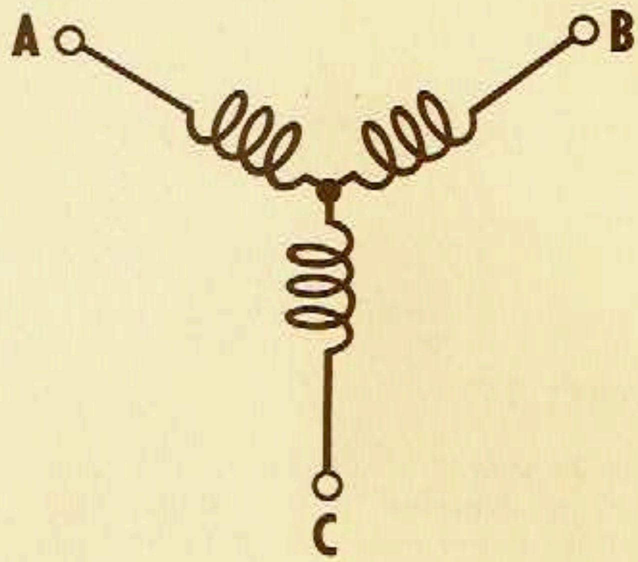
Chart 10

This diagram graphically portrays the three phase voltages, or voltages between the three winding ends. It is interesting to note that the peak voltage for each phase occurs at equal intervals as the rotor turns. This shows graphically how maximum phase voltage is more nearly constant as described in the discussion concerning Chart 9. This type of connection is called a "wye" or "Y" connected stator.

ALTERNATING VOLTAGE
— THREE PHASE —



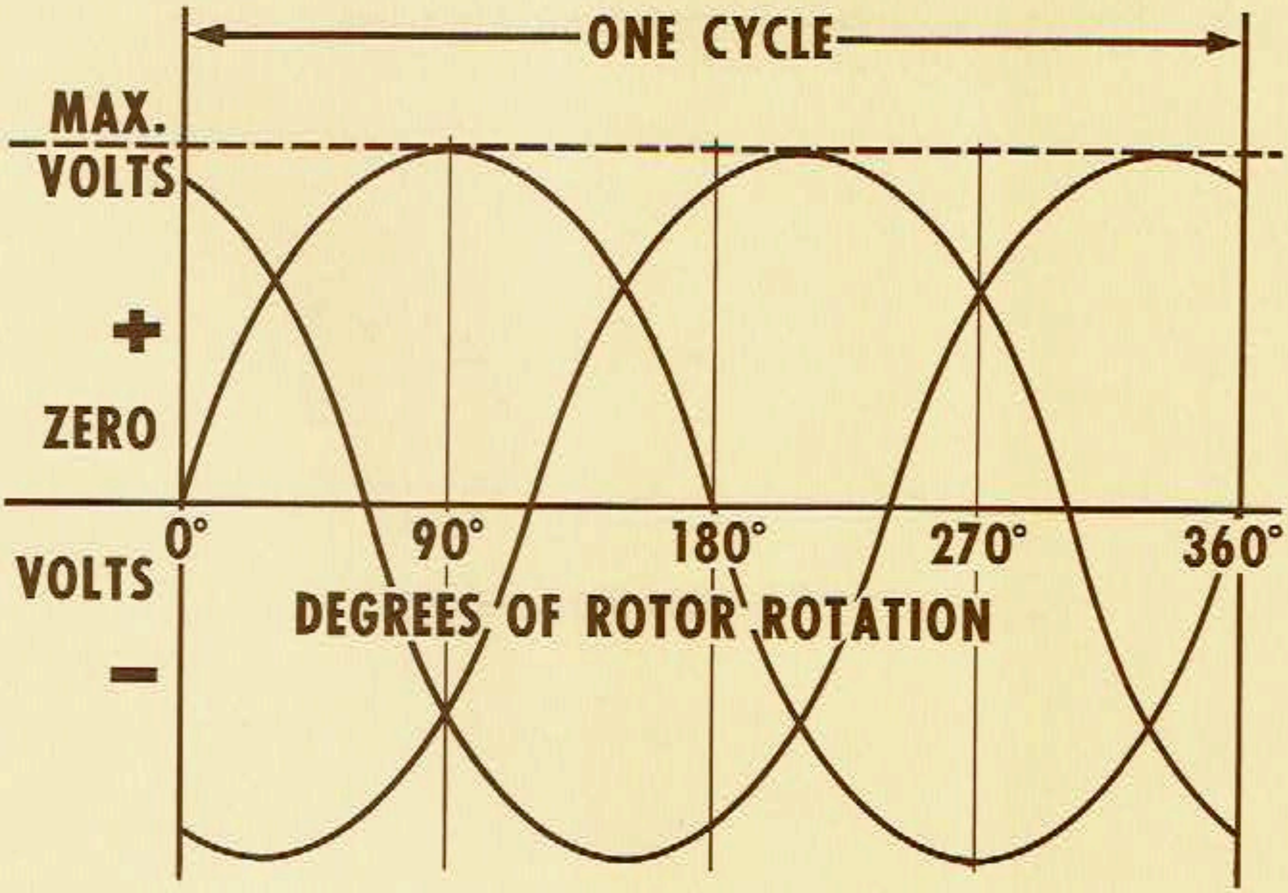
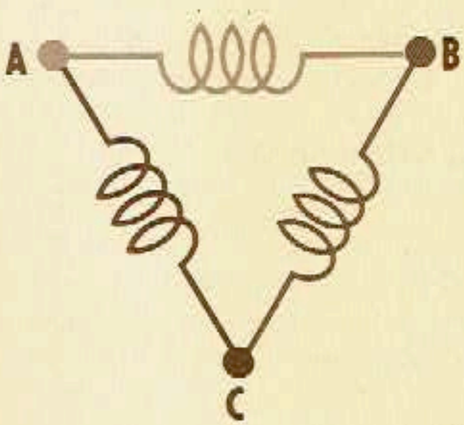


