

# Music Box

# Music Box

A hand-cranked music box that  
plays back a picture

# Parts

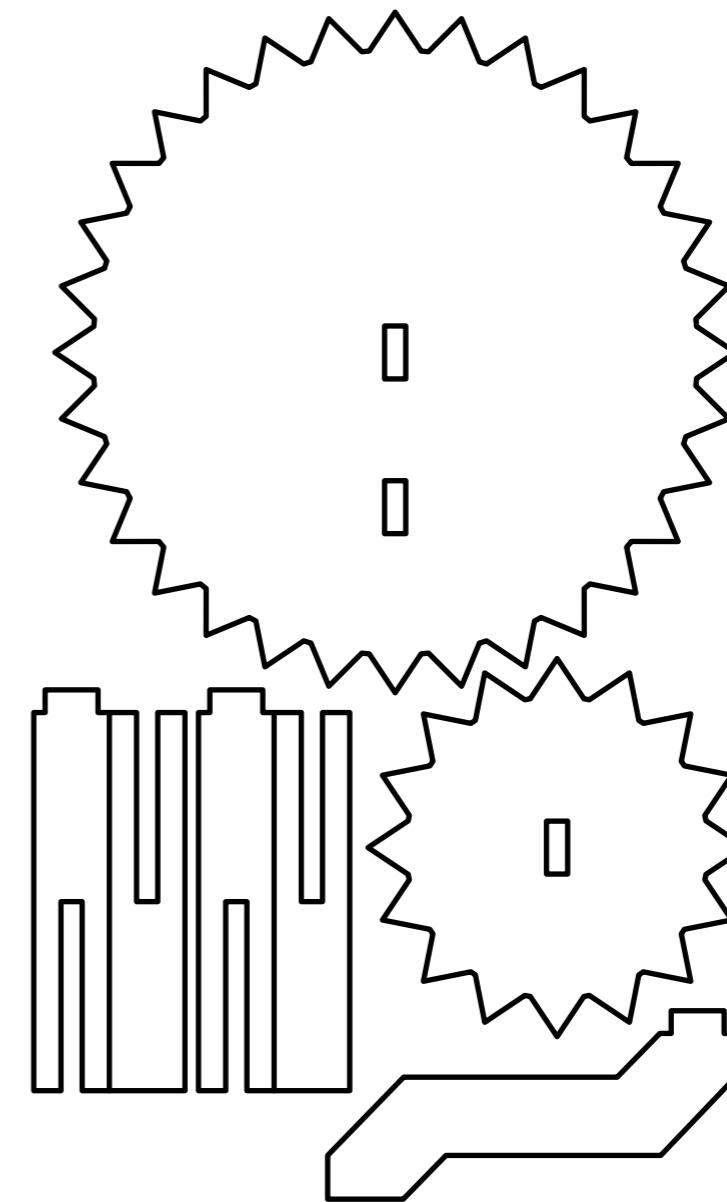
- Gear system & hand-crank
- Box enclosure
- Spool to hold picture
- Electronics for sound

# Gears

- Went through 3 iterations
- First spiky, then rounded
- Finally, gear generator in InkScape
- Tiny gear with big gear for slow speed

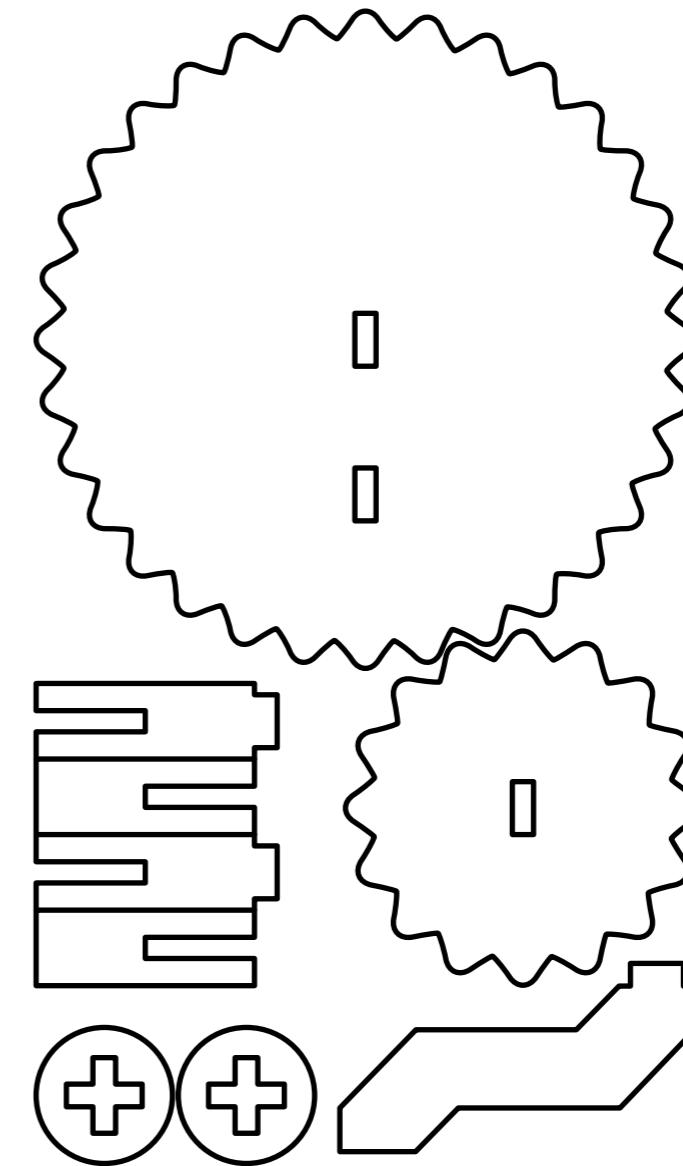
# Spiky gears

Didn't really mesh very well



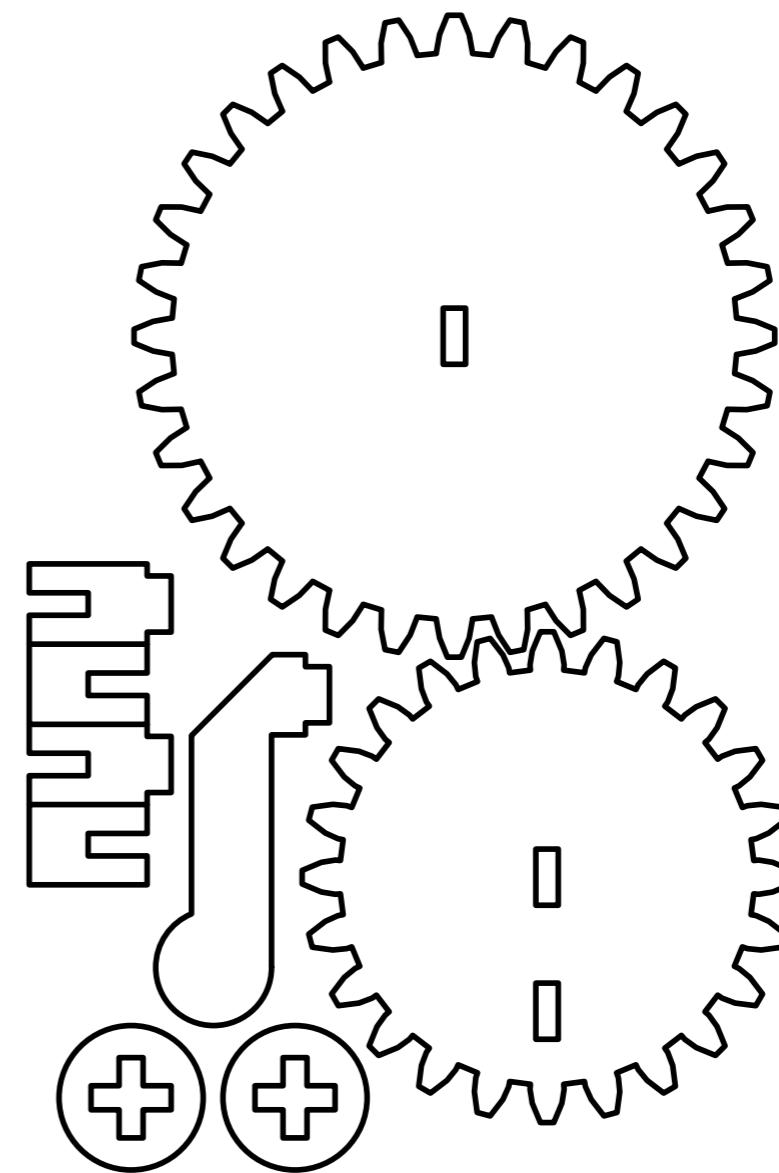
# Round gears

Better but still not smooth



# InkScape gears

The real deal! Smooth,  
detailed and super meshing.



