How to build a solar beep

Material

You will need the following materials for the construction:

- Fundament of the experiment (wooden plate, piece of wood, etc.)
- Thick copper wire (1 mm or 1.5 mm diameter), possibly insulated
- Flexible cable (preferably in two colours, for positive and negative)
- Electric buzzer ("beeper"), 3-6 V (max. 12 V) DC as normal operating voltage
- Solar panel: For 3V at least 6 solar cells in series, for 6V at least 12 cells in series, (for 12V at least 24 cells in series), approx. 100 mA rated current
- Luster terminals (insulating screw joint)
- Drilled-through piece of wood or a piece of plastic pipe for the handle of the ring

Optional :

- Large capacitor (max. working voltage at least 2V higher than the open circuit voltage of the solar panel), at least 1 microfarad
- Small digital voltmeter
- Switch
- Push button switch (normally off)
- Decorating material
- (Hot) glue
- Cable ties
- Small screws
- Insulating tape

Tools

For the construction you need the following tools:

- Drilling machine and drill set
- Wire stripper
- Electrician's screwdriver
- Scissors
- Carpet knife (cutter)
- Soldering iron
- Soldering tin

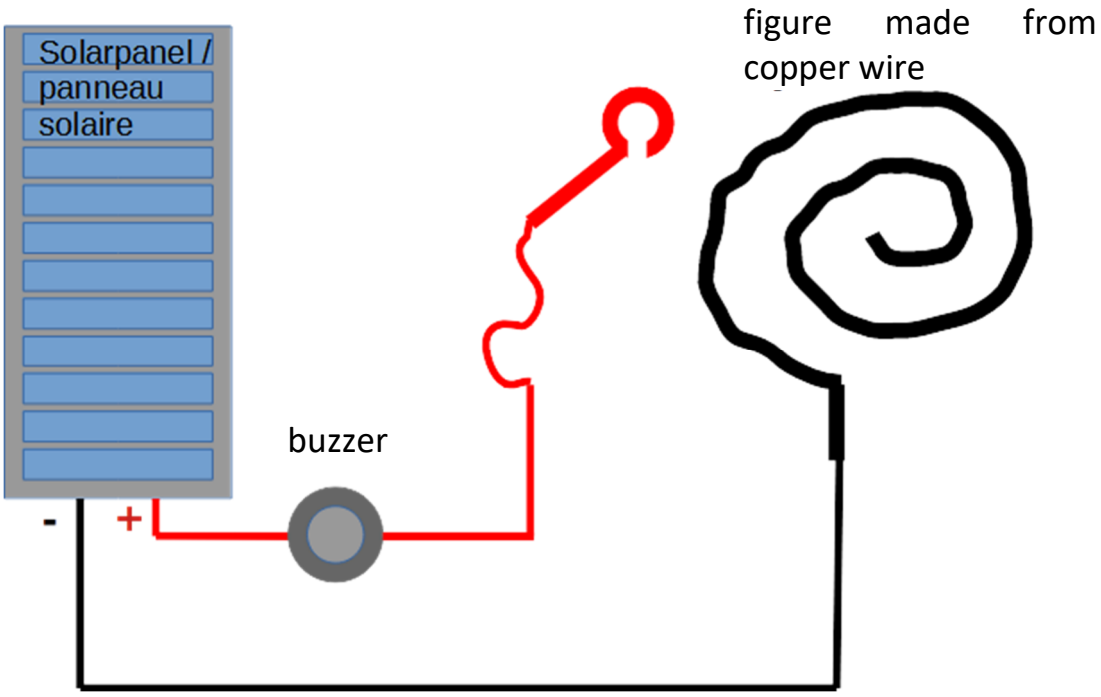
Step by step instruction

Schritt 1: Construct and test the electrical circuit

It is best to first build and test the electrical circuit. The drawing below shows the simplest version. This works in direct sunlight or outside when the sky is very bright.

