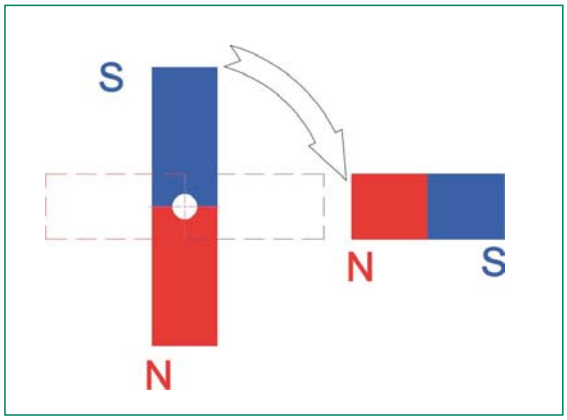
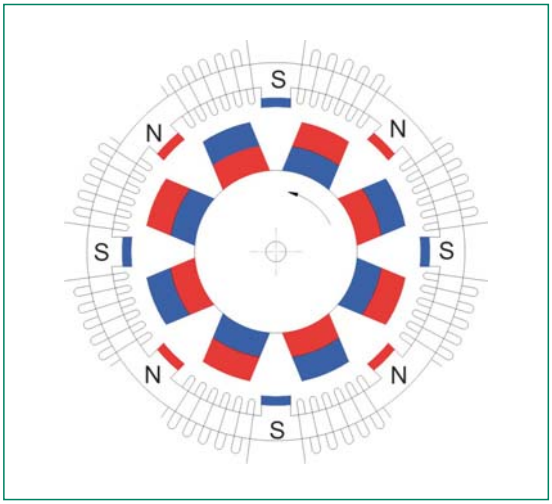
Basics of an Electric Motor

Magnets have two poles north and south. Most people are familiar with the way that “like” magnetic poles repel one another, while “unlike” poles attract. This is the basic mechanism whereby force is generated in a Wellington Drive motor (and in other brushless DC motors).



The mechanism is easily understood by considering two magnets: one fixed to a shaft through its centre so that it is free to spin, and the second held in hand. When the magnet held in hand is brought close, the mounted magnet will spin around the shaft until a north pole aligns with a south pole. If the handheld magnet is reversed (turned end for end), the process will repeat. This is the basic turning force that makes an electric motor spin.

An electric motor is more complicated in one basic way. Rather than two magnets, the turning force in a Wellington Drive electric motor is derived from many permanent magnets, while the place of the handheld magnet in the simple experiment described above is taken by the magnetic field induced when an electric current flows through a wire. Importantly, the direction of the current determines the polarity of the magnetic field; hence, if the direction of current flow is reversed, the “north” and “south” poles of the magnetic field surrounding the wire will also reverse. When an electric motor is spinning at high speed, the permanent magnets are being driven around a shaft by an electrically induced magnetic field, which is being reversed in polarity many times per second. The magnetic field is electronically controlled to be synchronised with the rotating magnets so that a steady rotational force is produced.



In practice, the 'wire' that is inducing the electric current is a tightly wound length of copper wire (to concentrate the magnetic force), which will be immediately recognisable to anyone who has disassembled an electric motor.

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