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Period 4

4/20/2017

The Physics of Perpetual Motion

Rube Goldberg is a cartoonist who is famously known for the cartoons of extremely complicated machines which completed simple takes like turning off a light. Goldberg created these cartoons to poke fun at human nature that with the increase in technology created dependency and laziness in people.

Goldberg was born in San Francisco, 1883. After Goldberg graduated from University of California, Berkley with a degree in engineering, Goldberg moved to New York where he became a cartoonist for the *New York Journal.* His first Rube Goldberg Machine was the *Automatic Weight Reducing Machine* published in 1914. Goldberg continued to publish these complicated machines until he retired from cartooning in 1938.

Many people continued to enjoy his cartoons. In 1949, two engineers from Purdue University, Phi Chapter of Theta Tau Fraternity and Triangle Fraternity, created their own version of the Rube Goldberg Machine contest. Though the contest was held with the Engineering Ball, the contest died in 1955. Years later, in 1983, the Phi Chapter of Theta Tau Fraternity resurrected the Goldberg Machine contest. A few years later in 1988, the first National Rube Goldberg Machine Contest was held. A couple of years later (1992) the first National Rube Goldberg Machine Contest had a television showing.

Perpetual motion means a motion that will never stop. A perpetual machine would be a machine that would never stop until we reach the Big Freeze, the theoretical end of the universe. To create a perpetual machine would be impossible due to the fundamental physics that we know.

The most famous perpetual motion machine was created by Charles Redheffer in 1812. Charles Redheffer’s machine was exposed by two engineers who found that the machine did not work as he claimed. The reason we know that perpetual motion is impossible is due to the Laws of Thermodynamics. The First Law of Thermodynamics is the law of conservation of energy, which states energy cannot be created nor destroyed. With only looking at the first law, the machine cannot touch because if they do, it would create friction, which would create heat and slow down the machine. The machine would also need to be in a vacuum due to the air creating friction as well and cannot create sound because sound is also a form of energy. For some miraculous reason, you have met all those needs, you need to start the machine, which would need energy and the law of conservation states that energy cannot be created.

The Second Law of Thermodynamics says that energy is transferred or transformed, more energy becomes wasted, and increases disorder. If the machine is miraculously follows the first law and works, the machine cannot meet the Second Law of Thermodynamics due to not being able to transfer or transform any energy. With no energy being transferred or transformed, the energy cannot become disorganized.

One theory of perpetual motion is Einstein and Brownian Motion. Einstein created a groundbreaking conclusion of kinetic theory of gases. The 19th century physicists spent time refining Einstein’s kinetic theory of gases which state a nonstop or perpetual agitated motion of atoms. J. Willard Gibbs and Ludwig Boltzmann used this theory to resolve the reversibility paradox which came from the Second Law of Thermodynamics. When Einstein published the Laws of Thermodynamics, Ernst Mach and Wilhelm Ostwald argued that the laws should not base on mechanics but on energy alone. Another physicist, Jean Baptiste Perrin, conducted experiments which confirmed the hypotheses of Einstein.

In more recent years, physicist Frank Wilczek developed an idea of “time crystals” (physical structures that move in repeating patterns). Wilczek spent months figuring out equations that could indicate atoms can form regularly repeating lattice (a regular repeated three-dimensional arrangement of atoms, ions, or molecules in a metal or other crystalline solid) in time and return to the initial arrangement after continuous intervals. Though the theory was proved wrong by Patrick Bruno, this idea has created a dialogue of the possibility.

Earlier this year Harvard physicists were able to create time crystals from the basis of Wilczek’s idea from the early 2010s and quantum systems. The way that this system works is using a non-equilibrium state of matter and NV centers. The interaction with the NV centers stabilize the response creating a time crystal. With these advancements, the physicists creating time crystals, this will be helpful to the development of quantum computers and sensors, in the long run this technological advancement can help create other complex applications.

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