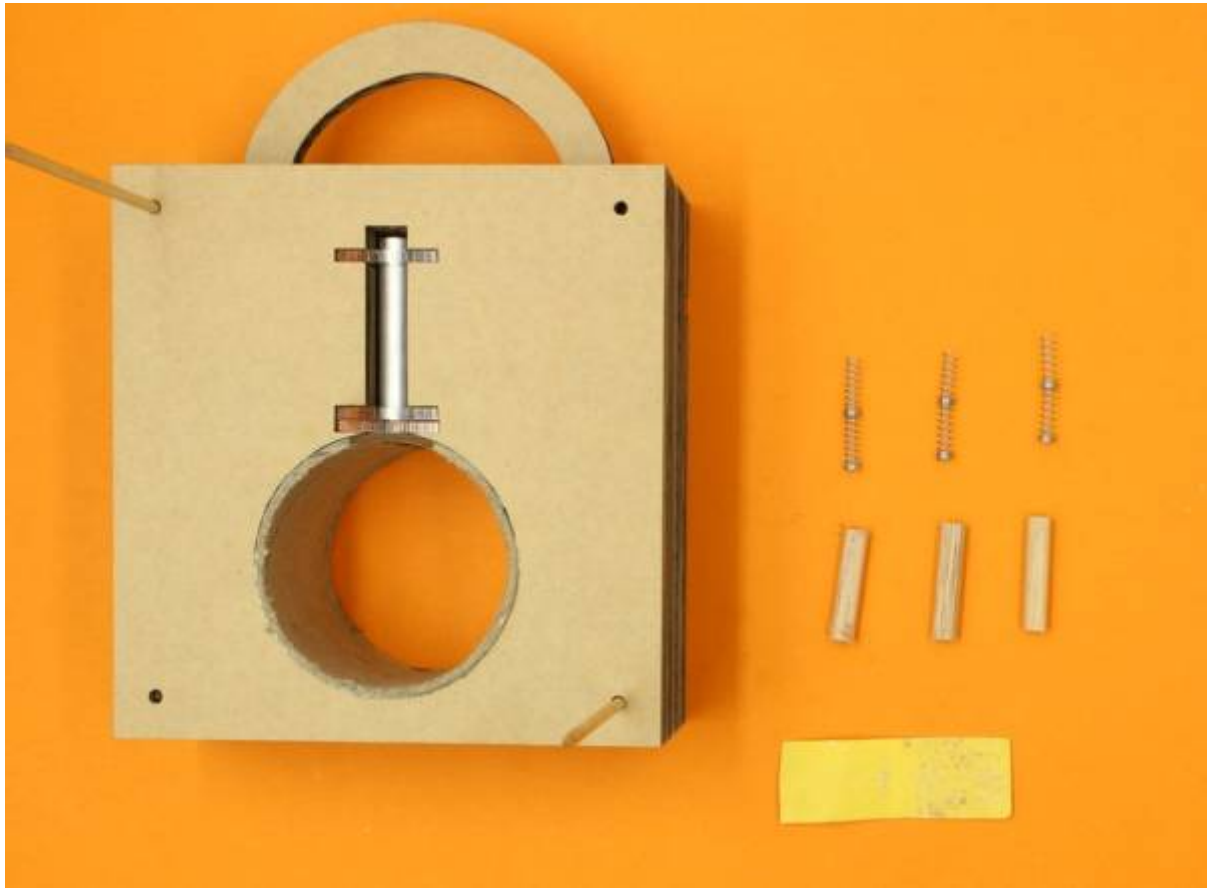
Now remove the bottom plastic chamber support (the one with the smaller holes) and line the hole in the Plug Sleeve (postal tube) with the Chambers. When you have this accurately aligned fit the sleeve by pushing down into the Hull



Now replace the bottom plastic Chamber Support



Step Nine: Install Set Pins



First deburr the **set pins** using the piece of sandpaper to ensure that they move freely in their chambers



Now install the springs. Make sure you have the springs up the right way



You want the smooth end at the bottom of the chamber and the rough end at the top of the chamber.
Hold your lock upside down so the springs and pins don't fall out



