Homemade Relay Shockers

Overview Today, you get to learn how to use an electrical switch that uses magnetism in order to operate. And you can shock yourself silly with this experiment at the end when you turn it into a buzzer.

What to Learn Relays are switches that turn on and off with electricity. They can be NO (normally open) or NC (normally closed), depending on how you hook them up. This relay experiment will actually give a nice blue spark when fired up, along with a nice zap to the hand that touches it in just the right spot. You can also use this relay in your electricity experiments as a switch you can use to turn things on and off using electricity (instead of your fingers moving a switch).

Materials

- Relay
- AA battery case
- 2 AA batteries
- LED
- Motor
- 9V battery with clip
- Alligator wires

Lab Time

This lab has two parts. The first walks you through how to use the relay as a switch, and the second shows how to wire up the relay so it's a buzzer/shocker.

Using the relay as a switch:

1. Snap the clip onto the 9V battery.
2. Connect the red positive wire from the 9V battery to an alligator clip lead. Connect the other end of the alligator clip lead to one side of the coil (the video will show you how to find out which tab on your relay this is).
3. Connect the black negative wire from the 9V battery to another alligator clip lead.
4. Tap the other end of this alligator clip lead to the other side of the coil (again, the video will show you how to find out which tab on your relay this is). Your relay should *click*. *Don't connect this wire permanently to the relay. Just tap it.*
5. Set this circuit aside. Leave the alligator clip from step 5 next to but not touching the relay terminal.
6. Insert your AA batteries into the case. Flat side (minus) goes to the spring.
7. Attach one alligator clip to each of the metal tips of the wires from the battery case. Make sure you've got a good metal-to-metal connection. You should now have two alligator clips attached to the battery pack.
8. Attach the end of the alligator clips that's connected to the black wire (negative) from the battery case to the flat side of the LED. It doesn't matter what color the alligator clip wire is.

9. Attach the other alligator clip that's connected to the red wire (positive) from the battery case to the longer LED wire. Again, it doesn't matter what color the alligator clip wire is.
10. Your LED should light up!
11. Once your LED is illuminated, what happens if you take it out and insert it in the opposite way into the circuit? (Reverse the polarity.) Does it still work?
12. You now have two circuits – one that lights up the LED and one that makes the relay click. Let's combine them so that when the relay clicks, it turns on the LED.
13. Remove one of the wires from the LED and replace it with a third wire. Spread this out in a big circle on your desk. When you touch the two free alligator clip leads together, the LED should still light up.
14. Now pull over your relay circuit. Clip one of the free alligator clip leads to the second and third contact of the relay on the same row of contacts of your relay.
15. Energize your coil by taping the alligator clip from step 5 to the terminal so it clicks. What happens? Write it here:

    _____

16. Move the alligator clip from terminal 3 to terminal 1 and then tap the coil to click the relay. How does this change your circuit? Write it here:

    _____

17. Can you replace the LED with a motor? Can you switch on the motor using the relay?
18. Can you figure out a circuit that will make both motor and LED work at the same time?
19. Draw one of the relay circuits that worked here, labeling all the parts:

Using the relay as a buzzer/shocker:

1. Remove all of the alligator leads from the previous steps.
2. We want to wire the relay so it energizes itself, because we want it to do it very quickly.
3. Clip one alligator clip lead to the coil, and the other end goes to the positive wire of the 9V battery.
4. Clip a second alligator clip to one of the contacts that the internal switch is normally touching when it's not energized. The other side of the alligator clip wire goes to the negative wire of the 9V battery.
5. Connect a third alligator clip lead to the bottom contact in the same row of contacts as the lead from step 3. (find the contact that is normally touching when the coil is *not* energized), and the other end of the alligator clip lead goes to the other side of the coil.
6. The relay should be buzzing! Can you find the blue spark? You can touch it – the amps are low so it's a nice, safe little zap.
7. How does this work? Why does the relay engage itself and disengage?
8. Draw the circuit with the three wires and battery and relay here (also indicate where to touch to receive a zap):

Reading

A relay is switch you can turn on and off using electricity. It uses an electromagnet to active the switch inside it. Relays are operated with a lower-power signal, but can switch a circuit of a high-power signal. They are often used when multiple circuits need to be controlled by one signal. The first relays used were in long-distance telegraph circuits as repeaters. They would repeat the incoming signal from one circuit and retransmit it to another circuit. The next lab, *Experiment 19: Telegraphs and Relays,* shows this very experiment.

There are many different types of relays: latching relays (shown in this video and also in the *Electricity* unit *Experiment 18: Latching Circuits*), reed relays (refer to *Experiment 7: Magnetic Sensors*), mercury switches (where the contacts are wetted with mercury, contactor (used for heavy-duty electric motor circuits), solid-state (which doesn't have any moving components), and more. In addition, some relays are SPST (single-pole single-throw) while others are DPDT (double-pole double-throw).

Exercises

1. Is there a permanent magnet and/or an electromagnet inside a relay?

2. What makes the relay a switch?

3. What makes the relay turn on and off (*click*)?

4. Is the same power source that activates the relay also used for the circuit it's switching?

Answers to Exercises: Homemade Relay Shockers

1. Is there a permanent magnet and/or an electromagnet inside a relay? (Electromagnet.)
2. What makes the relay a switch? (When the electromagnet inside is energized, the relay switches things on or off, depending on how the circuit is connected.)
3. What makes the relay turn on and off (*click*)? (When power is added to the tabs that connect to the electromagnet, the electromagnet attracts the metal contact, which makes the click.)
4. Is the same power source that activates the relay also used for the circuit it's switching? (No, they are two different circuits, so you can use a low-power signal to activate the relay but run high-power through the switch contacts.)