# Box Enclosure

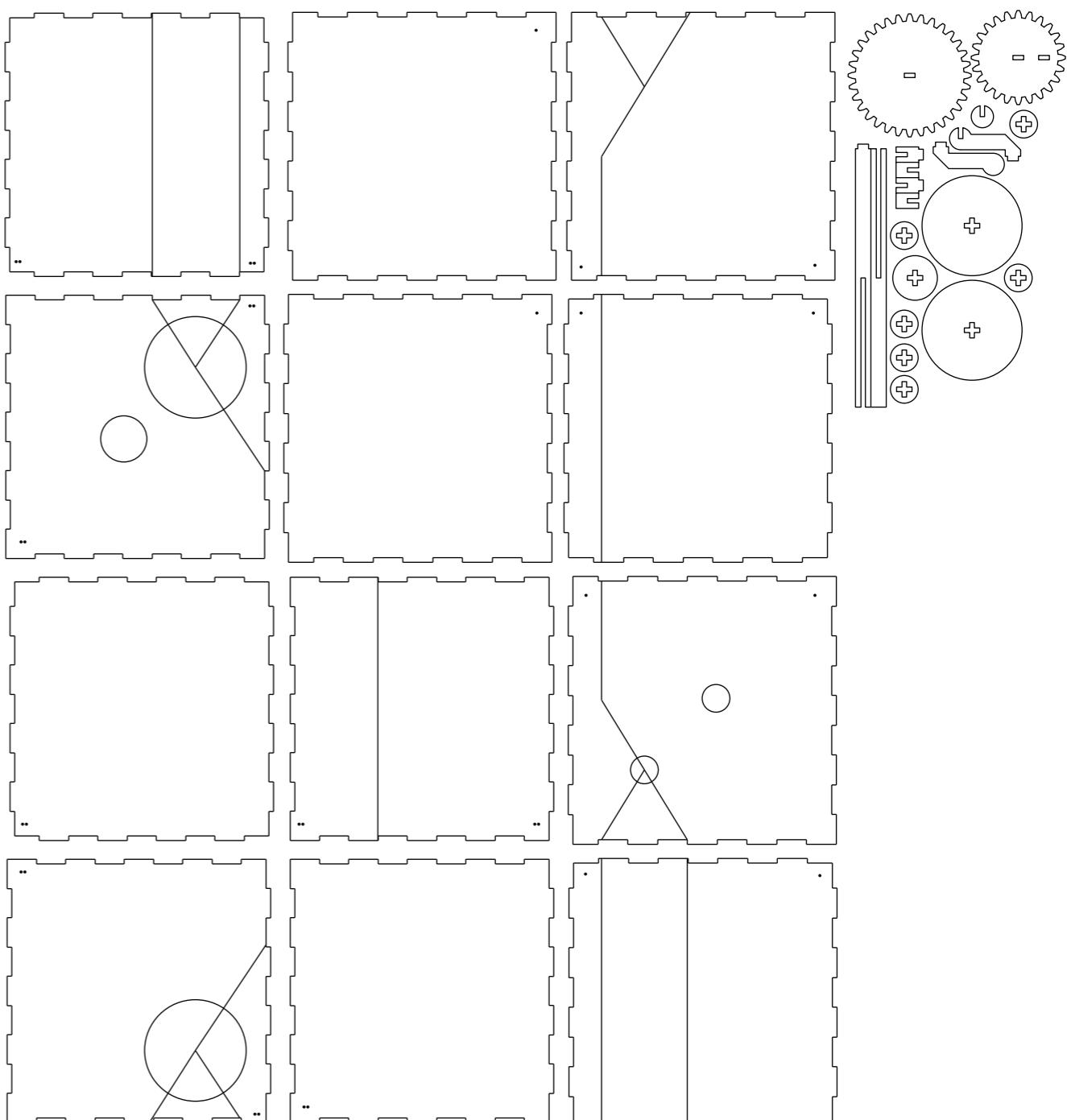
- This was especially confounding
- Two versions in all, but countless changes
- First version was two nested cubes – overall a 175mm. cube.
- Second one – a tilted, much smaller cuboid

# Cut Diagram ver. 1

Cut the entire thing at one go. Big mistake!

Gears worked, nothing else did.

Measurements were off – by 3mm.

