



Highly Commended

# Models & Inventions

## Year 7-8

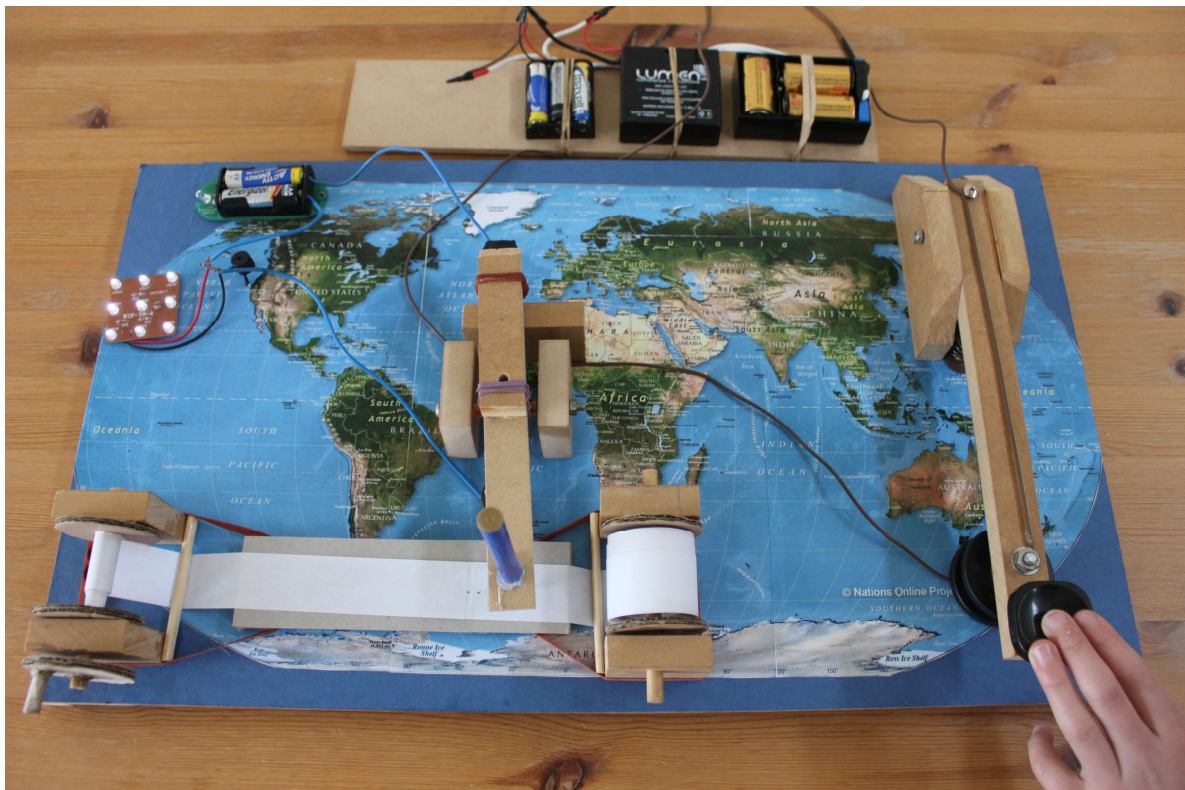
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# Morse Messenger

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### What does the Morse Messenger do?

Morse Messenger transmits dot and dash code by pressing a lever which closes an electrical circuit. The code has multiple combinations of dots and dashes for the letters and numbers. It uses an electromagnet to draw the message on paper.