Now install the pins into their chambers



Step Ten: Install the Plug in the Hull to complete the Lock Mechanism



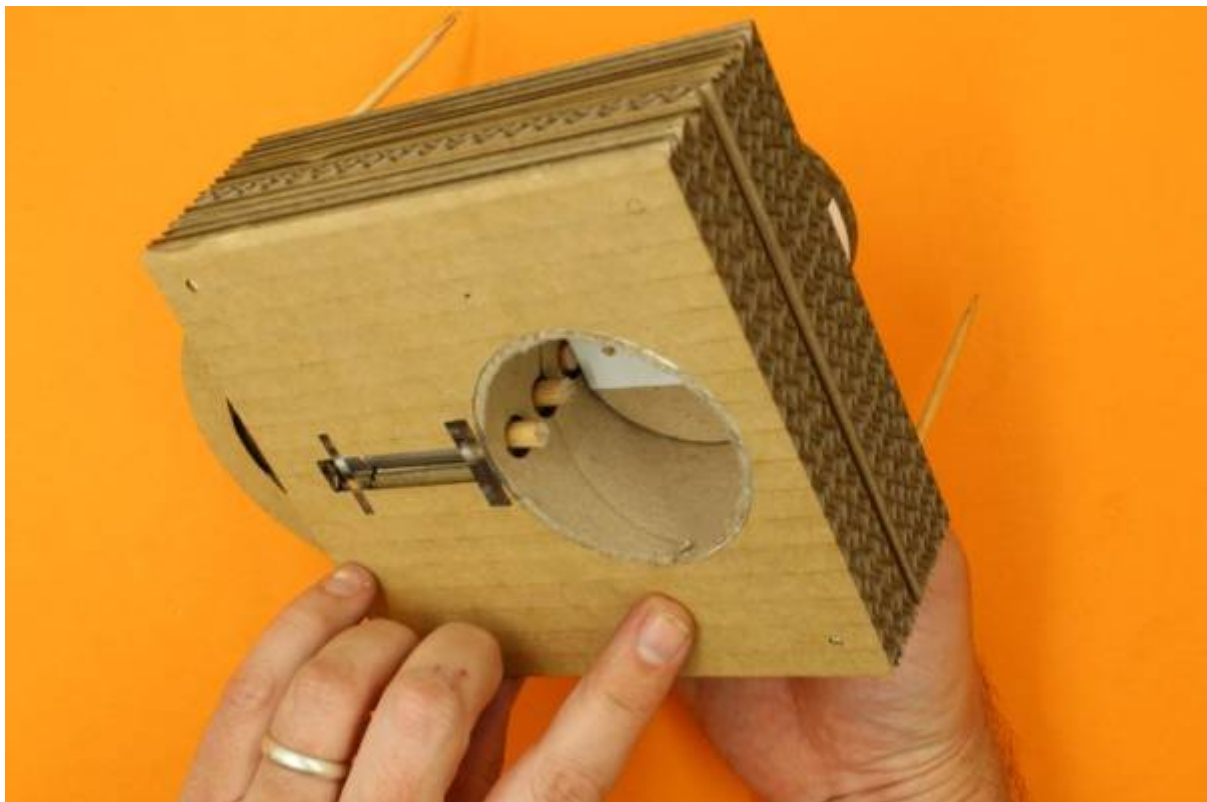
Start by checking that your Key Pins are all sitting neatly in their Plug Supports...
and that none of the Set Pins or their springs have fallen out. (This will require patience!)



Orient the Plug so that the Key Pins and the Plug Support are at 90 degrees from the Chambers (i.e. 9 O'clock Position). The Chambers should actually be lined up with your tape



In one hand hold The Hull and Plug in position...



press the Set Pins one at a time so you can slide the plug into position



The back should look like this..



And the front like this



Step Eleven: Finishing Touches

Next we'll give our lock its finishing touches...



by adding the attractive "Limited Edition" back...



And Front Plates...



Add some rubber bands to keep it all together...



Add the last two skewers into their registration holes.

Finally, trim your skewers...

Congratulations!

You just made a cardboard Tumbler Lock!

The only thing now is to test if it actually **locks**.

And to pick it!

Step Twelve: Test and Pick Your Lock

To test your lock insert the long end of your tension bare (plastic “L” shape) into the square hole at the bottom of your key hole and rotate the plug until it is in the vertical home (12 O'clock) position



As you do this you should hear you lock **click** as the springs force the pins into position



Once it is in the 12 O'clock position and the pins are engaged, you should not be able to rotate the plug



To pick the lock insert your tension wrench and use it to apply a slight rotational force (torque) to the plug



