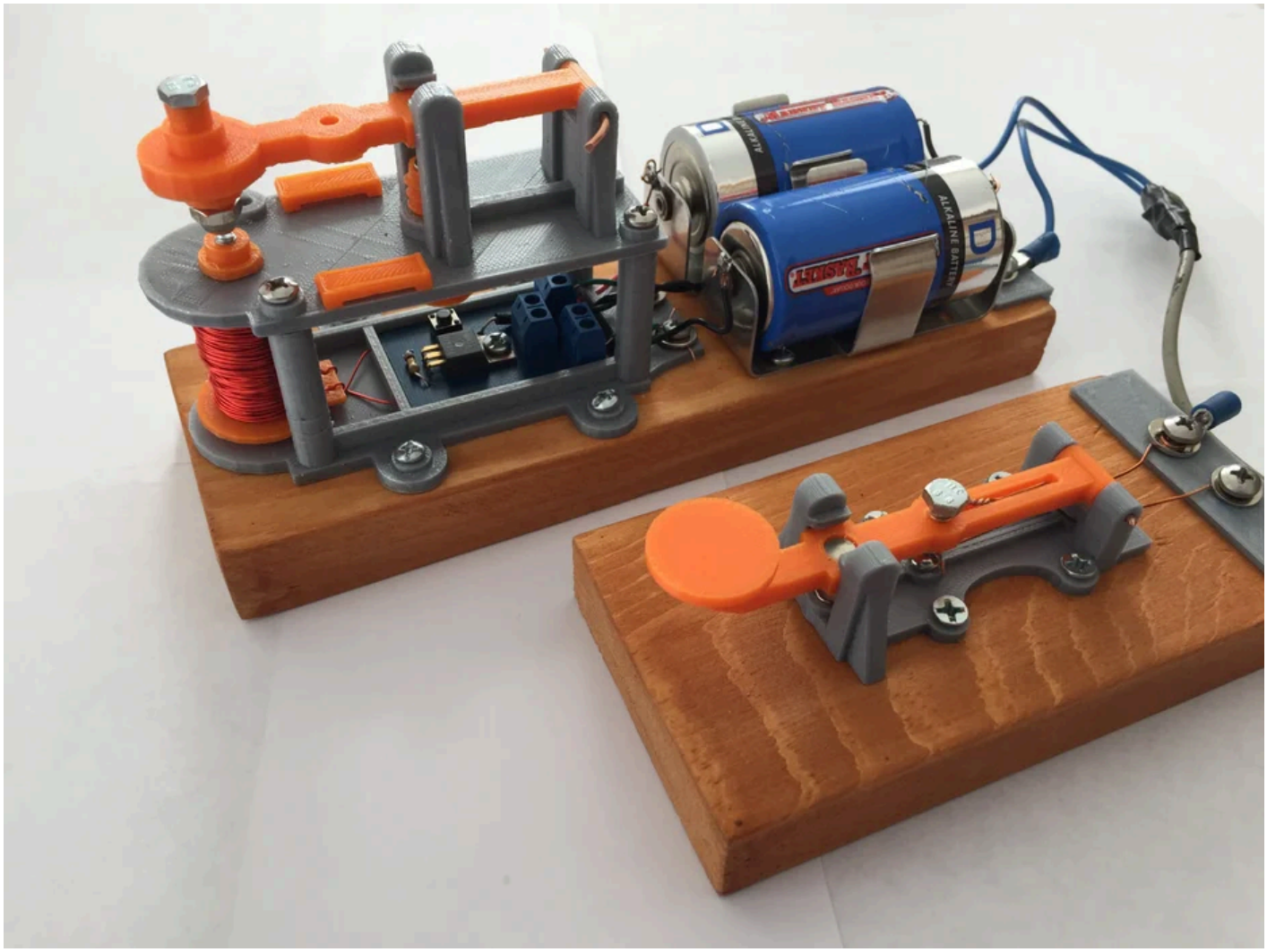
AUTODESK Instructables

3D Printed Telegraph Key & Sounder

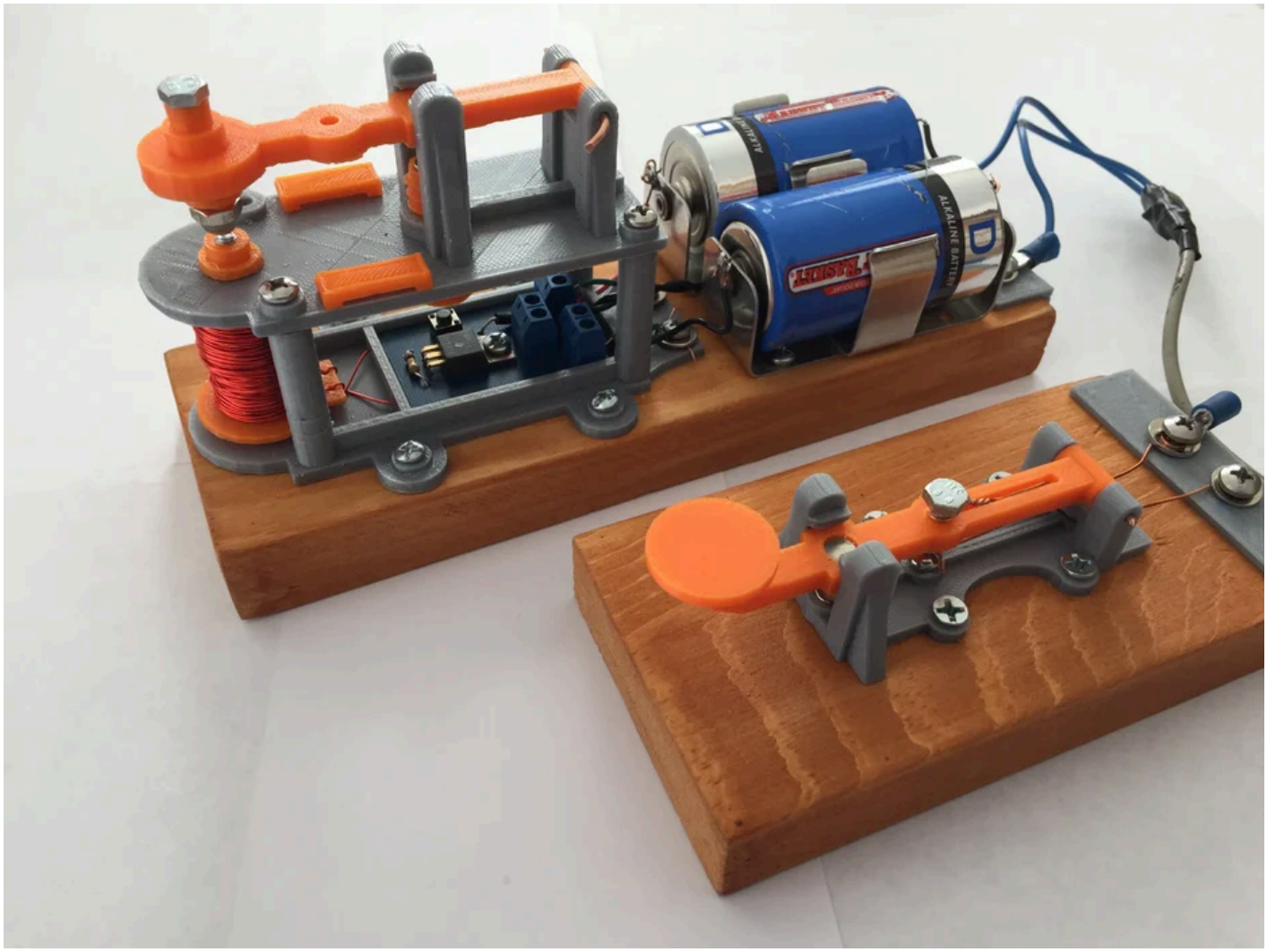
By Mattosx in Workshop3D Printing

Introduction: 3D Printed Telegraph Key & Sounder



There are some examples of 3D printed telegraph keys, but never a complete system — until now! This instructable contains all the 3D designs for both the telegraph key and sounder.

