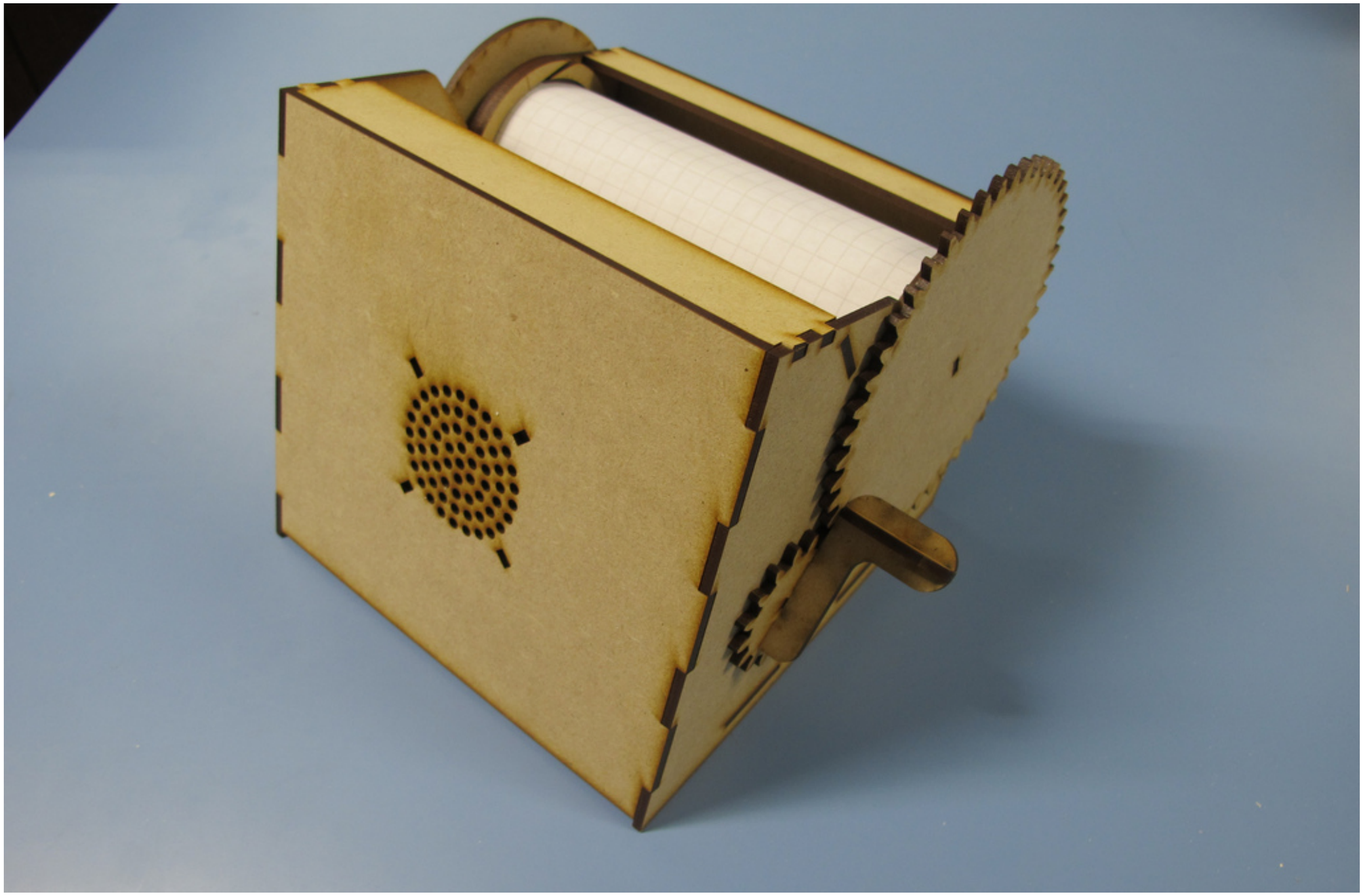


Music Box

Music Box

A hand-cranked music box that plays back a picture

Parts

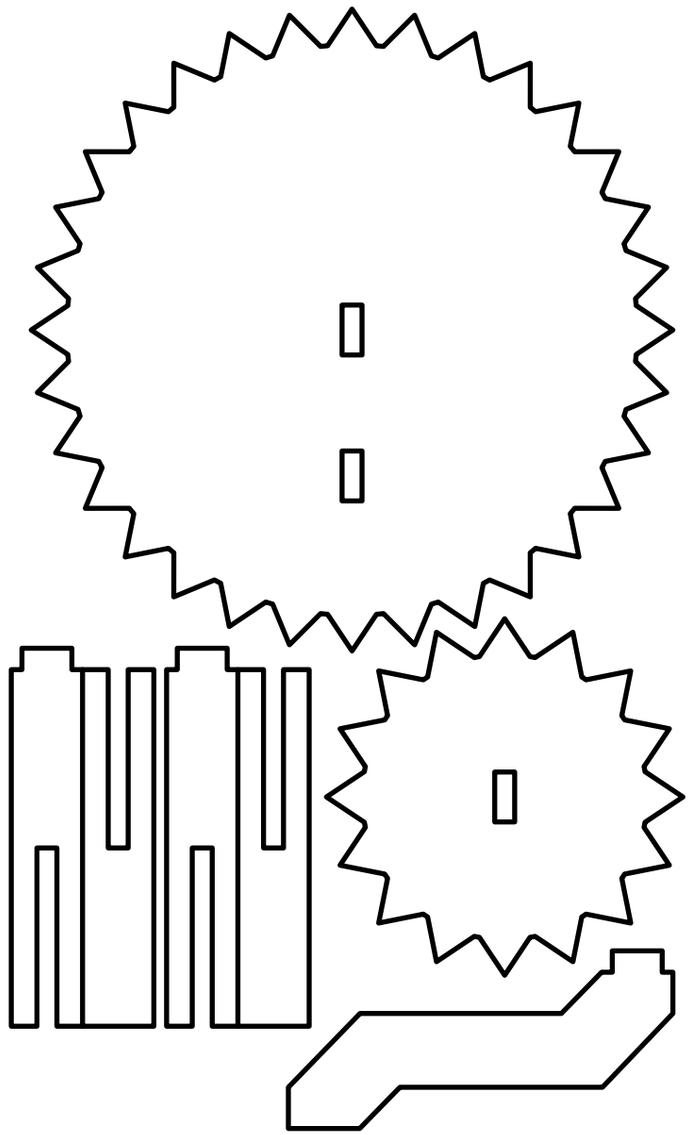
- Gear system & hand-crank
- Box enclosure
- Spool to hold picture
- Electronics for sound

Gears

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

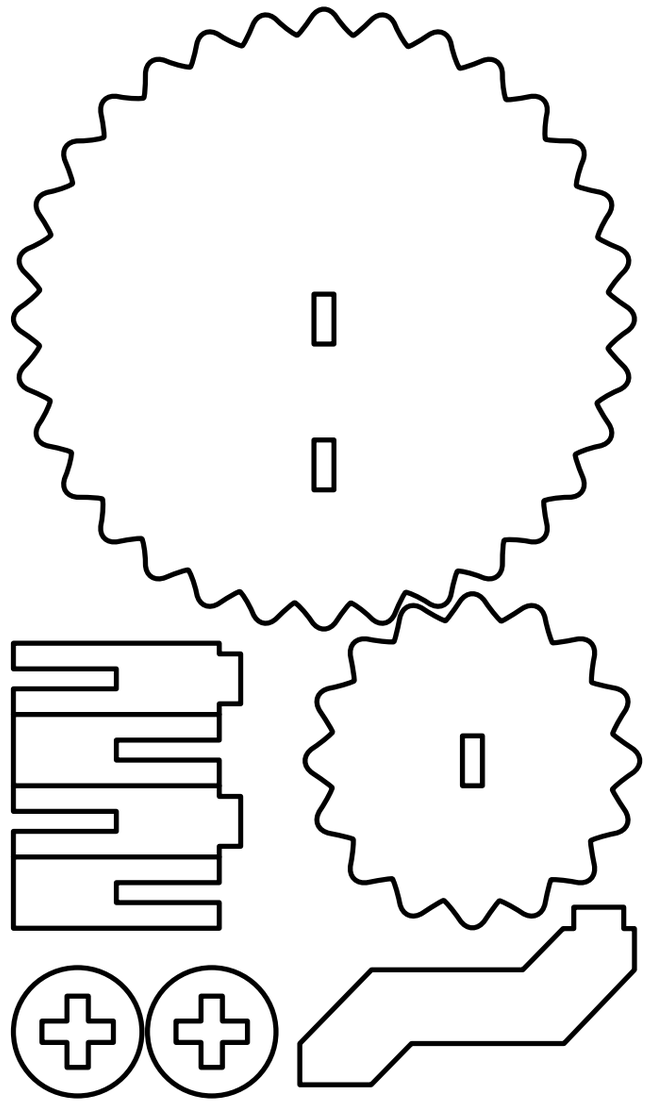
Spiky gears

Didn’t really mesh very well



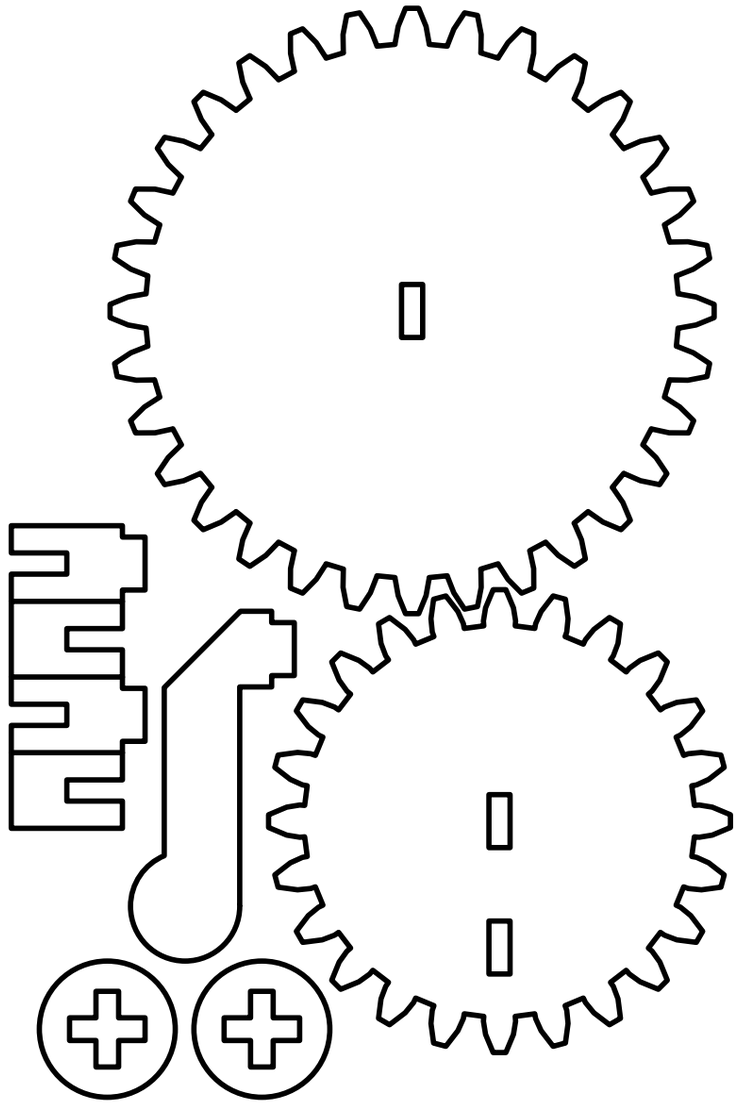
Round gears

Better but still not smooth



InkScape gears

The real deal! Smooth, detailed and super meshing.



