

is to create a stronger magnetic field. With a strong field on its left and a weak on its right, the conductor moves toward the right.

A single conductor passing through a magnet isn't a very effective tool. If we bend the conductor into a coil so it comes back through the magnet, we have a rudimentary motor. With the current applied in the direction of the arrows, the forces of the magnetic fields tend to push up the left side of the coil and push down the right side.

By attaching the coil to a freewheeling shaft, it will rotate in a clockwise direction as shown in Figure 8-16. This primitive, low-power motor can be somewhat enhanced by using heavy copper wire for the coil, which permits heavier current flow and a stronger magnetic field. Similarly, if current is run through windings around the magnetic poles, called *field windings*, there also will be a stronger magnetic field between them. Our single-coil system still would operate poorly because the torque and speed would vary dramatically as the coil moved from high magnetic influence to low.

The solution is a motor armature composed of many insulated coils connected to an iron or steel core. The core, mounted on a shaft with bearings at each end, increases and focuses the strength of the magnetic field to maximize its use. As one coil moves out of the magnetic field, another coil enters it. The armature turns continuously and smoothly as long as current is applied.

The starting circuit system includes the starter motor, switch, battery, and load circuit. The battery powers the starter motor and operates electrical equipment whenever the aircraft generator is unable; therefore, a healthy battery is essential to effective starter operation. The starter switch activates and deactivates the starter motor. It completes the circuit between battery and motor. Load circuit is the term used for all the cables that connect the individual units of the starter system, including the battery ground strap, the battery-to-starter switch, and the starter switch to motor.

The load circuit must be of sufficient capacity to carry the necessary starting current with minimal loss to resistance. These cables are chosen carefully to handle high current; a smaller size causes significant reduction in cranking power and can be a fire hazard. Cable connection points should be inspected periodically to assure they are tight and clean because any unnecessary resistance also will reduce cranking power.

The starter motor converts battery electrical potential to mechanical rotary power. Its frame and field assembly house and support all motor components. The field windings and pole shoes combine with the metal frame assembly to provide a path for the magnetic field in which the armature will turn, as shown in Figure 8-17. A simple but effective brush and holder system feeds the rotating armature with battery power. The brushes seat against, and slide across, the commutator as it turns. Each segment of the copper commutator is insulated from the others and the armature shaft, permitting battery power to go to each individual coil. The armature bearings are seated on the end with the commutator end head, and on the other end in a pinion housing, which also contains the gear drive mechanism that turns the engine.

Various airframe manufacturers employ different methods of activating the starting circuit. Many old aircraft have a T-handle to pull or a solenoid button to push. Most modern aircraft have a key switch similar to an automobile. When the switch is turned, battery current goes to the starting motor terminal, which divides it between the field