Chart 11

When the ends of the loops of wire are connected as illustrated, a basic three phase "delta"-connected stator is formed. The three A.C. voltages available from the delta-connected stator are similar to the three voltages previously discussed.

DELTA-CONNECTED STATOR



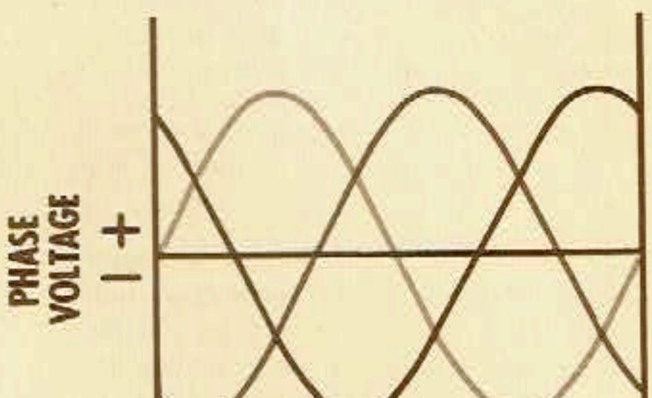


Chart 12

The accompanying illustration shows an external view of a diode along with the diode symbol used in wiring diagrams. This symbol indicates by the arrow that current will flow only in the direction of the arrow.

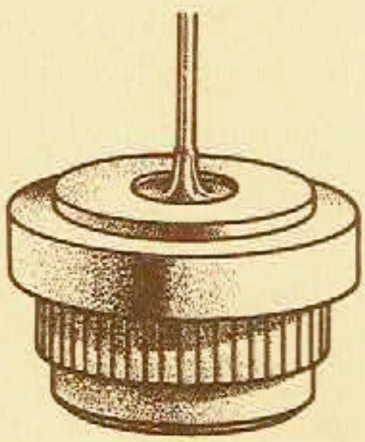
A cross-sectional view of the diode is shown with the thin silicon wafer, called a "die," in position at the bottom of the diode case. The heavy case walls serve to protect the delicate silicon wafer and also to dissipate the heat produced by current flow. The diode is tightly sealed to prevent any entry of moisture.

The function of a diode is to permit current flow in the circuit in only one direction and to block it from flowing in the opposite direction. This is made possible by the electrical characteristic of the silicon die or wafer within the diode.

