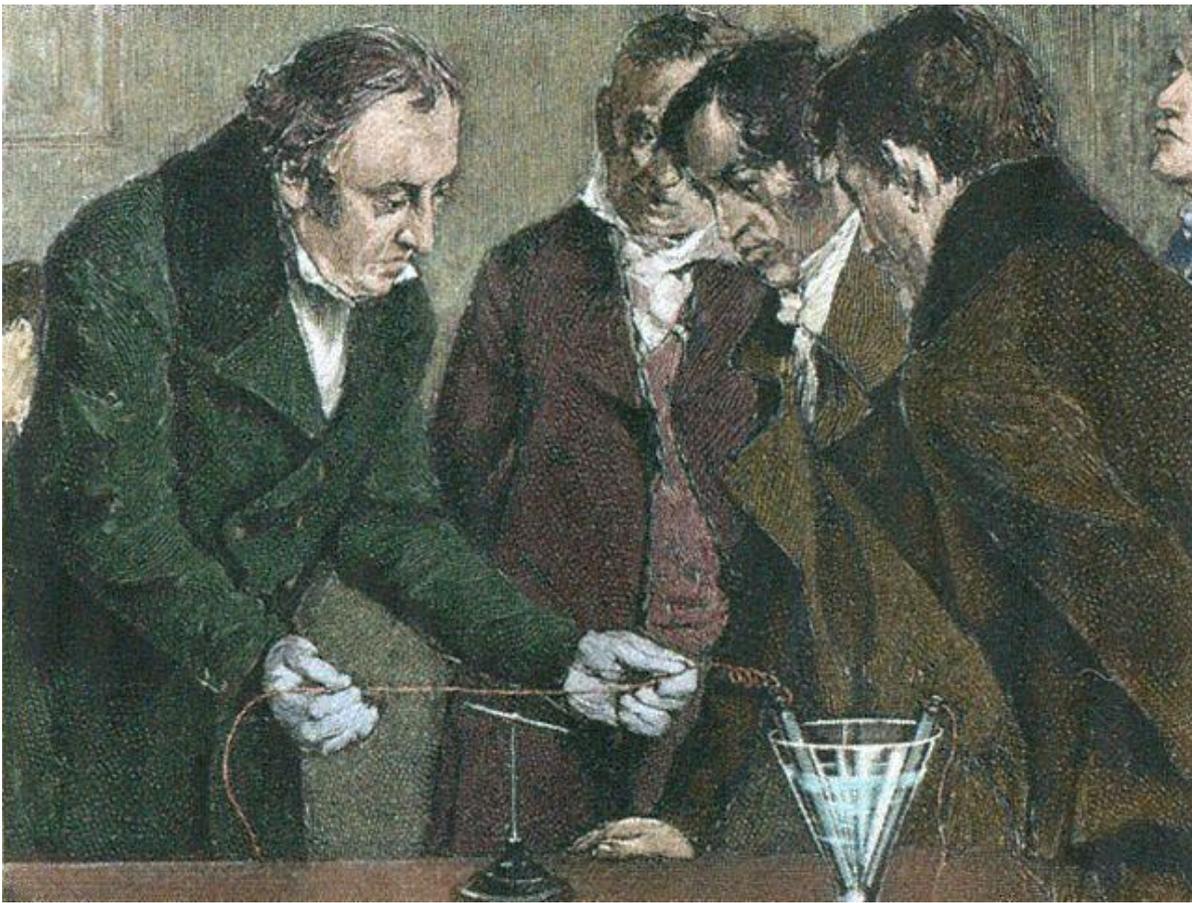


NOTES 21.1

What is Electromagnetism?

Chapter 21: Using Electricity and Magnetism

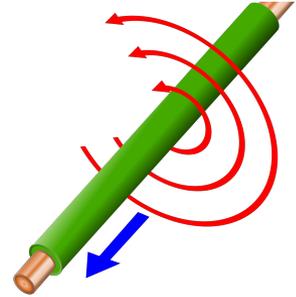


In 1820, Hans Christian Oersted discovered that compass needles changed direction when they came near a wire with current.

Oersted was the first to discover that electricity and magnetism are related.

Wherever there is electricity, there is magnetism.

An electric current produces a magnetic field.



The relationship between electricity and magnetism is called electromagnetism.

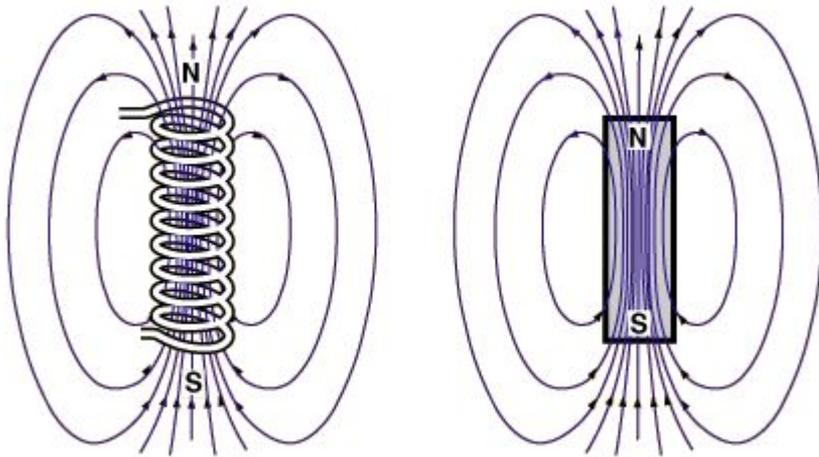
A compass will normally point north because it aligns itself with the Earth's magnetic field. It will point in different directions only if another magnetic field is present.