Box Enclosure

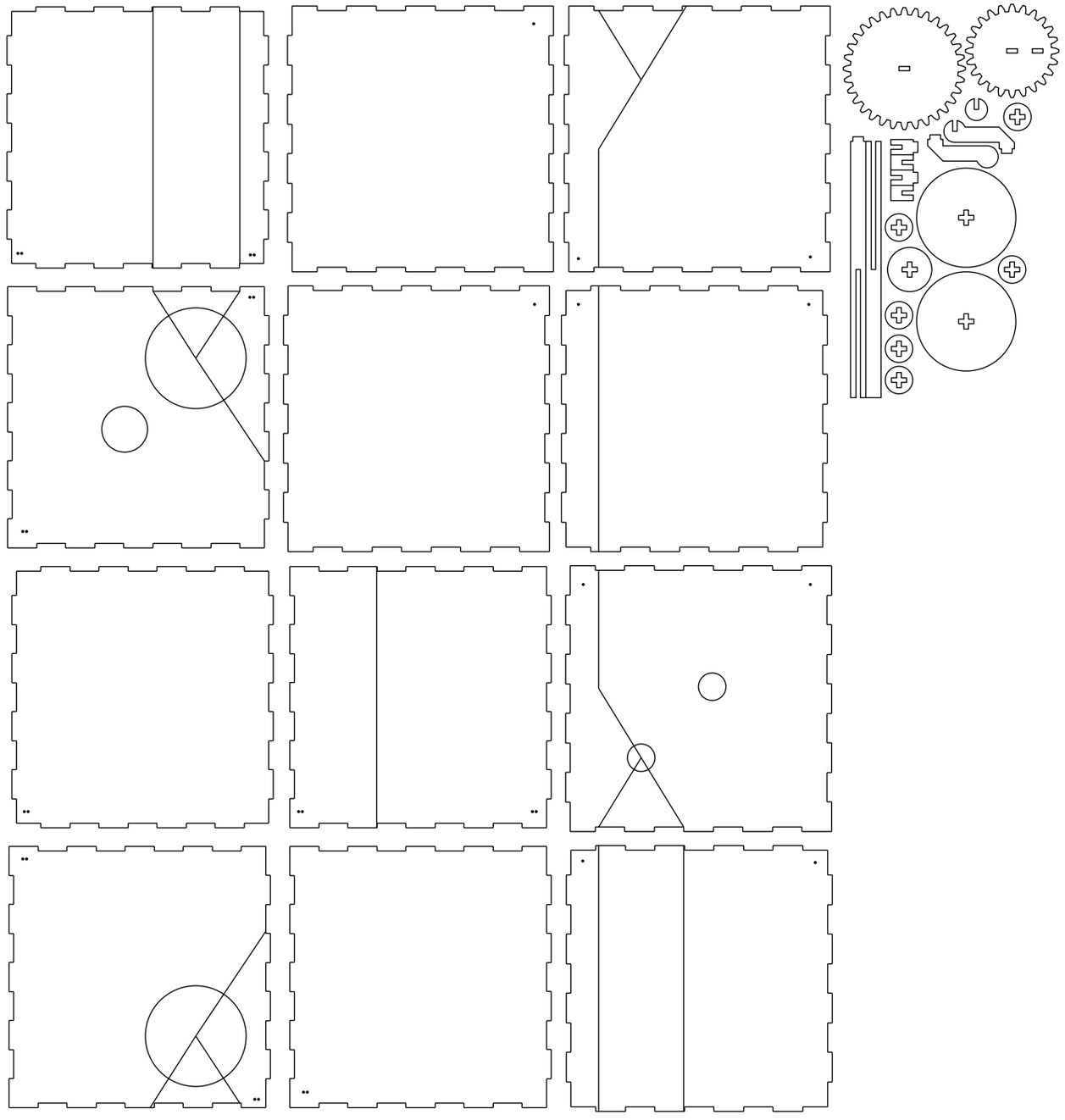
- This was especially confounding
- Two versions in all, but countless changes
- First version was two nested cubes – overall a 175mm. cube.
- Second one – a tilted, much smaller cuboid

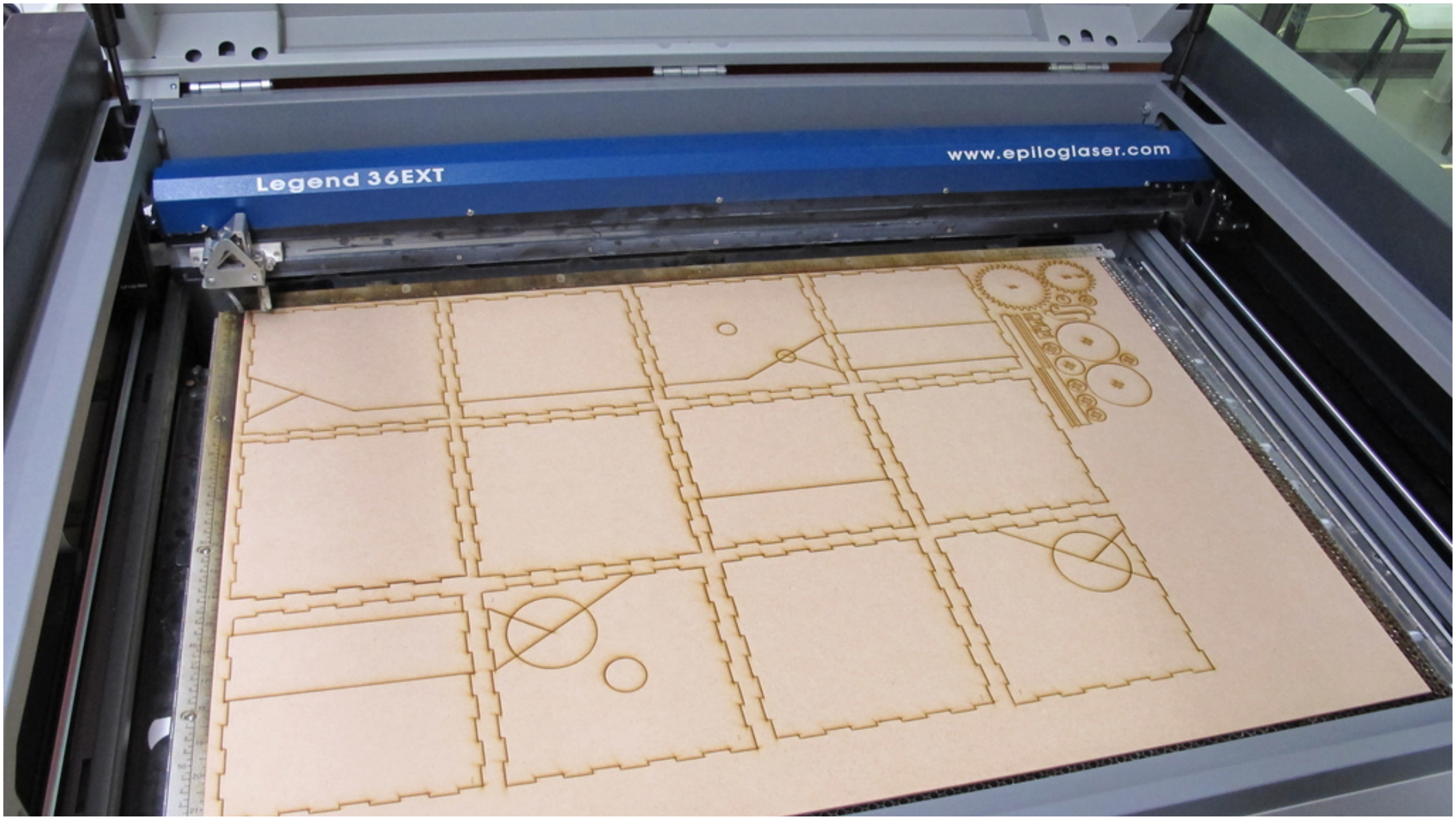
Cut Diagram ver. 1

Cut the entire thing at one go. Big mistake!

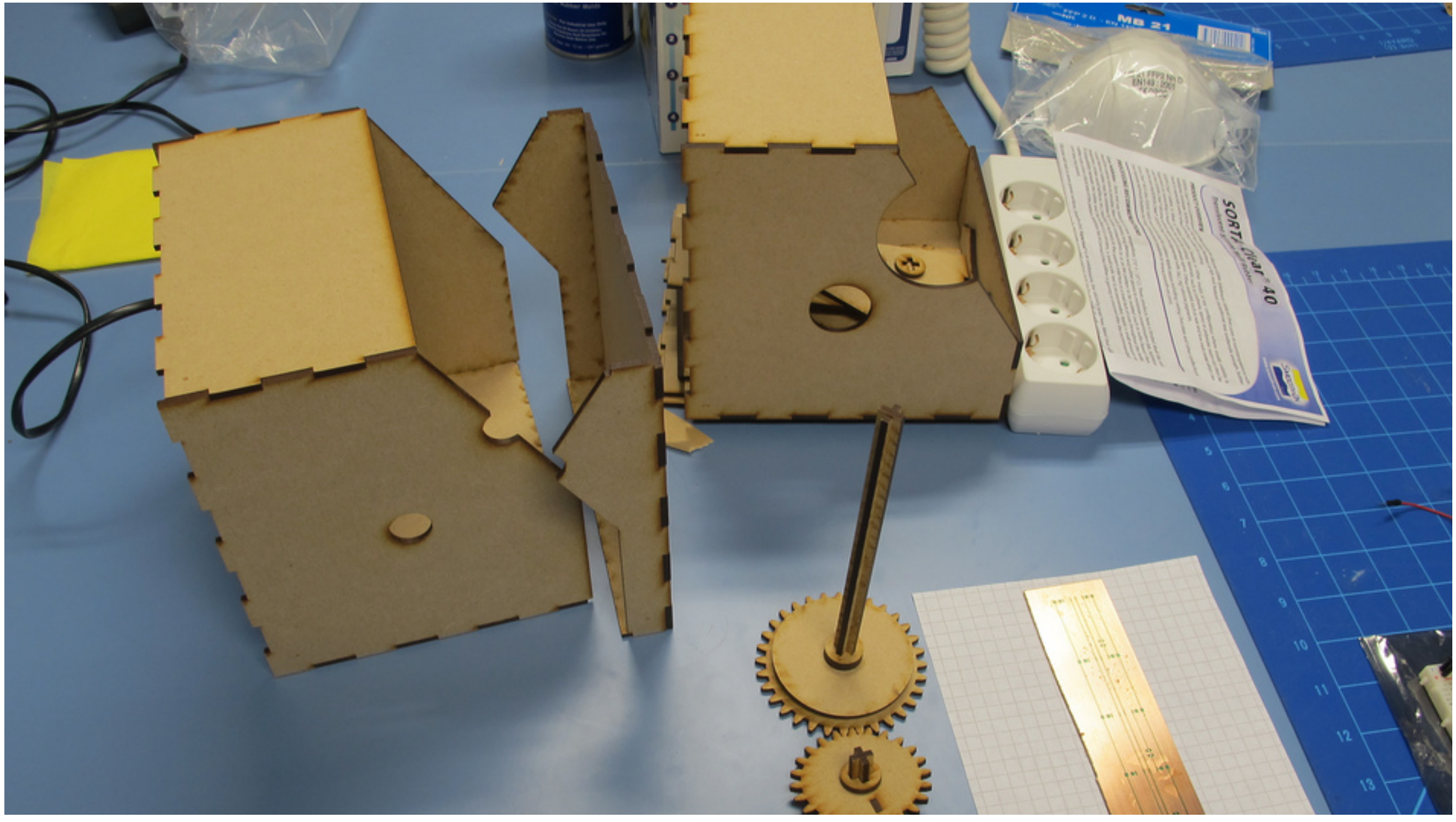
Gears worked, nothing else did.