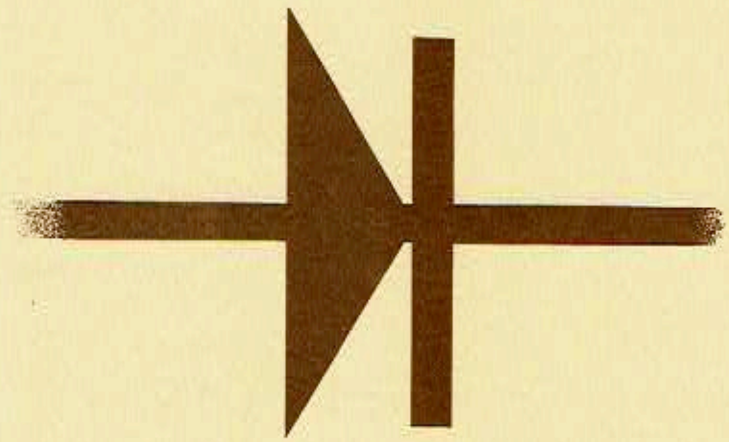
For example, when the diode is constructed with the silicon die placed in one direction, current will flow through the diode when positive voltage is connected to the diode lead or stem and a negative voltage is connected to the diode case. When the position of the silicon die is reversed and the above connections are made, no current will flow and the circuit is blocked. The diode, therefore, acts as a check valve and only allows current flow in one direction.

Although the diode is a comparatively rugged component, care should be exercised in handling it. Sudden impacts should be avoided to prevent the possibility of cracking the silicon wafer. If the diode lead is bent excessively there is a possibility of cracking the glass insulator, permitting moisture to enter the diode. Moisture in the diode could cause it to short and fail to operate. Pulling the diode lead should also be avoided because of the possibility of breaking the solder joint between the diode lead and the silicon die.