Here is my demo and electromagnet experiment

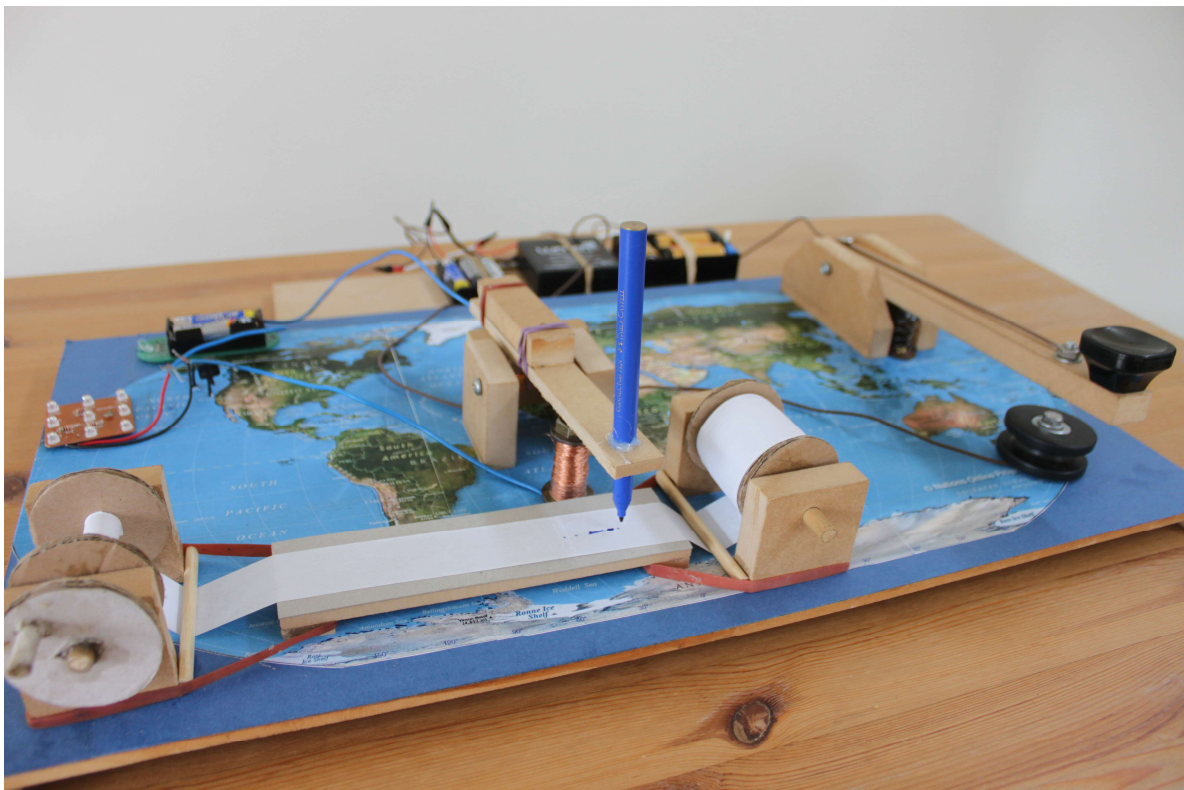
<https://youtu.be/L1wGFpSze2A>

### How does it work?

To send a code you press the lever (dot) or hold down it for a second (dash).

The transmitter circuit sends an electrical pulse powered by batteries through the wire to the copper coil to create an electromagnetic force field. Because of the electromagnetic field is right underneath the ruler, it pulls the ruler down and the pen draws the dot or dash.

The receiver circuit sends electrical current through the wire to the metal ruler and through the bolt. When the ruler is pulled down it touches the bolt and acts as a switch which also turns on a LED and buzzer.



## Electromagnet

An electromagnet is a coil of wire with a current flowing through. Inside the coil there is usually an iron rod which has two opposite poles, north and south. The magnetic force line (diagram 1) travels out from the red north pole all the way round into the blue south pole. This is called a magnetic field.

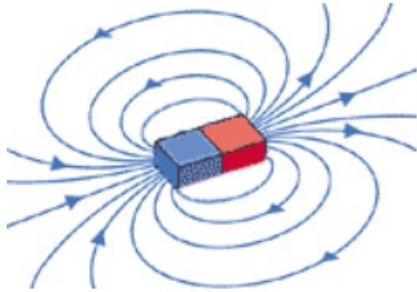


Diagram 1: Magnetic force lines.

When the coil of wire and the iron rod are together, they are called solenoids (diagram 2). Because metals like iron, steel and nickel make good magnets.

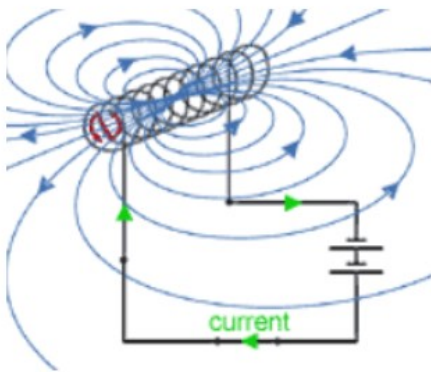


Diagram 2: Solenoid in circuit.

The flow of electric charge is called a current. Because the electric charge is negative, the direction it travels is from the positive north pole towards the negative south pole (diagram 3).



Diagram 3: Solenoid with copper wire.

