4.13.1 Single-phase Half-wave converter drive

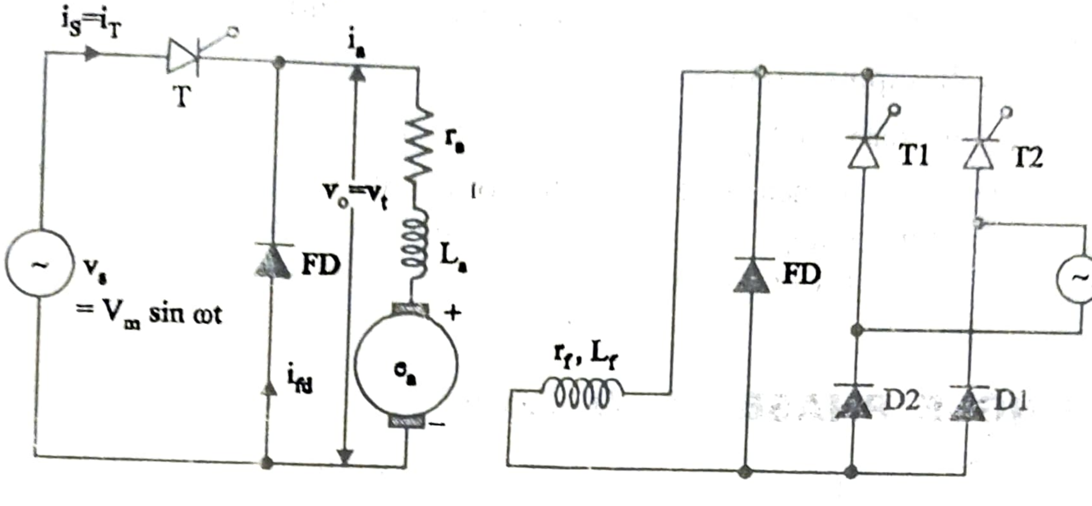

Fig. 4.18

Fig. 4.18 shows a separately excited DC motor, fed through a single phase half-wave converter. To reduce the ripples in the field circuit current, field circuit of motor is fed through a single-phase semiconverter drive. The load is highly inductive, hence the output current is considered to be continuous current. These type of drives can be used upto $\frac{1}{2}$ kW DC motors.

During the positive half cycle of the input supply, T will be forward biased and it conducts from $\omega t = \alpha_1$ to π. At $\omega t = \pi$, the thyristor T will be reverse biased, hence output voltage will be zero driving $\omega t = \pi$ to 2π. The inductor L_a in the motor, will reverse its polarity due to which free wheeling diode (FD) will be forward biased and hence conducts.

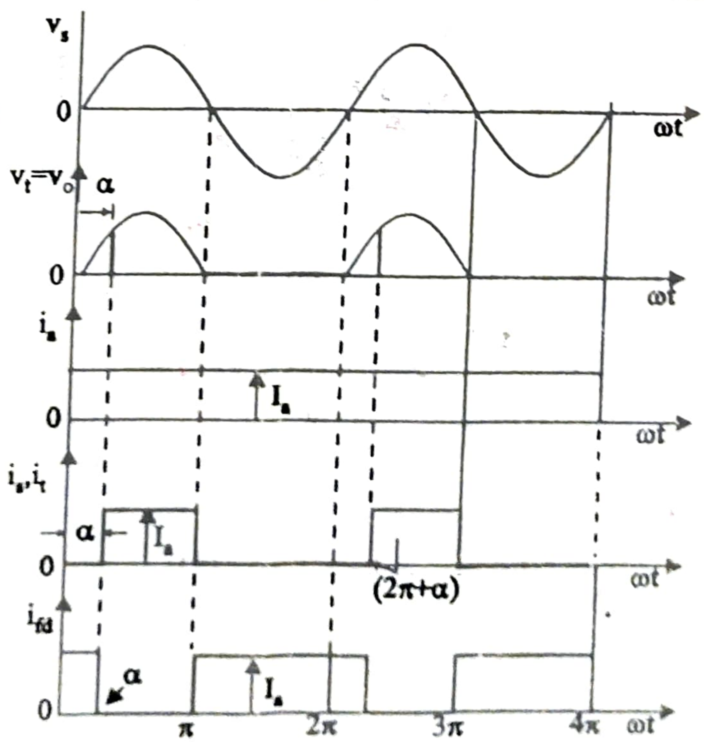

Fig. 4.19

So, the current I_a will be same and remains constant. Meanwhile during the next half cycle, $\omega t = 2\pi + \alpha_1$ Thyristor T is again triggered and the cycle continues.

For single-phase half-wave converter, average output voltage,

$$v_0 = \frac{v_m}{2\pi}(1 + \cos\alpha_1) \text{ for } 0 < \alpha_1 < \pi$$

where,

v_m - maximum value of source voltage.

4.13.3 Single-phase full converter Drives

Fig. 4.22 shows a single-phase full converter drive, in which there are two converter. One feeding the armature circuit of the drive and other feeding the field circuit. This scheme of operation has two-quadrant operation. It is applicable for drives upto 15 kW.