Measurements were off – by 3mm.





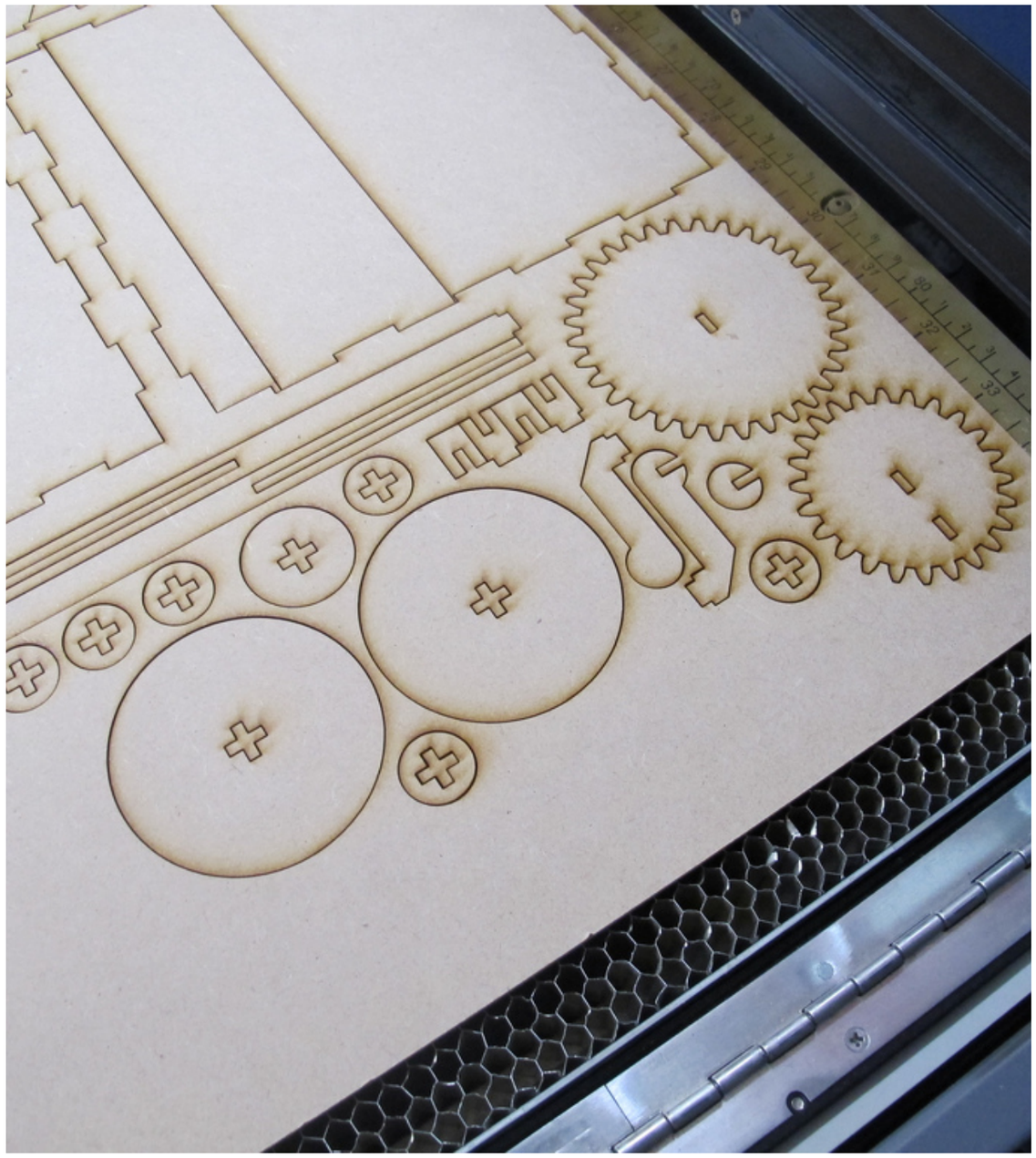
Box ver.1

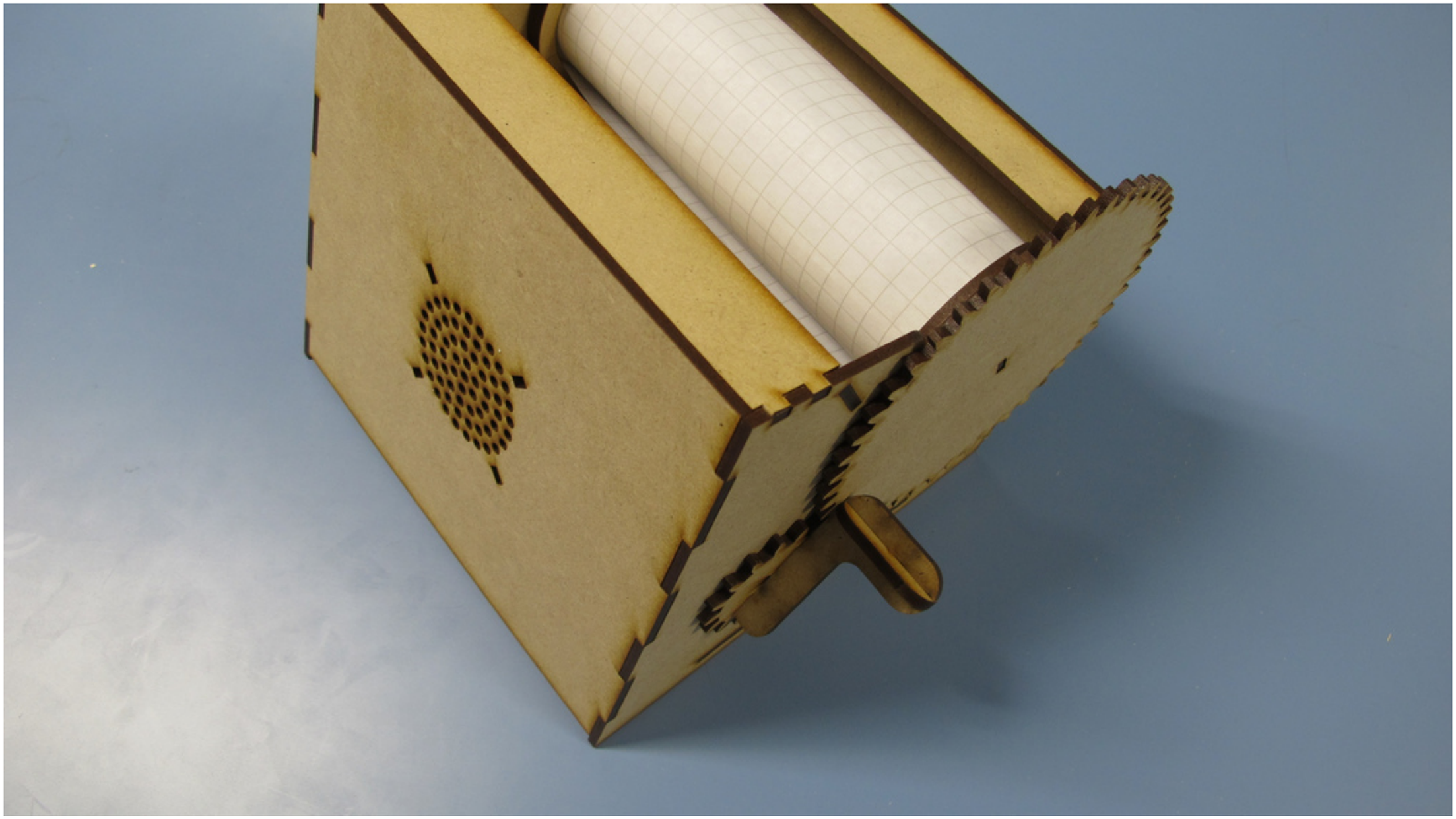


Failed Box ver.1

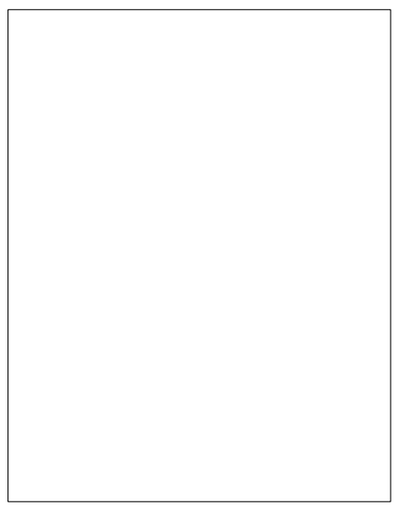
Learnings

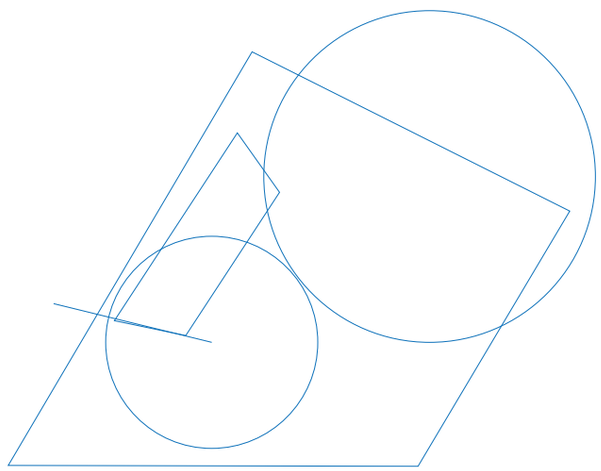
- Nested boxes need offsetting on both sides. And also needs a lot of material.
- A cube, simple and basic, encloses a lot of empty space.
- Prototype in parts.