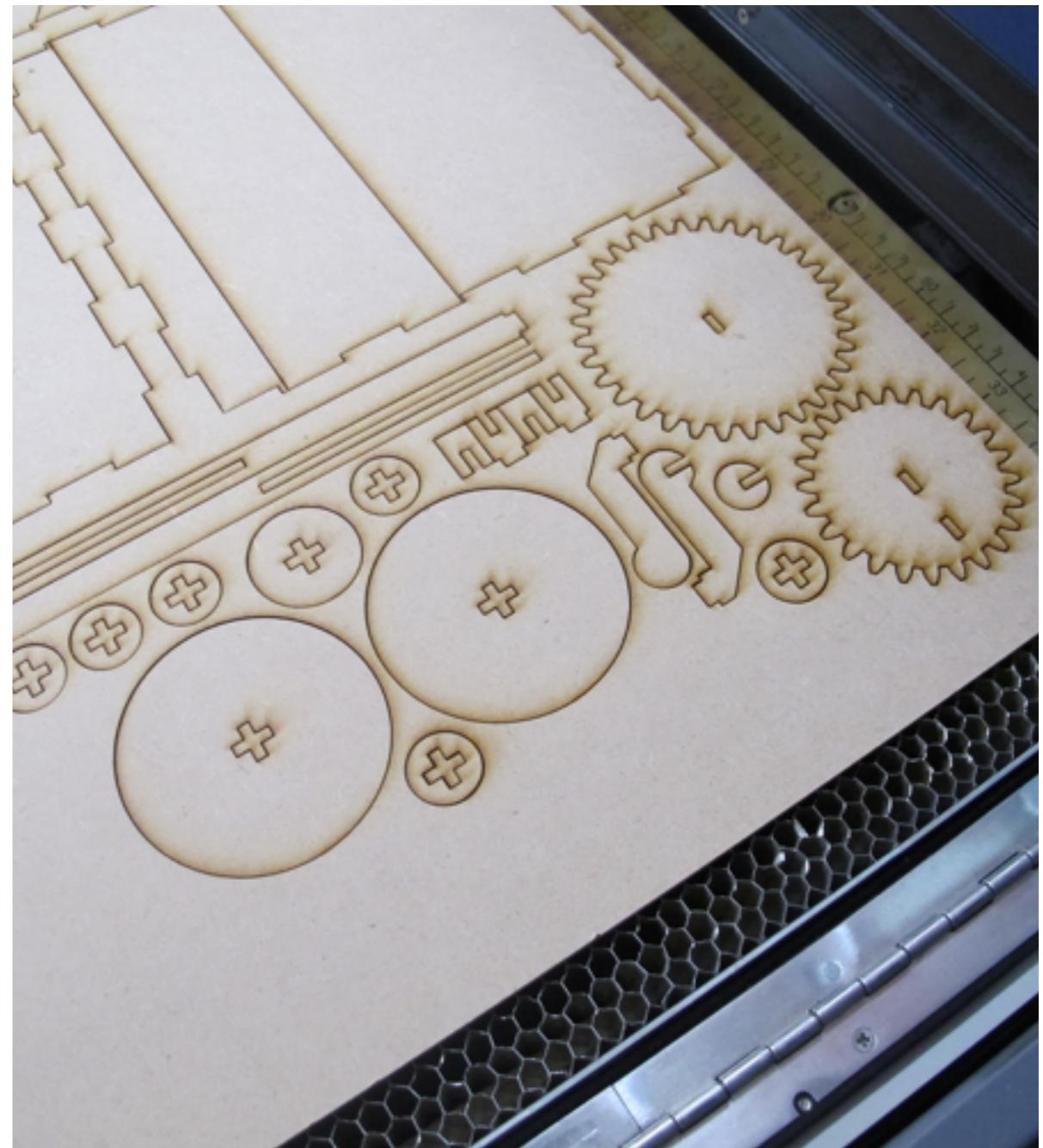


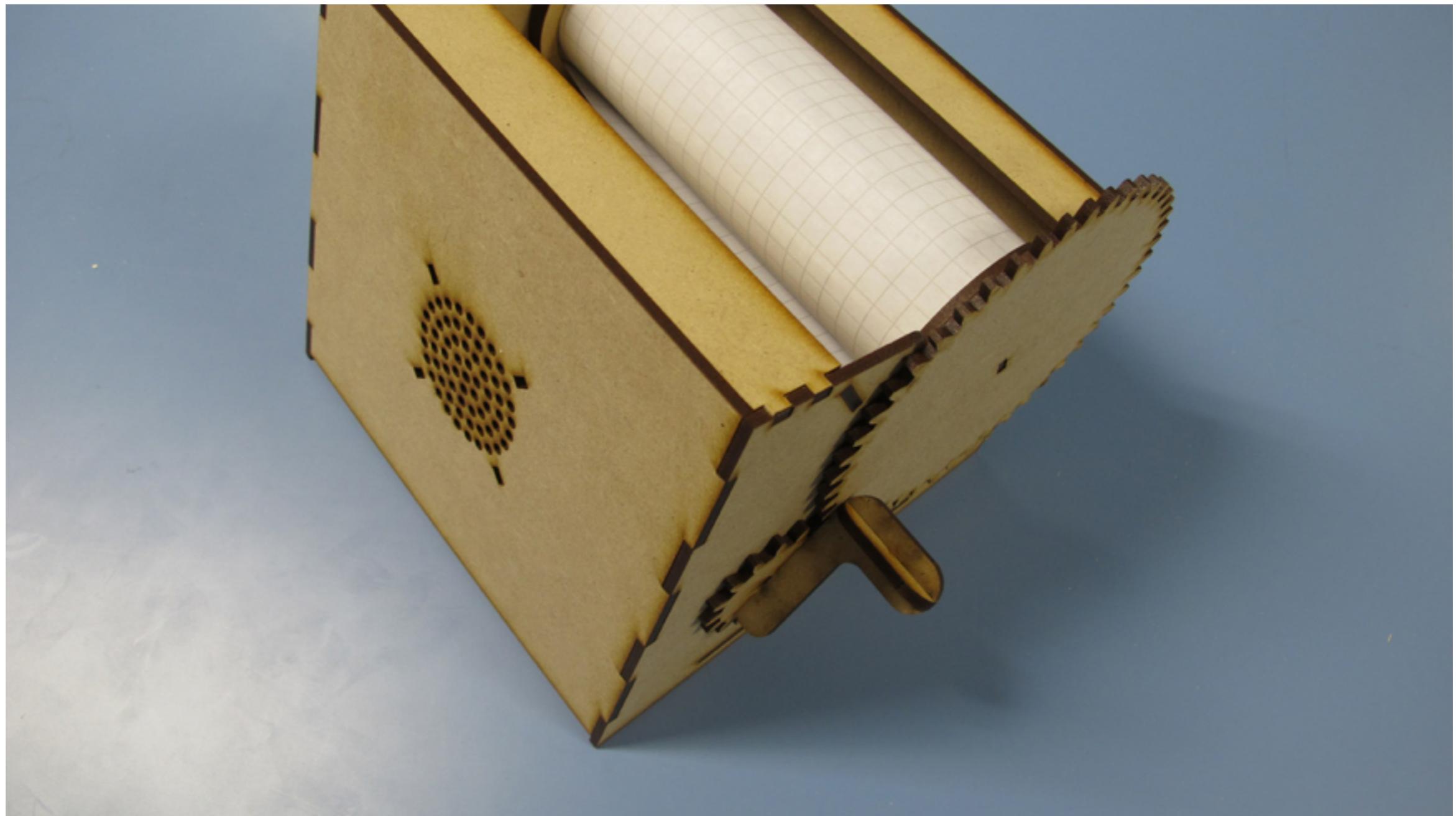


# Box ver.1

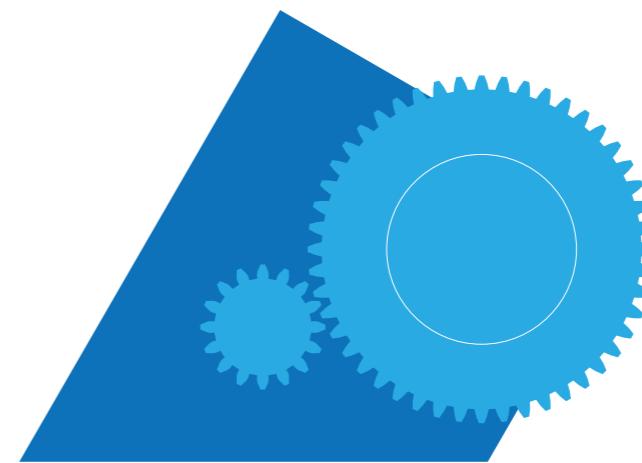
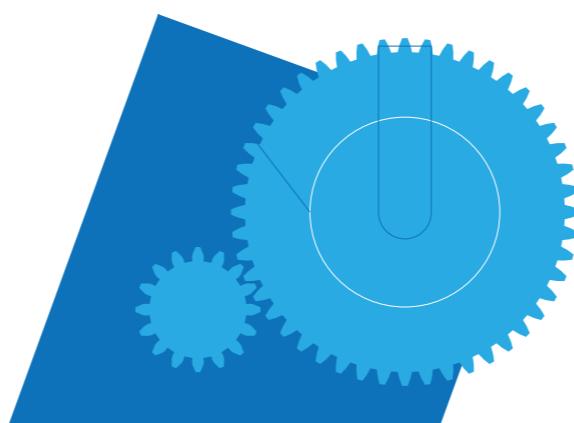
