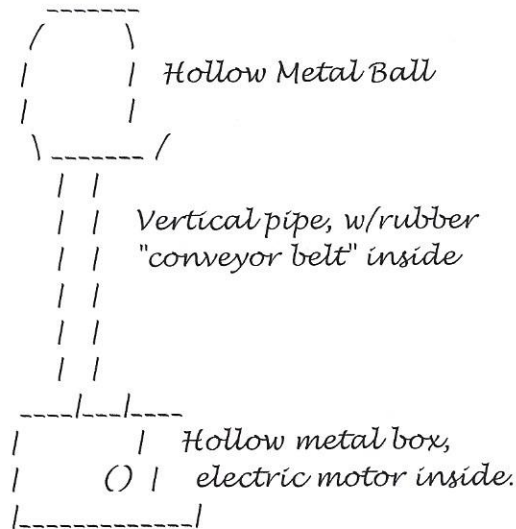


## The Van De Graaff Generator - An Electrostatic Machine

### WHAT IS A "VANDEGRAAFF MACHINE"?

A VanDeGraaff machine is a mechanical-electric device which produces extremely high voltage at low, safe levels of electric current. It also goes by the name "VanDeGraaff Electrostatic Generator." We usually encounter these devices in high school, where our physics teachers use them to raise the hair of some lucky student. :)



Tabletop versions of the VDG generator range in size from several feet tall producing half a million volts, down to tiny 2-inch versions which produce only five thousand volts. Physics researchers use larger ones, some of which are several stories tall and produce many megavolts output voltage.

### Q: HOW DO THEY WORK?

**Short Answer:** A VDG is a charge pump. One or both rollers become charged through contact with the belt. One roller sucks electric charges from its adjacent metal comb and onto the belt. The other roller pushes electric charges from the belt and onto the adjacent comb. When the belt is cranked along, the device sucks charges in at one end and spits them out at the other.

### Longer Answer:

Everyday objects are made up of equal amounts of positive electric charge and negative electric charge in almost perfect balance. We might say that ordinary matter is made up of "cancelled-out electricity." A VDG machine takes the mixed-up positive and negative charges of matter, sorts them out, then pulls them far apart from each other. A VDG is a "charge uncanceller" or "charge separator." The machine moves charge continuously, so it also acts as a mechanical charge pump.

A VDG machine contains a flat circular belt running on a pair of rollers, conveyor-belt style. The belt material must be an insulator; rubber or plastic for example. A metal "comb" is placed adjacent to each roller, with "teeth" pointing toward the belt surface. At each end of the belt, each roller and comb is enclosed inside a hollow metal box or hollow sphere. Each hollow box or sphere must be electrically connected to the metal comb inside. One of the rollers is spun by an electric motor so that the belt moves, and the other roller spins too.

To create a buildup of separated charge, the machine pulls one type of charge ( either pos. or neg. ) out of one comb and places it onto the belt's surface. The belt transports it to the far end of the machine. The electric charge is then pushed off the belt surface and onto the other metal comb, where it is sucked to the outside of the metal sphere. As the charge-transport process continues, the voltage (electric potential) between the two ends of the generator grows and grows