

# Lecture-62

## PMMC

Lecture delivered by:



# Topics

- Damping systems required for the Indicating Instruments
- construction and working of PMMC instrument



# Objectives

At the end of this lecture, student will be able to:

- Describe the damping systems required for the Indicating Instruments
- Discuss the construction and working of PMMC instrument
- State advantages and disadvantages of Moving coil instruments
- Discuss the applications of MC instruments

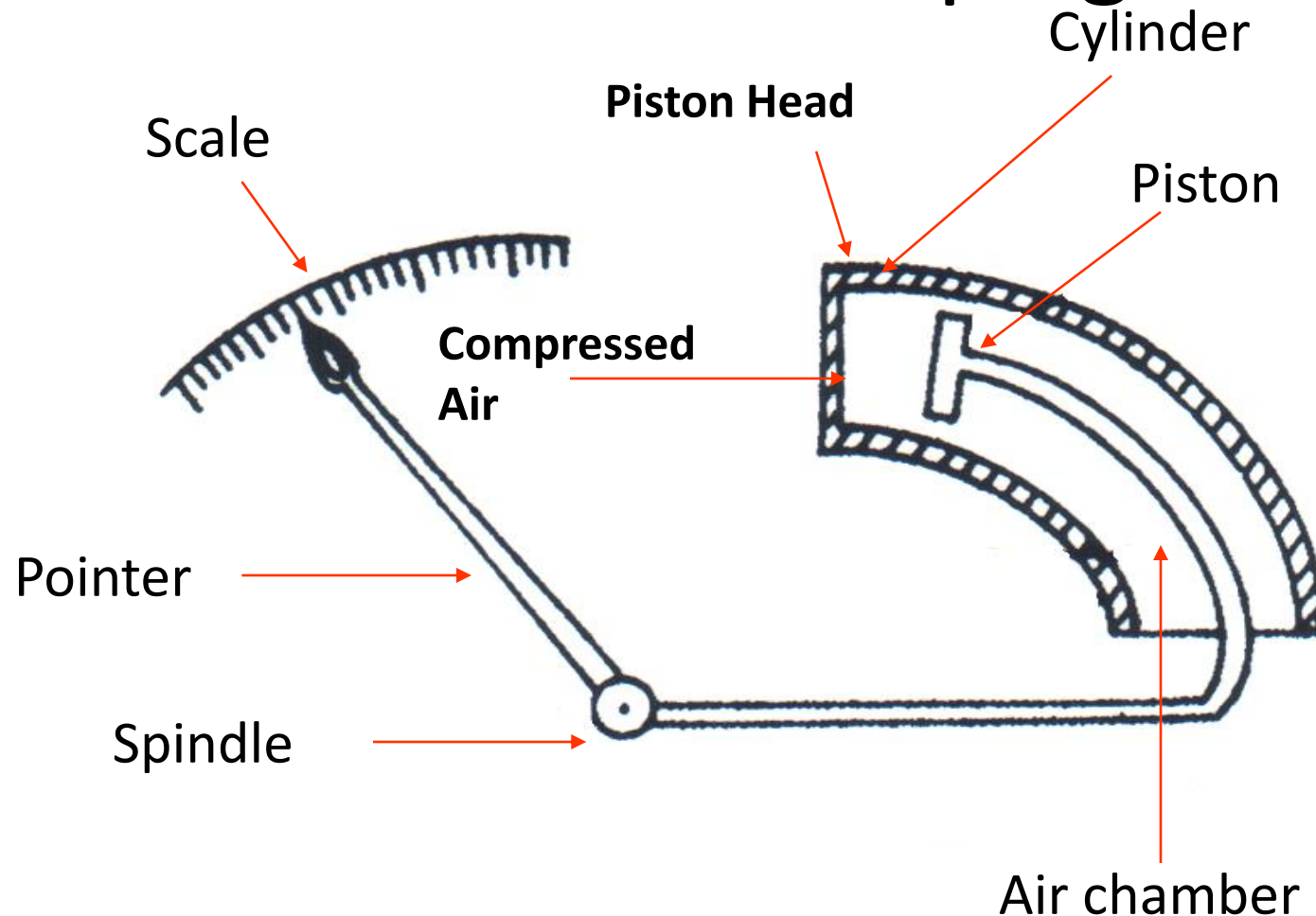


# Classification of Damping Torque

- Air friction damping
- Fluid friction damping
- Eddy current damping



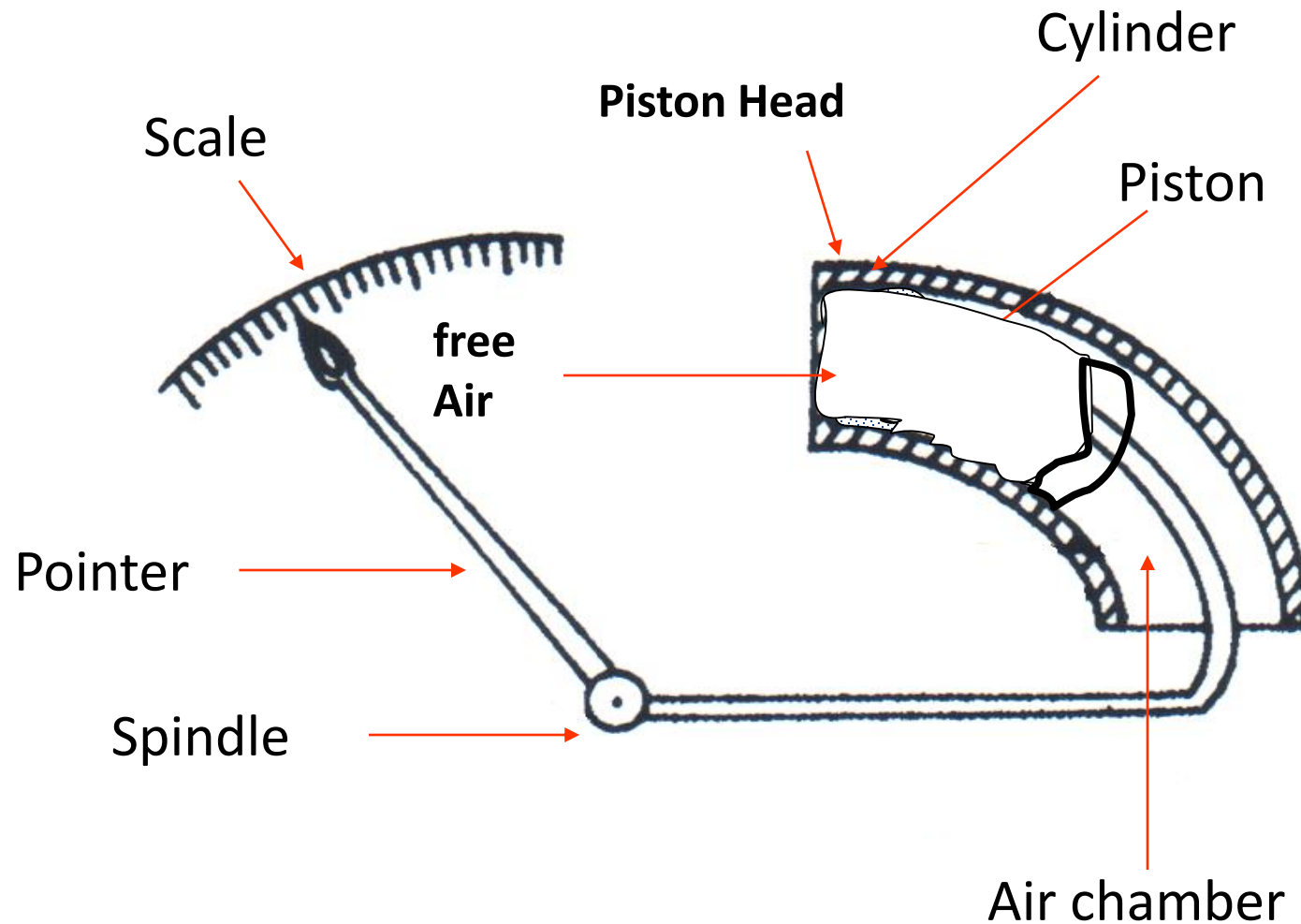
# Air Friction Damping



- Air is used as the medium to suppress the oscillations in an instrument as shown in the figure.



