MAGNETISM
and
ELECTRICITY

Manual of Instructions

NEW HAVEN, CONN., U.S.A.
The A. C. Gilbert Company

PRINTED IN U.S.A.
FOREWORD

MAGNETIC FUN and FACTS

Electrical current is the motion of the electrons through a conductor. This motion is caused by a force acting on the electrons, such as a battery or an electric generator. The force is provided by the magnetic field around the conductor. When an electric current flows through a conductor, it generates a magnetic field, which is used in many technologies, including motors, generators, and transformers.

Though it is possible to control the behavior of electrons, it is not possible to change the basic properties of electricity. Instead, electricity is controlled by changing its flow through a conductor.

Electrical current is measured in amperes (A) and is the amount of charge that passes a given point in a circuit per second. The SI unit of electrical voltage is the volt (V), and it is defined as the work required to move one coulomb of charge through a potential difference of one volt.

Electrical power is measured in watts (W) and is the rate at which electrical energy is transferred or converted.

Electrical energy is stored in various forms, including chemical energy in batteries, nuclear energy in nuclear power plants, and mechanical energy in wind turbines.

Electrical engineers design and develop electrical systems and devices, such as power plants, transformers, and power distribution systems.
You can easily demonstrate the approximate distance in which the field is present by the following experiment.

1. **Preparation**: Place a 12-volt battery and a 12-volt motor unit as shown in the diagram. Connect the positive lead of the battery to the positive lead of the motor, and the negative lead of the battery to the negative lead of the motor.

2. **Observation**: When the motor starts to turn, it will be attracted by the magnetic field. This demonstrates that the field is present within the area indicated by the circle.

**Conclusion**: This experiment shows that the magnetic field is present within the area defined by the circle around the battery and motor. The field's strength decays rapidly beyond this area, making it effective for applications requiring localized magnetic fields.
THE PERMANENT MAGNET

The magnetic moment is an inherent one which is made of anything and will remain the same regardless of its position or length. The permanent magnet is an object whose magnetic moment is not affected by this property. The magnetization process is relatively simple and can be achieved through the use of a powerful electromagnet. Once magnetized, the magnet will retain its magnetic properties for a long period of time.

MAGNETISM

The force of attraction between two magnets depends on their distance and orientation. The closer the magnets are, the stronger the magnetic interaction. The interaction can be attractive or repulsive, depending on the orientation of the magnetic poles. The force decreases as the distance between the magnets increases.

MAGNETIC PIN AND RATS

Wrap the work in a piece of cloth and suspend it from your stand. Connect a wire to the work and pass it through a magnet. The magnetic field will attract the work and hold it in place. This is a common technique used in metalworking to hold pieces in place during welding or machining operations.

ELECTRIC SPINDLERS

Electric spindlers are some of the basic tools used in metalworking. They are used to spin metal rods, bars, or wires into precise shapes and sizes. Electric spindlers are controlled by an operator and can be programmed to perform specific operations. They are widely used in the metalworking industry due to their precision and versatility.

CONDENSATION AND INSULATIONS

Condensation is a natural phenomenon where moisture forms on a surface when the temperature drops below the dew point. Insulation is the process of preventing the transfer of heat, sound, or electricity through a material. Good insulation materials are those that are dense, have a low thermal conductivity, and are capable of blocking the transfer of heat, sound, or electricity.
HOW TO MAKE MAGNETS

1. Obtain iron filings and mix them with a powdery substance like flour.
2. Shape the mixture into a sphere and wrap it in tin foil.
3. Heat the sphere until it glows red.
4. Cool it and remove the tin foil.

THE LAW OF POLLS

When two magnets repel each other, one pole will always be the north pole of one and the south pole of the other. This is because opposite poles attract each other, while like poles repel.

NORTH AND SOUTH POLLS

Place one end of a needle on the surface of a piece of paper. The needle will point towards the north pole of the magnet and away from the south pole.
Lines of Force.

With a magnet suspended to rotate, it can be seen that wherever a magnet is present, a magnetic field exists that can be measured. This field can be visualized by using iron filings or a bar magnet with a needle attached. The filings will align in the direction of the magnetic field, and the needle will point towards the field's center.

Magnetic Induction.

