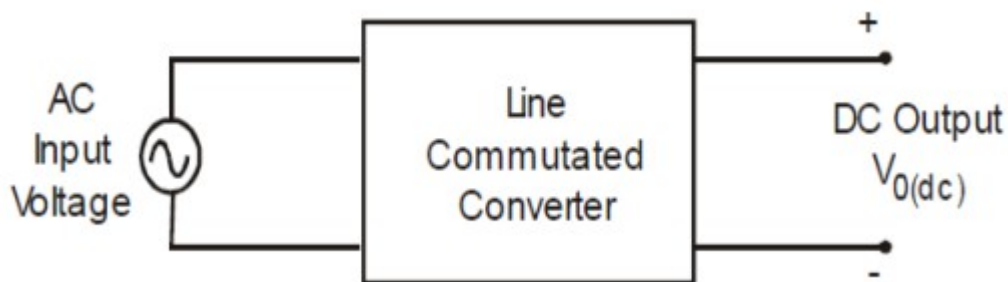


## 2.1 Introduction about Rectifier

- ❁ Rectifiers are ac to dc power converters which are used to convert a fixed voltage, fixed frequency ac power supply into variable dc output voltage.
- ❁ Type of input: Fixed voltage, fixed frequency ac power supply.
- ❁ Type of output: Variable dc output voltage



**Fig 2.1.1 Block diagram of controlled rectifier**

[Source: "Power Electronics" by P.S.Bimbra, Khanna Publishers Page: 176]

- ❁ The input supply fed to a controlled rectifier is ac supply at a fixed rms voltage and at a fixed frequency. We can obtain variable dc output voltage by using controlled rectifiers. By employing phase controlled thyristors in the controlled rectifier circuits we can obtain variable dc output voltage and variable dc (average) output current by varying the trigger angle (phase angle) at which the thyristors are triggered. We obtain a uni-directional and pulsating load current waveform, which has a specific average value.
- ❁ The thyristors are forward biased during the positive half cycle of input supply and can be turned ON by applying suitable gate trigger pulses at the thyristor gate leads. The thyristor current and the load

current begin to flow once the thyristors are triggered (turned ON) say at  $\omega t = \alpha$ . The load current flows when the thyristors conduct from  $\omega t = \alpha$  to  $\beta$ . The output voltage across the load follows the input supply voltage through the conducting thyristor. At  $\omega t = \beta$ , when the load current falls to zero, the thyristors turn off due to AC line (natural) commutation. In some bridge controlled rectifier circuits the conducting thyristor turns off, when the other thyristor is (other group of thyristors are) turned ON. The thyristor remains reverse biased during the negative half cycle of input supply. The type of commutation used in controlled rectifier circuits is referred to AC line commutation or Natural commutation or AC phase commutation.

- ✿ When the input ac supply voltage reverses and becomes negative during the negative half cycle, the thyristor becomes reverse biased and hence turns off. There are several types of power converters which use ac line commutation. These are referred to as line commutated converters.

### **APPLICATIONS OF PHASE CONTROLLED RECTIFIERS**

1. DC motor control in steel mills, paper and textile mills.
2. AC fed traction system using dc traction motor.
3. Electro-chemical and electro-metallurgical processes.
4. Magnet power supplies.
5. Portable hand tool drives.

6. Variable speed industrial drives.
7. Battery charges.
8. High voltage DC transmission.
9. Uninterruptible power supply systems (UPS).

The phase controlled converters are simple and less expensive and are widely used in industrial applications for industrial dc drives. These converters are classified as two quadrant converters if the output voltage can be made either positive or negative for a given polarity of output load current. There are also single quadrant ac to dc converters where the output voltage is only positive and cannot be made negative for a given polarity of output current. Of course single quadrant converters can also be designed to provide only negative dc output voltage. The two quadrant converter operation can be achieved by using fully controlled bridge converter circuit and for single quadrant operation we use a half controlled bridge converter.

### **CLASSIFICATION OF PHASE CONTROLLED RECTIFIERS**

The phase controlled rectifiers can be classified based on the type of input power supply as

Single Phase Controlled Rectifiers- which operate from single phase ac input power supply.

Three Phase Controlled Rectifiers -which operate from three phase ac input power supply.