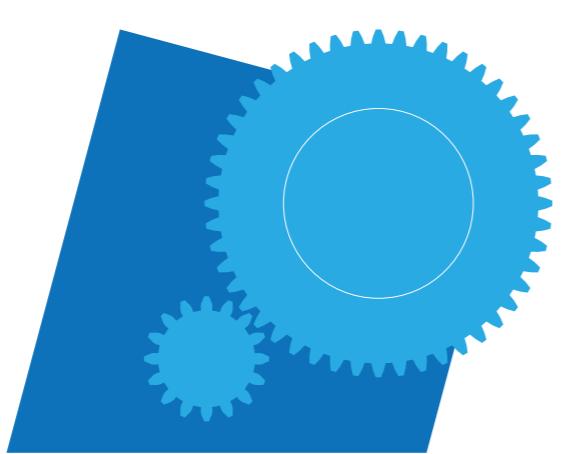
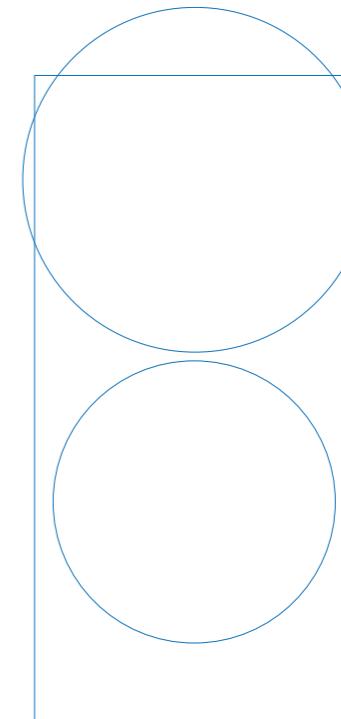
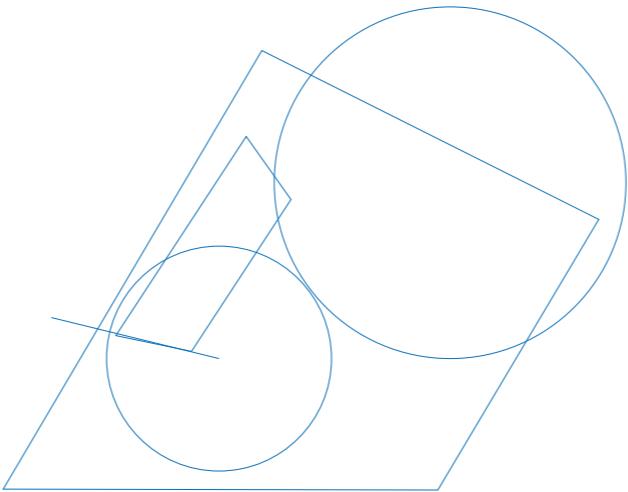
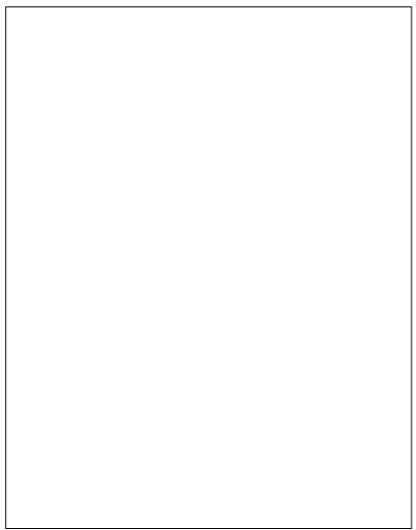
# Learnings