When the current flows through the wire, it turns the iron bolt to a powerful magnet. When there is no current the iron bolt and wire coil does not create an electromagnetic field (diagram 4). This is also a non-contact force because the electromagnet pulls down the metal ruler without touching it.

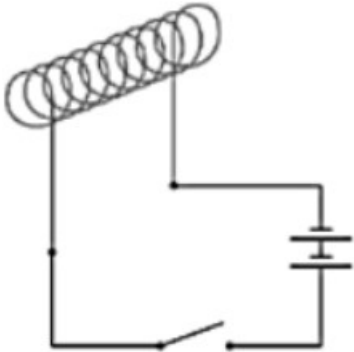


Diagram 4: Open circuit therefore no current and no electromagnetic field.

If there are more coil of wire around the iron bolt it makes the electromagnet field stronger (diagram 6). Also, if the current is increased the electromagnetism will become stronger too (diagram 5).

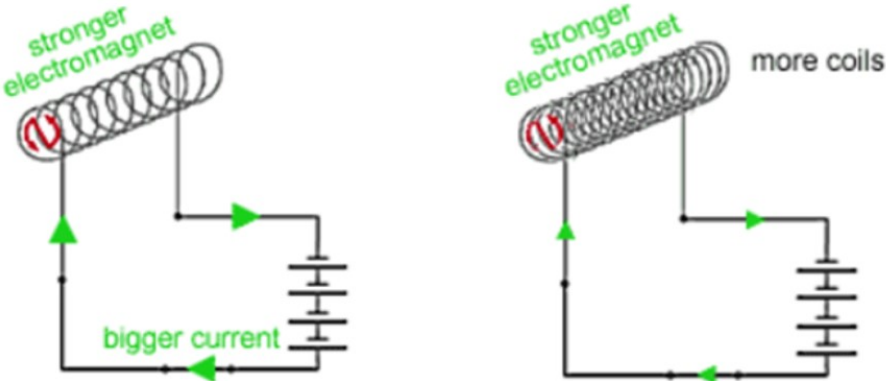
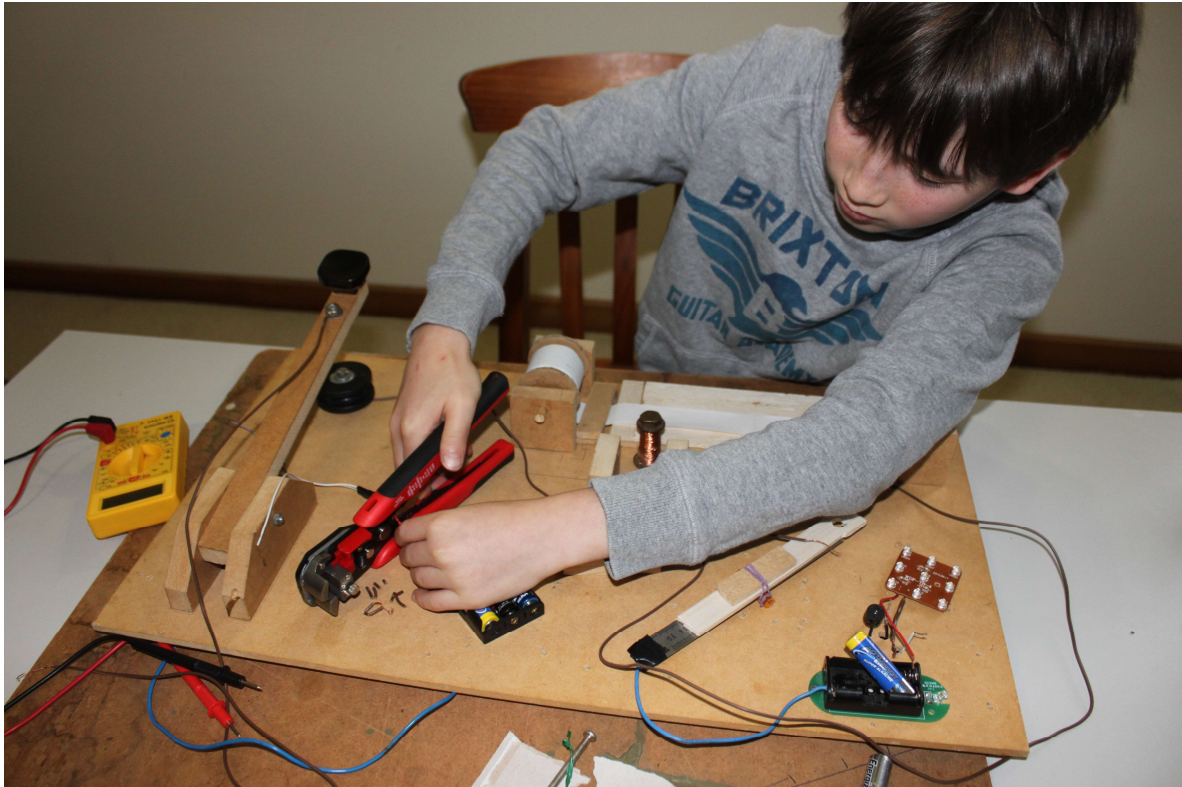


