A.C. GENERATORS

duction:

Induction is the process by which a magnetic field is used to create electric current. It is the operating principle of the generator.

We have seen that wherever an electric current is flowing, a magnetic field is present. Conversely, wherever there is a magnetic field, an electric current can be *induced.*

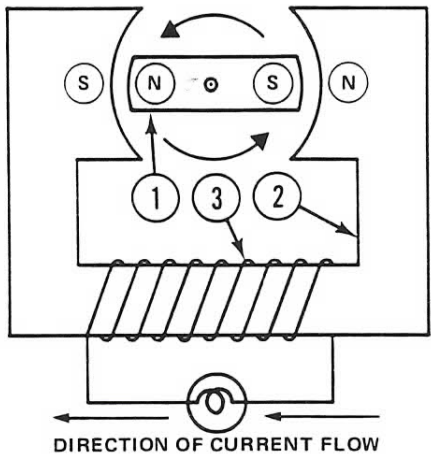
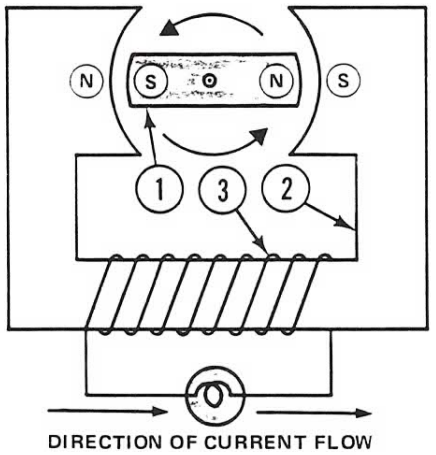


Fig. 15 Elementary A.C. Generator



(1) PERMANENT MAGNET
(2) SOFT IRON FRAME
(3) WIRE COIL

Fig. 16 Elementary A.C. Generator

An electric current is induced in a wire coil whenever lines of magnetic force are cut by the wires. The strength of the induced voltage depends on three factors:

1. The number of windings in the wire coil. The more windings there are, the more times the magnetic lines of force will be cut.

2. The strength of the magnetic field. Stronger magnets have more lines of force.

3. The speed with which the lines of magnetic force are cut by the wires.

A.C. Generator Operation:

Fig. 15 & 16 show an elementary A.C. generator. A permanent magnet (1) is suspended within a soft iron frame (2) which completes the circuit for the permanent magnet's lines of force. The soft iron frame thereby becomes a temporary magnet, concentrating lines of magnetic force around the wire coil (3).

When the permanent magnet (1) is rotated 180°, the magnetic polarity of the soft iron frame (2) is reversed. With each 180° of rotation, the magnetic lines of force around the soft iron frame collapse and then reestablish themselves in the opposite direction. Each time the lines of force collapse and rebuild, they are cut by the wire coil (3), and an electric current is induced in the wires.

The current thus generated is called "A.C." (alternating current) because the direction of current flow reverses each time the magnetic field is reversed.

The elementary A.C. generator shown in Fig. 15 & 16 has a two-pole rotating magnet and a two-pole soft iron frame. The induced current therefore reverses every 180°. A full cycle is completed every 360°.

If the motorcycle is equipped with a six-pole rotating magnet and a six-pole soft iron frame, as shown in Fig. 17, the induced current will reverse every 60°, and a full cycle will be completed every 120°. More current is generated because there are a greater number of generating coils in operation, and magnetic lines of force are cut more frequently.

An A.C. generator can be constructed with any even number of poles. It is common practice to use one set of coils to generate ignition current and another set to generate lighting current (Fig. 20), or to use one set of coils to generate the current needed for daytime operation with lights off and additional coils for nighttime operation with lights on (Fig. 17, 18, 19).

Fig. 18 illustrates the hookup for controlling the number of coils to be utilized in the generators shown in Fig. 17 & 19. Wire A carries the current produced by only one set of coils, and wire B carries the current produced by the other two sets of coils. Switch connections enable the motorcycle to be operated using A only, or A plus B.

The generator can be constructed with the rotating magnet at the center of the coil assemblies (Fig. 19) or with the coil assemblies at the center of the rotating magnet (Fig. 20). The effect is the same either way. The generator would also function if the magnet were stationary and the coil assemblies rotated, but this is not done as the coil assemblies are more susceptible to damage by centrifugal force.