DIODE



DIODE ASSEMBLY



DIODE SYMBOL

DIODE CROSS-SECTION

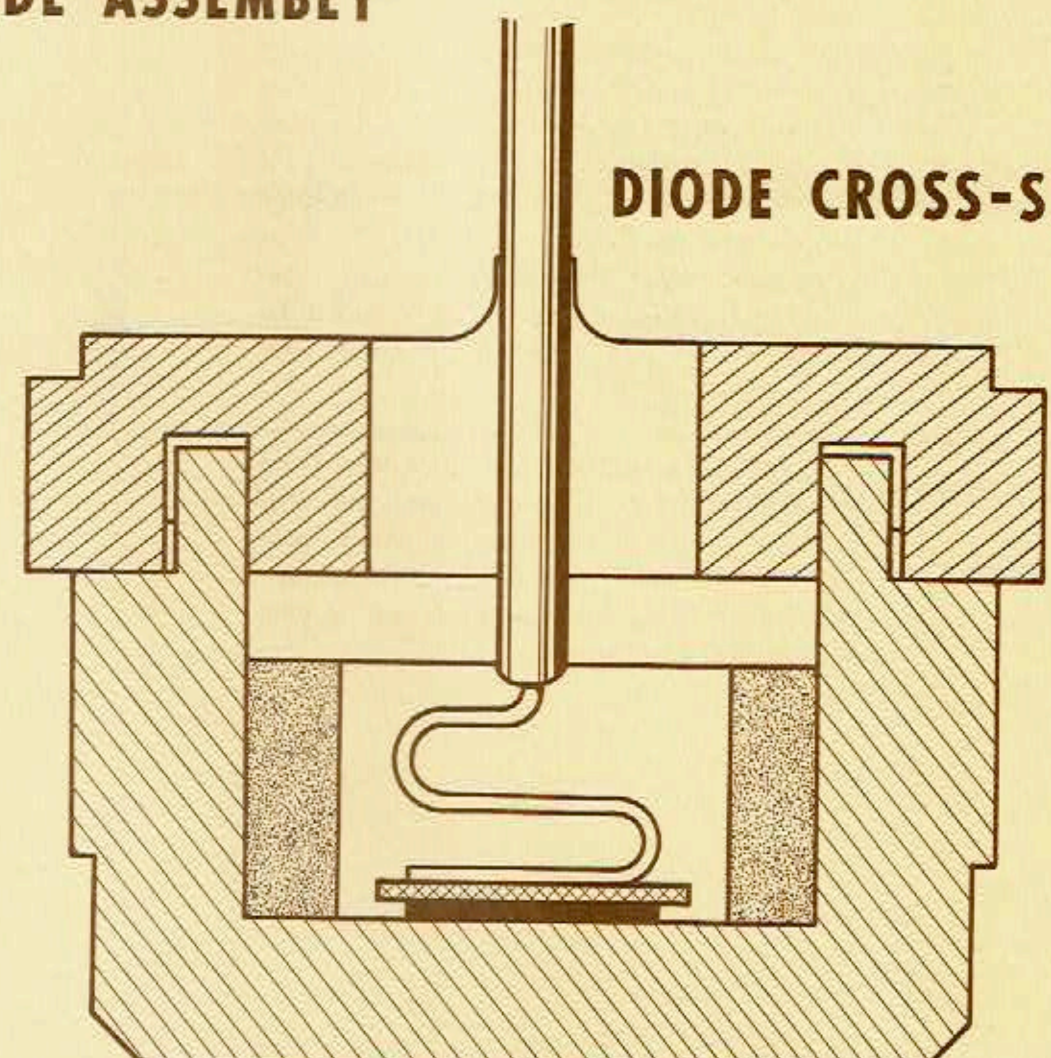


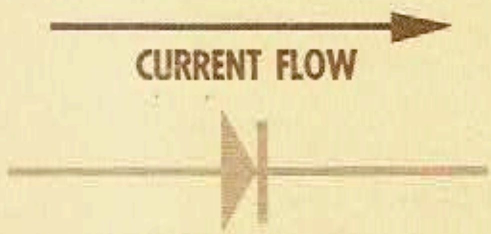
Chart 13

The diode is often pictured by this symbol, and current can flow through the diode only in the direction indicated by the arrow.

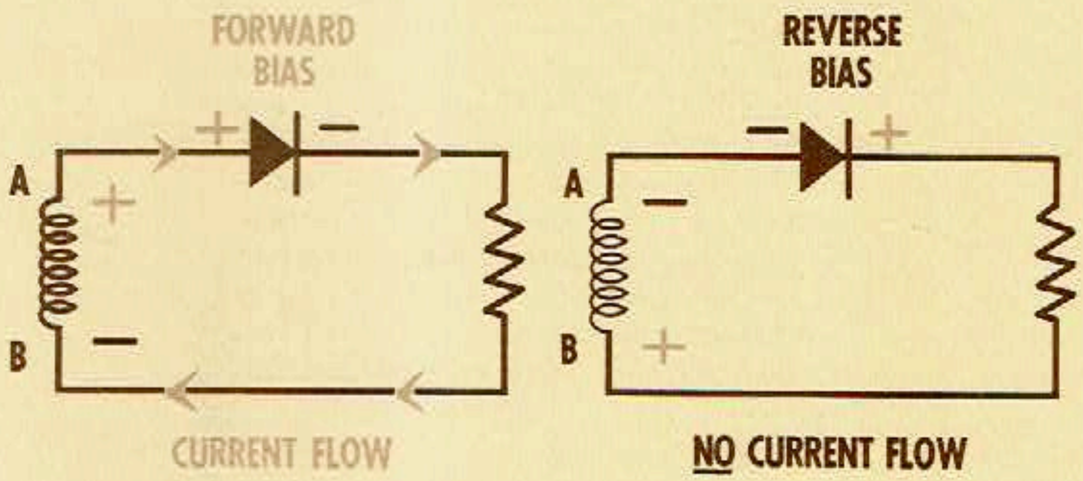
When a diode is connected to an A.C. voltage source having ends marked A and B, current will flow through the diode when A is positive (+) and B is negative (−). The diode is said to be "forward-biased," and with the voltage polarity across the diode as shown, it will conduct current. When the voltage at A is negative and at B is positive, the diode is said to be "reverse-biased" and it will not conduct current.

The current flow that would be obtained from this arrangement is illustrated. Since the current flows only half the time, the diode provides what is called "half-wave rectification." A generator having only one diode would provide very limited output.

CHANGING A.C. TO D.C.



