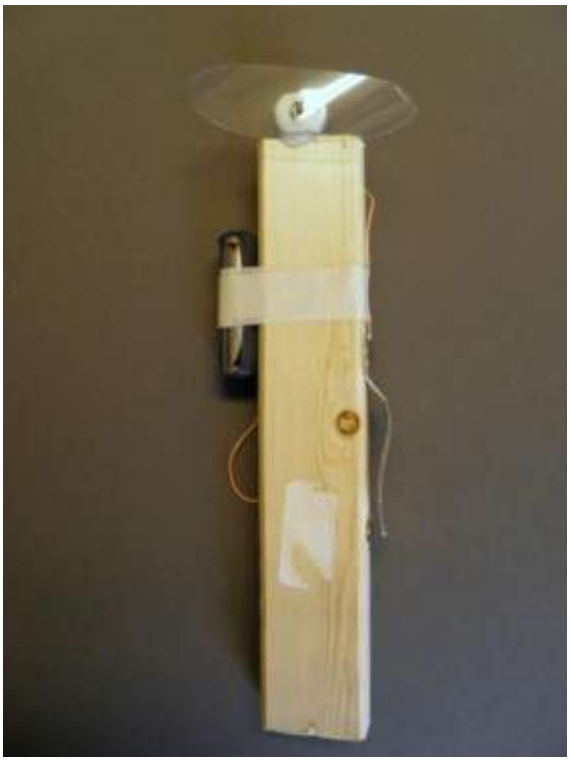
Personal Fan

Category: Physics: Electricity & Magnetism

Type: Make & Take



Rough Parts List:

1	Piece of wood for a handle
1	Plastic cup or bottle
1	Small piece of foil
1	Hobby motor
1	AA battery
3	6” pieces of electrical wire
3	Thumb tacks
1	Thick rubber band

Tools List:

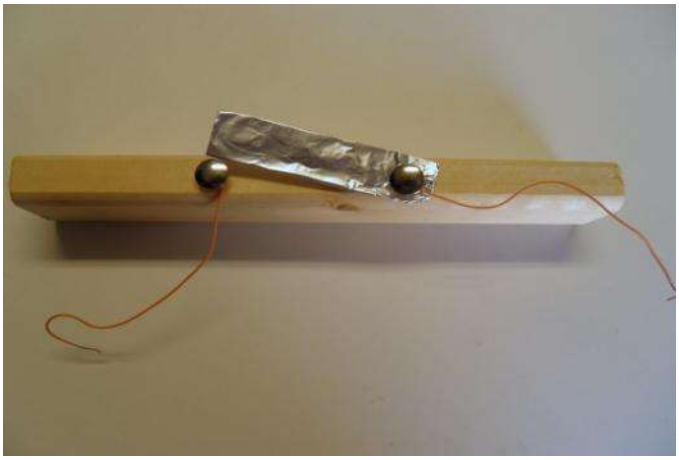
Scissors
Wire strippers
Hammer
Hot glue gun

Video: http://www.youtube.com/watch?v=am1iq6rl37Q&feature=plcp

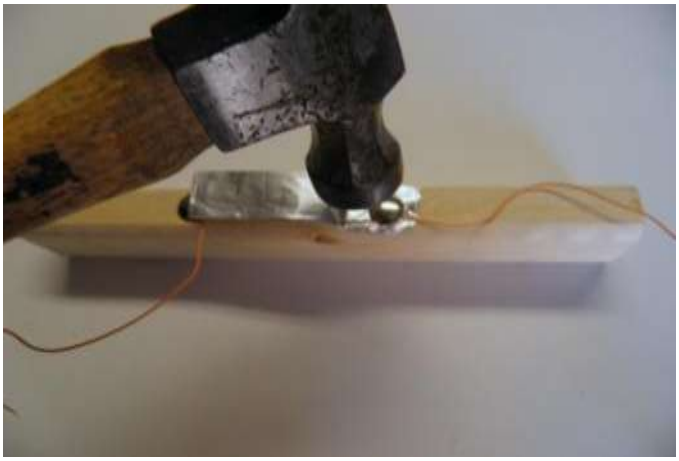
Blog Link: www.oaklanddiscovery.blogspot.com