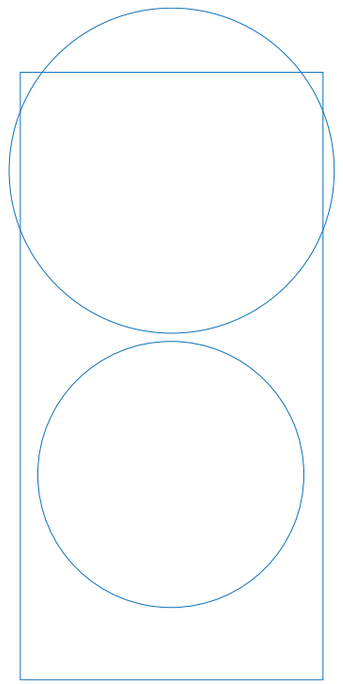


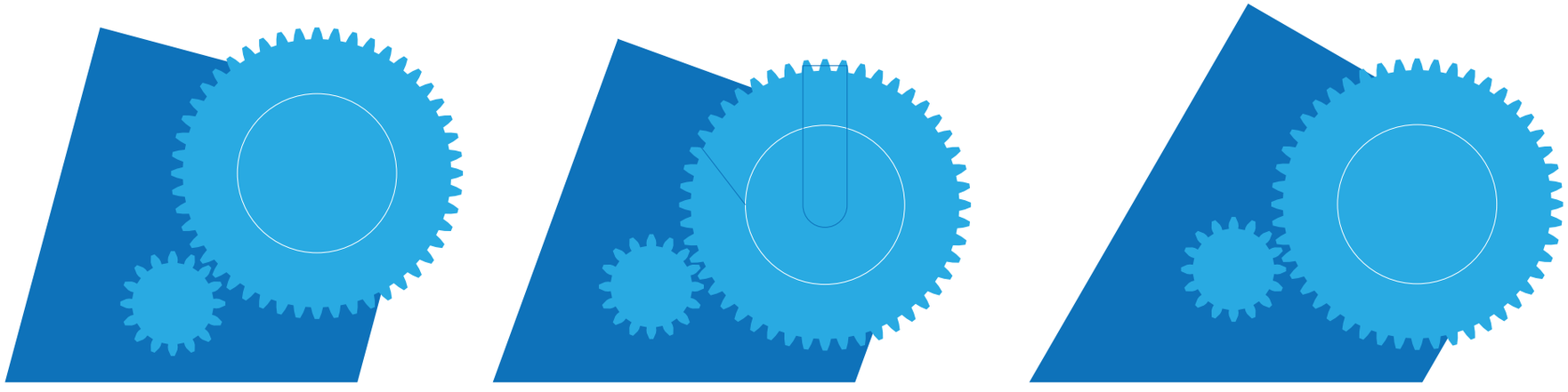


Box ver.2

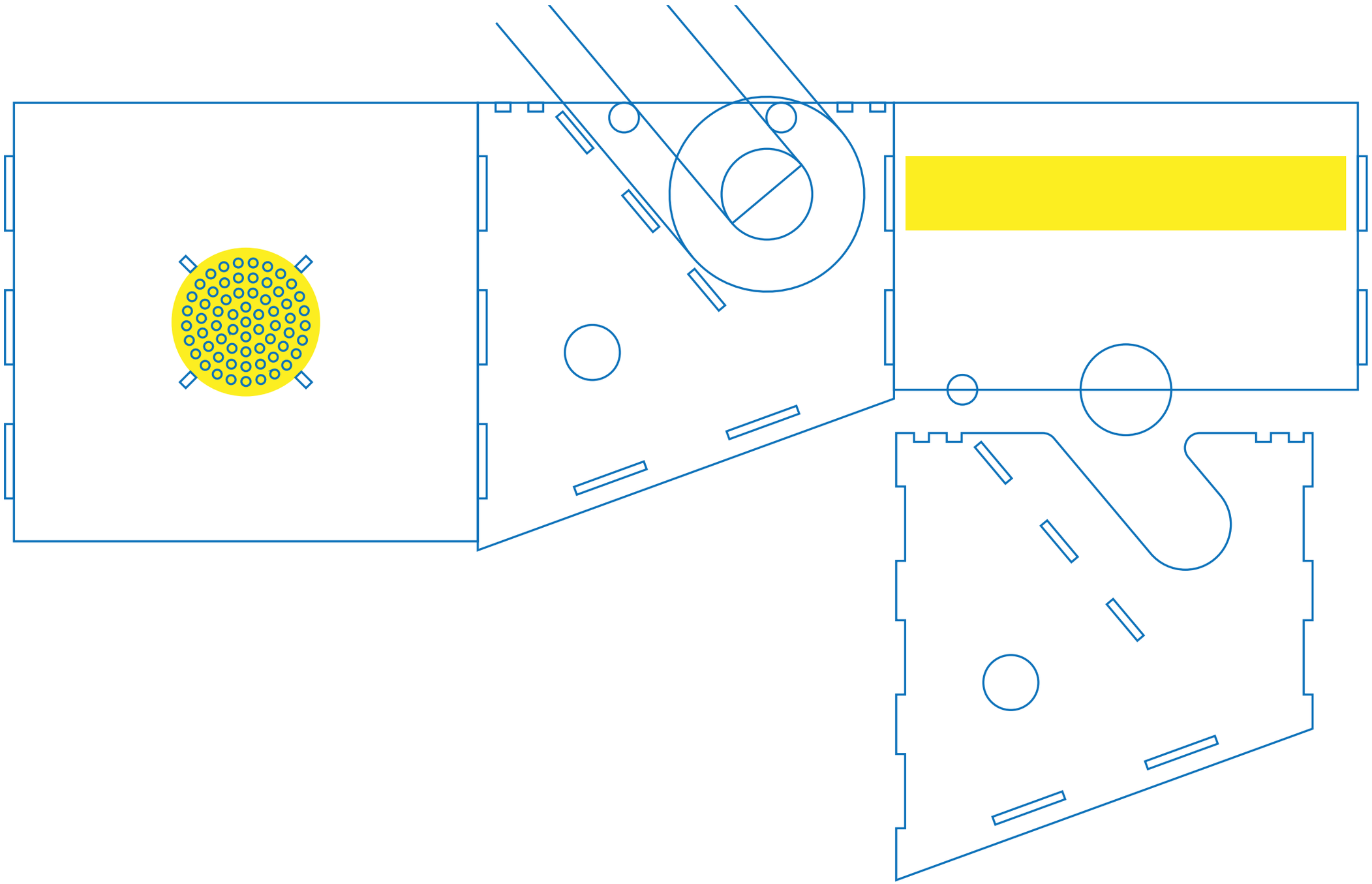








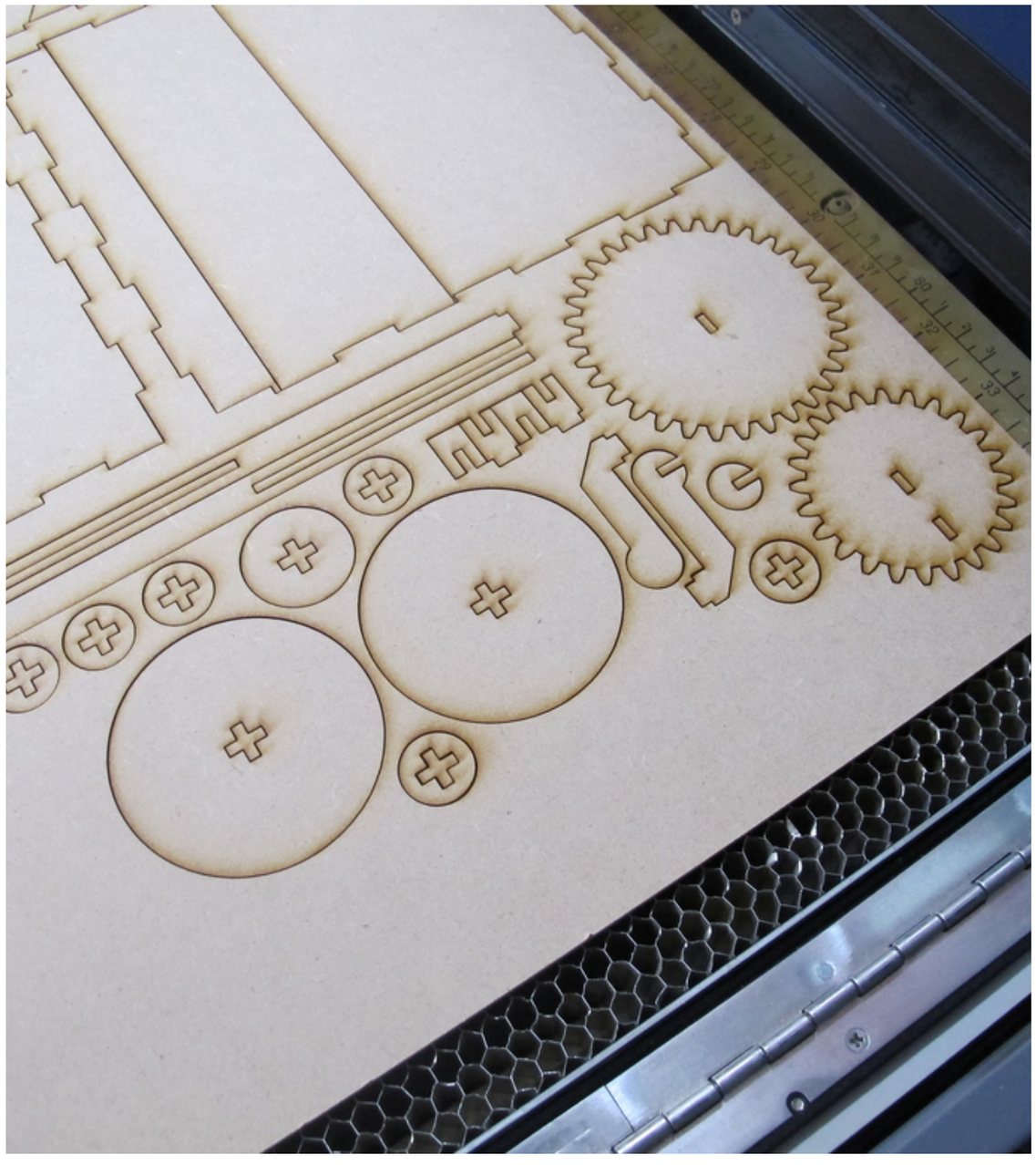
Ideation



Cut Diagram for ver.2

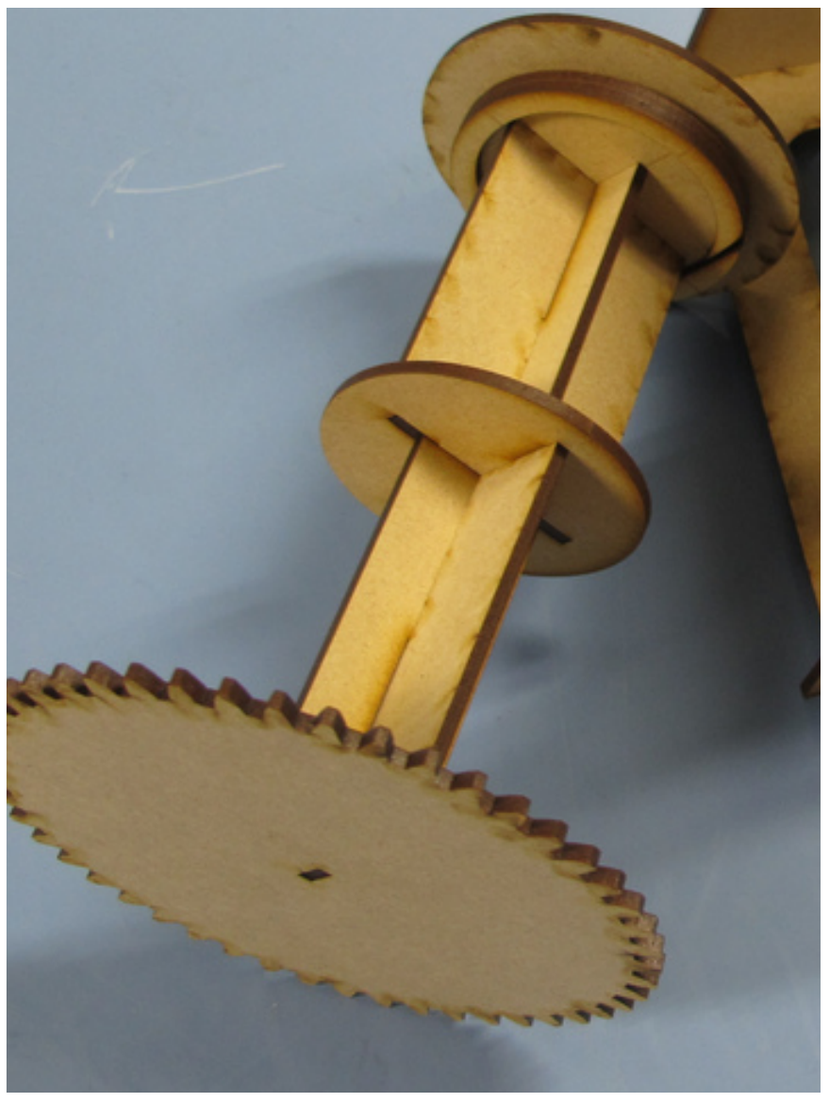
