The principle of electrostatic separation is based on the law that like charges repel and unlike charges attract. There are two ways that this principle can be applied. The first is accomplished by the use of a low intensity field (large electrode) to take advantage of the natural electrical charge which particles have. A positive or negative pole can be set up and particles will either be attracted or repelled depending on the charge. This is a true electrostatic separation and it is not too effective for seed separations.

The second method is to induce a charge (30,000 – 50,000 volts) by what is known as high intensity field. Some particles are better conductors than others, thereby losing the induced charge more readily than poor conductors. The good conductors maintain a more normal trajectory while poor conductors tend to be "pinned" to the ground rotor. A splitter is used to partition the deflected seeds into "accepts" and "rejects" categories. A schematic representation of an electrostatic machine is presented in Figure 1. Particles to be separated are placed in (A) a vibrating feeder and are uniformly fed to (B) ground rotor which in turn passes the seed through a high intensity field delivered by an electrode (C). Seeds are then pinned to the rotor or attracted to the electrode depending on conductivity and the deflection pattern is separated by splitters (D).

Some of the factors that affect the efficiency of seed separation in an electrostatic sorter are:

1. Seed
   a. Seed itself and in mixture
   b. Moisture content of seed
   c. Temperature of seed

2. Atmosphere
   a. Temperature
   b. Relative humidity

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3. Machines
   a. Rate of feed
   b. Speed of rotor
   c. Electrode
      (1) Number of electrodes
      (2) Position
      (3) Voltage - D.C., A.C., or combination
      (4) Polarity (+ or -)
   d. Deflectors
      (1) Position

Some of the separations which have been reported on the electrostatic machine are:

Pigweed - White Clover
Curly dock - Red Clover
Johnson grass - Sesame
Wild Onions - Wheat
Water cress - Rice
Ergot - Bent grass
Witch grass - Corn
Cockleburs - Cottonseed

**Cocklebur-Cottonseed Separation**

Preconditioning cottonseed-cocklebur mixtures to bring about a moisture differential can easily be demonstrated. Eighteen lots of cottonseed and four lots of cockleburs were conditioned in a near 100% relative humidity chamber for one hour with the result that cockleburs absorbed from 2 to 5 times as much moisture as cottonseed.

From the 1964 Mississippi cotton seed survey, 26 lots of seed were selected for experimentation with the electrostatic separator. The rate of contamination varied from 3 - 143 cockleburs per pound. One run and five runs through the machine were compared. Runs four and five were an attempt to recover some of the cottonseed loss by re-running the rejected portions from the first three runs. The following conclusions were drawn:

1. After the first run, 50% or more of the burs were removed in almost all cases with approximately 5 - 10% loss of cottonseed.
2. After the 3rd run 15 out of 24 samples had 100% of the burs removed with seed losses ranging from 10 to 44 percent.
3. Eighty percent or more of the burs were removed from approximately three-fourths of all samples after the fifth run.
4. Final cotton seed losses after 5th run were less than 6.3 percent in all cases.

Several twenty-two pound lots of cottonseed with contamination ranging from 1 - 8.3 burs per pound were run through the electrostatic machine under controlled conditions. On the average, the results indicated approximately 75, 88, and 92% of burs are removed after 1, 2, and 3 runs. Cottonseed loss ranged from 11 - 18%. Some lots responded very well with nearly 100% bur removal. Lots with the highest rate of contamination were reduced to less than 0.5 bur/lb. -- acceptable for general certification standards.

Electrostatic seed separation holds a very exciting potential for difficult seed sorts. Differential moisture rates of absorption may be the clue for high separating efficiency.
Figure 1. Diagram of the Carpco Laboratory High Tension Separator.