Wimshurst Machine

P6-3350

BACKGROUND:

Invented in 1883 by British inventor James Wimshurst (1832 – 1903), the Wimshurst Machine is an electrostatic generator. It requires no electrical input, only mechanical power This Wimshurst machine includes two Leyden Jars, which act as simple capacitors and allow more charge to be stored. Its invention preceded that of the Van de Graaff generator by about 50 years. Van de Graaff generators are more efficient and able to store more charge at a higher potential, and thus able to produce larger sparks for the same effort.

Demonstrations with an electrostatic generator such as this are a good introduction to current electricity and circuits.

The short circuit current for this machine is approximately 7μA. The maximum potential is approximately 75000V.

SAFETY:

This product is designed to emit electrostatic sparks. The sparks can be painful, but are not dangerous to healthy adults. People with sensitive hearts should not use the Wimshurst Machine. **Important: Discharge the machine by touching the two ball terminals together before touching any metal parts on the machine.**

OPERATION:

The Wimshurst machine's most distinguishing feature is the two disks made of Plexiglas and each with a series of metal foil strips. When the user turns the crank, the disks rotate in opposite directions. In front of each disk is a metal brush, which can be adjusted. The brushes collect charge from the metal foil stripes. This collected charge induces a charge in the ball-ended terminals and the Leyden jars.

A Leyden Jar is composed of two conducting layers separated by a dielectric such as glass or plastic. Charge is transferred to the inner conductor, and this causes an equal separation of charge on the outer conductor. With the Leyden Jar connected to the Wimshurst Machine, you can obtain larger, less frequent sparks. The Leyden Jars effectively increase the capacitance of the machine.

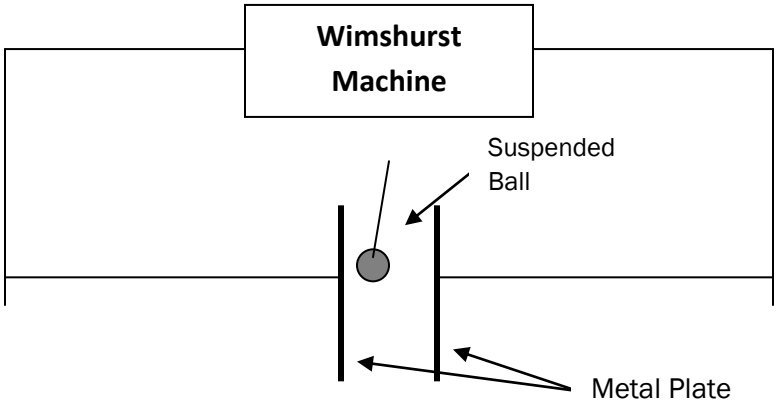
DEMONSTRATIONS:

1. Basic spark discharge. Separate the ball terminals by a small distance. Turn the crank to create opposite charges in the terminals. When the voltage difference between the terminals is sufficient, a spark will form. (The maximum spark distance will vary depending on the humidity. The maximum spark distance for dry air is approximately 75mm. The short circuit current is approximately 7μA.)

2. Effect of Leyden Jars. Using the thumbscrews, remove the metal bar at the base of the apparatus to disconnect the Leyden jars. Observe the change in the size and frequency of the sparks when the charge is delivered only to the terminals.

3. Volta's Hail Storm. Separate the ball terminals by a large distance. Connect one to the top terminal of the Volta's Hail Storm apparatus (P6-3320), and the other to the bottom. Turn the crank and observe the behavior of the "hail" in the apparatus as it is alternately attracted to and repelled from the plates.

4. Electric Bell. After explaining the behavior of the "hail" above, build an electric bell. Connect each terminal to a metal plate or bell. Mount the bells close together, with a small metal ball or other conducting object suspended between them. Turn the crank and observe the behavior of the suspended ball.



5. Other Applications. The Wimshurst Machine can be used in many applications when an object needs to be given an electrical charge.