- Nested boxes need offsetting on both sides. And also needs a lot of material.
- A cube, simple and basic, encloses a lot of empty space.
- Prototype in parts.

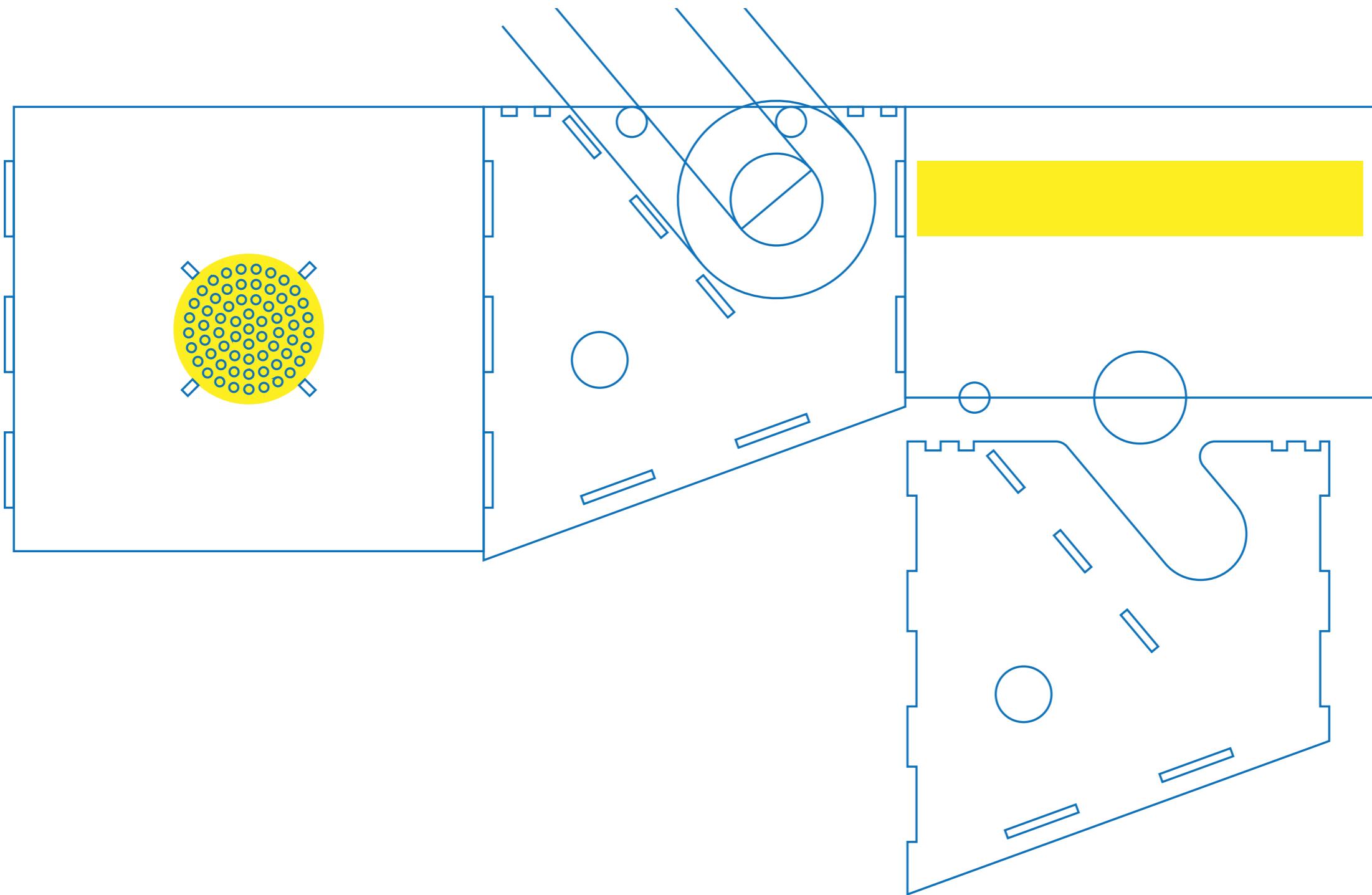




Box ver.2



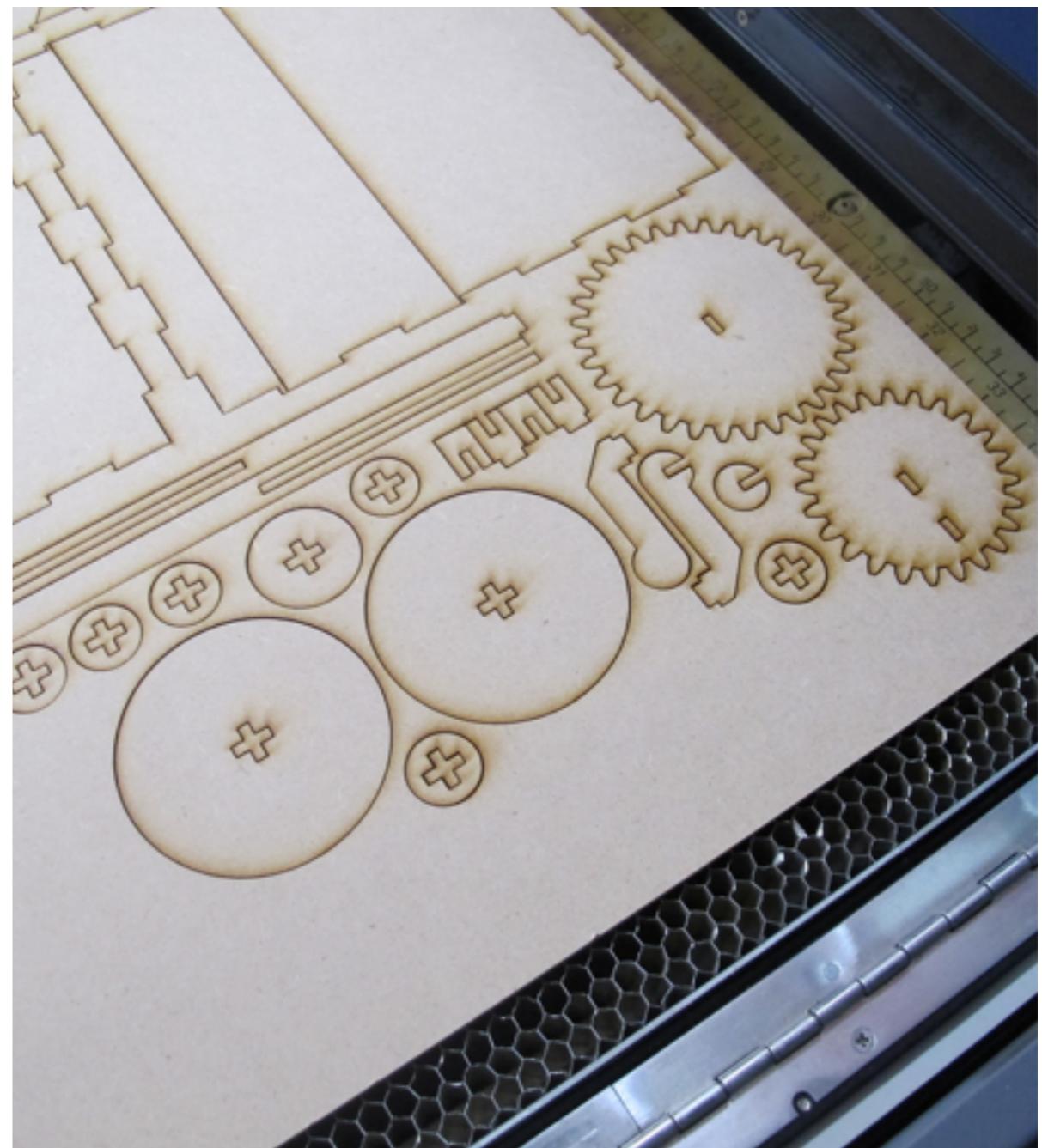
# Ideation



# Cut Diagram for ver.2

# Learnings

- Illustrator shape-builder rules!
- Simpler solutions have complex processes and are more time-consuming to get to.



# Spool ver.1

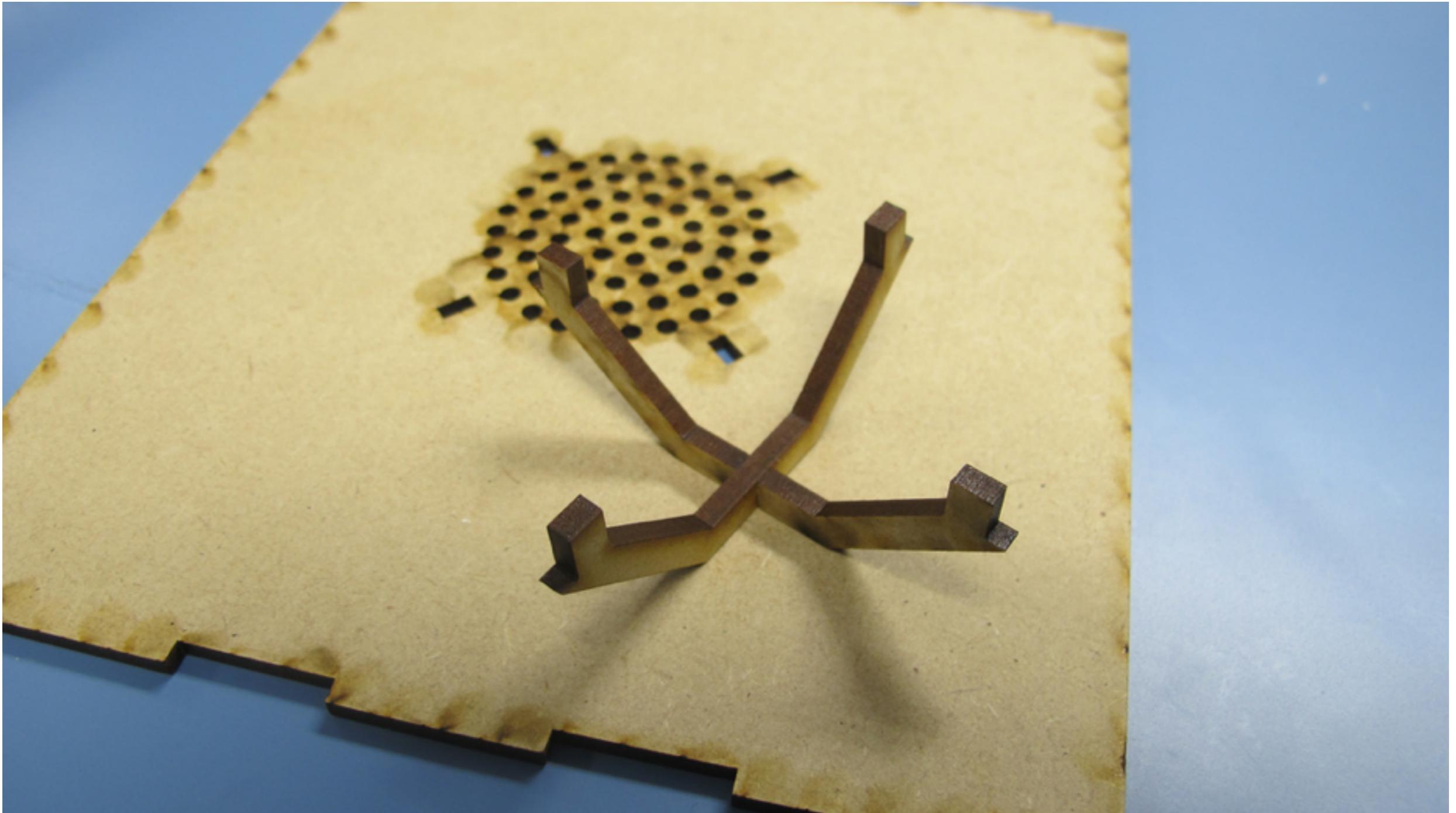
- Works but slightly clumsy.
- Middle joint makes the axis weak.
- Middle circle is too big.



# Spool ver.2

- Stabler and cleaner.
- Works but still needs refinement.
- Version 3 will have better paper loading.





