the current flows into the battery, recharging it while simultaneously supplying its own field rotor with the required 2-amp excitation.

Most aircraft systems use DC voltage, so the alternator's AC output is converted (rectified) to DC through an integral silicon diode rectifier. The diodes act as one-way doors with very high resistance to current flow in one direction and low resistance in the other. They only permit current flow from the alternator to the battery. The diode prevents AC flow reversal, thereby rectifying it to DC. The DC voltage resupplies the battery and is directed to the aircraft's main bus through a 60-amp circuit breaker, where it supplies the electrical system. It also serves as the rotor's exciter current.

As the demand on the alternator increases or decreases, voltage is varied by a regulating field current. DC output is fed to a regulator-voltage-sensing coil via the 2-amp circuit-breaker alternator field switch. The coil works like a governor, sensing electric bus voltage and varying system resistance as necessary. If the bus voltage is too high, the sensing coil shifts the position of a movable contact, which puts a resistor in the circuit. This reduces the field excitation, thereby reducing the alternator output voltage. If the bus voltage is too low, the sensing-coil spring pulls the contacts back and removes the resistor from the circuit, increasing field excitation, thereby increasing alternator output voltage.

Newer alternators use solid-state regulators. This type of regulator replaces the sensing-coil mechanism and moving resistor contacts with transistors and a zener diode. The transistor acts as an electric current on/off switch and has no moving parts. The zener diode allows current to move in only one direction, except at a specified voltage value, then it reverses direction. This serves as a voltage-sensing device to vary current in conjunction with the transistors.

The modern light aircraft alternator is almost identical to its automotive counterpart. The only real difference is the aircraft alternator has a holder and special brushes for high-altitude operation. Figure 8-12 shows that the rotor is a single-field coil encased between a pair of four-poled iron sections on a shaft with insulated slip rings at one end and a nut and washer at the other. This is connected to a drive pulley that runs off the engine accessory section (or crankshaft).

Typically, the alternator field switch is interlocked with the battery master switch, which allows the pilot to shut down the alternator without turning off the battery. When the battery master is turned on, the bus bar is energized. This sends power through the alternator field switch to the brushes and slip rings. The primary difference between the brushes on an alternator and those on a generator is the alternator brushes handle only a few amps, whereas the generator brushes handle up to 60 amps. From the slip rings the power goes to the rotor. The rotor turns inside the stator, and its magnetic field cuts through the stator's three, single-phase windings, which are spaced so that the voltage induced in each is 120 degrees out of phase with the voltages in the other two windings. This Y-shaped arrangement is what produces the three-phase AC, and system voltage builds up rapidly. From there the power goes to ground, completing the circuit.

Today, because of the requirements of FAR 23, it is common for light, single-engine aircraft to come standard with a 60-amp alternator to meet the heavy demand for in-flight power. According to FAR Part 23, Airworthiness Standards—Normal, Utility,