





this theory, he disagreed, concluding instead that the electricity was generated in some other way and that the animal tissue was merely reacting to an external stimulus.

Galvani and Volta engaged in a serious feud over this issue, conducting various experiments to prove their opposing theories. One of Volta's experiments consisted of joining two different metal wires—copper and zinc, say—at one end, touching the other ends to the animal muscle, and observing that the muscle responded. Volta concluded there was a contact potential—although I'm sure he didn't use that term—between the dissimilar metals and that this was the source of the electricity. In order to improve the contact between the two metals, he interposed a piece of cloth that was soaked in a brine solution and found the effect was actually enhanced. We can only speculate about why Volta took the next step, stacking several metal pairs on top of each other, but so he did. He piled up 30 pairs of silver and zinc discs with intervening brine-soaked pieces of paper and created what came to be known as the voltaic pile. He also experimented with other combinations of metals such as zinc and copper as shown in the diagram at left. Volta's invention, published in 1800, has been formally recognized as an IEEE Milestone.

The voltaic pile was quickly recognized as a significant invention and various scientists and engineers set about improving it and, especially, making ever larger batteries. They were larger in the sense of having more cells—hundreds, in some cases—and also in the size of the plates and the nature of the electrolyte separating the metal electrodes. Soon, the fabric interlayer was eliminated and the electrodes were immersed in the liquid electrolyte.

For decades, the only batteries available had a finite lifetime, providing current only until the electrodes had been consumed. In 1859, this limitation was overcome when a French physicist, Gaston Planté, invented the lead-acid cell which could be recharged. Today, of course, storage cells are a far cry from those early inventions and are the subject of much ongoing research.

Today, we call the voltaic pile a battery which means a collection of things. An artillery battery is a collection of guns and an electric battery is a collection of cells. Strictly speaking, then, a AAA battery is not a battery, but a cell. But don't go into the hardware store and ask for a package of AAA cells. They might know what you are talking about but may think you a bit odd. On the other hand, flashlights are often described as "three cell" or "five cell."

While English uses the word battery, other languages preserve the word pile. In Spanish, for instance, an electric battery is a *pila* and the French use both *batterie* and *pile*. It is also a *pila* in Italian where the basic meaning of the word is "stack."

#### Additional Investigation

As a little additional investigation to see how the cell/battery terminology issue is resolved in practice, I examined the packaging of a leading brand of US-made batteries. Nowhere on the package label or the cell label does either word appear. There is a warning in French that the "pile" may explode if it is mistreated and in Spanish that the "pila" may explode. In English, they simply state, "May explode ...". There must be a story behind that, but I have no idea what it might be.

The voltaic pile, the first device capable of delivering a continuous flow of the "electrical fluid," opened whole new fields of experiment and investigation. Having current available and not just voltage—using today's terminology—allowed people to explore electrochemistry as well as heating and lighting effects and, eventually, electromagnetism. But that is a story—or several—for another day.

For now, just remember that every time you say or write "volt" or its symbol "V"—a capital letter since it is named for an individual—you are commemorating the work of Alessandro Volta, an 18th century physicist. That's why we call a volt a volt.

Want to know more about our history? Check out the Engineering Technology and History Wiki: <http://ethw.org>

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