AWESOME stories

LIGHTNING in a BOTTLE

This image is a colorized version of "Franklin's Experiment, June 1752," published by Currier & Ives in 1876. An original is maintained by the Library of Congress.

Living in Britain's American colony of Pennsylvania, Benjamin Franklin thought about the Leyden Jar. What made it work? Why did some of its characteristics seem so strange?

- Why, for example, was an electric shock greater when the electric fluid leaked?
- Why wasn't it more intense when all the electric fluid stayed in the jar?
- How was it that electricity could spark, shock, move-around *and* be stored?

Franklin thought about some experiments which might answer his many questions:

- What would happen if someone flew a kite during a thunder-and-lightning storm?
- Was the lightning electricity?

If lightning *were* electricity, it had to be *naturally* produced electricity (instead of *artificially* produced like the Leyden-Jar experiments). But ... could it really be that the same phenomenon—electricity—could be produced both naturally and artificially?

If, so ... how??

In his autobiography, Franklin tells us that he personally flew a kite during a storm, but that was after other individuals had tested his idea "for drawing lightning from the clouds." Two Frenchmen (Thomas-Francois Dalibard and Georges-Louis Leclerc, Count de Buffon) translated Franklin's theories which he'd published around 1750. Then they put those ideas into motion during 1752.

Following Franklin's direction, the Frenchmen set-up a 40-foot metal pole which they anchored, on the ground, in a glass wine bottle near the town of Marly-la-Ville (northeast of Paris). Franklin's idea was to capture lightning to test whether it was electrically based.

The metal rod would start the process. The rod would capture the lightning, which would then pass through the metal rod on its way to the glass wine bottle where the electrical charges could be stored (and then examined).

On the 10th of May, 1752, a storm passed by Dalibard's gadget. Lightning hit the top of the metal rod, producing a spark. The spark, which Dalibard reportedly touched with his finger, burned his hand. The following year, Georg Wilhelm Richmann (1711-1753), a German experimenter working in St. Petersburg (Russia), died (from a lightning strike) when he tried to repeat the experiment.

Franklin's suggested experiment proved that lightning was the same type of electricity as that made by man. It also showed that lightning, as a force of nature, was waiting to be tapped.

Franklin had another insight. He thought about electricity as money in a bank. Positive charges were like debits; negative charges were like credits. A Leyden Jar, said Franklin, presented an accountancy problem.

Here's how it works.

A negative electrical charge makes its way into the Leyden Jar. If the jar is held by someone, a positive charge is sucked up through the holder's body from the ground to the outside of the jar, trying to cancel-out the negative charge inside the jar.

The positive and negative charges are stopped from canceling-out because the glass acts as an insulator. The charge just grows and grows on both sides of the glass. But ... if jar-holders touch the top of the jar with their other hand, the electrical circuit becomes complete.

When the electrical circuit is complete, this event allows the negative charge on the *inside* to pass through the jar-holder's hand to the positive charge on the *outside*, finally canceling out. This type of movement causes a massive charge and often a spark. (See the animation in this video clip.)

The modern equivalent of the Leyden Jar is the capacitor. It is one of the world's most common electrical components. Capacitors help to smooth electrical surges and protect components, even today.

Solving the mystery of the Leyden Jar, recognizing lightning as a kind of electricity and inventing the lightning rod were great successes for Benjamin Franklin and the Enlightenment movement. But there was a new kind of electricity for theorists to consider. And ... *it* came from a most-surprising place.

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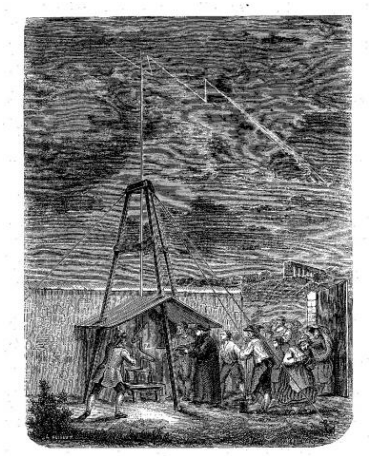

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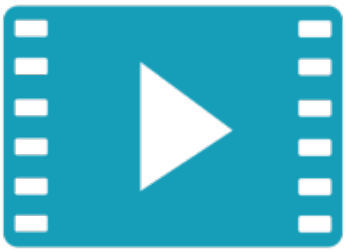

Discovering Electricity - Lightning in a Bottle

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