# Air Friction Damping

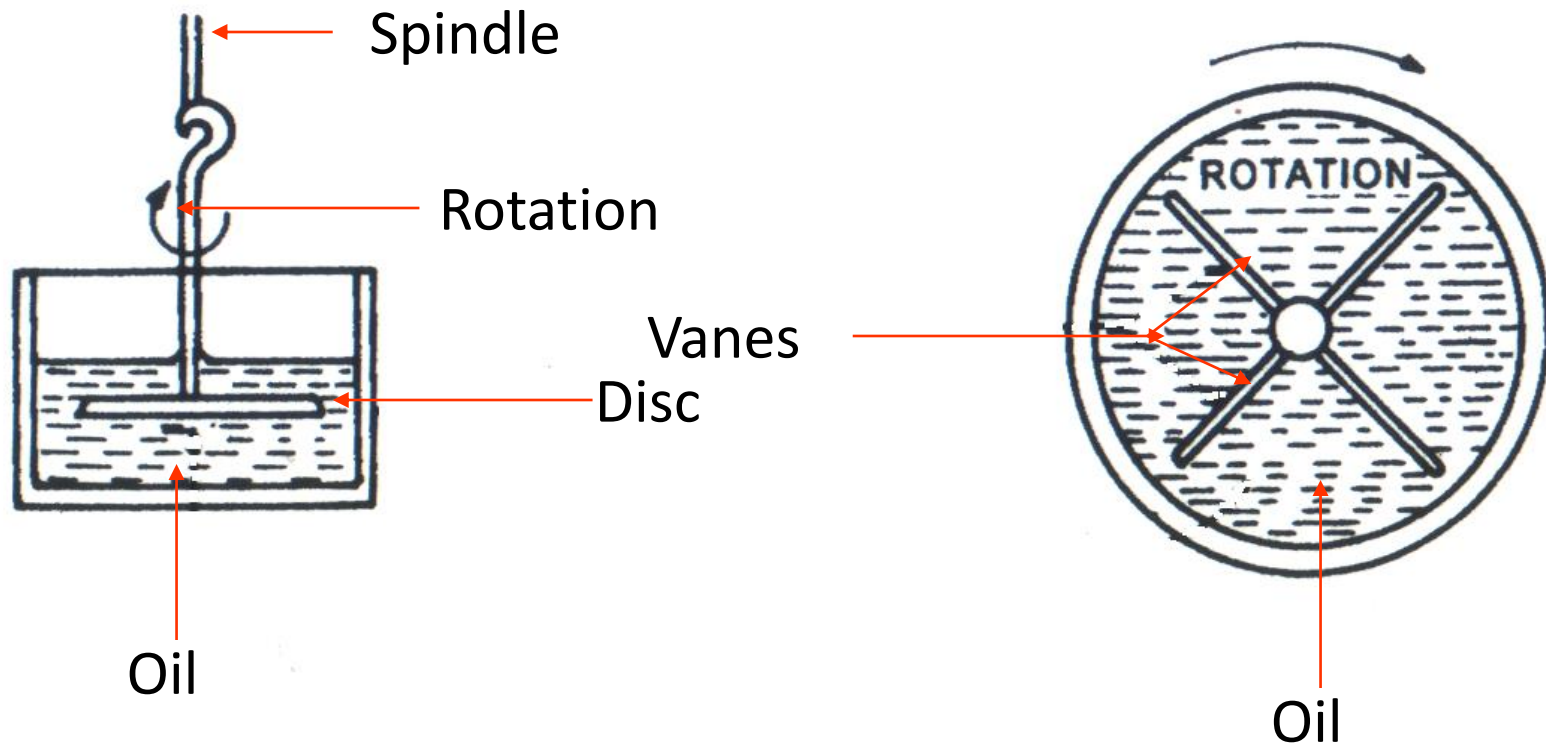


# Precautions

- The piston should not touch the walls of the chamber.
- Applications
  - Hot wire instruments
  - Moving iron instruments
  - Dynamometer type instruments



# Fluid Friction Damping



Fluid (high viscosity damping oil) is used as the medium to suppress the oscillations in an instrument as shown in the figure.





