A.C. Servomotor :

Most of the servomotors used in low power servomechanisms are a.c. servomotors. The a.c. servomotor is basically two phase induction motor. The output power of a.c. servomotor varies from fraction of watt to few hundred watts. The operating frequency is 50 Hz to 400 Hz.

13.3.1 Construction :

It is mainly divided into two parts namely stator and rotor.

The stator carries two windings, uniformly distributed and displaced by 90°, in space. One winding is called as **main winding** or **fixed winding** or **reference winding**. This is excited by a constant voltage a.c. supply. The other winding is called **control winding**. It is excited by variable control voltage, which is obtained from a servoamplifier. This voltage is 90° out of phase with respect to the voltage applied to the reference winding. This is necessary to obtain rotating magnetic field. The schematic stator is shown in the Fig 13.1.

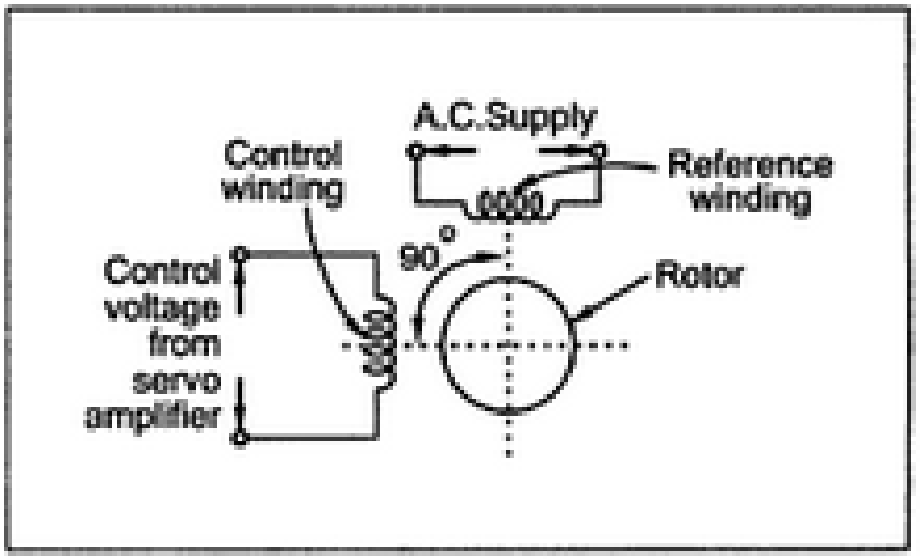
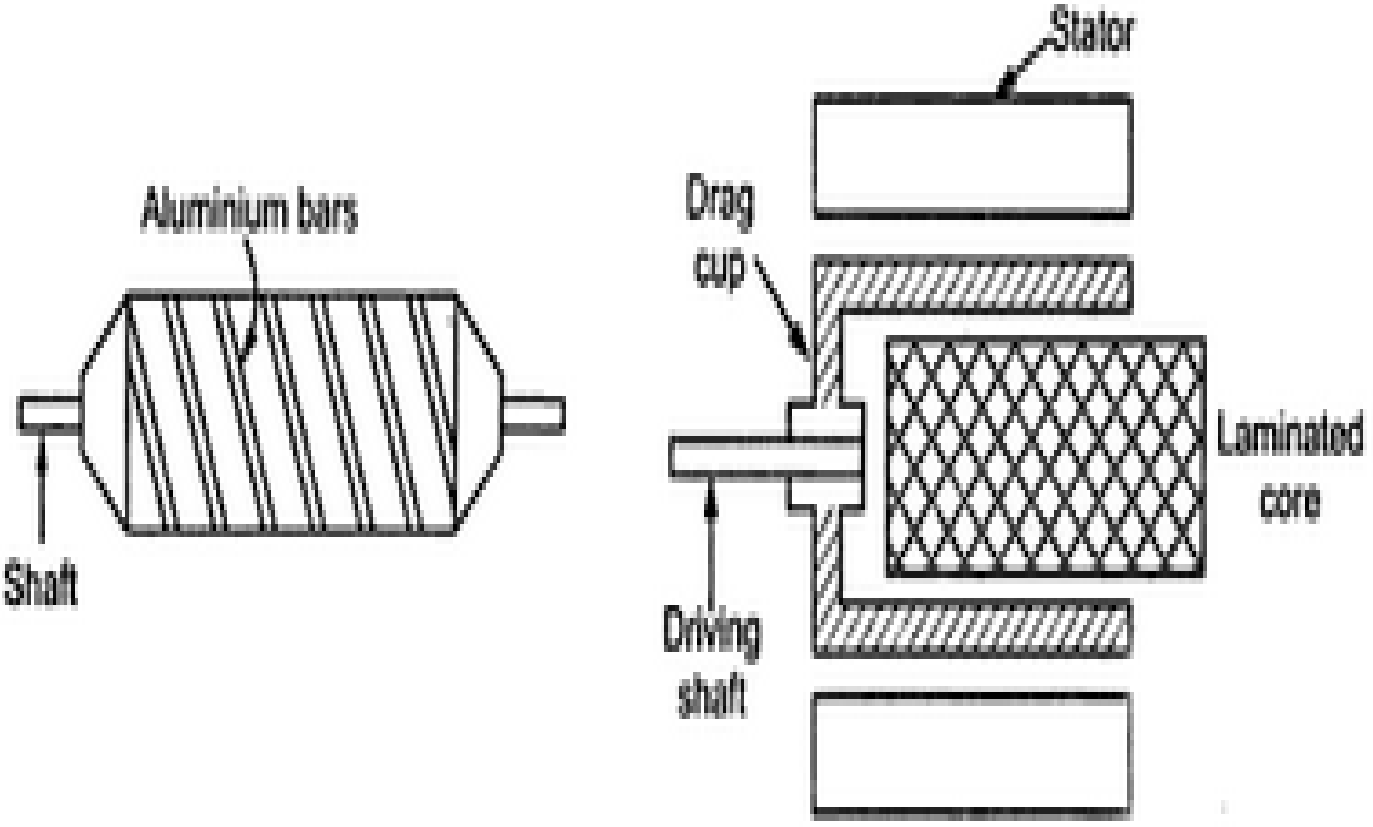