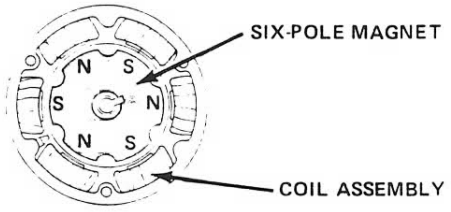


Fig. 17 Six-Pole A.C. Generator

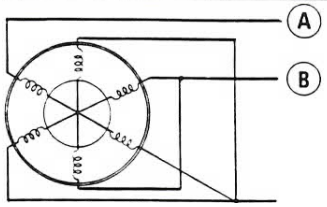


Fig. 18 Hookup for Controlling Number of Coils Used

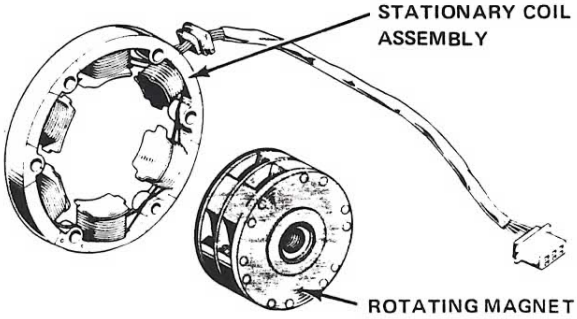


Fig. 19 A.C. Generator with Magnet Inside Coils

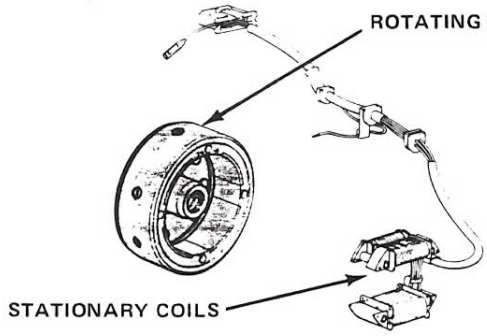


Fig. 20 A.C. Generator with Coils Inside Magnet

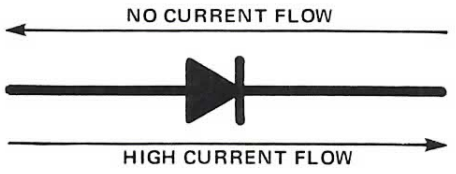


Fig. 21 Symbol for Rectifier Element

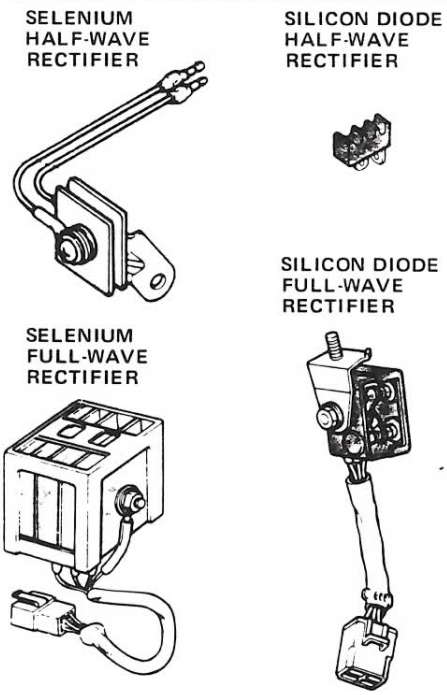


Fig. 22 Honda Motorcycle Rectifiers

A rectifier is a device for converting alternating current (A.C.) to direct current (D.C.). Because the A.C. generator produces only alternating current and the battery can only be charged by direct current, a rectifier must be installed in the circuit between the A.C. generator and battery.

Motorcycle rectifiers are constructed using selenium plates or silicon diodes which act as one-way valves, permitting current flow in one direction and resisting all current flow in the opposite direction.

The symbol used to represent a rectifier on wiring diagrams incorporates an arrow which points in the direction that *conventional current* (See Current Flow, page 5) is permitted to flow (Fig. 21).

Rectifier elements (selenium plates or silicon diodes) can be used individually as half-wave rectifiers, or grouped in bridge circuits as full-wave rectifiers.

Half-Wave Rectifier:

A.C. generator output can be illustrated as a wave form (Fig. 23) corresponding to the movement of an ammeter needle as current increases and decreases in one direction, and then increases and decreases in the opposite direction when the A.C. generator's magnetic field is reversed.