# Fluid Friction Damping

- The vanes or discs are attached to the spindle of the moving system.
- It dips into the pot of damping oil .
- The friction of the damping oil opposes the motion of the moving system.
- The damping force increases with the increase in velocity of vane and viscosity of the oil.

**Example** : Kelvin electro-static voltmeter



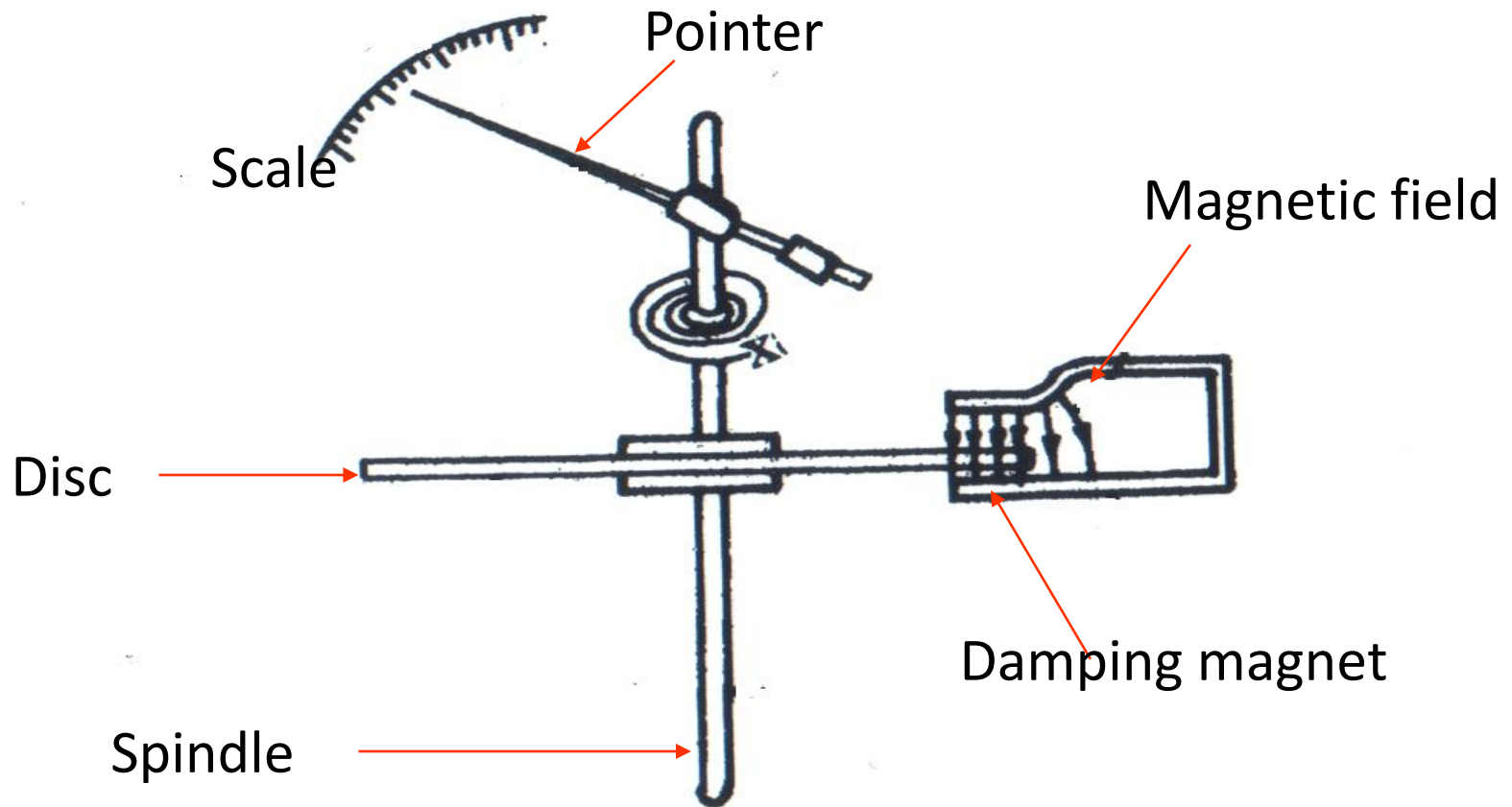
# Fluid Friction Damping

## Disadvantages:

- Oil creeps out if the sealing is not perfect.
- The instrument should be in vertical position.