Fig. 13.1 Stator of A.C. servomotor

Rotor :

The rotor is generally of two types. The one is usual squirrel cage rotor. This has small diameter and large length. Aluminium conductors are used to keep weight small. Its resistance is very high to keep torque speed characteristics as linear as possible. Air gap is kept very small which reduces magnetising current. This cage type of rotor is shown with skewed bars in the Fig. 13.2 (a). The other type of rotor is drag cup type. There are two air gaps in such construction. Such a construction reduces inertia considerably and hence such type of rotor is used in very low power applications. The aluminium is used for the cup construction. The construction is shown in the Fig. 13.2 (b).



(a) Squirrel cage rotor

(b) Drag cup type rotor

Torque-speed Characteristics :

The torque-speed characteristics of a two phase induction motor, mainly depends on the ratio of reactance to resistance. For small X to R ratio i.e. high resistance low reactance motor the characteristics is much more linear while it is nonlinear for large X to R ratio as shown in the Fig. 13.3.

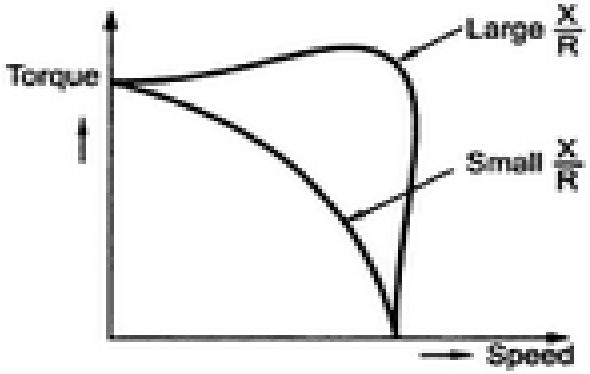


Fig. 13.3

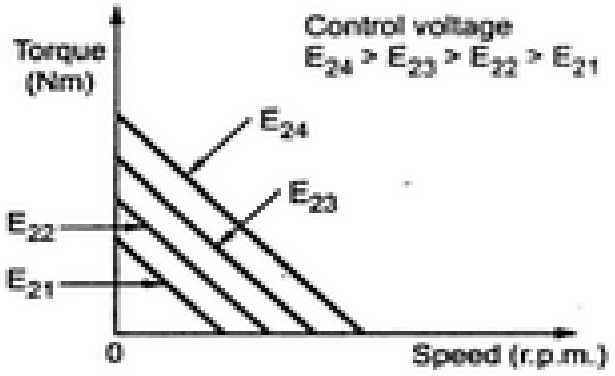


Fig. 13.4

In practice, design of the motor is so as to get almost linear torque-speed characteristics. Fig. 13.4 shows the torque-speed characteristics for various control voltages. The torque varies almost linearly with speed. All the characteristics are equally spaced for equal increments of control voltage. It is generally operated with low speeds.

