

OPERATING INSTRUCTIONS

Electric Whirl No. 30825-01

1. Introduction

The purpose of the Electric Whirl is to make evident the motion of ions under the influence of an electrostatic field.

2. Description

The Electric Whirl consists of a pointed metal shaft mounted on an insulated base. Placed on the tip of this shaft is a three-pronged mill.

Caution: The pointed shaft is very sharp and can puncture the skin if not handled properly.

3. Operation

Without the mill in place on top of the shaft it is possible to see a corona discharge with the metal point of the shaft. Being careful to hold the shaft by the clear insulating rod, bring the point of the metal shaft toward a running electrostatic generator. It may be necessary to dim the lights to see this effect. A corona glow can be seen on the point of the metal shaft.

With the mill in place on the point of the shaft, verify that the base of the electric whirl is vertical and steady. Ground the shaft by connecting an alligator clip from the metal shaft to ground. Bring the assembly close to the generator and steady it. Start the generator and observe the ensuing motion, particularly the direction of motion. Observe that the mill will not start if it is stopped and the ground lead removed even if brought closer to the generator.

Stop the generator and discharge it. Remove the test lead end of the mill that is connected to ground and connect it to the globe. The mill should now be attached to the globe. Steady everything and start the generator. **Be sure to stand clear of the Electric Whirl and the generator!** The rotational speed attained with this setup will be greater, but notice that the direction of spin is the same.

Caution: Always take great care when performing any experiments involving an electrostatic generator. Shocks from an electrostatic generator can be quite painful.

4. Theory

Whether the Electric Whirl is connected to ground or to the sphere, a net charge is maintained on it. When the whirl is connected to ground, the charges that have been repelled by the charge on the sphere are subsequently bled to ground by electrostatic repulsion. When the whirl is connected to the sphere, the sphere and the whirl constitute a single conductor, which is charged by the belt. Corona discharges are established around the pointed regions of the whirl. The ionized particles with the same kind of charge as the whirl are repelled. Consequently, forces are exerted upon those pointed regions of the whirl in the opposite direction. The ionized particles with charges of the opposite sign are attracted. Because they have very little distance to travel until they arrive at the whirl, the momentum gained is small, and the charges attracted to the whirl will have little effect. It

follows that there is a set of net forces acting on the points, which result from a torque acting on the whirl as a whole. Notice that the sign of the charge is irrelevant as the experiment has shown. When the whirl is isolated, the charges leaving the points and the charges entering the points all have the same momenta, and the net force is zero.

It is possible to feel the electric wind on one's hand by removing the whirl from the shaft when the shaft is connected to the generator sphere.

5. Maintenance

The electric whirl needs no special maintenance. Should a problem develop contact Central Scientific Company, giving details of the problem. So we may better take care of your order, do not return anything without written authorization from Central Scientific Company.

Written 3/91