# Eddy Current Damping



Eddy current is used as the medium to suppress the oscillations in an instrument as shown in the figure.



# Eddy Current Damping

When the disc rotates in the magnetic field:

- Disc cuts the magnetic lines.
- Eddy currents are produced in the disc.
- Damping force opposes the very cause of producing it (Lenz's law).



# Construction of PMMC instruments

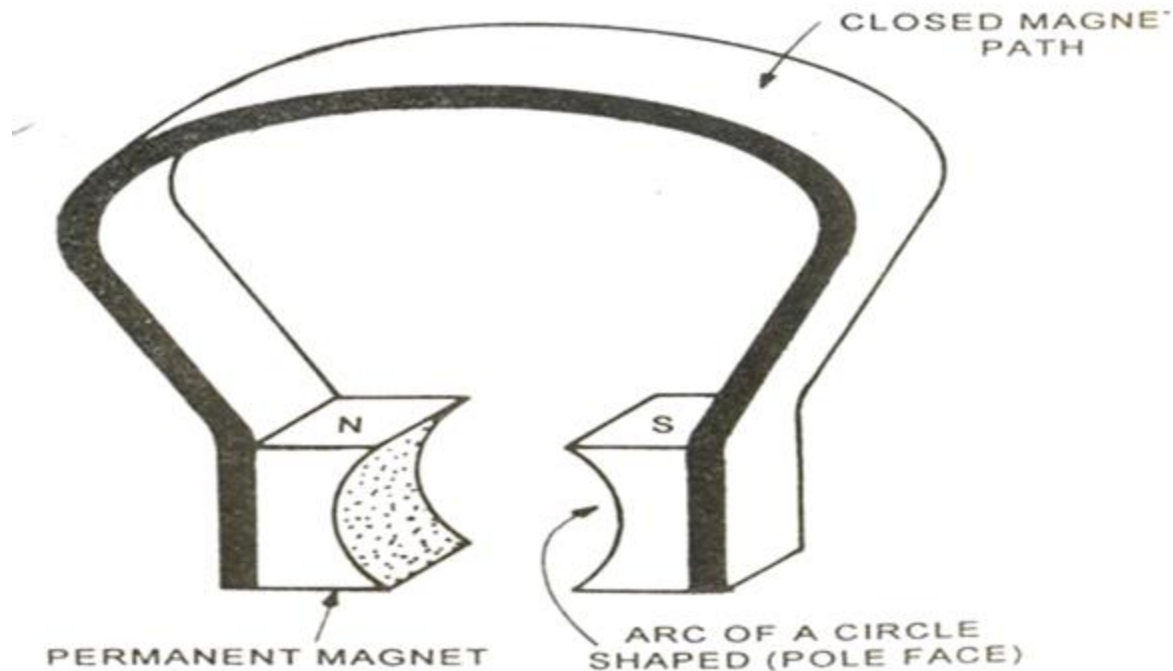
## Contains:

- U-shaped permanent magnet.
- Light rectangular coil wound on aluminum former used as iron core
- Iron core makes the field uniform and decreases the reluctance of the air path between the poles
- Rectangular coil is supported by jeweled bearings
- Pointer and control springs are attached to the spindle
- Aluminum former provides support to the coil and provides eddy current damping.