During positive half cycle of input supply, T_1 and T_2 will be forward biased and conducts for $\omega t = \alpha_1$ to $\pi + \alpha_1$ and the motor will be connected to the supply. At

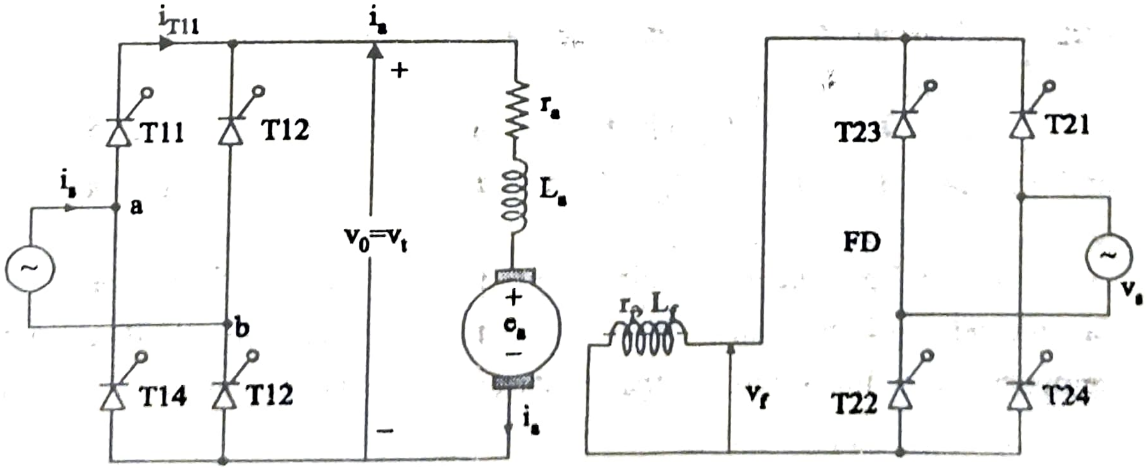

Fig. 4.22

$\omega t = \pi + \alpha_1$, T_3 and T_4 will be triggered. Hence T_1 and T_2 will be turned off because of reversed supply appearing across them. Now the armature current will transfer from T_1T_2 to T_3T_4. Hence there is no dis-continuity an armature current so free wheeling diode is not needed. During $\omega t = \alpha_1$ to π energy flows from source to load. But during $\omega t = \pi$ to $\pi + \alpha_1$, the energy is fed back to source from load. This is used for applying regenerative braking in the drive.

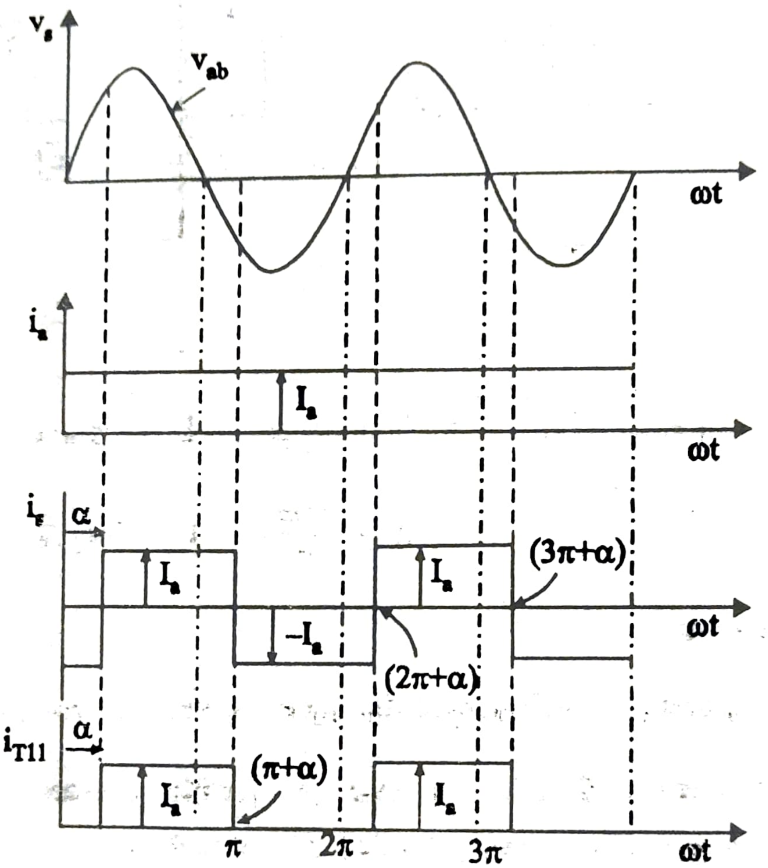

Fig. 4.23

For a single-phase full wave converter, the output voltage (applied to the armature) is given by,

$$v_0 = \frac{2v_m}{\pi}(1 + \cos\alpha) \text{ for } 0 \le \alpha_1 \le \pi$$