How To:

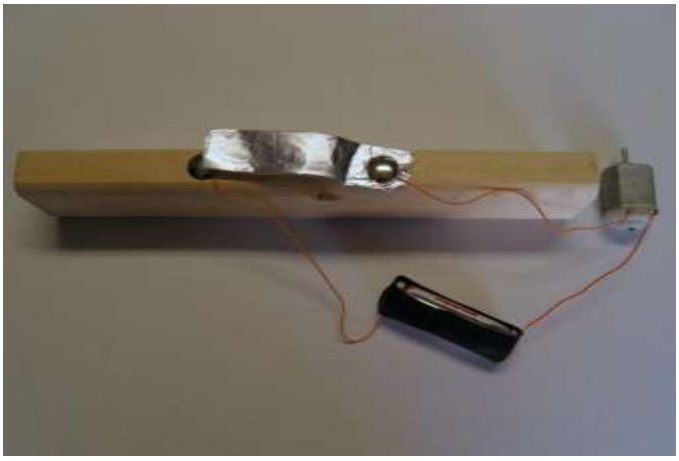
Fold the foil into a strip 2” long and the same width as the narrow side of the wooden handle. Loosley tack it in place onto the handle.



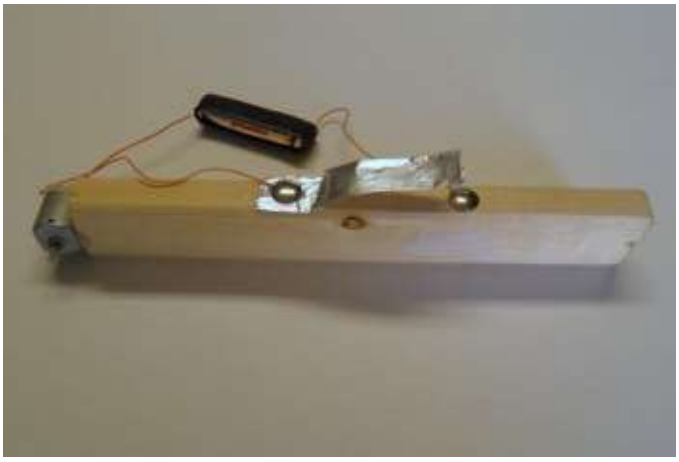
Add a second tack under the other end of the foil. Wrap a piece of wire (ends exposed) around each tack.



Hammer the tacks in to lock the wires in place. This completes the fan's switch.

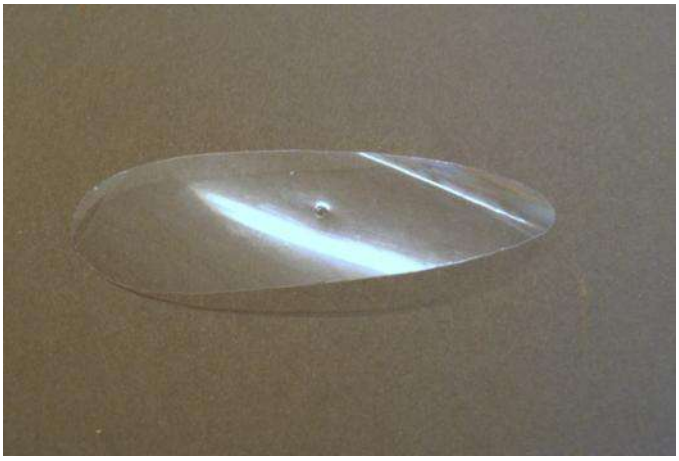


Add a third piece of wire to create a complete circuit between the tacks, motor, and battery. Wrap a thick rubber band or tape around the battery to keep the wires secure.