Diagram 5: Closed circuit with more current make stronger electromagnet.  
Diagram 6: Closed circuit with more coils make stronger electromagnet.

### How did I make the Morse Messenger?

I used wood and a bolt for the axle to make the transmitter lever. I made the receiver with a metal ruler, rubber band, bolt and some wood. The hardest part was making the solenoid using a drill to wind the thin wire around the bolt. I also glued cardboard circles to a stick to make a wheel for the paper. Lastly, I cut off the plastic insulation on the wires before wiring the circuits.





### How did I overcome the problems?

To make the solenoid, I tied the very thin copper wire to the bolt but it kept breaking, so I had to be careful each time. Also, I didn't have enough batteries as the current was too weak with 8V for electromagnet to pull the metal ruler. So I added 4V batteries to the circuit.

### References

- 1) <https://www.ducksters.com/science/magnetism.php>
- 2) <https://www.dkfindout.com/us/science/magnets/solenoids/>
- 3) [https://www.kidsgen.com/school\\_projects/electric\\_magnets.htm](https://www.kidsgen.com/school_projects/electric_magnets.htm)
- 4) <https://copperalliance.org.uk/knowledge-base/education/education-resources/electromagnets/>
- 5) <https://online.clickview.com.au/libraries/videos/3715219/magnetic-force>

### Acknowledgement

Thanks Dad for teaching, filming and supervising me to saw, drill and wire cut. Helping me make the solenoid when the wire kept breaking.

Morse Code

<b>A</b> ALFA •••	<b>B</b> BRAVO ••••	<b>C</b> CHARLIE •••••	<b>D</b> DELTA ••••	<b>E</b> ECHO •	<b>F</b> FOXTROT •••••	<b>G</b> GOLF ••••	<b>H</b> HOTEL •••••	<b>I</b> INDIA •••
<b>J</b> JULIETT •••••	<b>K</b> KILO ••••	<b>L</b> LIMA •••••	<b>M</b> MIKE •••••	<b>N</b> NOVEMBER •••••	<b>O</b> OSCAR •••••	<b>P</b> PAPA •••••	<b>Q</b> QUEBEC •••••	<b>R</b> ROMEO •••••
<b>S</b> SIERRA ••••	<b>T</b> TANGO ••••	<b>U</b> UNIFORM •••••	<b>V</b> VICTOR •••••	<b>W</b> WHISKEY •••••	<b>X</b> X-RAY •••••	<b>Y</b> YANKEE •••••	<b>Z</b> ZULU •••••	<b>0</b> NADAZERO •••••
<b>1</b> UNAONE •••••	<b>2</b> BISSOTWO •••••	<b>3</b> TERRATHREE •••••	<b>4</b> KARTEFOUR •••••	<b>5</b> PANTAFIVE •••••	<b>6</b> SOXSIX •••••	<b>7</b> SETTESEVEN •••••	<b>8</b> OKTOEIGHT •••••	<b>9</b> NOVENINE •••••
<b>.</b> PERIOD •••••	<b>,</b> COMMA •••••	<b>?</b> QUESTION •••••	<b>!</b> EXCLAMATION •••••	<b>'</b> APOSTROPHE •••••	<b>"</b> QUOTATION •••••	<b>(</b> OPEN •••••	<b>)</b> CLOSE •••••	<b>/</b> SLASH •••••
<b>_</b> UNDERSCORE •••••	<b>:</b> COLON •••••	<b>;</b> SEMICOLON •••••	<b>+</b> PLUS •••••	<b>-</b> HYPHEN/MINUS •••••	<b>=</b> DOUBLE DASH •••••	<b>&amp;</b> AMPERSAND •••••	<b>\$</b> DOLLAR SIGN •••••	<b>@</b> AT SIGN •••••