DIODE SYMBOL



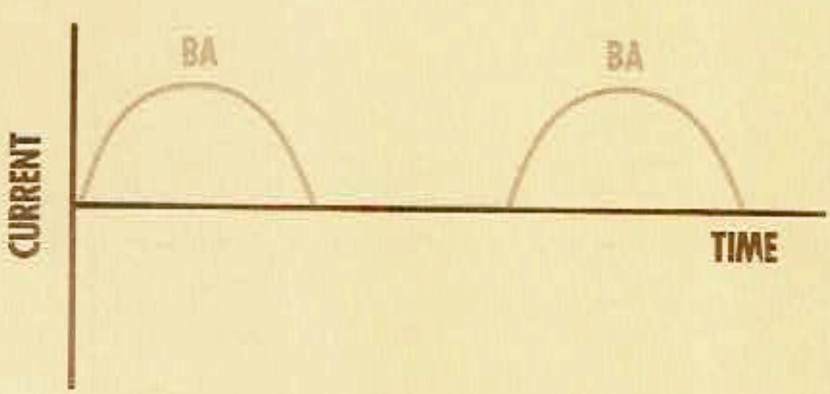
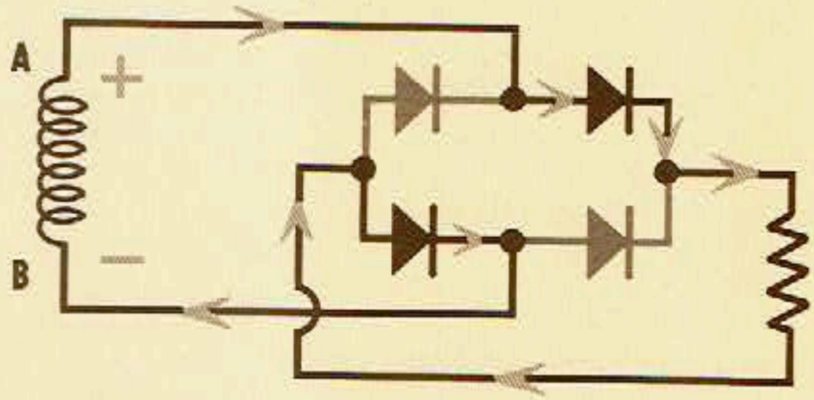
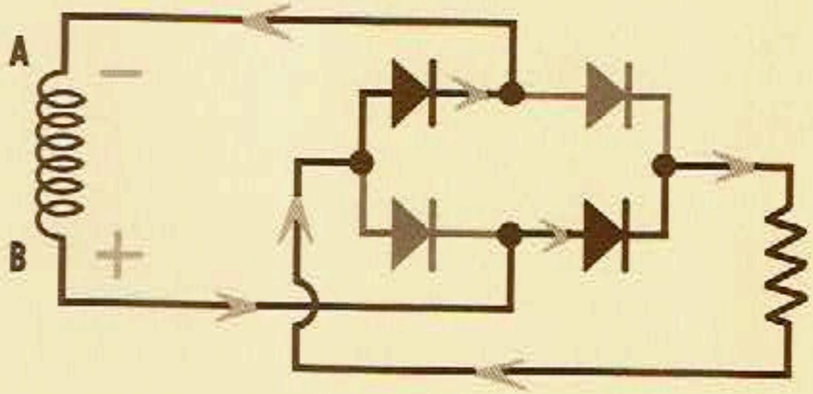


Chart 14

The output is increased when four diodes are used to provide "full-wave rectification." Note that the current is more continuous than with one diode, but that the current varies from a maximum value to a zero value. It is particularly important to observe that the current flow through the external load resistor is in one direction only. The A.C. voltage and current have, therefore, been rectified to a unidirectional or D.C. voltage and current.

CHANGING A.C. TO D.C.