Learnings

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



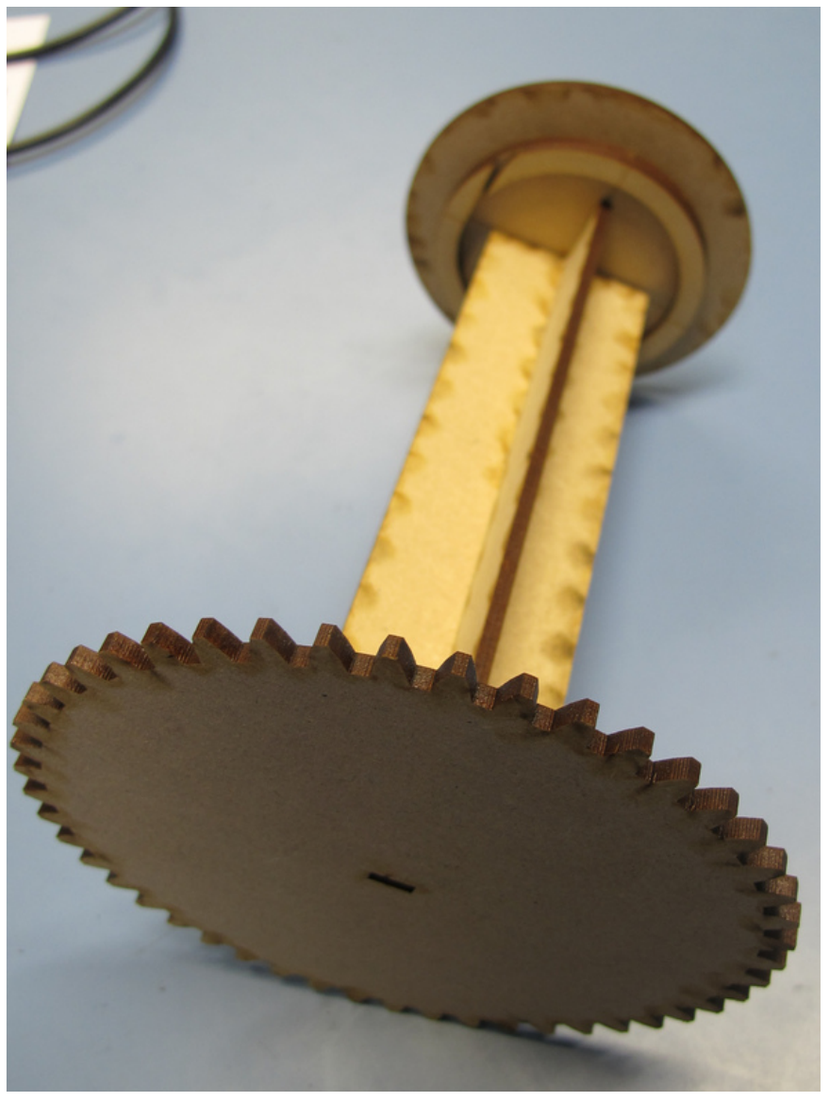
Spool ver.1

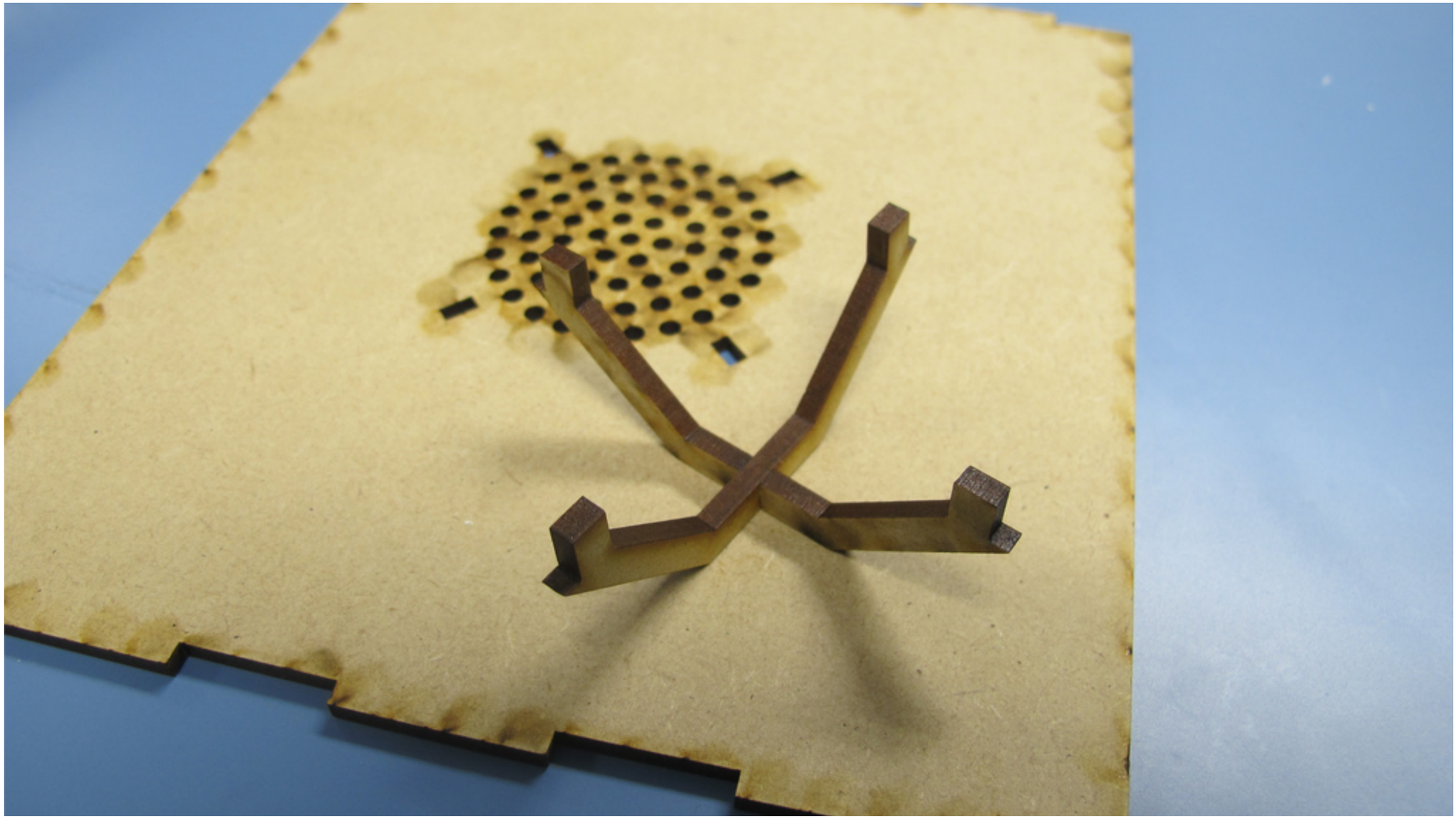
- Works but slightly clumsy.
- Middle joint makes the axis weak.
- Middle circle is too big.