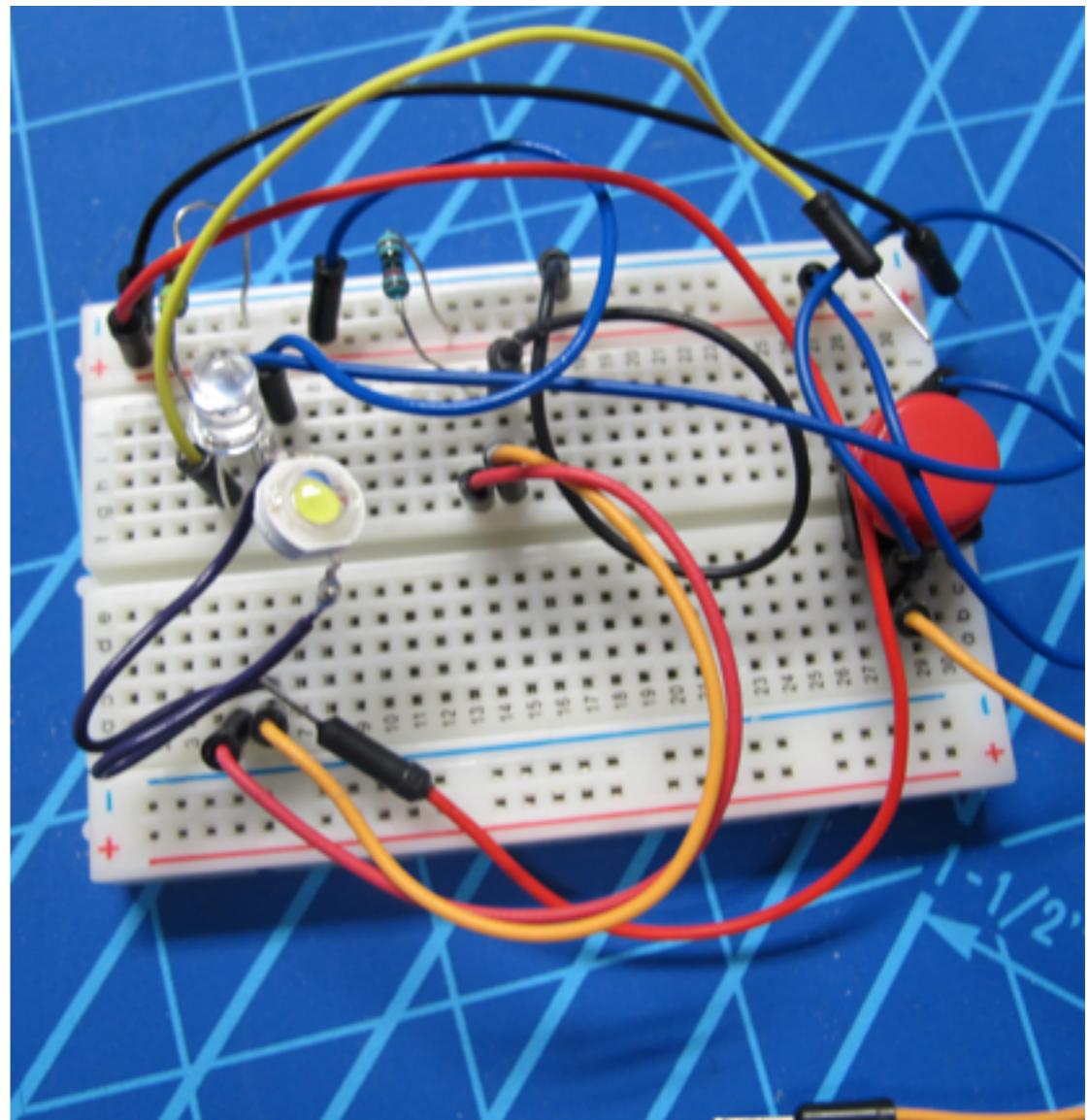
# The speaker grille

# Circuitry

- Arduino based.
- Simple brightness detection.
- Ver.1 used white LED for illumination.
- Ver.2 uses IR LED.
- Output is a standard  $8\Omega$  RC speaker.

