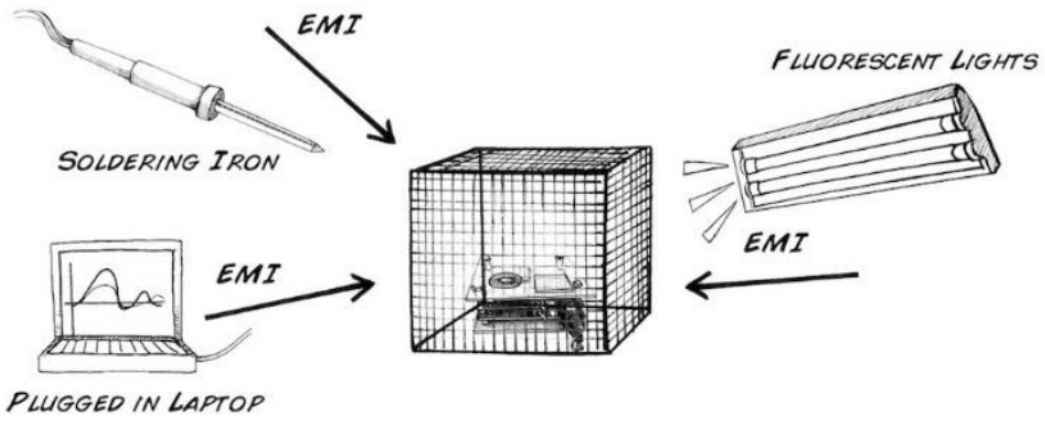
Implementing an Effective Faraday Cage

Adam McHale

1. Function of the Faraday Cage

A Faraday Cage operates to protect an object or series of contents from stray electromagnetic waves. This is done by placing an electromagnetic-sensitive device inside a container constructed of conductive metal.



Picture 1: A Faraday Cage protecting a device from EM interference

In the presence of an external electric field, the charges within the conductive material of the Faraday Cage redistribute themselves appropriately under the effect of the external field.

The then rearranged charges induce an electric field in directional opposition to the applied external field, negating its magnitude.

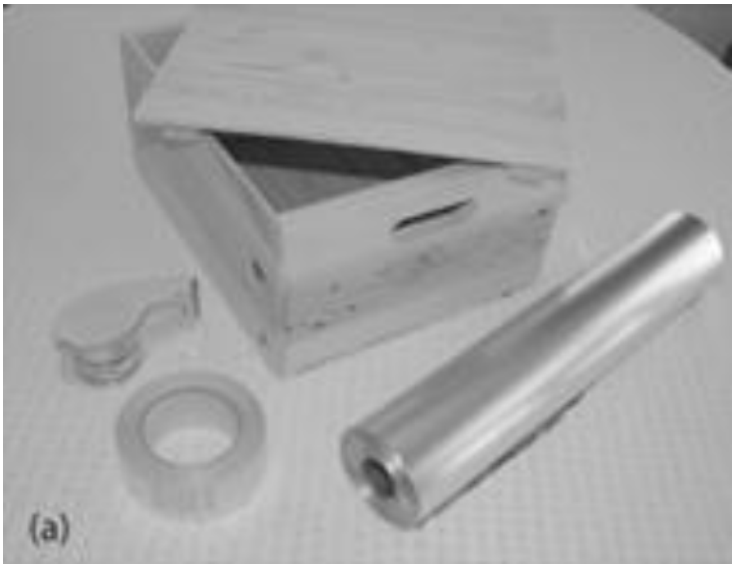
The net impact is an electromagnetically-neutral volume of the Faraday Cage.

2. Selecting Materials

Construction of a Faraday Cage requires several materials. The quality and magnitude of such materials will vary depending on the intent of the established Faraday Cage.

A sealable container must be appropriately chosen such that it may fully contain the desired contents of the Faraday Cage. Minor Inconsistencies in the shape and structure of the container are acceptable as the container will be sheltered in conductive material.

A conductive material with the capability of surrounding the determined container is also necessary.