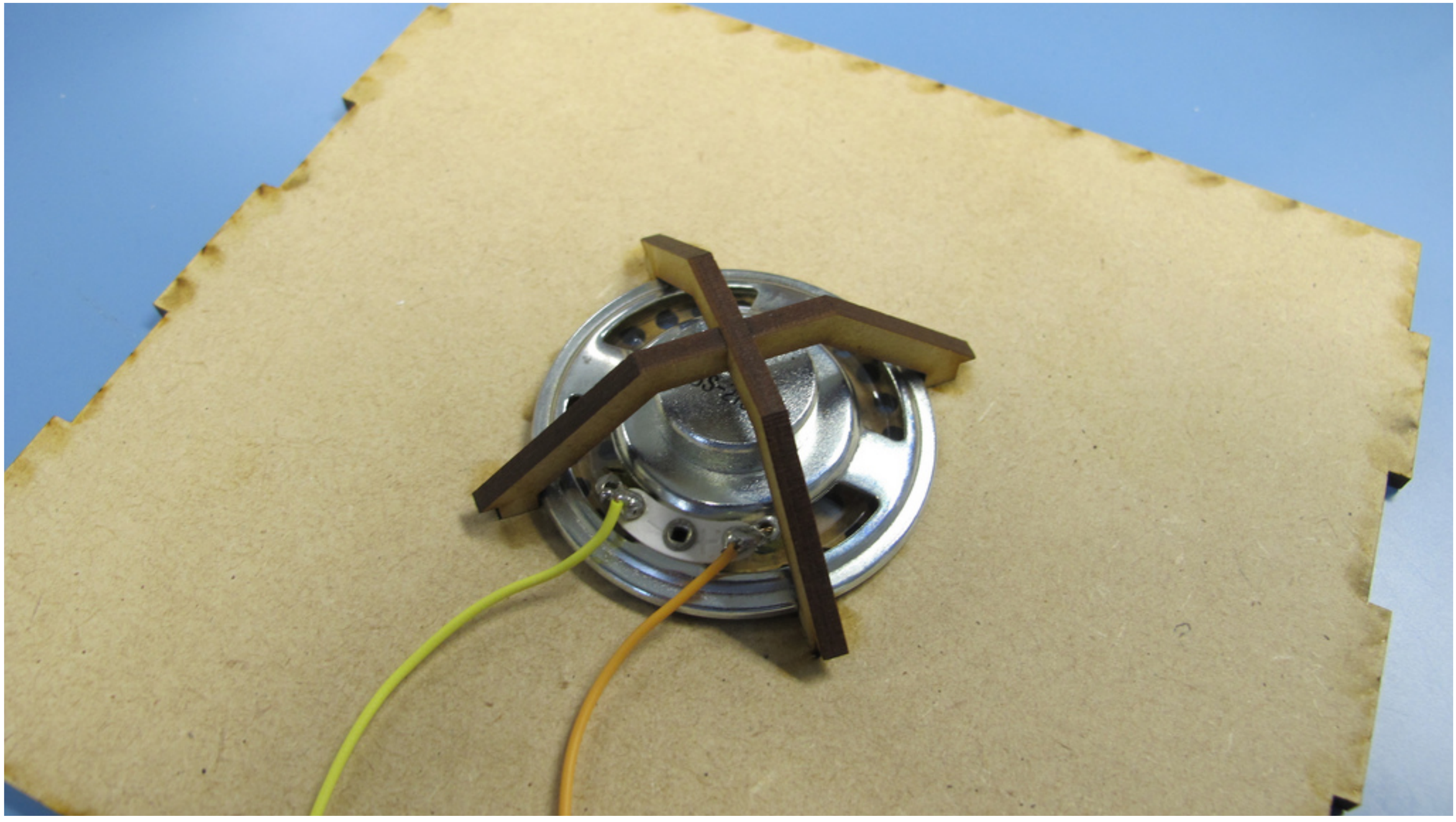
Spool ver.2

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





The speaker grille



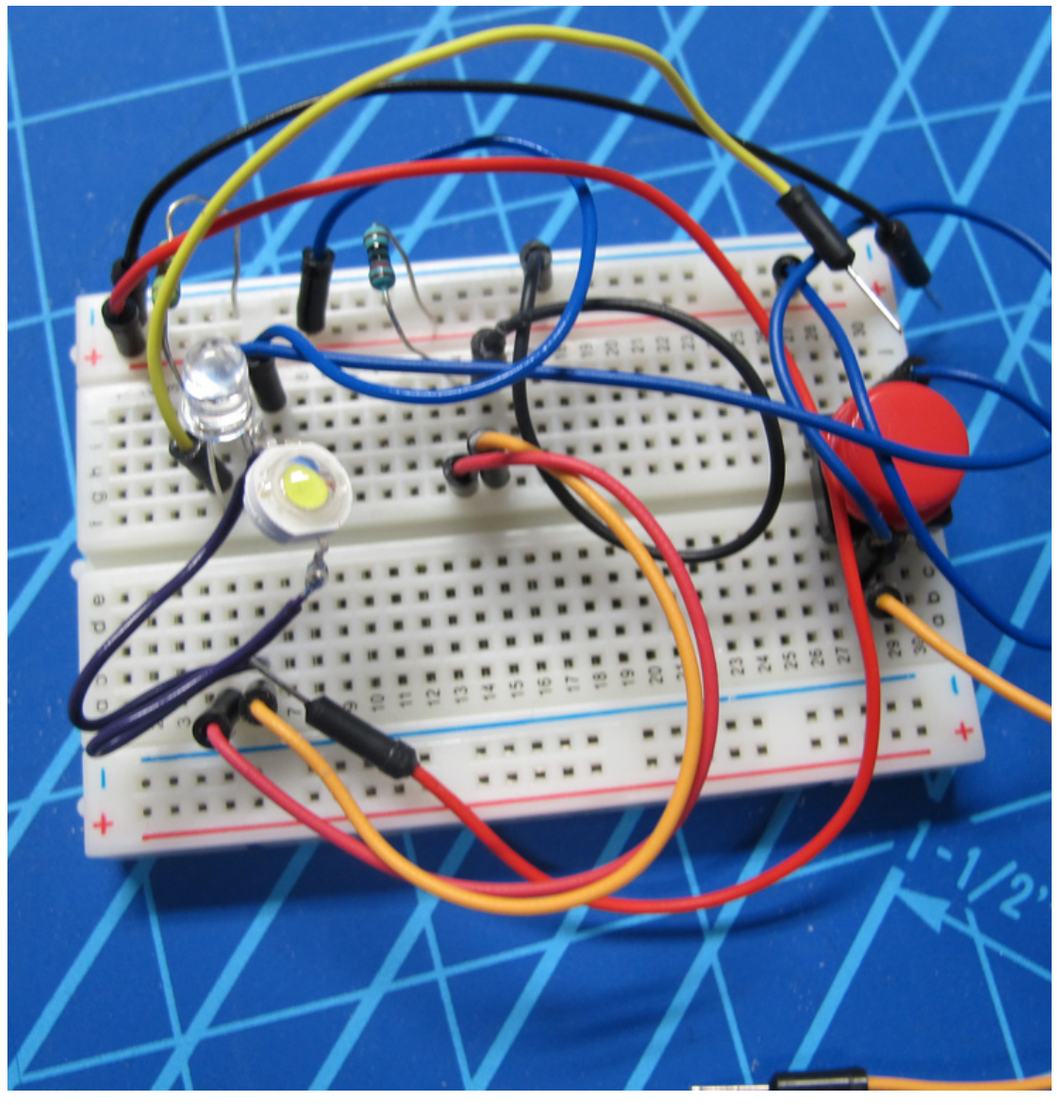
The speaker grille

Circuitry

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

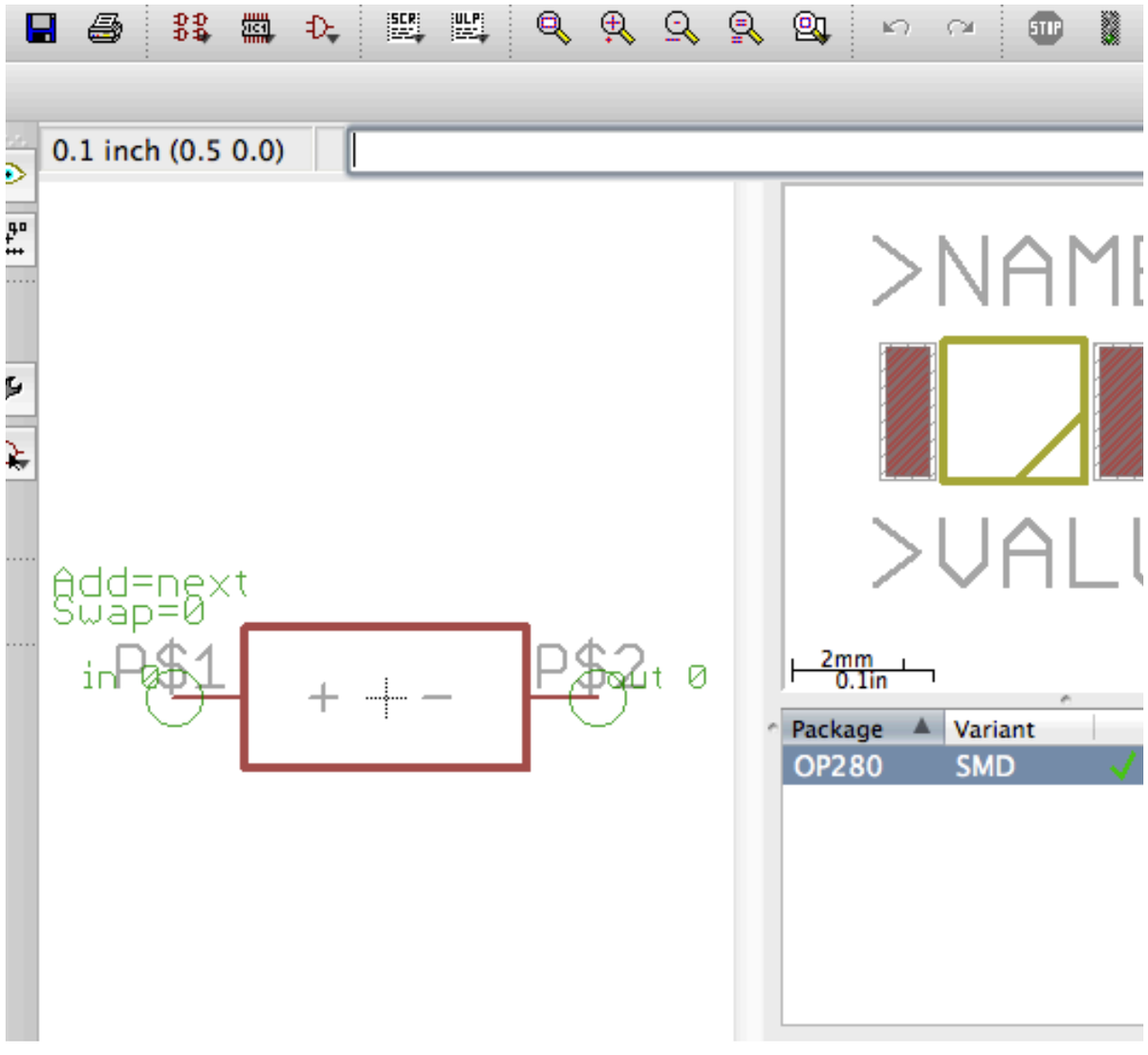
Proto-circuit

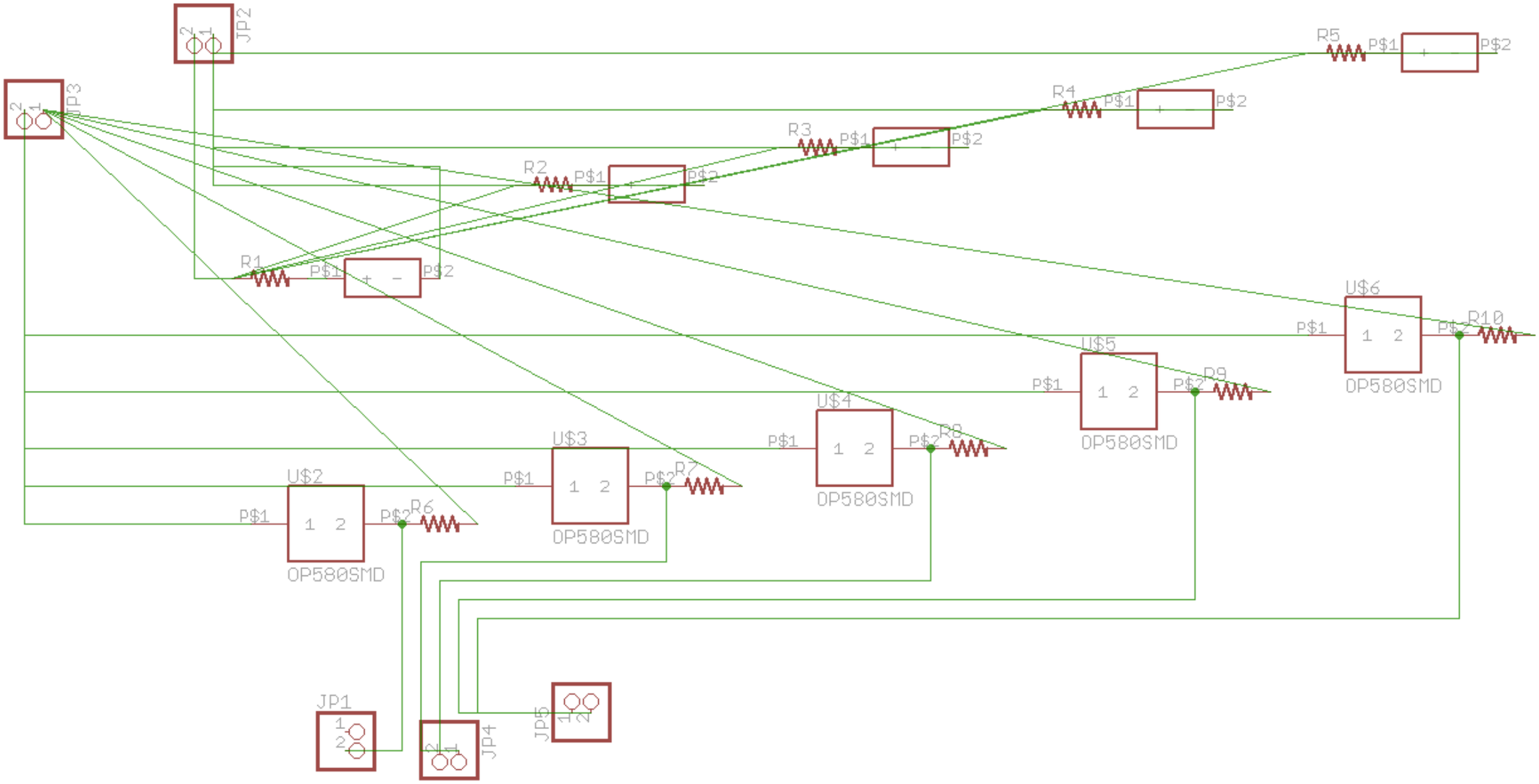
- White LED and phototransistor.
- Switch to turn on and off. Discarded later.