13.3.4 Features of A. C. Servomotor :

The a.c. servomotor has following features :

i) Light in weight ii) Robust construction iii) Reliable and stable operation. iv) Smooth and noise free operation. v) Large torque to weight ratio vi) Large R to X ratio i.e. small X to R ratio. vii) No brushes or slip rings hence maintenance free

13.13 Synchros :

Synchros are used widely in control systems as detectors and encoders because of their rigidness in construction and high reliability. Synchro is basically a rotary device, an electromagnetic transducer which operates on same principle as that of transformer. It converts angular position of shaft into an electric signal.

13.13.1 Synchro Transmitter :

This is a basic synchro unit. It's construction is similar to that of 3 phase alternator.

The stator which is stationary part is made up of laminated steel. This part is slotted to accommodate a balanced three phase winding. The stator windings are star connected which are usually of concentric coil type structure.

The rotor which is rotating part is a salient pole, dumb-bell shaped magnet with a single winding. Schematic diagram is as shown in Fig. 13.17.

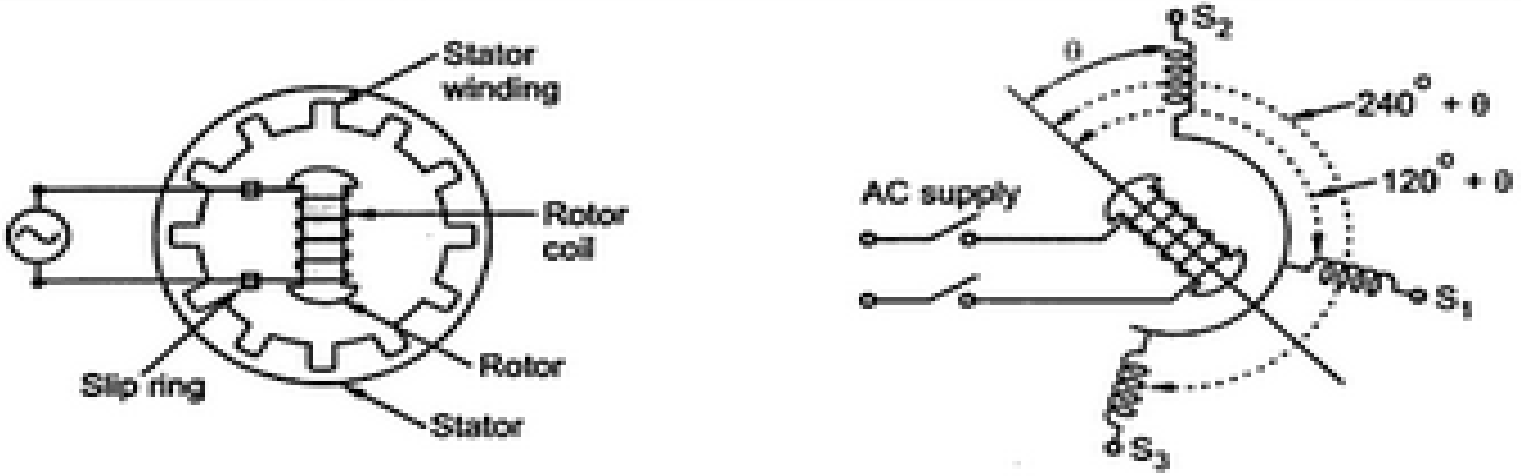


Fig. 13.17

A single phase AC voltage is applied to the rotor through slip rings. The symbol 'G' is used to denote synchro transmitter. Also known as synchro generator.

Let ac voltage applied to rotor is

$$e_r(t) = E_r \sin \omega_0 t$$

When $\theta = 0°$ with reference to schematic diagram, voltage induced in s_2 winding will be maximum and position is called as *electric zero*.

The applied voltage causes a flow of magnetising current in rotor coil which