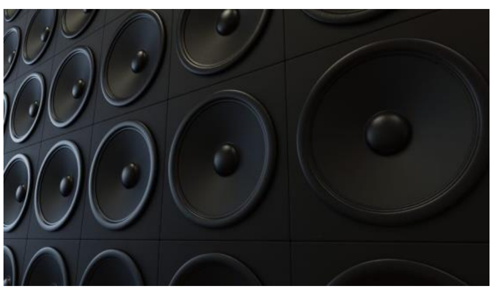
Everyday Uses of Magnets

Just like the planet Earth, magnets have a north pole and a south pole. The opposite poles attract each other, while the like poles repel each other. This creates a magnetic field that causes magnets to stick to some metals such as iron and nickel, as well as to other magnets. The Roman Empire and ancient Greek and Chinese civilizations took advantage of magnetic energy to improve their day-to-day lives. In the 21st century, magnets continue to be versatile tools that assist people around the world in many different ways beyond serving as decorations on a refrigerator.

You come into contact with magnets many times in the course of your daily life. They play an important role in a wide range of devices including simple toys, computers, credit cards, MRI machines and business equipment. Magnets range in size from barely-visible specks to industrial monsters weighing tons. Though some are plainly visible, others are often tucked inside the inner workings of appliances and other household, medical and commercial items, doing their job silently and unseen.



Speakers

Whether they are in a TV, computer or headphones, speakers that project sound use magnets. Inside a speaker, there is a cone, an electromagnet in the form of a coil and a permanent magnet.

Sound is a mechanical wave. Electromagnetic coils inside speakers respond to the electric current coming in. When the coil moves with the help of the permanent magnet, it pushes and pulls on the speaker cone. These electromagnetic interactions affect the air in front of the speaker and create sound waves for us to hear.

Compass

Compasses help countless travelers find their way using a magnetic field. A compass needle aligns itself with the Earth’s magnetic field, so it always points north. For hundreds of years, this gave wanderers and explorers a reliable and stable sense of direction. Compasses had an important impact on history as they enabled geographical discoveries.

Health and Medicine

MRI

Magnets are found in some commonly used medical equipment such as and Magnetic Resonance Imaging machines. MRIs use powerful magnetic fields to generate a radar-like radio signal from inside the body, using the signal to create a clear, detailed picture of bones, organs and other tissue. An MRI magnet is very strong – thousands of times more powerful than common kitchen magnets. Another medical use for magnets is for treating cancer. A doctor injects a magnetically-sensitive fluid into the cancer area and uses a powerful magnet to generate heat in the body. The heat kills the cancer cells without harming healthy organs. A magnet is the most vital part of the MRI system. It uses the body's natural magnetic properties to produce detailed images from every part of the body. Thanks to this process, MRI scans enable doctors to diagnose and treat patients accurately.

Computers

Every time you store photos, music or text documents on your computer, you use magnets. Many computers use magnets to store data on hard drives. Magnets alter the direction of a magnetic material on a hard disk in segments that then represent computer data. Hard disk drives store the data thanks to the billions of magnets that cover them. The north and south poles of these magnets on the surface of hard disk drives can represent either zeros or ones, enabling the data storage through the function of the magnets to attract and repel. Later, computers read the direction of each segment of magnetic material to "read" the data. The small speakers found in computers, televisions and radios also use magnets; inside the speaker, a wire coil and magnet converts electronic signals into sound vibrations.

Electric Power and Other Industries

Magnets offer many benefits to the industrial world. Magnets in electric generators turn mechanical energy into electricity, while some motors use magnets to convert electricity back into mechanical work. In recycling, electrically-powered magnets in cranes grab and move large pieces of metal, some weighing thousands of pounds. Mines use magnetic sorting machines to separate useful metallic ores from crushed rock. In food processing, magnets remove small metal bits from grains and other food. Farmers use magnets to catch pieces of metal that cows eat out in the field. The cow swallows the magnet with its food; as it moves through the animal's digestive system it traps metal fragments.