We connect with a cable (e.g. by soldering or connecting with a luster terminal) the negative pole of the solar panel with the "figure", which we bend from a thick copper wire. If the wire is insulated, we first remove this insulation with the carpet knife (cutter).

Connect the buzzer to the positive pole of the solar panel with one cable. With a second cable, we connect the buzzer to the copper ring, which we bend from a piece of the same wire as the "figure". It is best to make a wooden or plastic handle for the ring. The last piece of wire in front of the ring should be made of a flexible cable, so that the person playing can easily move the ring.



Sketch of the electrical circuit in its simplest version. (Thick line: copper wire, thin lines: flexible cable)

Additional options:

- To be able to switch off the experiment completely, we install a "main switch". A simple electrical switch that we install in the positive cable directly after the solar panel is sufficient for this.

- To make the hot wire work even with less light, we can install a capacitor in parallel to the solar panel. This charges slowly and can deliver the current for buzzing in a short time.

The capacitor is installed parallel to the solar panel: the positive pole of the capacitor is connected to the positive wire, the negative pole to the negative wire.

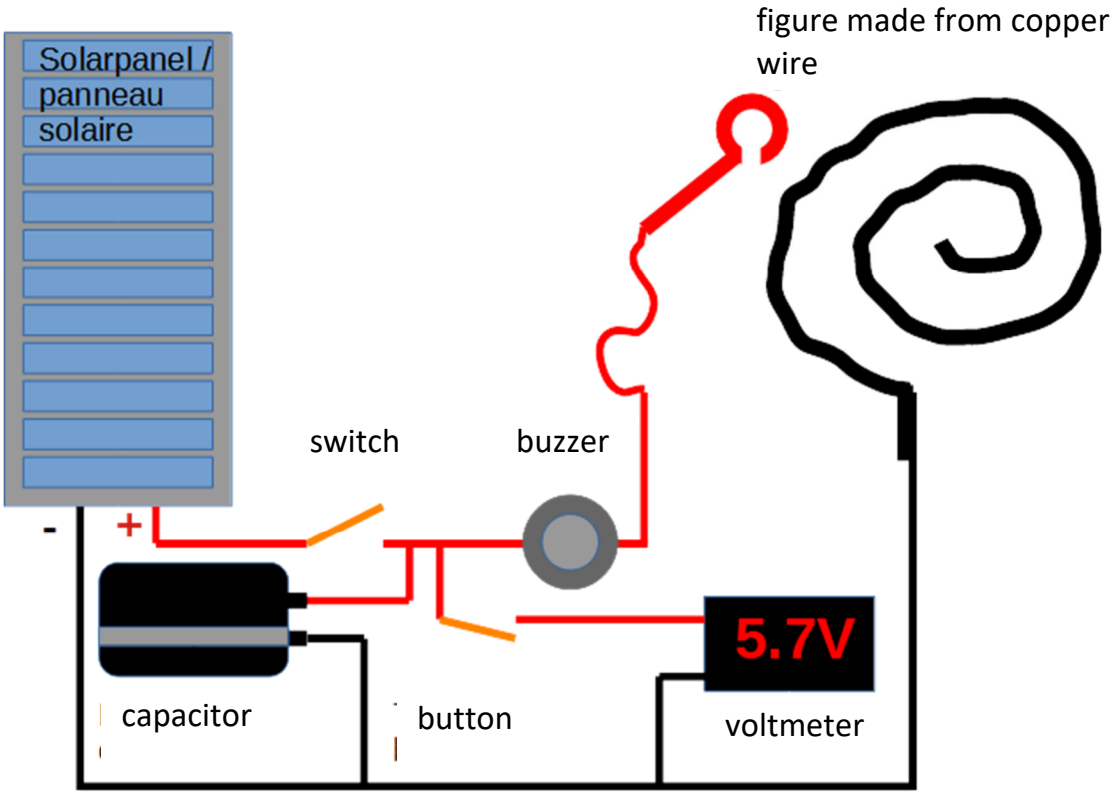
- To be able to measure the state of charge of the capacitor, we optionally install a small digital voltmeter. Since the voltmeter itself needs a few volts to function, this only makes sense with a buzzer of at least 6 V operating voltage (or solar panel of at least 6 V normal working voltage).

