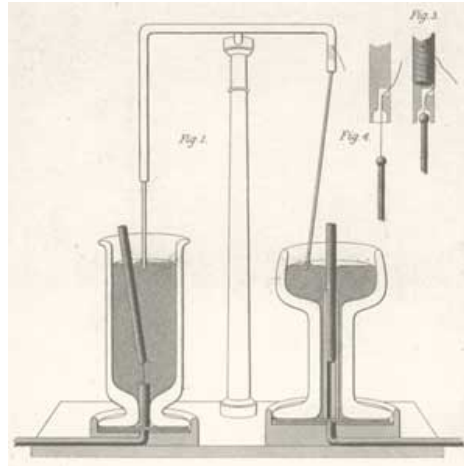


Solutions for a Sustainable Future

Electric Motors



As, is so often the case, with any invention, the credit for development of the electric motor belongs to more than one individual. Using a broad definition of "motor" as meaning any apparatus that converts electrical energy into motion, most sources cite Faraday as developing the first electric motors, in 1821. They were useful as demonstration devices, but that is about all, and most people wouldn't recognize them as anything resembling a modern electric motor.

Nearly all electric motors are based around magnetism. In these motors, magnetic fields are formed in both the rotor and the stator. The two fields give rise to a force, and thus a torque on the motor shaft. One, or both, of these fields must be made to change with the rotation of the motor. This is done by switching the poles on and off at the right time, or varying the strength of the pole. Electric motors are found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives. They may be powered by direct current (e.g., a battery powered portable device or motor vehicle), or by alternating current from a central electrical distribution grid or inverter. Medium-size motors of highly standardized dimensions and characteristics provide convenient mechanical power for industrial uses. The very largest electric motors are used for propulsion of ships, pipeline compressors, and water pumps with ratings in the millions of watts.



Factoid: The reverse process, producing electrical energy from mechanical energy, is done by generators such as an alternator or a dynamo. Many types of electric motors can be run as generators and vice versa.

The physical principle of production of mechanical force by the interactions of an electric current and a magnetic field was known as early as 1821. Electric motors of increasing efficiency were constructed throughout the 19th century, but commercial exploitation of electric motors on a large scale required efficient electrical generators and electrical distribution networks.

Factoid: Nikolaus Otto invented the internal combustion engine in 1862. Electric cars were first experimented with by Anyos Jedik in 1828.

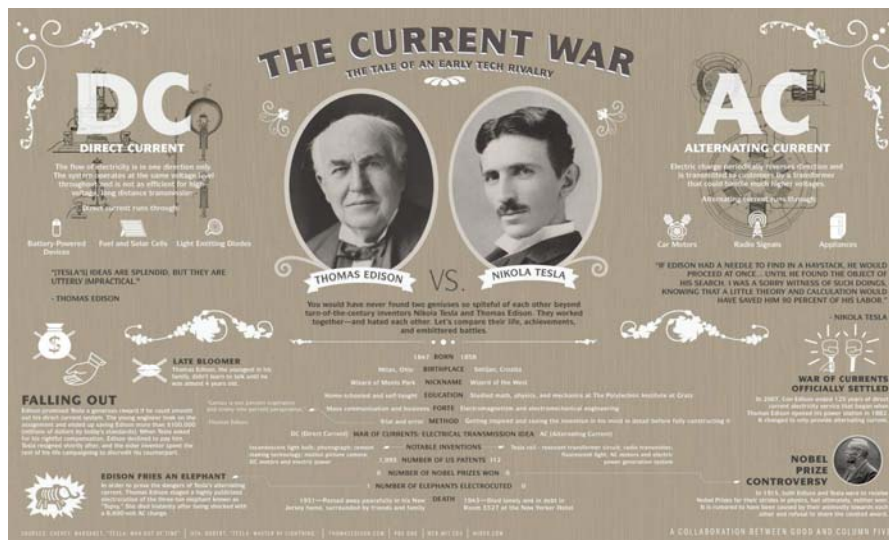


Electric motors are the single biggest consumer of electricity. They account for about two thirds of industrial power consumption, about 45% of global power consumption, according to the International Energy Agency (Lighting is a distant second, consuming about 19%). 300,000,000 industrial electric motors are currently installed worldwide. This number increases by about 10% per year. Approximately 50% of these motors are installed in the U.S., EU and China.

Factoid: 90% of installed motors run continuously at full speed and use mechanical systems to regulate output. That is like driving with the accelerator fully depressed while using the brake to control your speed.

This means that almost every second power plant is producing electricity for the sole purpose of running motors.

Historical Factoid: Although we all take it for granted now, there was a huge debate on whether our countries electrical system should be based on A/C (Tesla) or D/C (Edison) current. Edison's DC distribution system consisted of generating plants feeding heavy distribution conductors, with customer loads (lighting and motors) tapped off them



In the alternating current system, a transformer was used between the (relatively) high voltage distribution system and the customer loads. Lamps and small motors could still be operated at some convenient low voltage. However, the transformer would allow power to be transmitted at much higher voltages (ten times that of the loads). This had the practical significance that fewer, larger generating plants could serve the load in a given area. Large loads, such as industrial motors or converters for electric railway power, could be served by the same distribution network that fed lighting, by using a transformer with a suitable secondary voltage.

Factoid: Edison and his company, though, would have profited extensively from the construction of the multitude of power plants required to make electricity available in many areas.

Direct current could not easily be converted to higher or lower voltages. This meant that separate electrical lines had to be installed to supply power to appliances that used different voltages, for example, lighting and electric motors. This required more wires to lay and maintain, wasting money and introducing unnecessary hazards. A number of deaths in the Great Blizzard of 1888 were attributed to collapsing overhead power lines in New York City.

Alternating current could be transmitted over long distances at high voltages, using lower current, and thus lower energy loss and greater transmission efficiency, and then conveniently stepped down to low voltages for use in homes and factories. When Tesla introduced a system for alternating current generators, transformers, motors, wires and lights in November and December 1887, it became clear that

AC was the future of electric power distribution, although DC distribution was used in downtown metropolitan areas for decades thereafter.

Edison carried out a campaign to discourage the use of alternating current, including spreading disinformation on fatal AC accidents, publicly killing animals, and lobbying against the use of AC in state legislatures. He also tried to popularize the term for being electrocuted as being "Westinghoused".

Factoid: Edison opposed capital punishment, but his desire to disparage the system of alternating current led to the invention of the electric chair. Harold P. Brown, who was being secretly paid by Edison, built the first electric chair for the state of New York to promote the idea that alternating current was deadlier than DC.

I am Jim Steigner (Mr. Comfort), and I just wanted you to know. As always please feel free to contact me at www.mrcomforthvac.com, under the "Ask Mr. Comfort" Section, with any questions thoughts or ideas.