In the Home

Though it may not be obvious, most homes contain many magnets. Refrigerator magnets hold papers, bottle openers and other small items to the metal refrigerator door. A pocket compass uses a magnetic needle to show which way is north. The dark magnetic strip on the backside of a credit card stores data in much the same way as a computer's hard drive does. Vacuum cleaners, blenders and washing machines all have electric motors that work by magnetic principles. You'll find magnets in phones, door bells, shower curtain weights and children's toys.

Magnets for Detection: Burglar Alarms and Magnetometers

At heart, a burglar alarm consists of a contact switch, which responds to changes in the environment and sends a signal to a noisemaking device. The contact switch may be mechanical—a simple fastener, for instance—or magnetic. In the latter case, a permanent magnet may be installed in the frame of a window or door, and a piece of magnetized material in the window or door itself. Once the alarm is activated, it will respond to any change in the magnetic field—i.e., when someone slides open the door or window, thus breaking the connection between magnet and metal.

Though burglar alarms may vary in complexity, and indeed there may be much more advanced systems using microwaves or infrared rays, the application of magnetism in home security is a simple matter of responding to changes in a magnetic field. In this regard, the principle governing magnetometers used at security checkpoints is even simpler. Whether at an airport or at the entrance to some other high-security venue, whether handheld or stationary, a magnetometer merely detects the presence of magnetic metals. Since the vast majority of firearms, knife-blades, and other weapons are made of iron or steel, this provides a fairly efficient means of detection.

At a much larger scale, magnetometers used by astronomers detect the strength and sometimes the direction of magnetic fields surrounding Earth and other bodies in space. This variety of magnetometer dates back to 1832, when mathematician and scientist Carl Friedrich Gauss (1777-1855) developed a simple instrument consisting of a permanent bar magnet suspended horizontally by means of a gold wire. By measuring the period of the magnet's oscillation in Earth's magnetic field (or magnetosphere), Gauss was able to measure the strength of that field. Gauss's name, incidentally, would later be applied to the term for a unit of magnetic force. The gauss, however, has in recent years been largely replaced by the tesla, named after Nikola Tesla (1856-1943), which is equal to one newton/ampere meter (1 N/A·m) or 10^4 (10,000) gauss.

As for magnetometers used in astronomical research, perhaps the most prominent—and certainly one of the most distant—ones is on *Galileo* , a craft launched by the U.S. National Aeronautics and Space Administration (NASA) toward Jupiter on October 15, 1989. Among other instruments on board *Galileo*, which has been in orbit around the solar system's largest planet since 1995, is a magnetometer for measuring Jupiter's magnetosphere and that of its surrounding asteroids and moons.

USES OF MAGNETS IN ROLLER COASTERS

Roller Coasters have many functions that involve electromagnets. They now use magnetic propulsion, the attraction of magnetic fields between the track and the bottom of the train. It creates a quick acceleration, whereas before roller coasters relied on an uphill chain start. Magnetic brakes have also been applied to roller coasters so that magnets attract each other, which gradually slows down the roller coaster.

In replace of an uphill chain start, roller coasters use magnetic propulsion. When the ride starts, the electromagnets on the car move closer to the electromagnets on the track. Then the engineer will flip a switch, creating an electric current through the car and the track. Initially, the magnets will attract due to opposite charges, but when the current is reversed the (like) charges propel the cars forward.

The Maverick, at Cedar Point, will accelerate from 0-70 mph in a matter of a few seconds due to electromagnetism.

The Rock n' Roller Coaster at Orlando, Florida accelerates from 0 to 57 mph in 2.8 seconds due to electromagnetism.

Electromagnets are also used when roller coasters need to carefully slow down and stop like brakes would. A current runs through the conductor on the track which creates an opposite charge to the magnets on the car itself. The opposite charge forms a magnetic attraction between the track and the car which slows the car down. The magnets on the track gradually increase in strength so that when the car reaches the last magnet it will completely stop any motion.