Demo 20-01 Jumping Wire

A wire originally lies between the pole tips of a strong C-magnet as shown in *Figure 1*.[†] When the wire is connected across a power supply so that a large current flows in the wire, a force is exerted on the wire, causing it to jump out of the magnet. An animation sequence indicates the relationship between the directions of the magnetic field, the current, and the magnetic force on the wire.

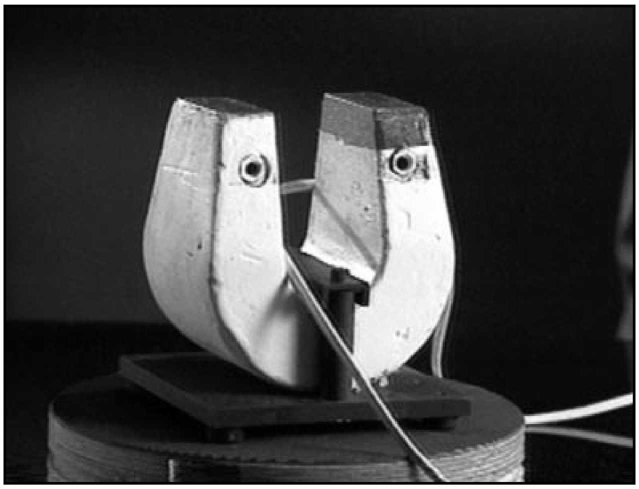

Figure 1

† Sutton, *Demonstration Experiments in Physics*, Demonstration E-131, Force on Conductor Carrying Current Perpendicular to Magnetic Field.
Freier and Anderson, *A Demonstration Handbook for Physics,* Demonstration Ei-12, Magnetic Force on a Wire.

We'll use a large horseshoe magnet and a current-carrying wire to show the force of magnetic field exerts on a current. The wire is placed between the arms of a horseshoe magnet, then twenty amps is run through the wire in the direction shown by the arrow.

The wire jumps out of the magnet.

This diagram shows the directions of the current, the magnetic field, and the force on the wire as predicted by the right-hand rule.

If we reverse the magnet, and run the same current through the wire, what will the wire do?

This time the wire doesn't leap out. The magnetic force on the current now pushes the wire down.

Equipment

1. Large horseshoe permanent magnet.
2. Lazy Susan.
3. Length of wire across a heavy-duty switch.
4. Appropriate electrical leads.
5. DC power.

Demo 20-02 Ampere's Frame

The large wire frame shown in *Figure 1* is mounted on a pivot bearing and connected to a current source through pools of mercury, so that it rotates with little friction.† When a magnet is brought near the current-carrying wires, a magnetic force is exerted on the frame, causing it to rotate, as shown in the video.

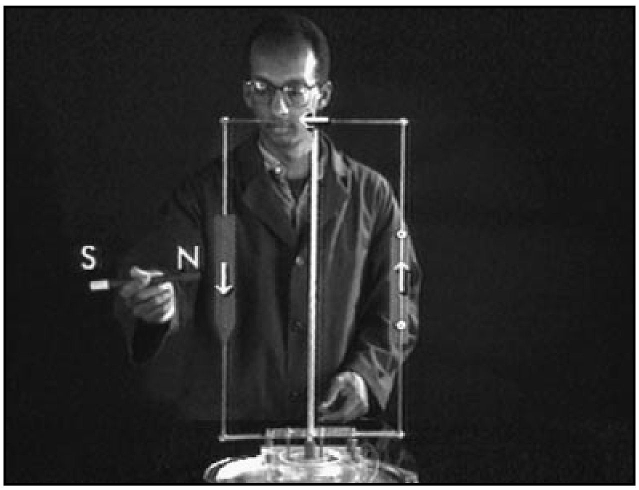

Figure 1

† Sutton, *Demonstration Experiments in Physics*, Demonstration E-133, Electromagnetic Swing—Ampere's Experiment.

Ampere's Frame / Script

This square aluminum frame rotates on a pivot bearing. At the bottom of the frame contacts dip down into two separate pools of mercury, which allow us to run current through the frame, yet leave it free to rotate.

We'll run a current in this direction through the frame, then bring a bar magnet up to the frame north pole first. The frame rotates to the right.

If we repeat with the south side of the magnet, the frame rotates to the left.

Equipment

1. Aluminum frame with a vertical suspension that allows it to rotate freely while the lower end points pass through electrically isolated concentric troughs of mercury that have terminal connectors.
2. Heavy-duty switch.
3. Appropriate electrical leads.
4. DC power.
5. Bar magnet.