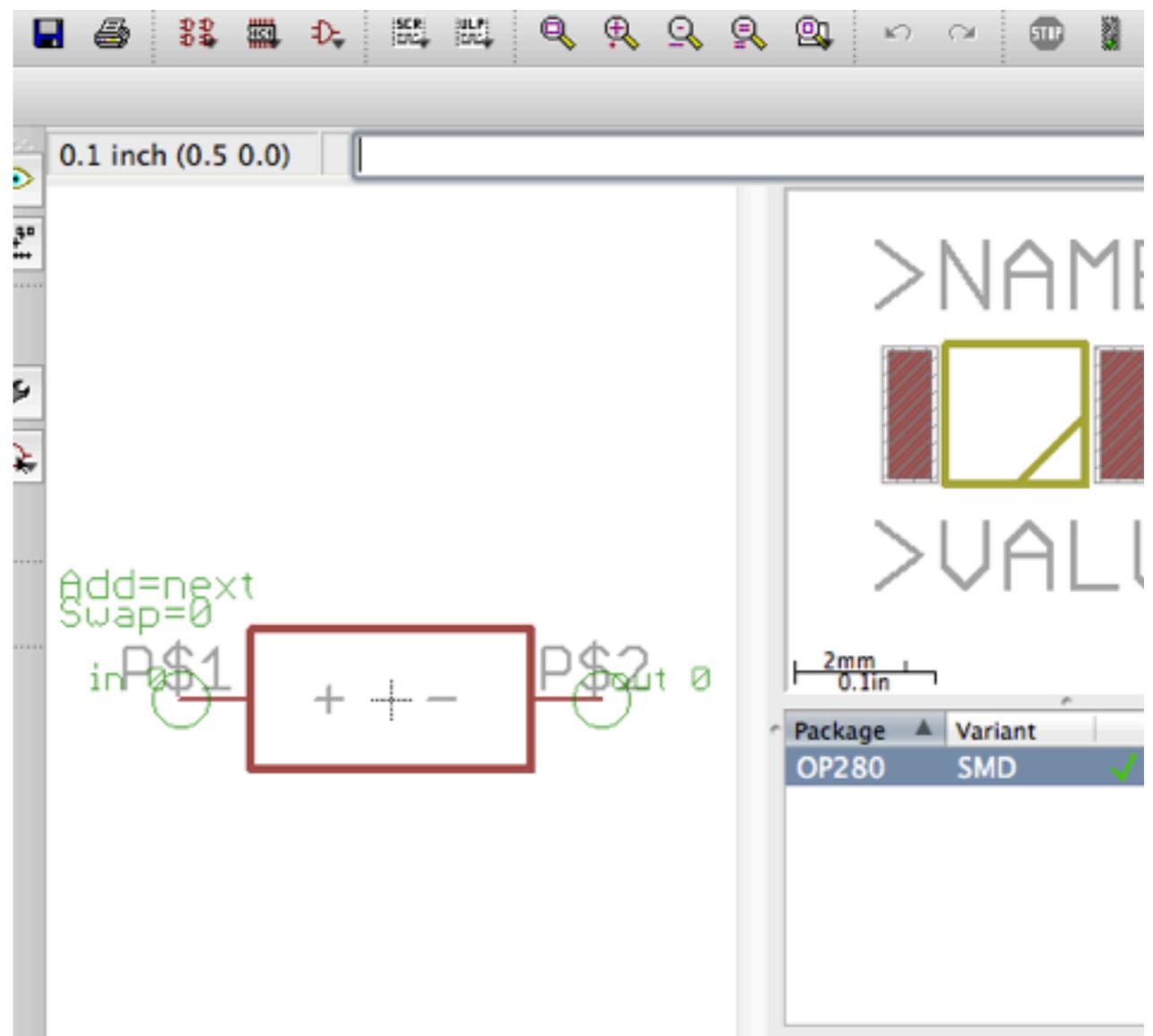
# Proto-circuit

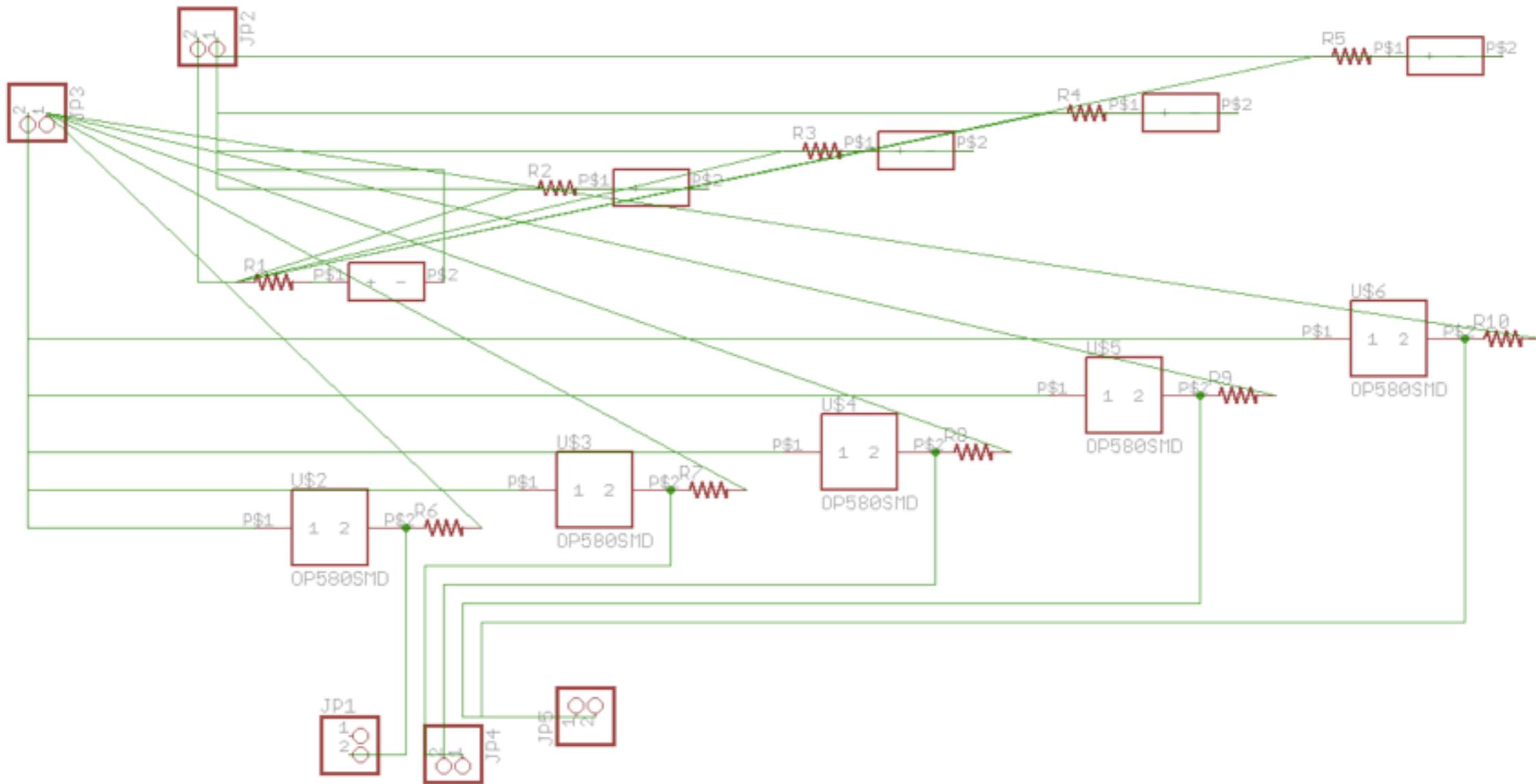
- White LED and phototransistor.
- Switch to turn on and off. Discarded later.



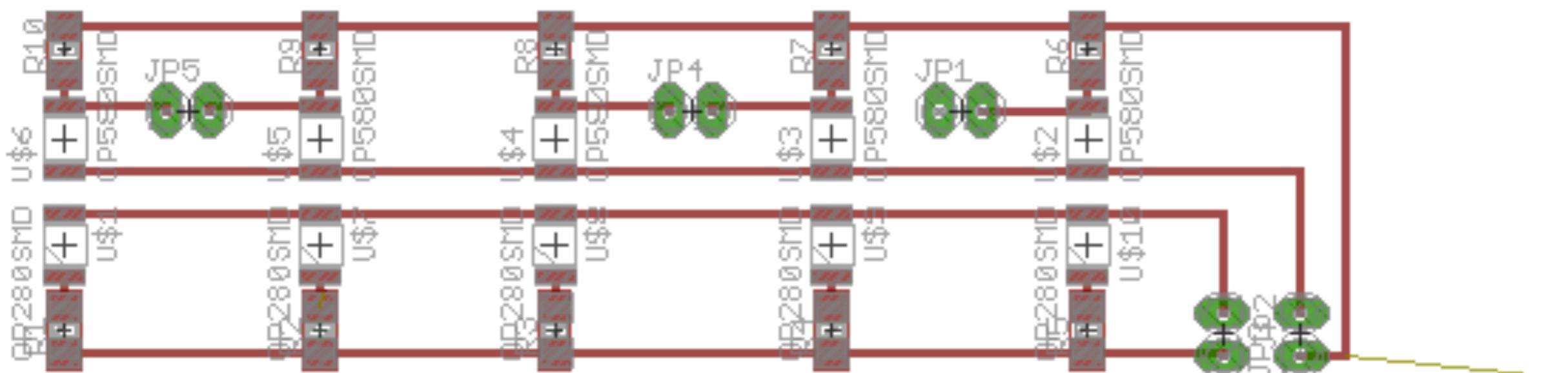
# Eagle

- Simple application with horrible UI.
- Made custom components, laid out circuit.
- Exported circuit for fabrication.
- Process on GitHub.