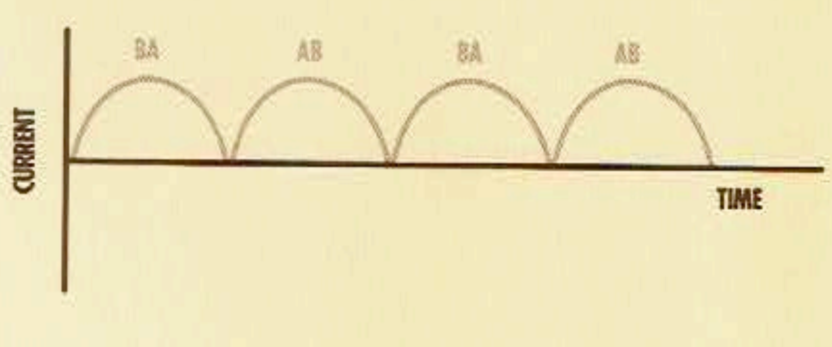


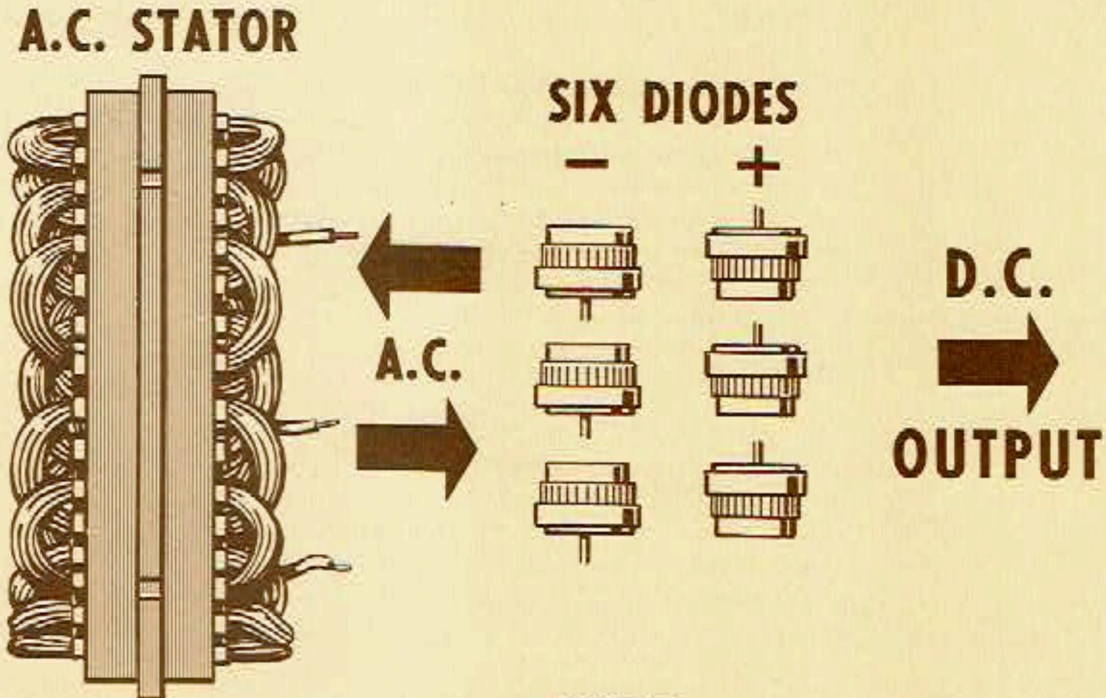
Chart 15

Six diodes are mounted in the slip ring end frame of the Delcotron. Three negative diodes are mounted in the end frame. Three positive diodes are mounted in the heat sink and are insulated from the end frame. These diodes when connected serve as a rectifier assembly that changes the alternating voltages developed in the stator windings to a single uni-directional voltage. Therefore, uni-directional voltage appears at the output terminal on the Delcotron, and. consequently, the Delcotron supplies d.c. or direct current to charge the battery and to operate electrical accessories.

The method by which the diodes are connected to the stator is shown in the chart. This type of circuit arrangement provides a smooth flow of direct current to the battery and other accessories connected to the Delcotron. Also, the blocking action of the diodes prevents battery discharge through the Delcotron and thus eliminates the need for a cutout relay.

The capacitor, connected between the "BAT" terminal of the Delcotron generator and common ground, protects the diodes from voltage surges as they block current flow.

CHANGING A.C. TO D.C.



