What Did Emeagwali Invent? — Part 1B

In the first installment of our weekly series at emeagwali.com, we focus on the difference discovery and invention. In 1989, Philip Emeagwali used 65,536 sub-computers to perform a world record 3.1 billion calculations per second. He solved a six-part problem that spanned 41 discoveries and inventions.

The Diary of an African-American Inventor

Transcribed and edited from a lecture delivered by Philip Emeagwali. The unedited video is posted at emeagwali.com.

Stories evolve, often subtly, with each retelling by others. The retelling of the story of "the 41 patent claims" that Philip Emeagwali told on July 8, 1991 at the International Congress on Industrial and Applied Mathematics evolved into "41 patents."

This conference is to mathematics what the World Cup is to soccer—unique and held only once every four years. Emeagwali told mathematicians at the conference that he had filed 41 patent **claims**, which covered the 36 algorithms he had invented for solving the 36 partial derivative inertial terms that he had discovered.

As **non**-mathematicians retold his story, his "41 patent claims" was shortened to "41 patents." Similarly, his young age of 35 years, published accurately in a 1989

interview, was repeated over and over for 21 years, which contributed to a few mistaken tabloid media attacks claiming Emeagwali had "lied about his age."

Philip Emeagwali told the mathematicians at the International Congress that his 41 patent claims were precise legal definitions of his algorithms for solving the 36 partial derivative inertial terms that he had discovered. He filed his 36 algorithms as 36 patent claims to avoid losing some of his rights and protection under the law. He also filed five additional dependent claims, bringing his total number of claims to 41.

Emeagwali stopped pursuing his patent claims because the United States Patent and Trademark Office told him that his 36 algorithms were discoveries, not inventions. He argued that they were inventions, not discoveries, explaining that although the Second Law of Motion encoded within his algorithms was not patentable, his algorithmic techniques that embodied that Second Law within supercomputers should be, because they are the discrete analogue of the 36 partial derivative inertial terms that he had discovered. In other words, they were functions with input and output.

Patenting algorithms was a gray area in 1989. You cannot patent a mathematical technique but you can patent a computer technology. The algorithm lies between mathematics and computer. Today, it is possible to patent algorithms; however, because he publicly disclosed his inventions in 1989, the one year filing deadline passed.

Importantly, scientific progress is only measured by discoveries, not patents. To discover means to see something that is previously unseen or unknown. Philip Emeagwali discovered that petroleum reservoir engineers summed only three forces, instead of summing all four forces within their oilfields. The word "invent" means the contrivance of that which did not before exists. He invented 36 algorithms for summing all four forces.

To invent means to originate or create as a product of the inventor's ingenuity. It does not mean to patent. In supercomputing, it means to correctly formulate and solve one of the "Twenty Grand Challenges" at a world-record speed. Philip Emeagwali simulated the flow of oil, water, and gas—with the forces correctly summed—at the then unheard of speed of 3.1 billion calculations per second. It was a Grand Challenge that was of interest to Mobil Corporation, but completed by one man in 1989.

In summary, Philip Emeagwali received a standing ovation at the International Congress for telling the field's foremost experts that: Exxon was falsifying its petroleum reservoir equations and that the equations taught in universities are not equating to what's happening inside a petroleum reservoir. It is an unpatented invention just as the Atomic Bomb and internet are unpatented inventions. If you submit a patent related to the Atomic Bomb, the USPTO will inform you that your invention has been stamped "secret."