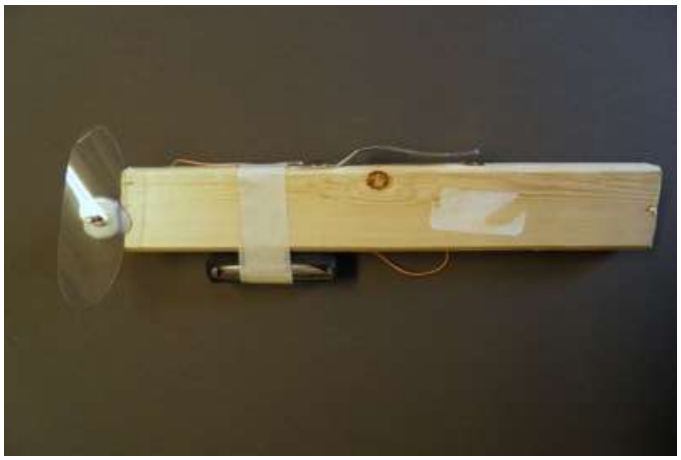


Hot glue the motor to the top of the handle. Bend the foil up away from the tack. Tape the battery to the handle.

Cut an oval out of a plastic bottle or jar. This will be the fan's propeller. Cut it at an angle like shown and it will have the necessary curvature built into it.



Use a tack to poke a hole in the center.



Attach the propeller to the motor shaft. Press the foil into the thumb tack to turn on your fan!

Fine Points:

→ Poke a very small hole into the propeller so it will snugly attach to the motor's driveshaft. It can also be hot glued onto the shaft.
→ The thick rubber bands that come on broccoli are perfect for this project!

Concepts Involved:

- A circuit is a path for electricity to flow through.
- Fans help us cool down though conduction and evaporation.

Focus Questions:

1. An electrical circuit is a circular pathway of wires that electrons can flow through. What is the power source in this circuit? Why do you need to press down on the foil to turn on the fan?
2. Try cutting out different sizes and shapes of propellers. Which one makes the best fan?
3. Watch the direction the propeller spins. Take it off the motor, flip it around, and put it back on. Does it still spin the same direction, and does it still blow in the same direction? Now take the battery out and flip it around. Did it change direction?
4. How does the fan help you cool down in the heat?

Elaboration:

In the process of building this fan, you have created an electrical circuit. Circuit sounds like the word "circle" for a reason. An electrical circuit is a closed pathway of wires and other conductors that electrons can flow through. The circuit is closed when everything is connected; in other words, when you press down on the foil you are creating a closed circuit. The electrons flow from the power source, the battery, all the way to the motor to give it the power to work. When the foil and tack aren't connected, the circuit is open and the electrons cannot flow to the motor. That's why the fan is off.

Fans are very convenient to have in warm weather; they help cool you down. There are two ways that fans achieve this: conduction and evaporation. Conduction is the transfer of heat through materials. If the air in a room is cooler than your body, the fan can cool you down by means of conduction. Your body heat transfers to the air closely surrounding your body, warming up that air in the process. The fan helps circulate the air in the room, moving cooler air to displace the warmer air surrounding you. You have probably noticed this happening outdoors when the wind picks up. The air temperature could stay the

same, but wind creates "wind chill" which makes it feel colder than it is because your body is losing heat more quickly.

When it's really warm the air in a room can be hotter than your body temperature. In this case evaporation will be more helpful in cooling down your body. Your body sweats all the time, and even more when it gets overheated, like when you're exercising or outside on a hot day. When you use the fan, the breeze it creates helps your sweat evaporate more quickly. Evaporation is when a liquid, like your sweat, turns into a gas. This process requires energy, and your body's heat provides it. Thus evaporation whisks away heat and lowers your body temperature.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation:
Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:
1.0 Students make decisions about how to approach problems:
1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:
1.1 Use estimation to verify the reasonableness of calculated results.
1.2 2.2 Apply strategies and results from simpler problems to more complex problems.
1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:
3.1 Evaluate the reasonableness of the solution in the context of the original situation.
3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade Standard Set 1. Physical Sciences:
1.f Students know evaporation and melting are changes that occur when objects are heated.

Grade 4 Standard Set 1. Physical Sciences:
1.a Students know how to design and build simple circuits and parallel circuits by using components such as wires, batteries, and bulbs.
1.g Students know electrical energy can be converted to heat, light, and motion.

Grade 6 Standard Set 3. Heat (Thermal Energy) (Physical Sciences):
3.c Students know heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and by convection (which involves flow of matter).

Grades 9-12 Standard Set 3. Heat and Thermodynamics:

1.a Students know that heat flow and work are two forms of energy transfer between systems.