Biology

Electric motor

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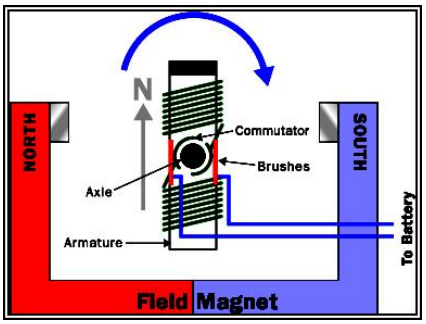
Introduction to electric motors

An electric motor is all about magnets and magnetism. An electric motor uses magnets to create motion. You know the law of magnets: opposite poles attract and like poles repel. So if you have two bar magnets with their ends marked "north" and "south," then the north end of one magnet will attract the south end of the other. On the other hand, the north end of one magnet will repel the north end of the other. Inside an electric motor, these attracting and repelling forces create rotational motion.



What is an electric motor?

An electric motor is an electromechanical device that converts electrical energy to mechanical energy. This mechanical energy is used, for example, to rotate a pump impeller, fan or blower, drive a compressor, lift materials etc. Electric motors are sometimes called the “work horses” of industry; it is estimated that motors use about 70% of the total electrical load in industry.

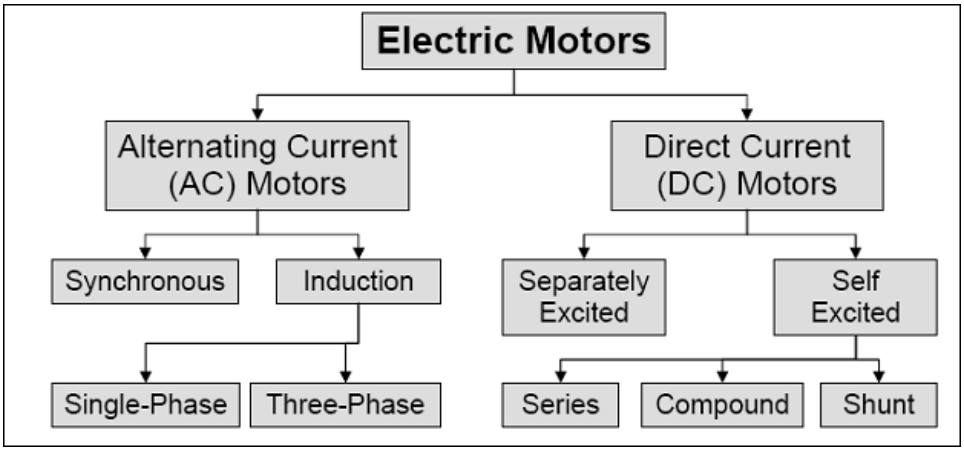
Components of electric motors

If you take apart a small electric motor, you will find that it contains the following: two small permanent magnets inside casing, two brushes held in housing, and an electromagnet that is made by winding wire around pieces of shaped metal (laminations) on a steel shaft, known as an armature or rotor. The rotor will almost always have three poles or more, and there are two good reasons this:

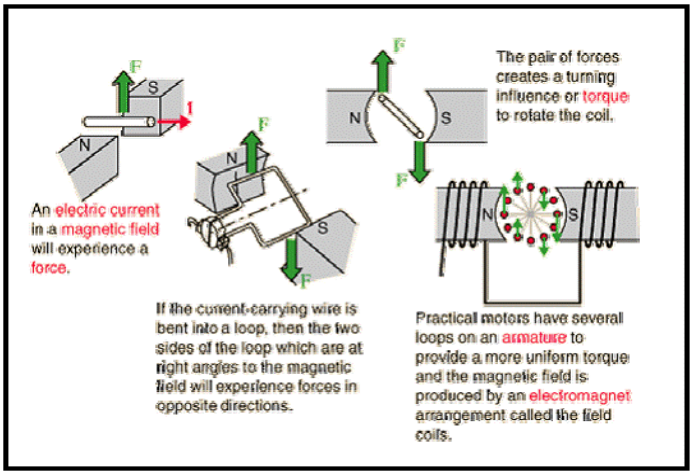
1. Having three or more poles causes the motor to have better dynamics (movement). In a two-pole motor, if the electromagnet is at the balance point, which is perfectly horizontal between the two poles of the field magnet when the motor starts, you can imagine the armature getting "stuck" there. That never happens in a three-pole motor, which can start turning from any starting position.
2. Each time the commutator hits the point where it flips the field in a two-pole motor, the commutator temporarily shorts out the battery (i.e., it directly connects the positive and negative terminals). This shorting wastes energy and needlessly drains the battery. A three-pole motor solves this problem. In fact, an efficient motor's timing switches on the armature when the magnetic repulsion is strongest.

An electric motor can have any number of poles, depending on the size of the motor and its specific application. Motors come in different shapes and sizes to fit almost anywhere.

Types of Electric Motors



How does an electric motor work?



The general working mechanism is the same for all electric motors (see first figure above):

a) An electric current in a magnetic field will experience a force.

b) If the wire that carries current is bent into a loop, then the two sides of the loop, which are at right angle to the magnetic field, will be forced in opposite directions.

c) The pair of forces creates a turning torque to rotate the coil.
d) Practical motors have several loops on an armature to provide a more uniform torque. The magnetic field is produced by electromagnet arrangement called the field coils.

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Reference links:

- http://en.wikipedia.org/wiki/Electrical_conductor
- http://www.en.wikipedia.org/wiki/magnetic_field
- http://www.coolmagnetman.com/magsolen.htm

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