The voltmeter is installed in parallel with the solar panel and the capacitor: the positive pole of the capacitor is connected to the positive cable, the negative pole to the negative cable.

Since the voltmeter consumes energy and thus empties the capacitor, it makes sense to connect it via a push-button switch. When the push-button is pressed, the voltage of the capacitor is briefly displayed.

The push-button switch is installed between the positive cable and the voltmeter.

The following sketch shows the setup with a main switch, a capacitor and a small voltmeter:



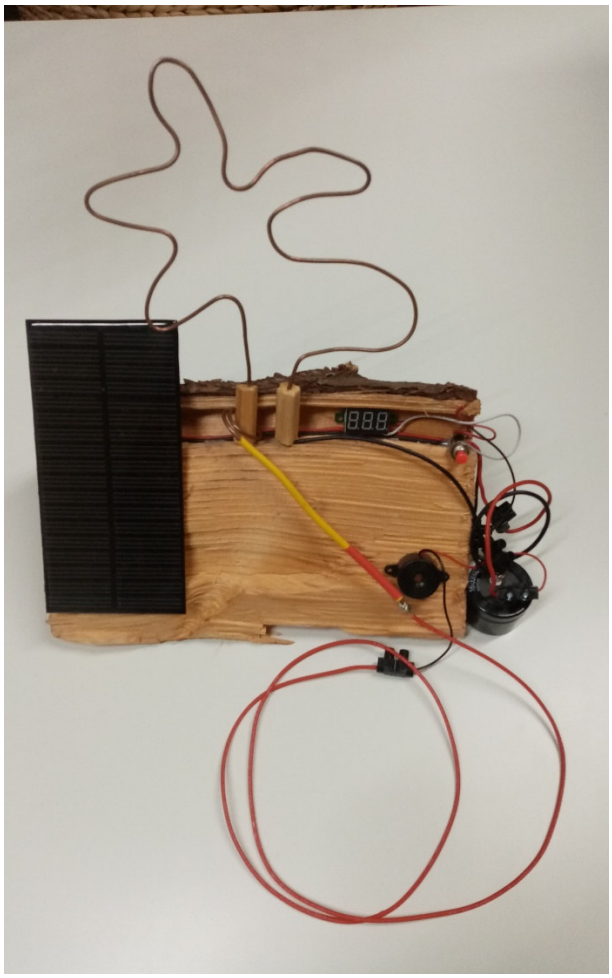
Sketch of the electrical circuit with main switch, capacitor and voltmeter. (Thick line: copper wire, thin lines: flexible cable, orange line: switch)

Step 2: Inserting it in a wooden base

As soon as the electrical construction is working, we can make a fundament out of a wooden board, a piece of plywood, etc. We use the drill to make the necessary holes to be able to put the figure in. With the drill we make the necessary holes to be able to put the figure in. Then we fix all the elements with small screws, glue or cable ties. It is recommended to insulate a small piece of copper wire at the very beginning and possibly at the end of the "figure" (e.g. with insulating tape) so that the ring can be "parked" there when no one is playing, without it buzzing all the time.

Step 3: Decorate

Finally, we can paint and decorate our experiment. The following photos give a few ideas for this:



Two examples of how the electrical components are attached to a fundament.

Maintenance

Over time, the copper wire oxidises and the electrical contact deteriorates. The buzzing sound is only heard when contact is made with more pressure. When this happens, we should grind the surface of the non-insulated wire of the "figure" as well as the ring with a small piece of sandpaper.