Step 1: Project Overview



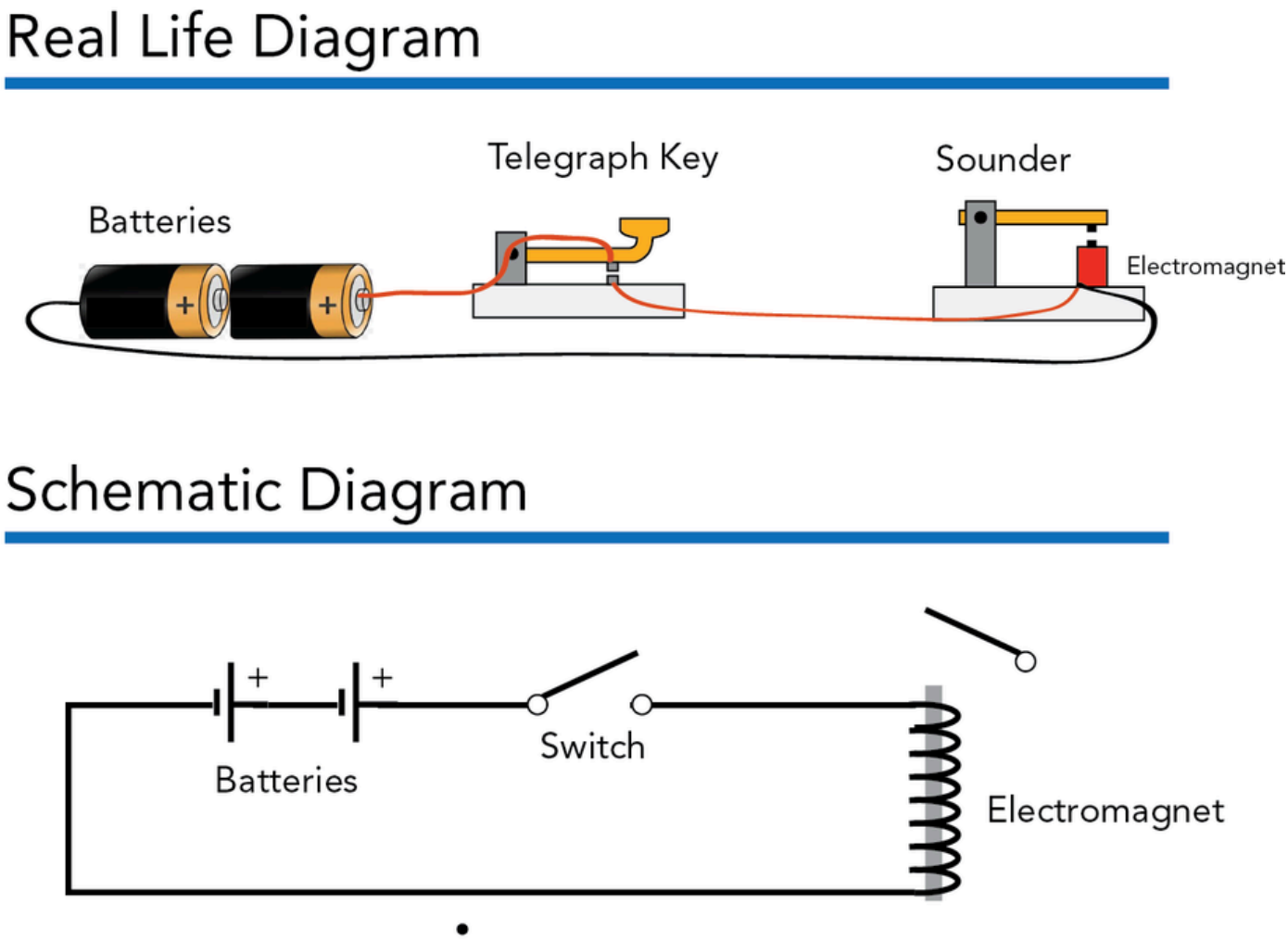
Goals

There are some examples of 3D printed telegraph keys, but never a complete system — until now! In this instructable you can download all the .STL files and print your own telegraph system which can be downloaded on the last step.

Materials Needed

- Magnet Wire
- M3.5 Bolts
  - One 40 mm long bolt
  - One 20/25 mm long bolt
  - One 15 mm long bolt
- Washers
- C or D Batteries
- Wood Screws — needs to fit in 3.5 mm holes
- Four 6x3 mm neodymium magnets
- Patience...