The strength of the magnetic field depends on the size and shape of the magnet, as well as the material it is made of. A stronger magnet will produce a stronger field, and a larger magnet will extend the field over a greater distance.

Care of Magnets.

To protect magnets from damage, they should be stored in a cool, dry place and away from other magnets or metal objects. Exposing them to extreme temperatures can also affect their strength. Regularly cleaning magnets with a soft cloth can help maintain their performance.
MAGNETIC FUN AND FACTS

THE COMPASS

The compass is a device used to determine direction. It contains a magnetized needle that aligns itself with the Earth's magnetic field. The needle points towards the magnetic north pole. To use a compass, you need to align the needle with the direction you want to travel. The compass can be used to navigate through open fields or mountainous areas where other navigation tools may not be effective. It is also useful in situations where you need to establish a bearing or direction to a distant landmark.

THEORY OF MAGNETISM

Magnetic poles are located on the Earth's surface. The north magnetic pole is located in the Arctic region, and the south magnetic pole is located in the Antarctic region. The Earth's magnetic field is generated by the movement of molten iron in the Earth's core. The magnetic field is strongest at the poles and weakest at the equator. The Earth's magnetic field is constantly changing, and this can be measured using a magnetic compass or a surveying device called a theodolite.

MAGNETIC STRENGTH

The strength of a magnetic field is measured in units called teslas. The Earth's magnetic field is typically measured at about 0.5 to 0.6 teslas. The strength of a magnetic field is affected by the distance from the source of the field and the material the field is passing through. The Earth's magnetic field is much stronger than the magnetic field generated by human-made magnets.

ECOLOGICAL IMPACTS

Magnetism is a powerful force that can affect the behavior of animals. Some animals, such as birds, use the Earth's magnetic field to navigate during migration. Others, such as some fish and crustaceans, use the Earth's magnetic field to orient themselves in the water. Magnetic fields can also affect the behavior of some plants, such as lichens, which use the Earth's magnetic field to orient themselves in the soil.

MAGNETIC REMNANCE

Magnetic remanence is the ability of a material to retain its magnetic properties after the external magnetic field is removed. This property is important in many applications, such as in the production of permanent magnets. Magnetic remanence is measured by the ratio of the magnet's remanent magnetic field to its peak magnetic field. The remanent magnetic field is the magnetic field that remains in the material after the external field is removed.

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The electricity is made by using the current in a cell. If you move a magnet around a cell, you will find that the electric current is generated. In a dry cell, you can see two poles, the positive pole and the negative pole. The positive pole is where the cell is inserted, and the negative pole is where the cell is connected to the circuit. The cell contains a liquid called the electrolyte, which allows electric charges to flow. The metal parts of the cell are connected to the outside world through wires or connections. The cell is a container made of special materials that protect the electrolyte and keep the cell from leakage.
ELECTRICITY SETS UP MAGNETISM

Place your compass on a table. Next, take a piece of ungrounded wire. Join
the wire to one end of the magnet. Connect your battery to the other end.

HOW TO MAKE A RESISTOR

HOW TO TASTE ELECTRICITY

MAGNETIC AND ELECTRICITY

YOUR OWN ELECTRIC LIGHT PLANT

You can make a simple electric light plant. First, connect a battery to a circuit.
Then, connect the light bulb to the circuit. The light bulb will light up when
the circuit is complete.

MARKING AN ELECTRIC SPARK

Select two wires or two small metal objects. Hold the wires or objects
about 2 inches apart. Then, connect the wires to the battery. The wires will
light up when the battery is connected.
Voltaic: The amount of volts are determined by the use of a millivoltmeter.

In order to zero the current flowing in the circuit, we need to ensure that the pressure is

The Volt: The instrument used to measure the quantity of voltage.

The Ampere: The instrument used to measure the quantity of current.

The Quantity of Current Attracted into the Circuit: The following units of measure are useful when studying the amount of current attracted into the circuit.

1. Voltmeter
2. Ammeter

In measuring liquids and gases, a unit of measure based on the volume, such as a gallon, is commonly used.

ELECTRICAL UNITS

Fig. 22

As shown in Fig. 22, a galvanometer connects one end of the wire to a battery, and then expands some iron filings. Connect one end of this wire to a battery, then connect a piece of tree copper wire through it.

Another method of showing the lines of force around a wire is called the Cavendish method.