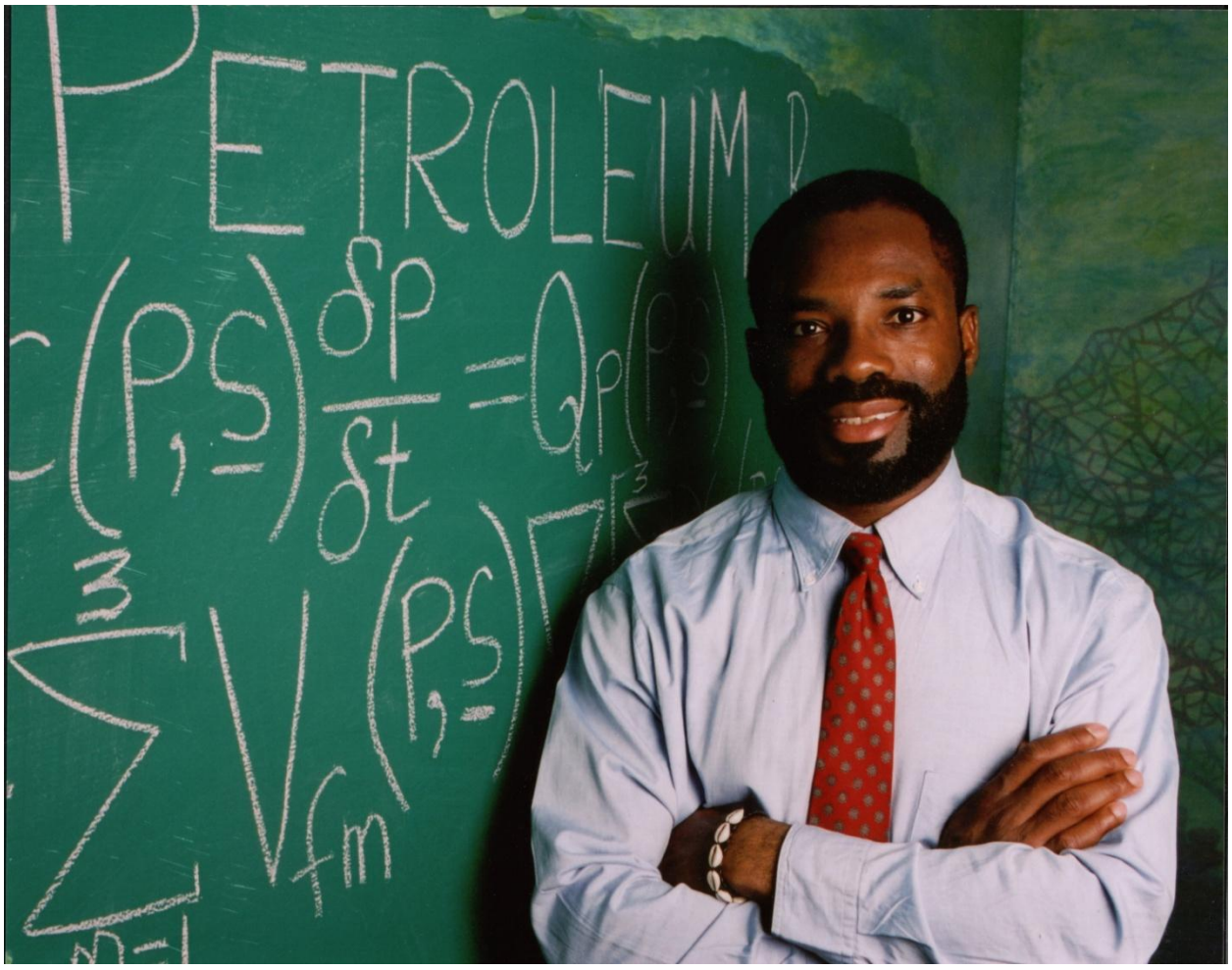
The internet is a planet-sized infrastructure comprising of billions of cables and computers. To patent it require that you build a prototype of the internet, which is impossible because:

- The Act of Congress of July 4, 1836, section 6, requires an inventor who is desirous to take out a patent for his invention, to furnish a model of his invention, in all cases which admit of representation by model, of a convenient size to exhibit advantageously its several parts.

The supercomputer he programmed—are 65,000 sub-computers that were connected like an internet—is comprised of millions of cables and sub-computers. What he achieved was to push it's frontier by extending the limits of computation and communication. It was newsworthy in 1989.

Your dictionary defines the word "invention" without using the word "patent" and groundbreaking inventions, such as the automobile, the airplane, and the Internet,

cannot be patented because each has many fathers, mothers, aunts, and uncles. Most importantly, the discoverer is the first teacher of his discovery to humanity.



His Inventions

Philip Emeagwali writes on the board the actual equations used by the oil company Exxon (now Exxon Mobil) to simulate the flow of oil, water, and gas inside its petroleum reservoirs. Emeagwali pointed out that four forces exist inside every petroleum reservoir; he discovered that the Exxon Mobil equation had summed only three forces. Emeagwali correctly summed all four forces, namely:

pressure, viscosity, gravity, and inertia. After learning about his discovery, Mobil Research and Development Corporation invited him (in a letter dated March 19, 1990) to help the company in “reservoir simulation.” It’s as abstract as the Navier-Stokes equations listed in the “Seven Millennium Problems” but yet computably solved by Emeagwali. His equivalent of six degrees in mathematics and engineering helped him to discover the 36 partial derivative inertial terms and to invent 36 algorithms for solving them.