Step 2: Circuit Diagram and Theory



A Little History

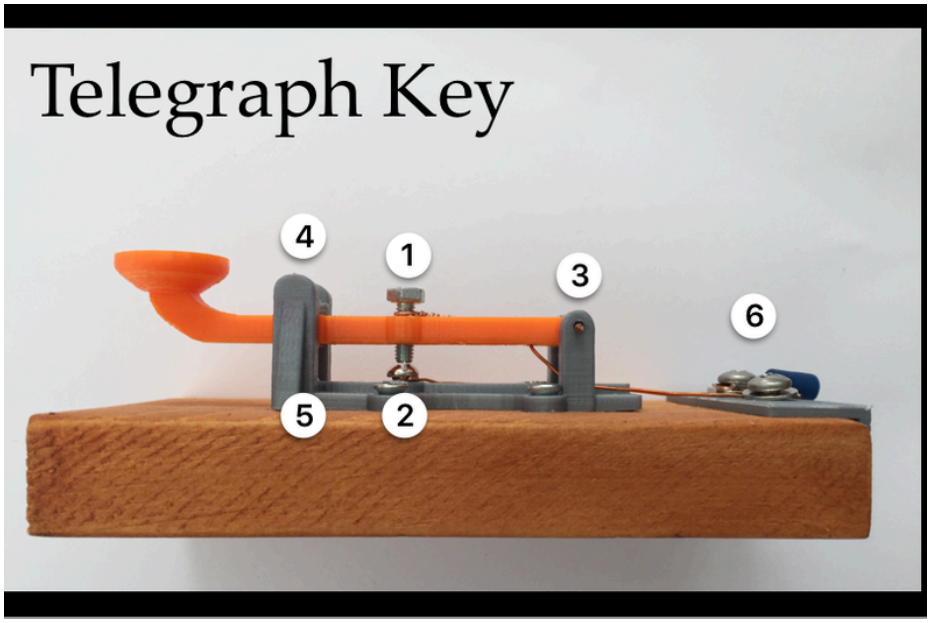
In 1820 Oersted performed an experiment where he showed a current flowing in a wire creates a magnetic field surrounding a wire. This led to the creation of the electromagnet. Some years later in the 1830s Morse took advantage of this to create an electric telegraph.

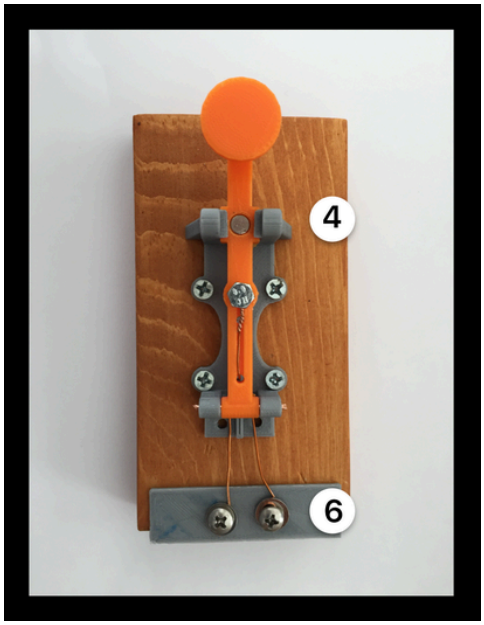
The Science behind it

First off, the electromagnet is the heart of the telegraph. A current carrying wire itself has a very weak magnetic field surrounding it. However, every time a loop of wire is wrapped around, say a bolt, the amount of magnetism keeps adding up. Eventually, there is enough magnetism to actually do something.

The telegraph is a simple loop circuit. When a telegraph key switch is pressed, the circuit is closed, and a current flows in the circuit and energizes the coiled loop of wire, the electromagnet. The electromagnet pulls a lever arm and makes a click. Releasing the key opens the circuit and the lever arm springs back up again.