The needles of the compass will align with the magnetic field that a current produces.

The magnetic field produced by a current has three distinct characteristics:

- 1. The field can be turned on or off.**
 - Turn off the current.**
- 2. The field's direction can be reversed.**
 - Change the direction of the magnetic field by reversing the direction of the current.**
- 3. The field's strength can be changed.**
 - If a wire is twisted into a loop around a cylinder, the magnetic field lines become bunched up inside the loop. The strength of the magnetic field increases as the number of loops, or coils, increases.**

By winding a wire with a current into many loops, the magnetic field is strengthened.

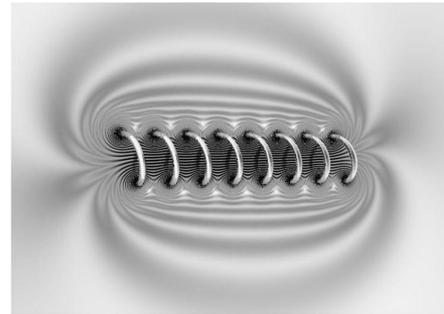


In a solenoid, however, the north and south poles change with the direction of the current.

The two ends will act like magnetic poles.

Iron filings would resemble the iron filings around a bar magnet.

A coil of wire with a current is called a **solenoid**.



A solenoid with a ferromagnetic core is called an electromagnet.

The magnetic field of an electromagnet is produced by both the current in the wire and the magnetized core.

The overall magnetic field can be hundreds or thousands of times stronger than the magnetic field produced by the current alone.

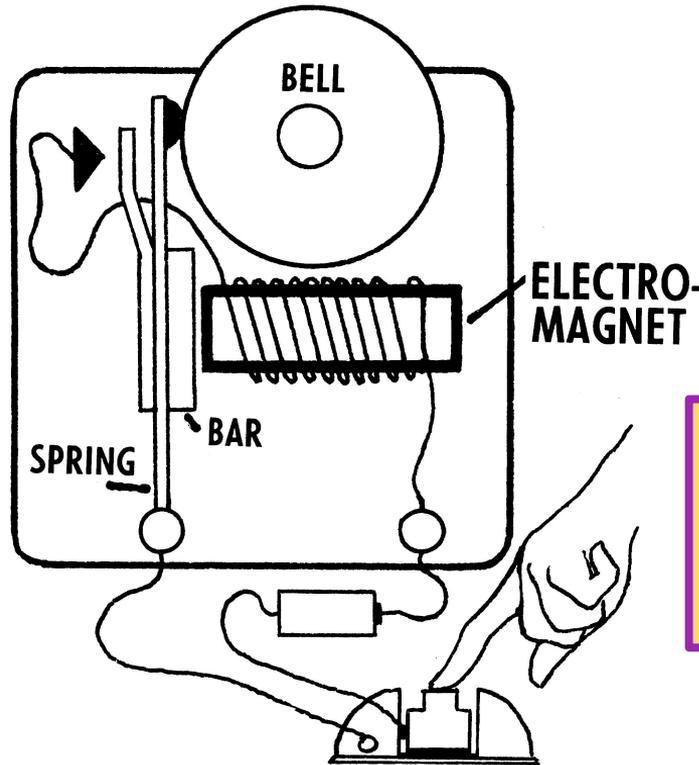
An electromagnet can be turned on and off.

The electromagnet's strength can be increased by:

- 1. Increase the current in the solenoid.**
- 2. More loops of wire can be added to the solenoid.**
- 3. The coils of the solenoid could be wound closer together.**
- 4. A stronger ferromagnetic material could be used for the core.**

The clapper is attached to the metal bar, which is attracted to the electromagnet.

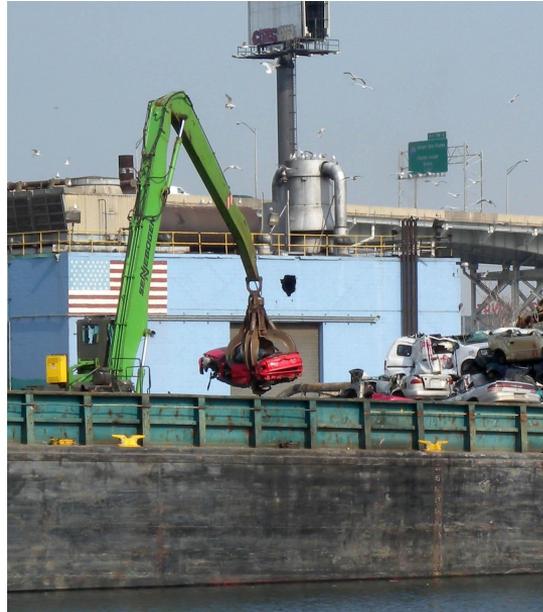
The electromagnet turns off because when it attracts the metal bar, the rising metal bar breaks the circuit.



The electromagnet attracts the metal bar.

Pressing the button closes the circuit and turns on the electromagnet.

Electromagnets are used to record information onto audiotapes, videotapes, computer hard drives, and credit cards.



A switch is turned on in the crane, producing a current in the electromagnet. This forms a strong magnetic field that attracts metal objects. To drop the object, the switch is turned off.