# Schematic



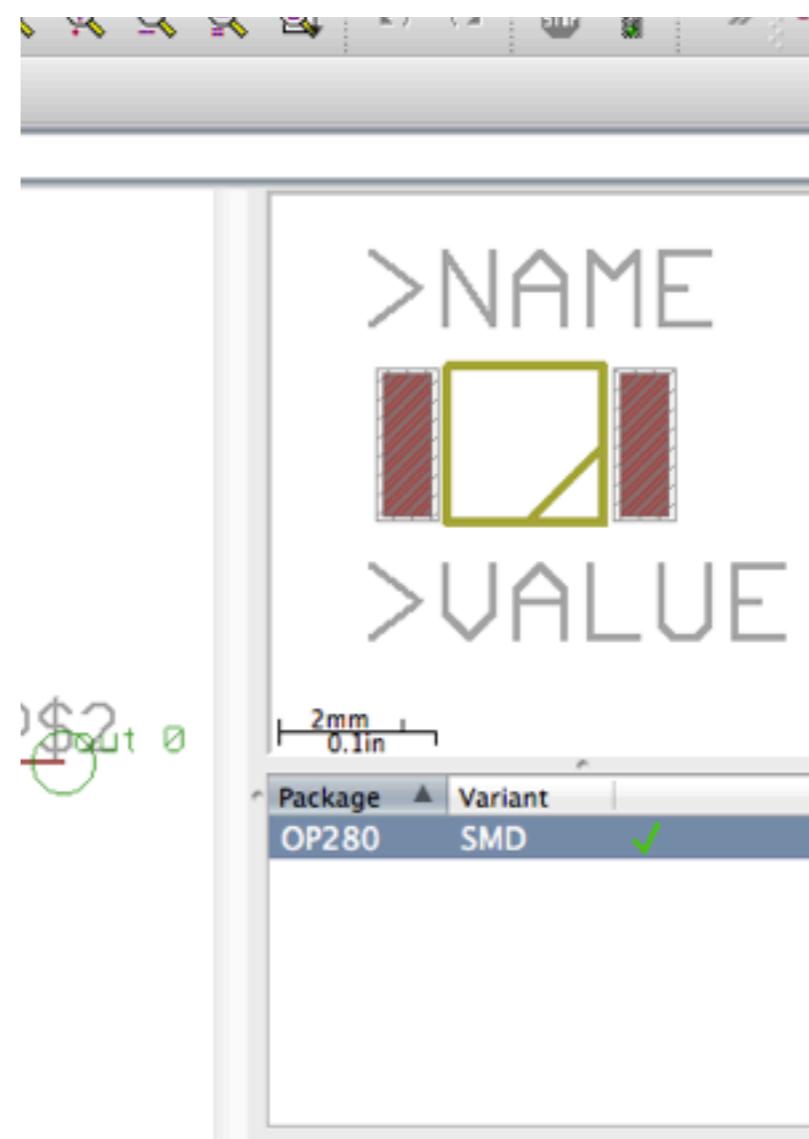
# Board

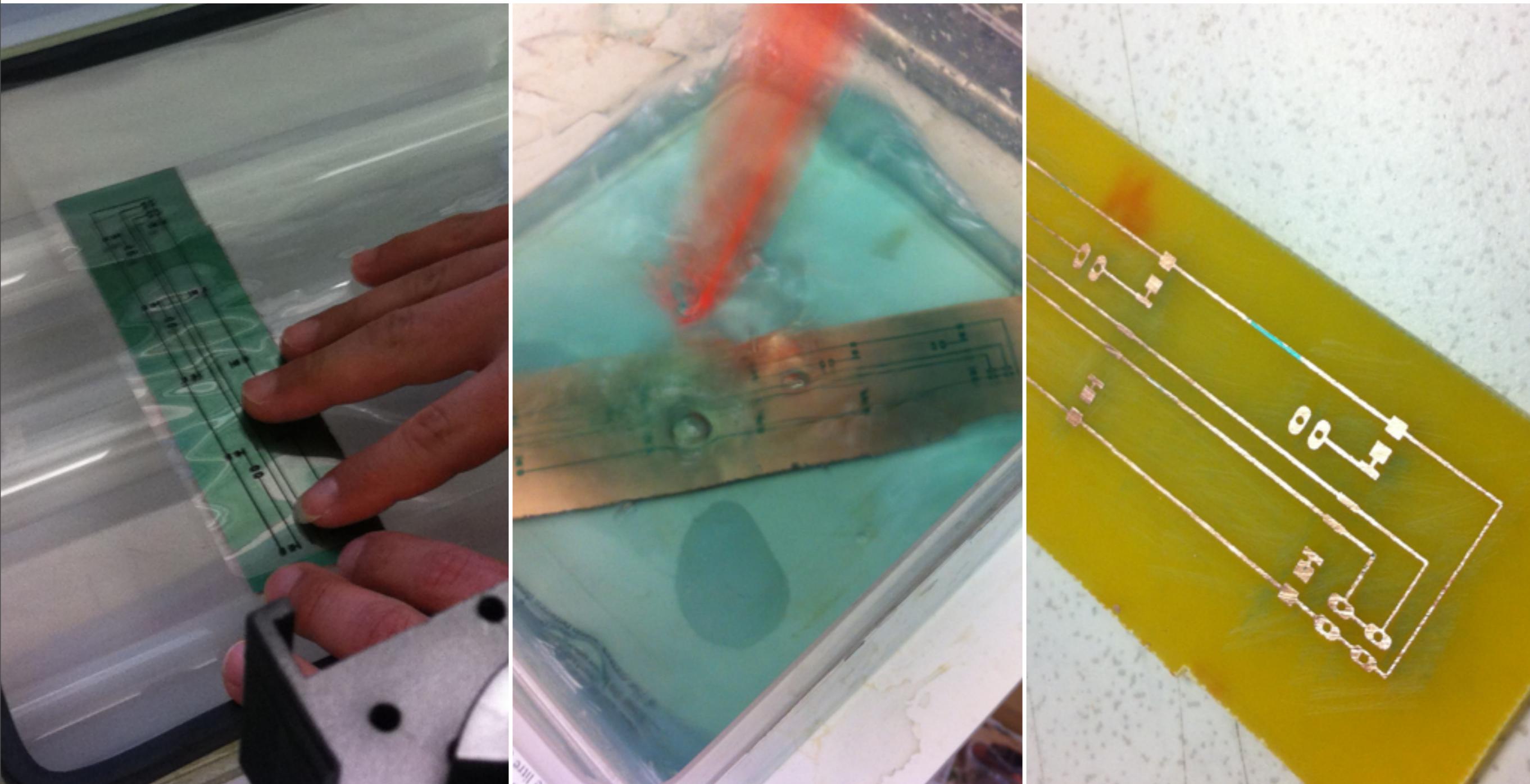


Layout for fabrication

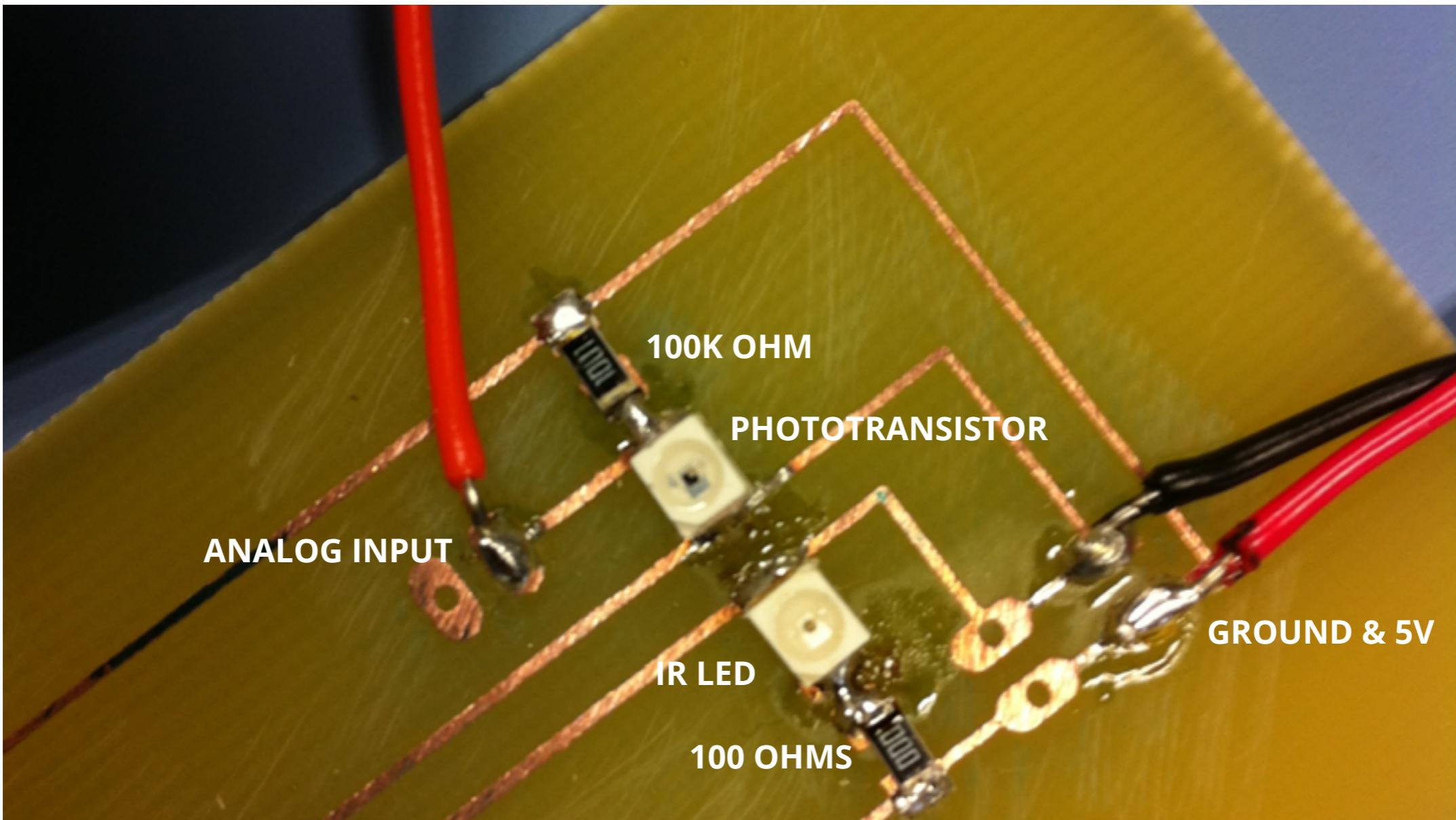
# Learnings

- Eagle is very efficient if you know how to use it – use the net to figure out how.
- Without spec-sheets for custom parts, you'll be stuck.
- Photoshop can double as a circuit editor.





# Expose and etch



# Soldered circuit

# Arduino

- Fairly straightforward
- Using tone-ac library from:  
[https://code.google.com/p/arduino-](https://code.google.com/p/arduino-tone-ac/)  
[tone-ac/](#)
- Read light › play sound