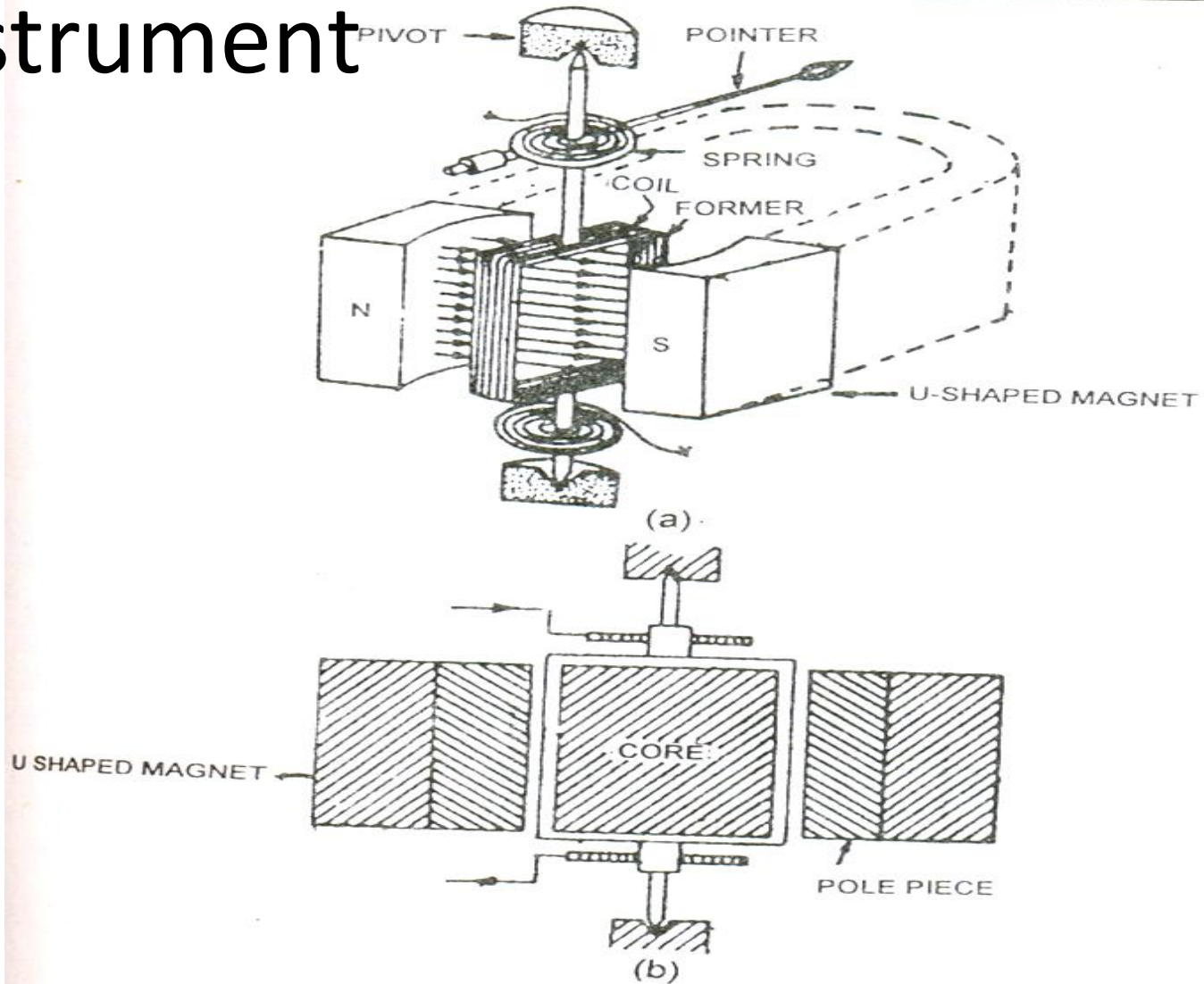


# Permanent magnet

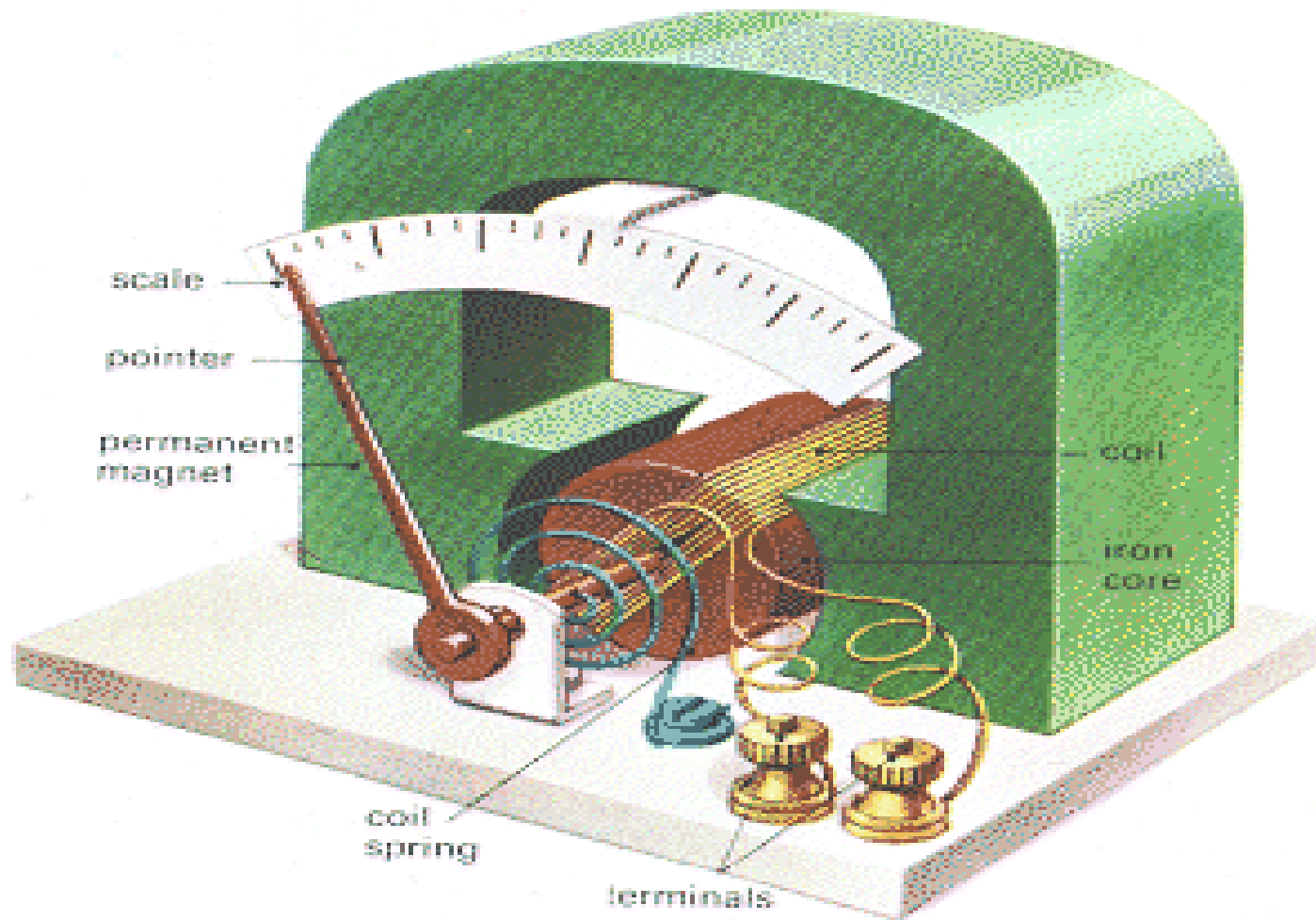
- Magnet is made of mumetal or alnico.
- Low hysteresis loss.
- Permanent magnet bend like horse shoe magnet



# Construction, Working of PMMC Instrument



# Open view of PMMC instrument





# Working of PMMC Instrument

When the disc rotates in the magnetic field:

- Disc cuts the magnetic lines.
- Eddy currents are produced in the disc.
- Damping force opposes the very cause of producing it (Lenz's law).



# Advantages of Moving coil instruments

- Consumes less power
- Scale is uniform
- High torque / weight ratio
- Range can be extended
- No hysteresis loss
- Effective and efficient damping
- Not effected by the stray fields



# Disadvantages of M.C. instrument

- Delicate construction
- Needs accurate design and assembly of parts
- Errors occurs due to ageing of springs
- Magnets weakens due to ageing



# Applications of MC Instruments

1. Laboratories on control panel to measure voltage and current etc.
2. Workshops to know the value of voltage, current power etc.
3. Sub-stations and power stations.
4. Irrigation pumps
5. Automobiles etc.



# Summary of Damping Systems

- Air friction damping :

The pressure inside the air chamber opposes the motion of the piston (deflecting torque).

- Fluid friction damping:

The friction of the damping oil opposes the motion of the moving system.

- Eddy current damping :

The eddy currents produced in the disc causes damping torque



# Summary of PMMC

- It works on the D.C motor Principle.
- When a current carrying conductor placed in a magnetic field, it starts moving.
- Controlling torque is produced by the phosphor bronze springs.
- Damping torque is produced by eddy current induced in the aluminum former.

