5.7 CONSTRUCTION AND EXPLANATION AND WORKING PRINCIPLE OF A PMMC INSTRUMENT:

The permanent magnet moving coil instrument is the most accurate type for dc measurements. The working principle of these instruments is the same as that of the galvanometers, the difference being that a direct reading instrument is provided with a pointer and a scale.

Construction of PMMC Instruments

- The moving coil is wound with many turns of enameled or silk covered copper wire.
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- The coil is mounted on a rectangular aluminum former which is pivoted on jeweled bearings.
- The coils move freely in the field of a permanent magnet.
- Most voltmeter coils are wound on metal frames to provide the require electro-magnetic damping.
- Most ammeter coils, however, are wound on non -magnetic formers, because coil turns are effectively shorted by the ammeter shunt.
- The coil itself, therefore, provides electromagnetic damping.

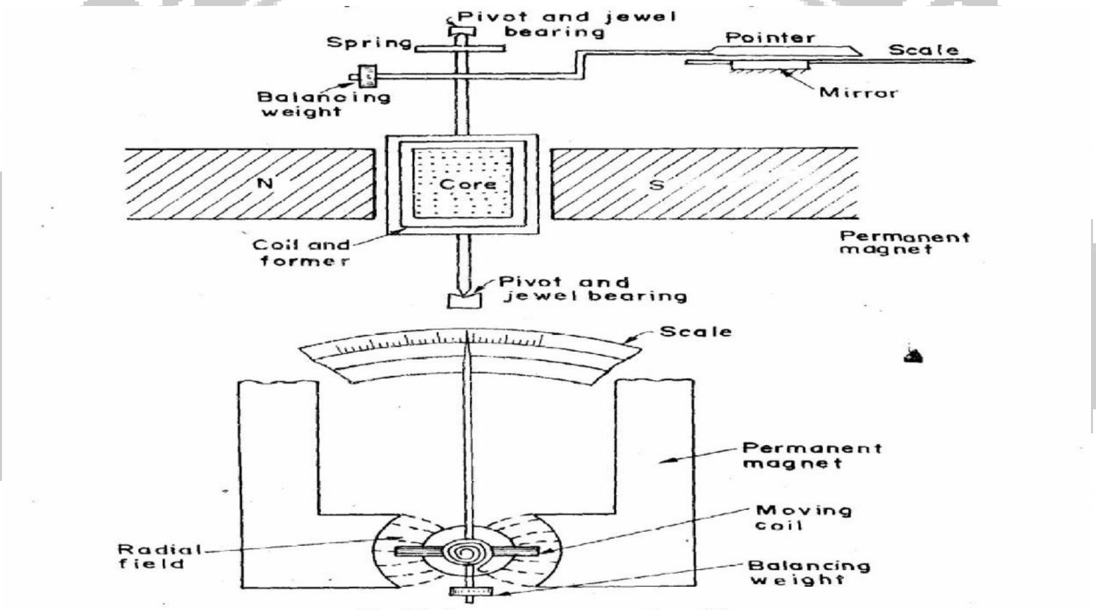
Magnet Systems

- Old style magnet system consisted of relatively long U shaped permanent magnets having soft iron pole pieces.
- Owing to development of materials like Alcona and Alnico, which have a high co-ercive force, it is possible to use smaller magnet lengths and high field intensities.
- The flux densities used in PMIMC instruments vary from 0.1 W b/m to 1Wb/m.

Control

- When the coil is supported between two jewel bearings the control torque is provided by two phosphor bronze hair springs.
- These springs also serve to lead current in and out of the coil. The control torque is provided by the ribbon suspension as shown.

- This method is comparatively new and is claimed to be advantageous as it eliminates bearing friction.



- Damping torque is produced by movement of the aluminum former moving in the magnetic field of the permanent magnet.

Pointer and Scale

- The pointer is carried by the spindle and moves over a graduated scale.

- The pointer is of light-weight construction and, apart from those used in some inexpensive instruments has the section over the scale twisted to form a fine blade.
- These springs also serve to lead current in and out of the coil.

Torque Equation for PMMC

The equation for the developed torque of the PMMC can be obtained from the basic law of electromagnetic torque. The deflecting torque is given by,

$$\mathbf{Td = NBAI}$$

Where,

Td = deflecting torque in N-m

B = flux density in air gap, Wb/m2

N = Number of turns of the coils

A = effective area of coil m2

I = current in the moving coil, amperes

Therefore, **Td = GI**

Where, G = NBA = constant

The controlling torque is provided by the springs and is proportional to the angular deflection of the pointer.

Tc = KØ Where,

Tc = Controlling Torque, **K** = Spring Constant Nm/rad or Nm/deg,

Ø = angular deflection For the final steady state position,

Td = Tc

Therefore **GI = KØ**

So, Ø = (G/K)I or I = (K/G) Ø

Thus the deflection is directly proportional to the current passing through the coil. The pointer deflection can therefore be used to measure current.