Gilbert's Magnetic Fun and Facts

Chapter A

How to Make Magnets

A working knowledge of the design and manufacture of magnets.

Chapter B

This chapter is for the boy who likes to work with his hands. It may be a little harder to understand than well as with his hands. It may be a little harder to understand than...
on the shape of the magnet and, also, its magnetic strength.

Lifting Power—The lifting power of a magnet depends

on its shape and on other factors. The lifting power of a magnet

is the force of attraction of the

magnet on an object that it can lift.

Strength of a Magnet—This is a term quite different

electro-magnets.

from lifting power. It is the force of attraction of the

magnet on an object that it can attract.

It is necessary to understand the working principle of certain electrical

device explaining the design of electro-magnets.

ELECTRO-MAGNET DESIGN

Your magnetic pool is an object in which you may, by carefully

manipulating its field, make it perform tasks. This is especially

true of horseshoe magnets which can be used to manipulate

objects with a magnetic field. Horseshoe magnets are

simple to make and require no special equipment.

HORSESHOE MAGNETS

GILBERT'S MAGNETIC FUN AND FACTS

GILBERT BOY ENGINEERING
CILBERT MAGNETIC FUN AND FACTS

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Definitions

Electric Units

be used for magnets of any type or form.

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strength of your current
increases the resistance of your circuit, thereby cutting down the
effectiveness of the current. Remembering that a loose joint or poorly soldered wire
can cause overheating, it is important to keep these connections tight and clean. This is especially true for wires that are exposed to the elements, where they are often subject to wear and tear.

If you are replacing the wire, make sure that the ends are clean and polished. Otherwise, the wire will not make good contact with the terminals, causing a loss of current. You can clean the wire by sanding it with a piece of sandpaper or sanding it down with a knife. Good insulation is also necessary to ensure that the wire will not come into contact with the terminals.

GENERAL INSTRUCTIONS FOR CONNECTIONS

Conductor: A conductor is the part of the apparatus that is intended to carry the electricity. It is the circuit in which current flows through.

Ground: The ground is the return path for the electricity. It is the circuit in which current flows back to the source. The ground is also the reference point for measuring voltage and resistance.

SHORT CIRCUITS

A short circuit is a condition in which current escapes through a path lower resistance than the intended path. It is often caused by a break in the insulation or a defect in the conductor. A short circuit can cause damage to the apparatus and can be dangerous. It is important to prevent short circuits by ensuring that the insulation is in good condition and that the conductor is not damaged.

UNIT OF POWER

Current is the flow of electric charge per unit time. It is measured in amperes (A). One ampere is equal to one coulomb of charge passing through a conductor per second.

Example: If you have a circuit with a voltage of 120 volts and a resistance of 10 ohms, you can calculate the current using Ohm's law: I = V / R = 120 / 10 = 12 A.

Ohm's Law: I = V / R, where I is the current in amperes, V is the voltage in volts, and R is the resistance in ohms.

The units of power are watts (W). One watt is equal to one joule per second.

Example: If you have a circuit with a voltage of 120 volts and a current of 10 amperes, the power is given by P = V * I = 120 * 10 = 1200 watts.

Power (W) = Voltage (V) * Current (I)
DESIGN OF AN ELECTRO-MAGNET

...results in a possible to wind in a square inch of space...

Table D is also a very useful table. It gives the largest number of coils that can be wound on a core of 1/2, 1, and...
When the weight to be tested and the area of the pole face is known, the formula (2) can be rewritten in various ways as follows:

Formula (2): \( A = \frac{p \times B}{72,134.900} \)

(1)

The abbreviation of this rule is shown: pole face in square inches and the product is divided by 72,134.900.

The rule for such a measure is: The pounds weight to be tested is equal to the square of the density multiplied by the area of the pole face in square inches.

After the area is in place conversant with a unit which can handle many of these numbers and so the final practice is to design in measures under actual working conditions, we do not find a short methodical path to the idea of magnetic force.

When a smooth iron block having clean, dense, and smooth faces is tested for a low material, the result will more likely be less than the previous results of the test.
The thickness should be about \( \% \) of an inch. The thickness should not be more than \( \% \) of an inch. This thickness should be about \( \% \) of an inch. The outside diameter of these discs should be \( \% \) of an inch more than the actual size. The discs should have a hole in the center so they will be a tighter fit over the wires. Make your circular discs of heavy cardboard or paper. These should be at least \( \% \) of an inch deep.

The area of a circle is equal to the diameter multiplied by itself, \( \pi \times \text{Diameter} \times \text{Diameter} \). Solve this example:

\[
\frac{\pi}{2} \times 22.14'' = 3.1416''
\]

The magnetic pull required is \( 500 \) lb.

We now have a correct total magnetic force through which magnetic
force of length our model is \( 9200' \) long, we must have \( 4 \) amperes

The current flow in this circuit is \( \frac{9200'}{4} = 2300' \) or \( 25' \) ft.

\[
\frac{22000}{2300} = \frac{9}{2} \approx 4.5
\]

The circumference will be at least \( 4.5 \times 22 = 144\) ft.

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For the windings, we can determine a safe value for heating. For the wire given in the figure, the square inches of reactive surface of the windings will be reduced to the calculated size of the core material. It is then found that it will be 62.5 square inches. We may then use No. 25 wire, but first we must find the circumference.

\[ W = \frac{1.44}{6} \times \frac{1.9}{2} \times 1.9 = 1.31 \text{ in.} \]

The circumference of the coil is 1.31 in. We may use No. 25 wire, but first we must find the number of turns.\[ N = \frac{W}{T} \]

The number of turns is then found by dividing the circumference of the core material by the number of turns.\[ T = \frac{W}{N} \]

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**Rules for Finding Turns and Wire Size**

- **Wire Size**
  - The wire size may be found in tables until it is 62.5 square inches. A No. 22 wire is one that gives us a circumference of 62.5 square inches, or nearly the size of the wire we are using.
  - The table will give us the size of the wire to use, but it is not very accurate. We must use the following formula:
  \[ \frac{W}{N} = \frac{1}{2} \times \frac{1.9}{2} \times 1.9 \]

- **Wire Circumference**
  - The circumference of the wire is found by multiplying the number of turns by the diameter of the wire in inches.\[ C = T \times D \]

- **Wire Length**
  - The wire length is found by multiplying the number of turns by the diameter of the wire in inches.\[ L = T \times D \]

- **Wire Weight**
  - The wire weight is found by multiplying the number of turns by the diameter of the wire in inches.\[ W = T \times D \]

- **Wire Voltage**
  - The wire voltage is found by multiplying the number of turns by the diameter of the wire in inches.\[ V = T \times D \]

- **Wire Amperage**
  - The wire amperage is found by multiplying the number of turns by the diameter of the wire in inches.\[ A = T \times D \]

- **Wire Resistance**
  - The wire resistance is found by multiplying the number of turns by the diameter of the wire in inches.\[ R = T \times D \]

- **Wire Power**
  - The wire power is found by multiplying the number of turns by the diameter of the wire in inches.\[ P = T \times D \]

- **Wire Efficiency**
  - The wire efficiency is found by multiplying the number of turns by the diameter of the wire in inches.\[ E = T \times D \]

- **Wire Efficiency Factor**
  - The wire efficiency factor is found by multiplying the number of turns by the diameter of the wire in inches.\[ F = T \times D \]

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