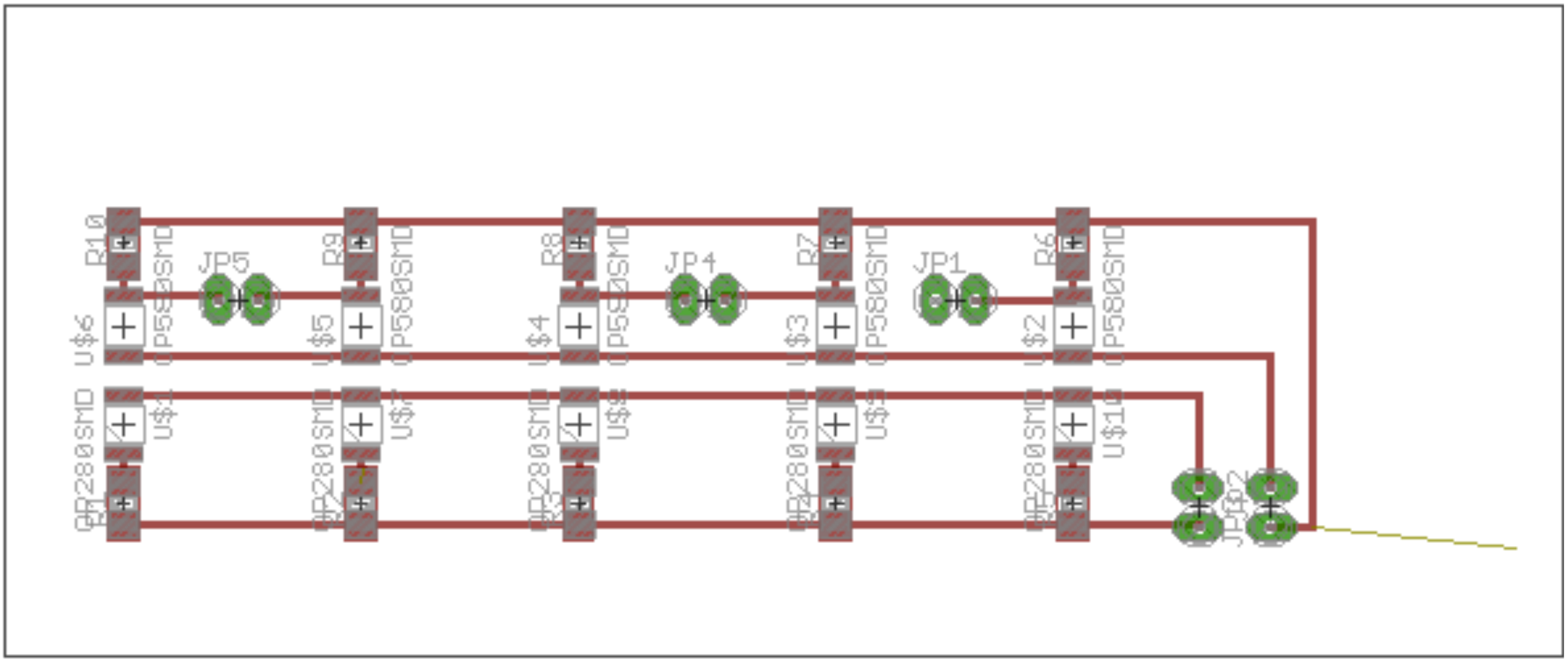
Eagle

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

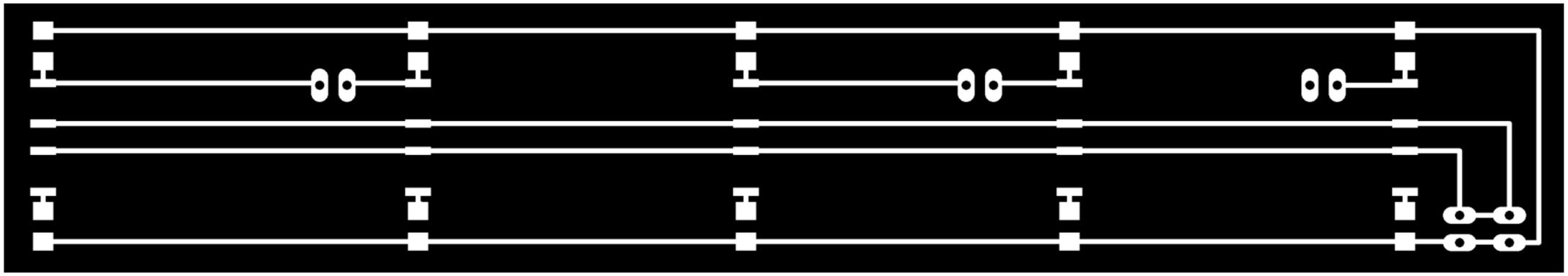



JP2
JP3
R5
P$1
P$2
R4
R3
R2
R1
U$6
R10
U$5
R9
OP580SMD
U$4
R8
U$3
R7
U$2
R6
JP1
JP4
JP5

Schematic



Board



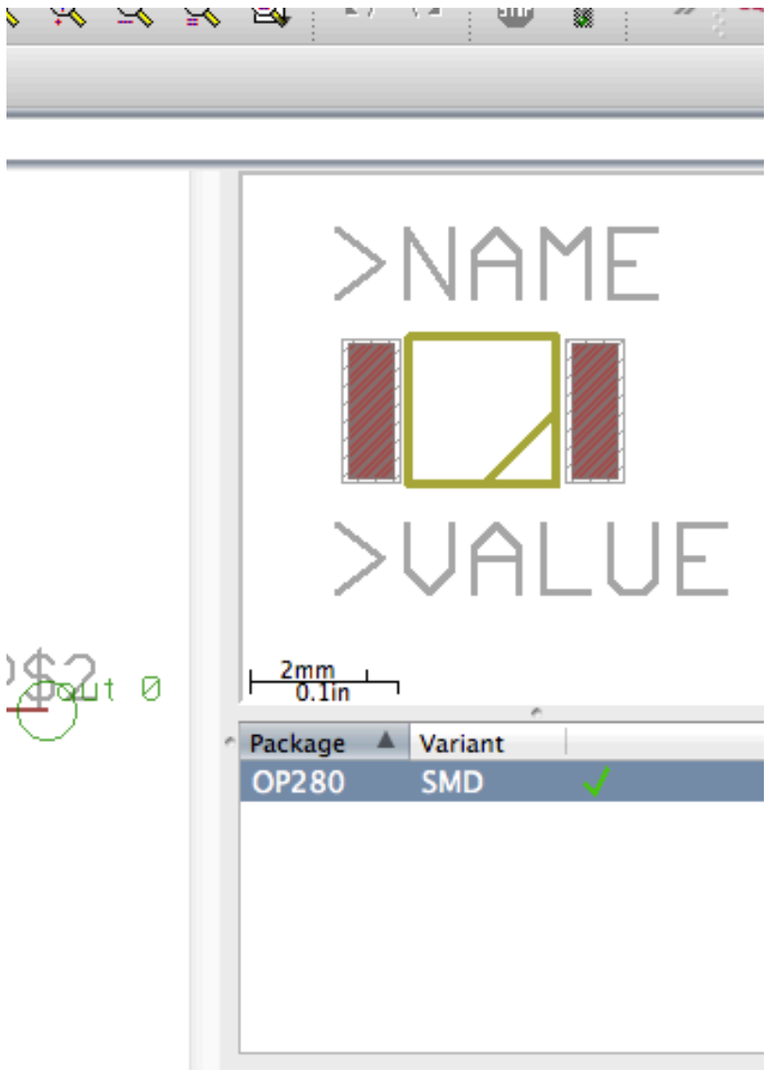
Layout for fabrication

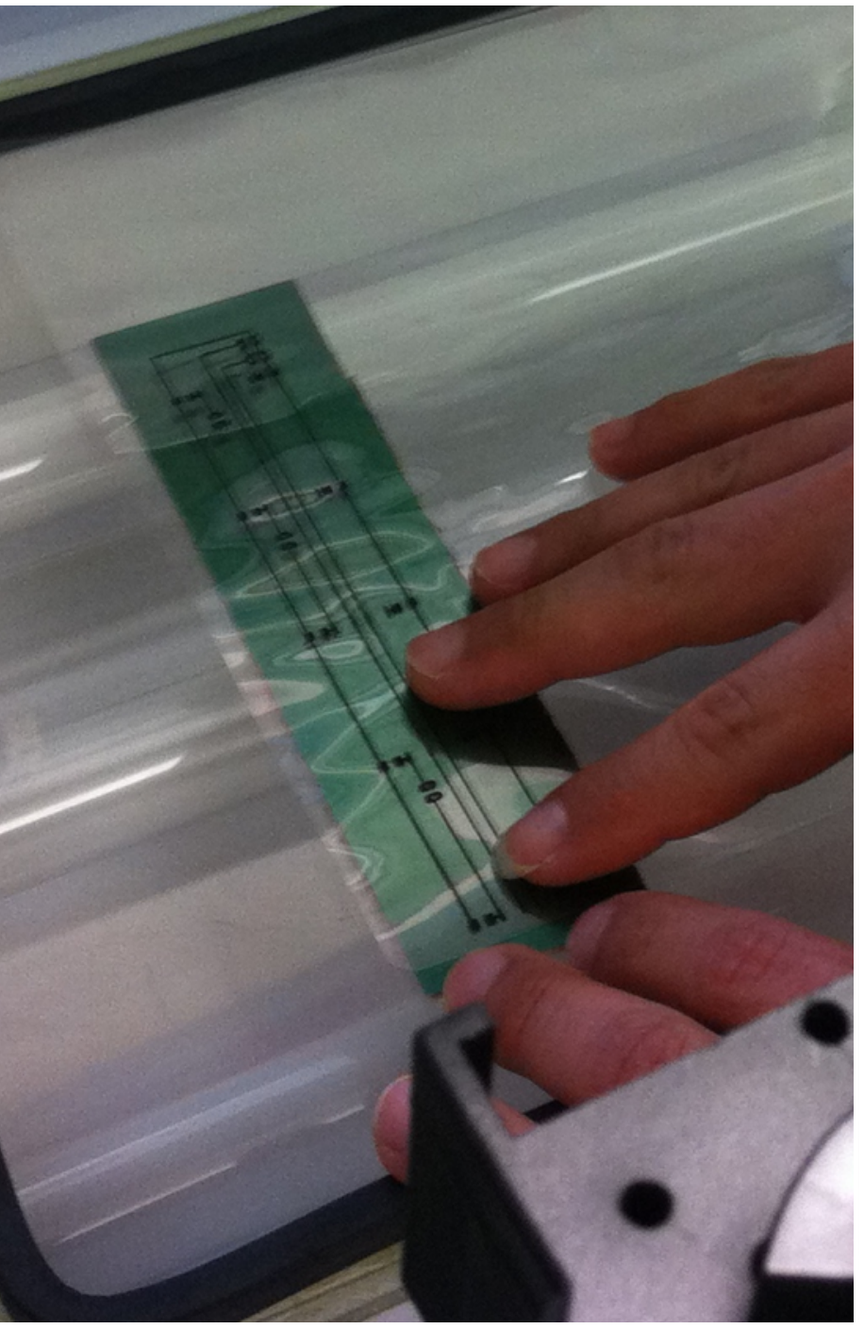