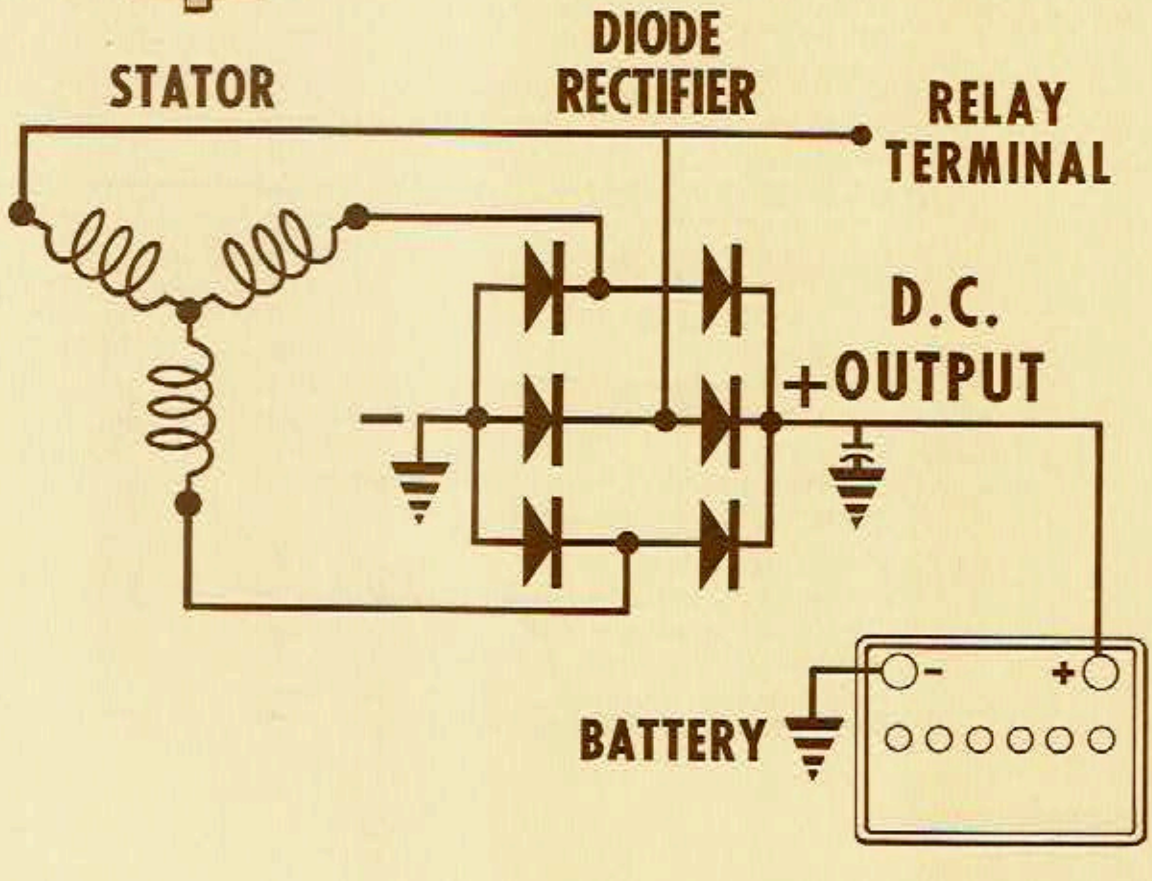


Chart 16

These diagrams show how the rectifier diodes either conduct or block the alternating current from the stator windings thereby rectifying it into direct current which is supplied for charging the battery and to power the electrical system. Only two of the three stator windings conduct current at any one time. Current flow to the third winding is blocked.

The upper diagram illustrates the time when the rotor poles induce voltages in the windings "A," "B," and "C"; and "A" winding is most positive. Current is blocked from "C" winding. In "A" and "B" windings, which are in series, current flows from the "A" terminal to the diode rectifier then through the conducting diode to the "BAT" terminal of the Delcotron generator. It then flows through the battery, and the ground circuit, to the conducting diode in the rectifier. From here it flows through the "B" and "A" windings, the source of voltage.

The lower diagram illustrates the time or period when the rotor poles induce voltages in the windings "A," "B," and "C"; and "A" winding is still most positive. Current is blocked from "B" winding. In the "A" and "C" windings, which are connected in series, current flows from the "A" terminal to the diode rectifier, through the conducting diode to the "BAT" terminal of the Delcotron generator. Then, current flows through the battery and ground circuit to the diode rectifier, through the conducting diode to the "C" terminal and through the "C" and "A" windings, the source of voltage.

From these illustrations, it can be seen that, regardless of the direction of current flow in the Delcotron generator, the direction of current flow through the battery is always in the same direction. Note, also, that two diodes "conduct" while four diodes block.

DIODE — RECTIFIED THREE PHASE OUTPUT