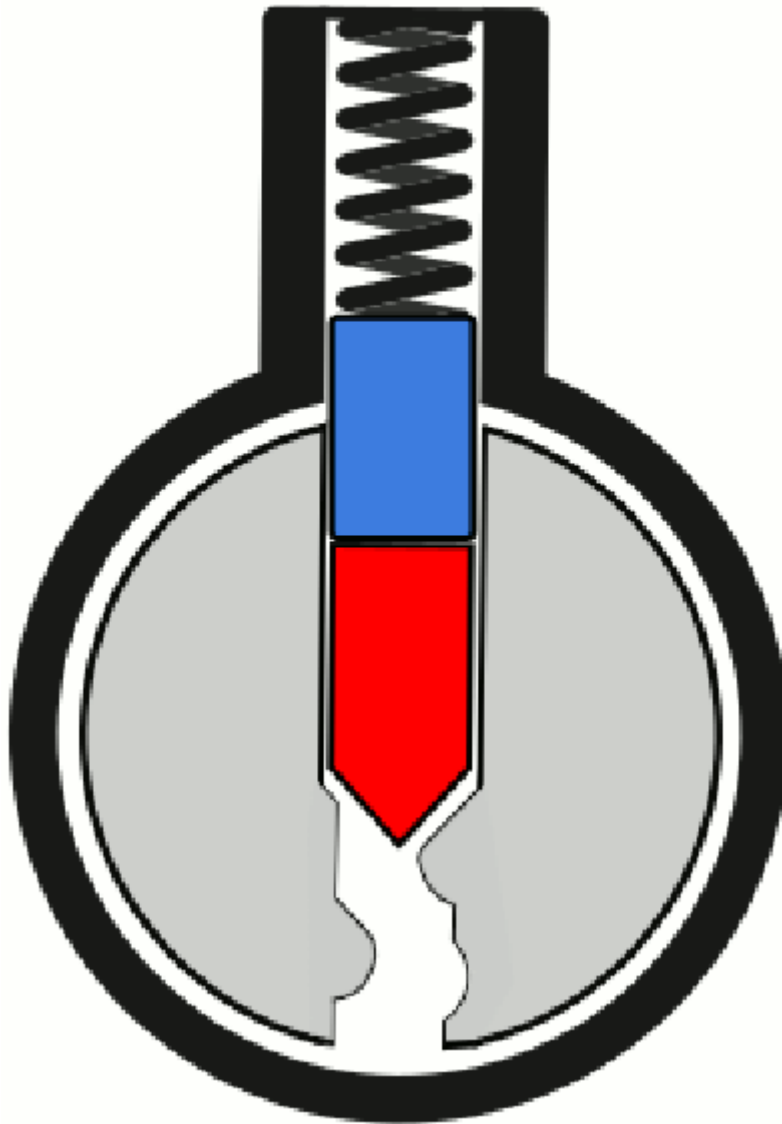
Then use your pick, via the keyhole, to momentarily raise the each of the Key Pins

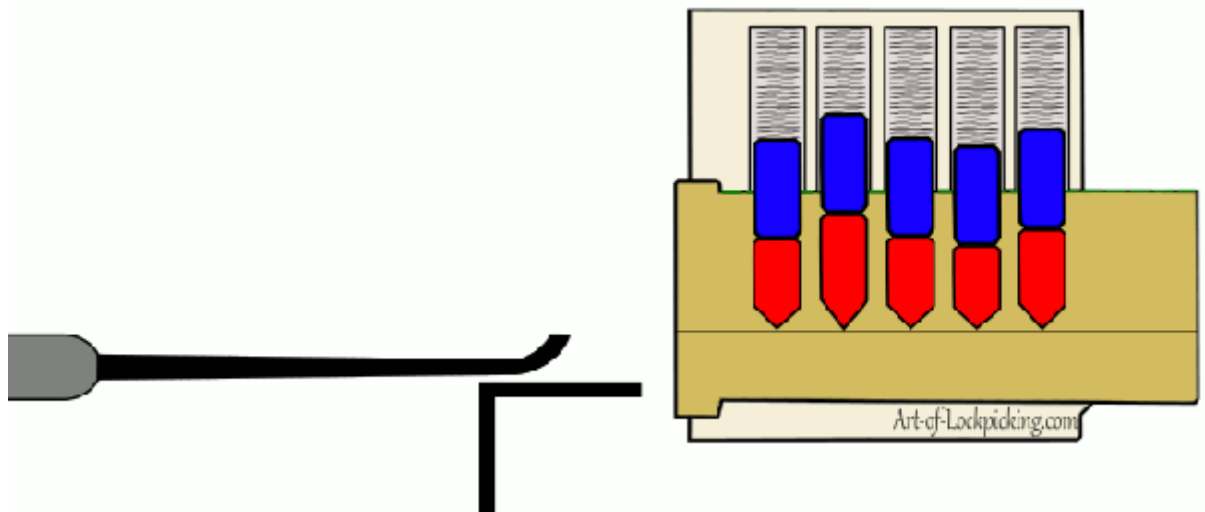


If you are doing this correctly the torque on the plug should provide a small ledge for the set pin to rest on at the “Shear Line”.

In our lock the shear line is the interface between the Plug Support and Plug sleeve.

It might help you to visualise this





Keep “picking” until you have all Set Pins resting on the ledge... when you do, the Plug will turn.

Good Luck!

And Remember



Production Notes

If you want to see how this workshop was put together, log in and check out the [production notes](#)