Step 3: The Telegraph Key





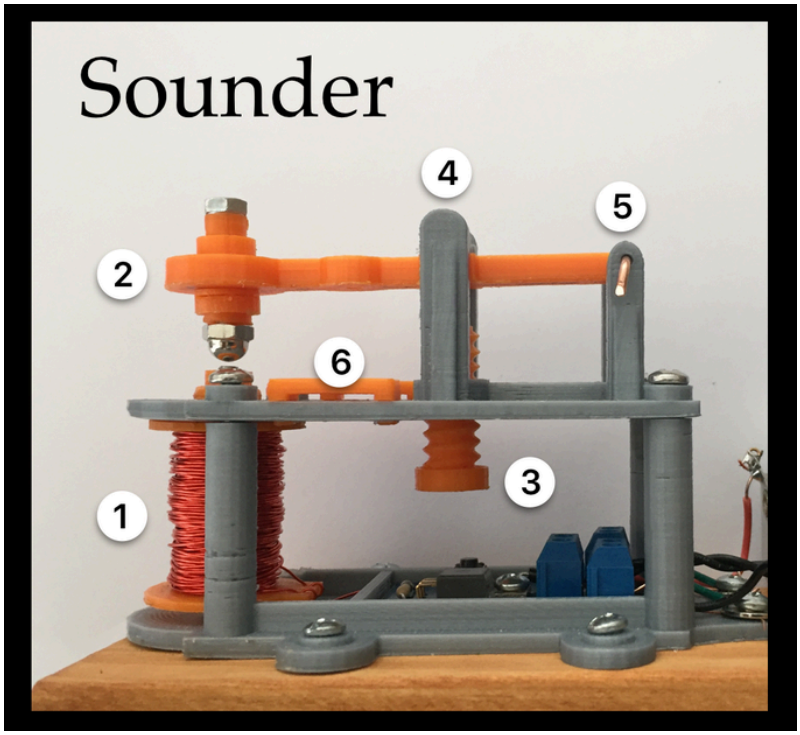
The telegraph key is the switch that completes the circuit and allows current to flow.

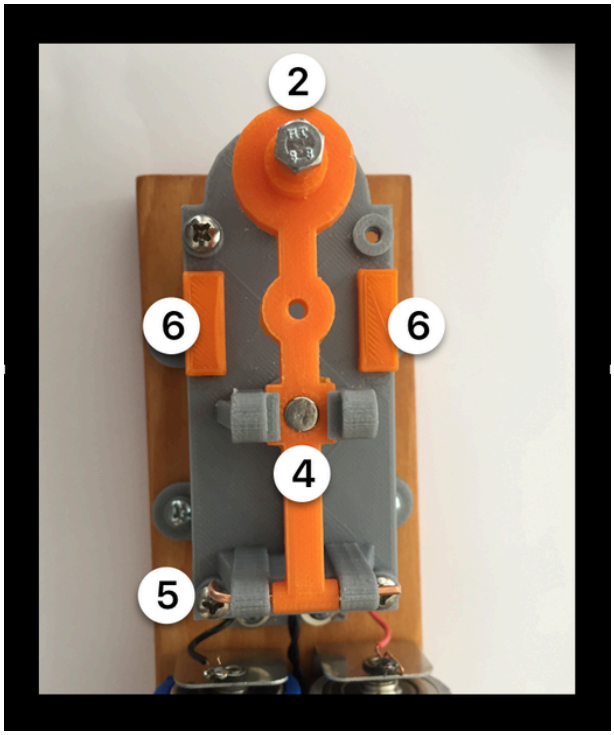
Here are the parts

1. **Top Contact Bolt** — this is a 3.5mm bolt. Wire is wrapped around the bolt to make electrical contact. Be sure to sand off the coating if you are using magnet wire. The convenient part about the bolt is that you can adjust how much travel the switch key has before hitting the bottom contact.
2. **Bottom Contact Bolt** — this can be any screw that fits. A wire is wrapped around the bolt for electrical contact.
3. **Hinge** — the hole size is 2 mm and I found 14 gauge home wiring copper wire worked perfectly.
4. **Upper Magnet** — insert two 6x3 mm neodymium magnets. You may need to shave some of the 3D printed material for the magnets to fit. You want a tight, permanent fit.
5. **Bottom Magnet** — insert two 6x3 mm neodymium magnets. Again, you want a tight permanent, fix. The bottom and top magnets must oppose each other as this is what keeps the key up. The magnets replace what would've been a spring in the original setup.
6. **Optional screw terminals** — the exposed wires are wrapped underneath a washer and kept in place with wood screws.

There has a tendency to be a spark every time the key is closed which leads to the connection becoming poorer and poorer over time. One has to clean the connection, but if you notice the image of the sounder, there is a tiny circuit board. As a modern solution, I added a MOSFET which locally switches the electromagnet on and off which takes the burden off the key. It makes it very responsive. The schematic diagram for this setup is included in a subsequent step.

