

General Motor Knowledge
Part 34

Magnets and Magnetism

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November 17, 1995
GMK34.wp5

Early history of the permanent magnet takes us to a district in Thessaly known as Magnesia. Today this region is part of Turkey. Certain rocks were discovered that would attract iron objects. These rocks occur naturally and are an oxide of iron called magnetite. They were called loadstone, or literally "way stone," because of the ability to guide a traveler on his way. Earliest reports of these stones date to around 600 B.C.. Greek philosophers described their unusual properties in the period of 400 to 200 B.C.. Around 1200 A.D. "touched" iron needles were being used as a compass. These needles had been "touched" by a loadstone and were then supported by a floating straw.

Sir William Gilbert is credited with the first systematic work on magnets about 1600. His was a great work of experimental physics during a period when most writings about magnets were tradition or superstition. He documented how loadstone could be improved by adding soft iron polecaps and how iron could be magnetized. He also realized that hardened steel made better magnets than soft iron. Tiberius Cavallo recorded in 1786 that brass could be made magnetic by hammering and that this magnetic property could be destroyed by heat. He concluded that the texture of the material rather than the presence of iron contributed to magnetism. André Ampère observed forces of a similar nature between conductors carrying currents. Discoveries since then have shown that all theories of magnetic materials can be developed and explained through the magnetic effects produced by electrons in motion.

In the atom of a ferromagnetic material (ferro means "like iron") more electrons spin in one direction than in the opposite direction. This unbalanced electron spin creates a magnetic moment. Also present are forces between the atoms that keep neighboring atoms parallel. These parallel groups of atoms form domains that are magnetized to saturation. These magnetic domains are arranged within the material in a random manner such that each cancels the other. The magnet becomes "magnetized" when the it is placed near a magnetic field strong enough to cause all the domains to rotate and align in the direction of the applied field. In a simple electrical circuit, DC voltage developed in a battery will cause current to flow through a wire to the load. Current flow is the movement of electrons between atoms in the wire. The current flow (movement of electrons) causes a magnetic field to be established around the wire.

There are many uses for magnets and magnetism. The electromagnet is the basis of the electric motor which how we make our living. A permanent magnet DC motor starts your car. Most computer information is stored magnetically. Audio and video cassettes are another example of magnetic storage of information. Magnetic levitation trains use strong magnets to float the train above the tracks so that there is no friction between train and track. Powerful magnetic fields are used in nuclear magnetic resonance imaging (MRI), an important tool used by doctors. You can use a magnet to keep this newsletter handy on your refrigerator door.