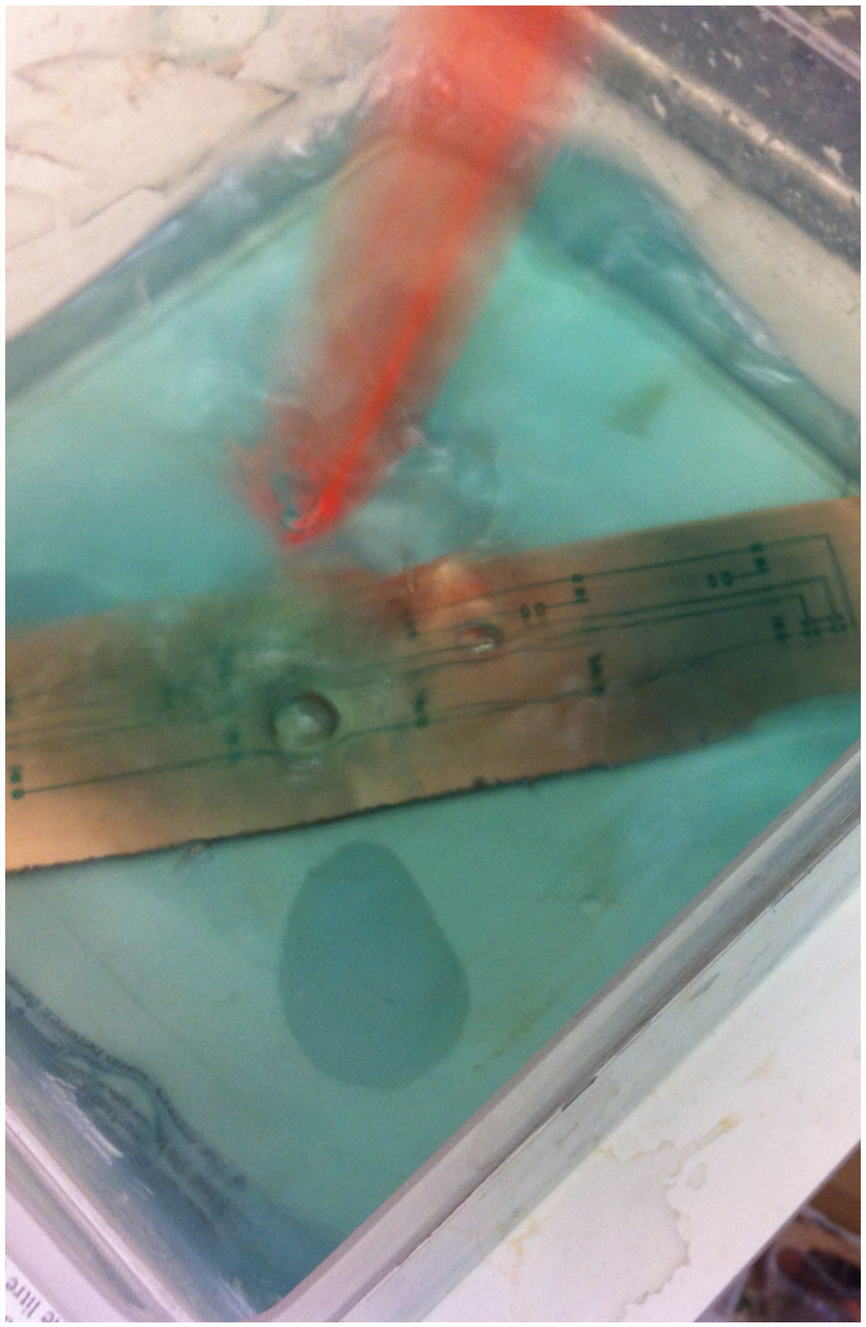
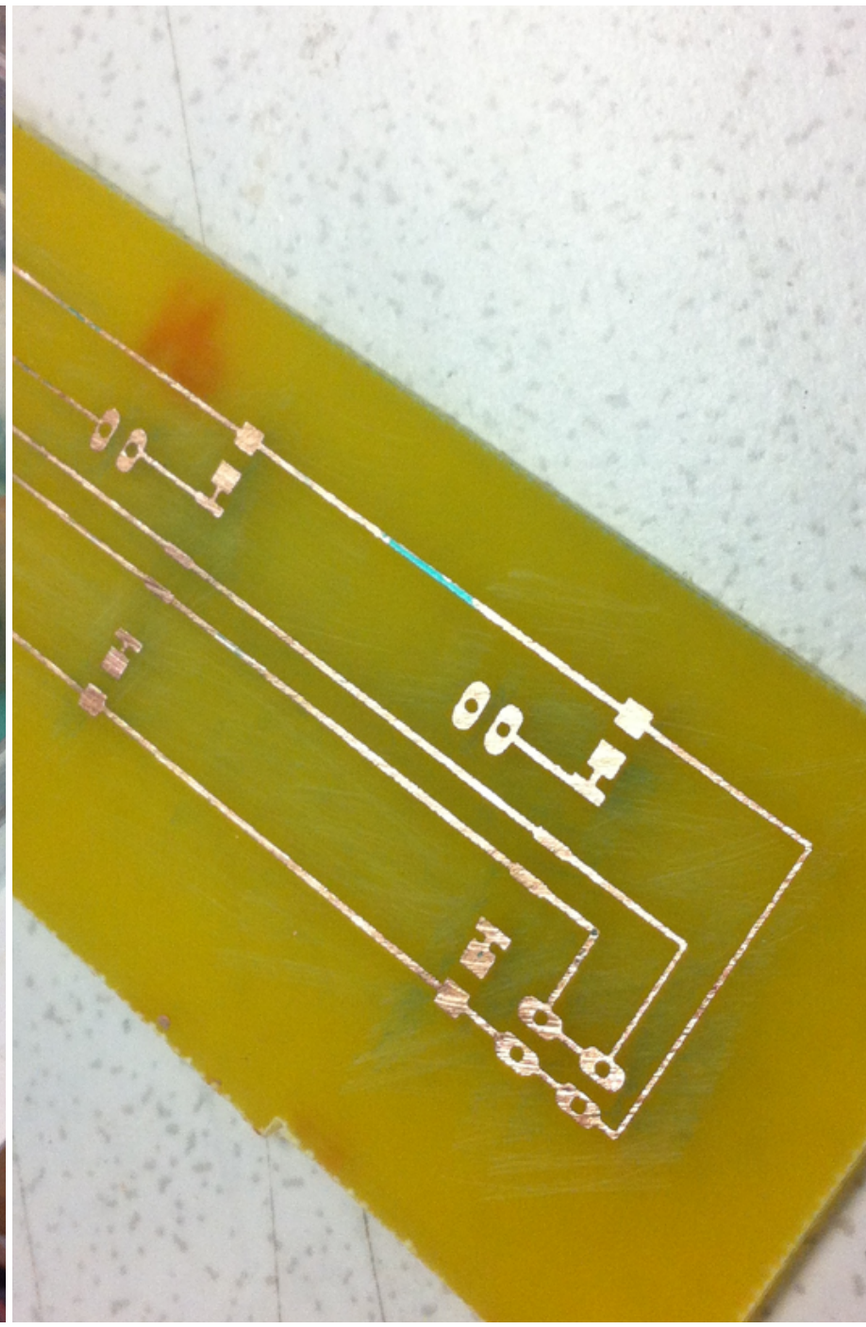
Learnings

- Eagle is very efficient if you know how to use it – use the net to figure out how.

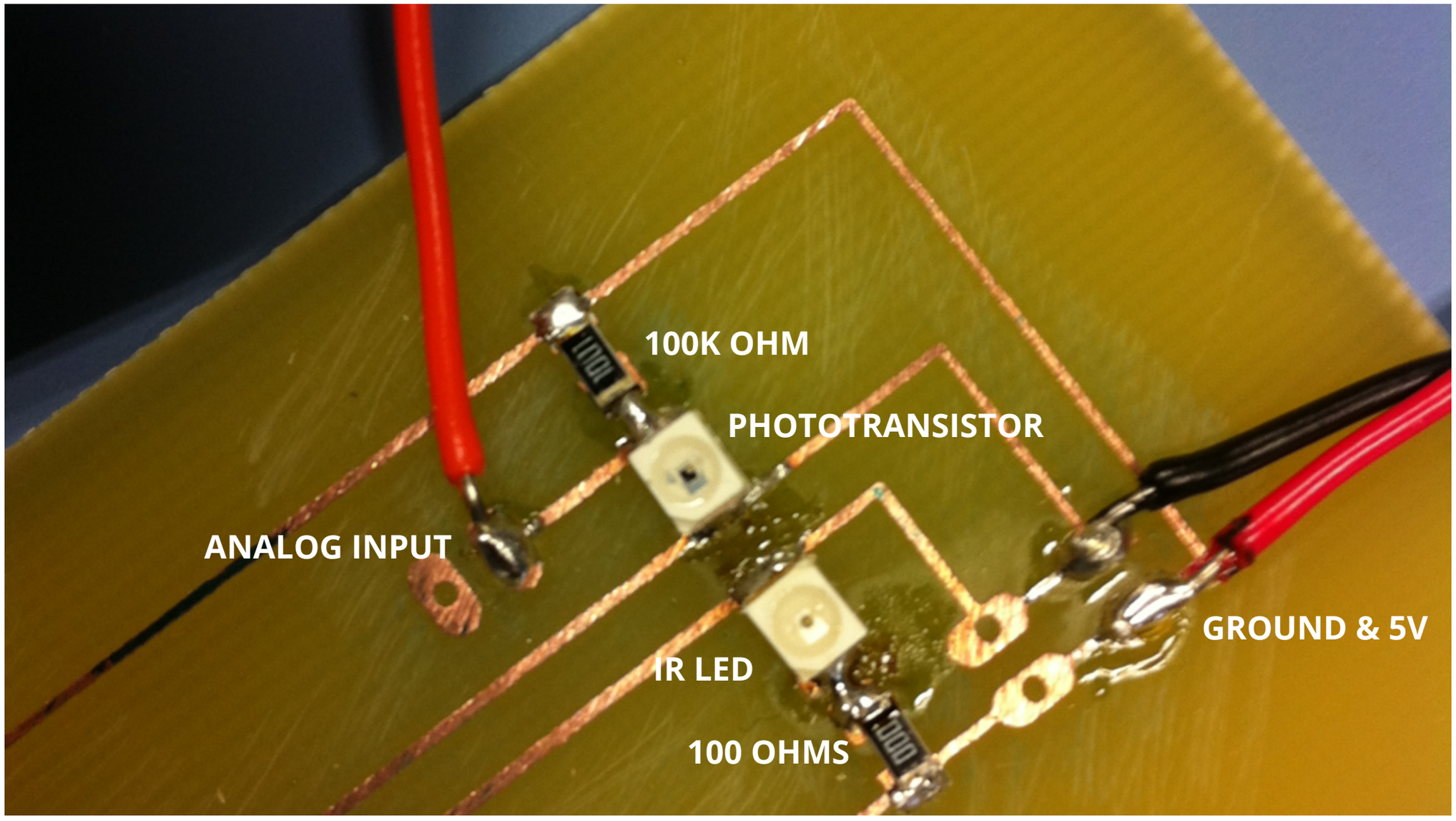
- Without spec-sheets for custom parts, you'll be stuck.

- 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-tone-ac/
- Read light › play sound