Step 4: The Sounder



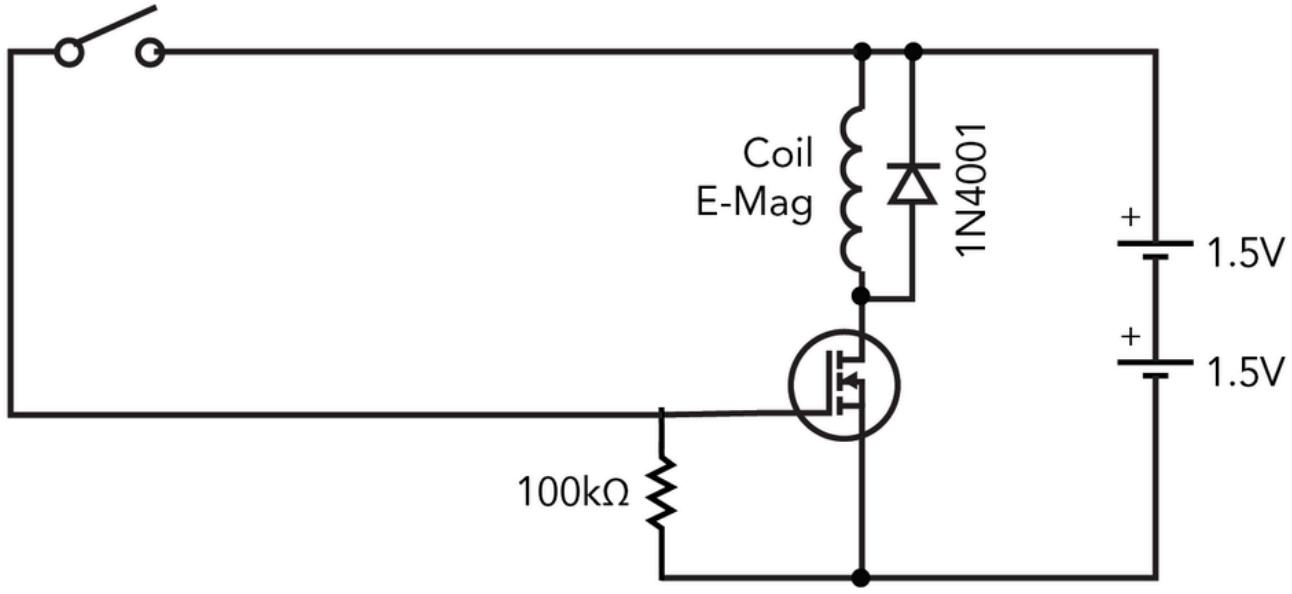


The sounder is what it sounds like — it makes sound when the electromagnet is energized by the switch. General notes: Be sure any bolts and acorn nuts you buy are magnetic!

Here are the parts:

1. **Electromagnet** — a 40 mm long 3.5mm wide bolt is used. There are a few hundred coils around the bolt which are held in place by the two orange face plates. Be sure to leave leave about eight inches of wires so there is plenty of slack to connect later.
2. **Swinging Lever** — a 20 mm long 3.5 mm bolt is used with an acorn nut at the bottom. The swinging lever is suspended by an upward magnetic force by neodymium magnets.
3. **Magnetic Force Adjuster Screw** — two 3x6mm neodymium magnets are at the top of this screw. The screw can be lowered or raised to adjust the magnetic strength to find the sweet spot for the swinging lever to operate.
4. **Upper Magnet** — two 3x6mm neodymium magnets that oppose the bottom magnets. Be careful the direction of the magnets are correct.
5. **Hinge** — a 2 mm hole where 14 gauge house wiring is perfect.
6. **Paper Tape Hole** — this is an experimental feature where paper tape can be fed through and a mark can be placed on the paper. Still a work in progress!

Step 5: Final Thoughts



As previously said, the spark on the telegraph key can degrade performance. While the telegraph will work with just a battery, switch, and electromagnet, a modern twist is to use a MOSFET to locally turn the sounder on and off. In addition to preventing wear on the telegraph key electrodes, the a long distance of wire does not negatively impact the strength of the sounder.

Parts:

- 100kΩ Resistor — use to keep the MOSFET low
- 1N4001 Diode — used as a flyback diode
- N-Channel MOSFET. I used an IRF3205

Step 6: The 3D .stl Files

The part you have been waiting for, the files!

- Everything.stl contains every 3D printed part as one big file
- GrayKeyBase.stl is the gray printed base to the telegraph key
- GraySounderParts.stl is the lower and upper structures of the sounder
- OrangeParts.stl is the orange parts as seen on the cover photo
- Wood_SidePlate.stl are the plates that can be screwed onto a wood base