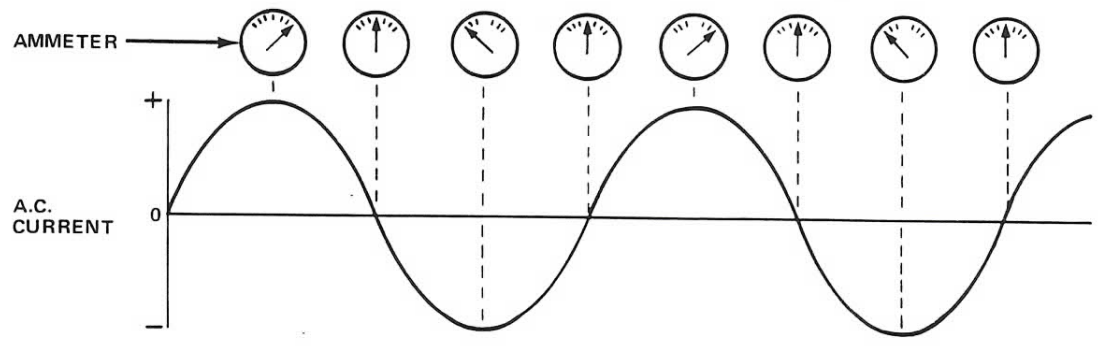


Fig. 23 Alternating Current Wave Form

If a selenium plate or silicon diode is connected between the A.C. generator and the battery, as illustrated in Fig. 24, current flow comprising the positive half of the wave form will be passed to the battery, while negative (reverse) flow will be prevented.

A half-wave rectifier utilizes half the generator's output, but is sufficient for use on some of the smaller Honda models. A greater flow of direct current can be obtained through a full-wave rectifier which inverts the negative half of the wave form.

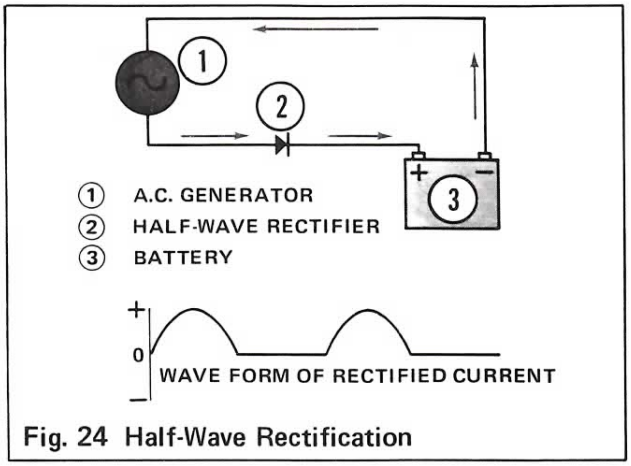


Fig. 24 Half-Wave Rectification

Full-Wave Rectifier:

The simplest full-wave rectifiers used on Honda motorcycles are made with four selenium plates or silicon diodes connected as shown in Fig. 25 (six diodes are used in rectifiers for three-phase A.C. generators). Each time the generator's alternating current reverses direction, the rectifier elements provide an alternate path to the battery. A full-wave rectifier converts the full output of the A.C. generator to direct current and passes it to the battery.

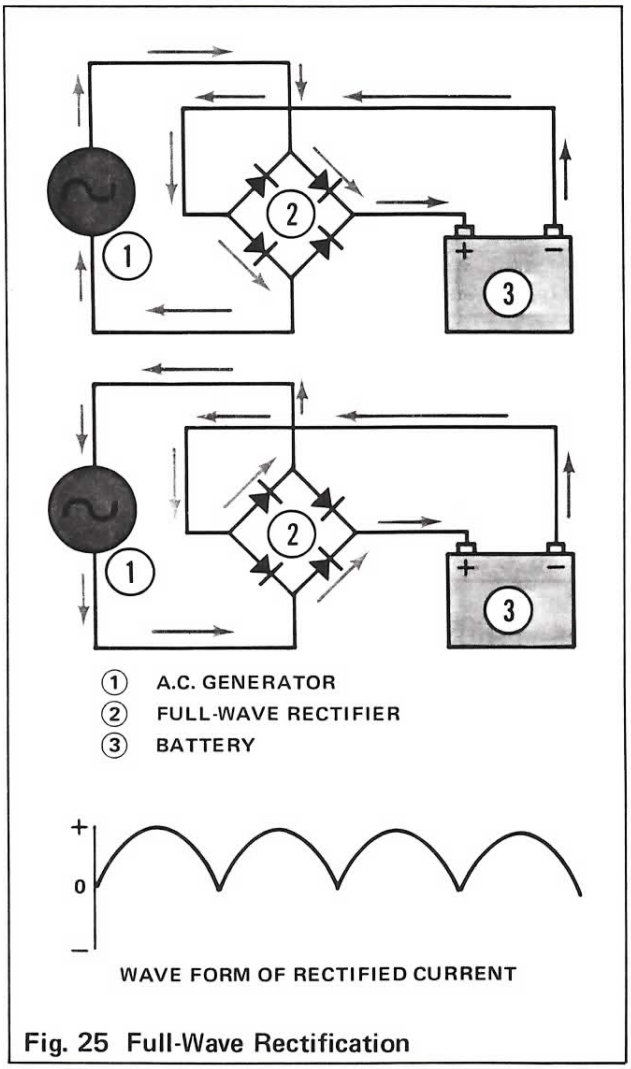


Fig. 25 Full-Wave Rectification