

Trip Wire Burglar Alarm

Overview: This alarm has a thin wire that someone “trips,” which pulls out the paper, closes a switch, and lights up the LED!

What to Learn: This particular burglar alarm is an NC (Normally Closed) switch, and today you get to learn how to wire it up in a circuit and pull the trigger.

Materials

- AA battery case
- 2 AA batteries
- 3 alligator clip wires
- wood clothespin
- 4-6” piece of steel wire, like picture hanger wire OR use un-insulated copper wire
- 2 unpainted steel tacks scrap of paper
- LED

Lab Time

1. Make the NC trip wire switch:
 - a. Cut a 3” piece of steel wire. Wrap the steel wire around the stem of the tack. Do this twice – once for each tack.
 - b. Open the clothespin all the way, and insert one of the tacks inside the jaw, like you’re inserting teeth. Do this for the upper and lower jaw of the clothespin.
 - c. Orient the wires so that one steel wire comes off to the left of the clothespin and the other off to the right. This will make sure that the wires don’t touch during your experiment.
 - d. Open up your paperclip, and grab a scrap of a sheet of paper. When you release the clothespin, the two metal tacks should be on either side of the paper.
2. Make the Trip Wire Circuit:
 - a. Use your batteries, wires, and LED to make the LED light up. (No trip wire yet.)
 - b. Remove one of the alligator wires from the LED and replace it with a third alligator wire.
 - c. Attach one of the free alligator wire ends to one of the steel wires coming from the clothespin.
 - d. Attach the remaining alligator wire to the last steel wire from the clothespin.
 - e. Yank the paper away – did the LED light up?
 - f. Attach string to the paper. The length of string you need is going to depend on where you install the trip wire alarm.
3. Installation Tip: Hide this switch down low by the door frame and use fishing line instead of string to make this burglar alarm virtually invisible. Use a tack in the frame or tie the line to the door hinge to secure and wait for the action...

Reading

Do you need a little help protecting your stuff, like from younger siblings or nosy friends? This burglar alarm relies on a special kind of switch: an NC (normally closed) switch. This means that when the switch is just sitting there, it allows current to flow. When it's activated, electricity stops. The opposite kind of switch is an NO (normally open) switch, which doesn't turn on the electricity until you push the button. (The burglar alarm in the next experiment uses an NO switch.)

This switch works because paper doesn't conduct electricity – it's an insulator, just like plastic. Since the trip wire is an NC switch, this circuit works *until* you trigger the switch. We need a way to stop the current (flow of electrons) until we want the LED to activate. When you stick the paper index card between the two tacks in the clothespin, it breaks the electrical connection and the switch goes in the OFF position. Remove the paper and your switch moves to the ON position, and electrons are flowing around and around your circuit, and you see the LED light up.

This is a *silent alarm*, but if you'd like a *loud* alarm, substitute a buzzer for the LED. Make sure to select a buzzer that is low voltage (under 6V), like Radio Shack part #273-053.

Installation Tip: Hide this switch down low by the door frame and use fishing line instead of string to make this burglar alarm virtually invisible. Use a tack in the frame or tie the line to the door hinge to secure and wait for the action...

Exercises

1. How does this work?
2. What type of switch is the trip wire?
3. Name three places you can install this alarm.

Answers to Exercises: Trip Wire Burglar Alarm

1. How does this work? (The LED lights up as you "push" (squeeze, really) the switch by opening the clothespin. We've reversed this so the LED is also dark until you yank the paper away. To arm the trip wire, insert a small scrap of paper between the tacks. This works because paper does not conduct electricity. When the paper gets yanked out, the tacks touch and... *GOTCHA!!!*)
2. What type of switch is the trip wire? (The trip wire is an NC [normally closed] switch.)
3. Name three places you can install this alarm. (Across the bottom of a doorway, inside a drawer, or attached to a cupboard door.)