AWESOME stories

Leyden Jar and a Near-Fatal Experiment

Pieter van Musschenbroek, discoverer of the Leyden Jar, writes a long letter to his contact in Paris, René Réamur. It is January 20, 1746, and the Dutchman tells the Frenchman about an amazing experiment.

The experiment involved an electrical charge in a glass jar. At the time, it was not-yet known as the Leyden Jar:

> *...I would like to tell you about a new but terrible experiment, which I advise you never to try yourself, nor would I, who have experienced it, and survived by the grace of God, do it again for all the kingdom of France.*

In other words ... the experiment could have killed the Professor.

Then the Dutchman, who ran the Leyden Theatrum Physicum at the University of Leyden (Leiden) in The Netherlands, tells Réamur exactly what happened to cause him such a shock. We can coordinate his words with this image (depicting a duplication experiment at the Royal Academy of Sciences in Paris, during 1746):

> *I was engaged in displaying the powers of electricity. An iron tube AB was suspended from blue-silk lines; a globe, rapidly spun and rubbed, was located near A, and communicated its electrical power to AB.*
>
> *From a point near the other end B a brass wire hung; in my right hand I held the globe D, partly filled with water, into which the wire dipped; with my left hand E I tried to draw the snapping sparks that jump from the iron tube to the finger; thereupon my right hand F was struck with such force that my whole body quivered just like someone hit by lightning.*
>
> *Generally the blow does not break the glass, no matter how thing it is, nor does it knock the hand away* [from the phial]*; but the arm and the entire body are affected so terribly I can't describe it.*
>
> *I thought I was done for. But here are some peculiarities. When the globe D is made of English glass, there is no effect, or almost none; German glass must be used. Dutch doesn't work either; D does not have to be a globe, a drinking glass will do ... I've found out so much about electricity that I've reached the point where I understand nothing and can explain nothing ...*

What made this experiment so effective? What do we now understand (which the Dutch Professor did not)? Tom Tucker tells us about it in his 2003 book *Bolt Of Fate: Benjamin Franklin and His Fabulous Kite*:

> *Glass is a good insulator. If you apply a charge to the inside of the glass jar, another charge immediately appears on the outside of the jar. Miraculous, it seems. Benjamin Franklin later identified the charges on opposites sides of the glass as "positive" and "negative."*
>
> *If you put one hand to a wire connected to the inside jar and with your other hand touch the outside, you complete the circuit - and take the celebrated violent snap.*
>
> *One physicist today compares the discovery of the Leyden jar to the advancement in technology from the firecracker to TNT, calling the Leyden jar "the electrical equivalent of the hand grenade."* (Tucker, at page 26.)

Note this important point in van Musschenbroek's letter: He stakes no claim of ownership to the device he invented. And ... the Professor doesn't realize that he was not the first to independently discover this interesting phenomenon. That honor belongs to Georg von Kleist of Cammin—also known as Ewald Jurgen von Kleist—a German cleric who also dabbled in electricity.

Kleist described his findings in a letter which he sent to five highly respected German scientists. But the language he used, to describe his experiment, was so obscure that no one really understood his description. Because no one understood how to process the experiment, no one could duplicate his findings.

Have we, in the modern age, completely solved the riddles about the Leyden Jar which Musschenbroek did not understand? The answer is ... not really. Some of those open questions are still open, including these:

- How does electricity in one place create electricity in another?

- How does this mysterious force operate at a distance?

Today, electricity runs the world in such a way that we are totally dependent on this amazing force. We control it, in our individual worlds, with on/off buttons. But despite incredible technological advances, we are still left with some basic questions to which we - like 18th-century experimenters - have only speculative answers.

Credits:

This image depicts the first illustration of a Leyden Jar, from J.H. Winkler, 1746; online, courtesy Spark Museum.

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