Picture 2: Simple materials for a small-scale Faraday Cage

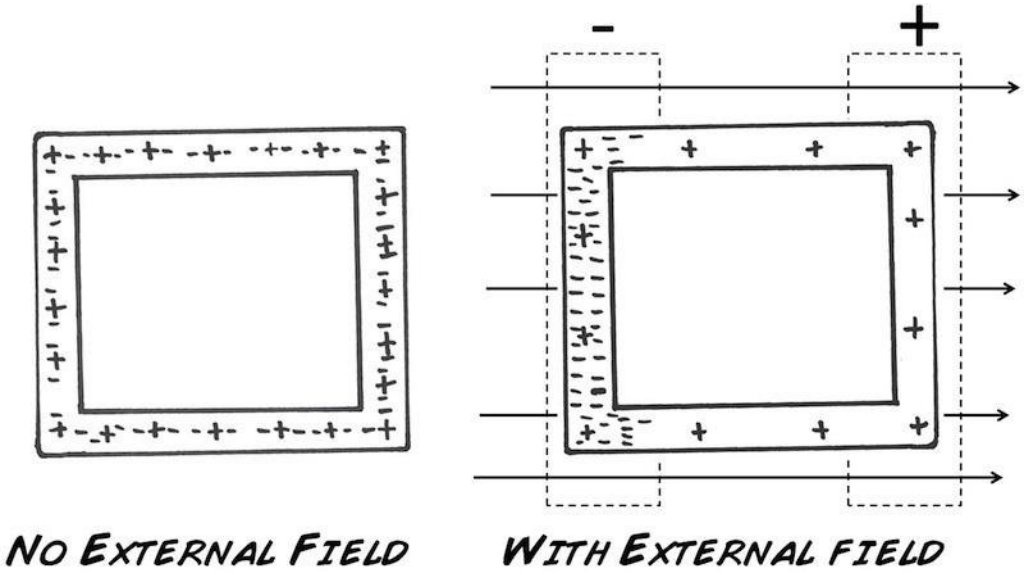
3. Quality of Conductive Material

The electromagnetic characteristics of the conductive material are only required to be capable of carrying charges while under the presence of a field of specified magnitude.

To this end, Silver is one of the most conductive materials available, but can be quite costly. Aluminum is much more accessible and manages sufficient conductivity.

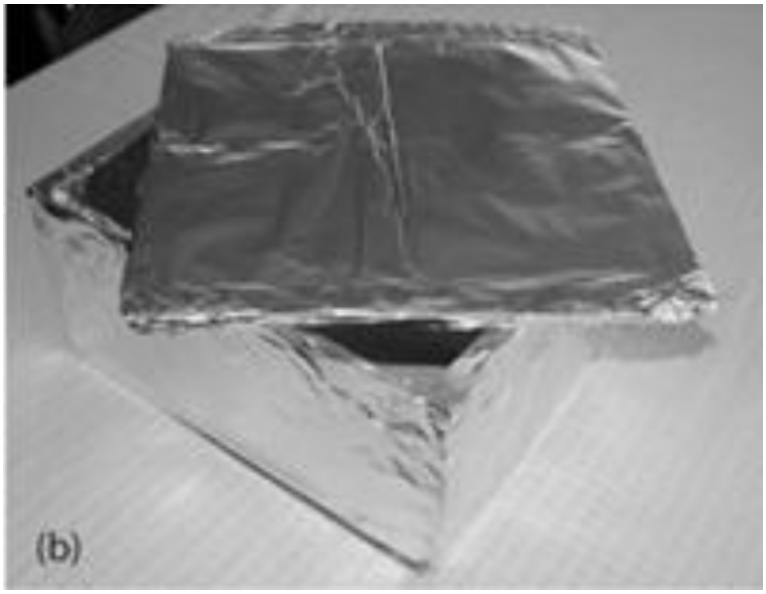
Under the presence of an external electric field, charges become redistributed throughout the conductive material so that like charges are pushed away from the source of the electric field, while opposite charges are attracted.

In this way, charges are separated so that they form an electric field in opposition to the applied one.



Picture 3: Depiction of the effect of conductive shielding

4. Construction of the Faraday Cage



Picture 4: Container shielded with conductive material

By wrapping the container in the chosen conductive material, the contents of the container will be fully shielded. This has the same effect as simply constructing a container out of a sufficiently conductive material altogether.

When an external electric field is now applied across the container, the charges within the conductive material will be distributed in a way such that their counteracting electric field yields an electro-magnetically neutral area on the inside of the container.

5. Testing the Faraday Cage

Testing the Faraday Cage is simple. Since any externally applied electromagnetic fields should be nullified within the container, such electromagnetic fields should not be detectable.

A simple test may be done with a cell phone. If the Faraday Cage has been constructed effectively, the cell phone should not be able to receive calls as any incoming electromagnetic fields should be negated by the Faraday Cage.

For large-scale testing, such as determining immunity to EMP disruption, high-magnitude waves in an array of frequencies would be necessary to test sufficient isolation performed by the Faraday Cage

Figure 5: Walky-talkies within a Faraday Cage

Resources

http://www.thesurvivalistblog.net/build-your-own-faraday-cage-heres-how/