

# Lecture-63

## MI Instruments

Lecture delivered by:



# Topics

- Types of moving iron instruments
- construction and principle of operation of the moving iron attraction type instruments
- construction and principle of operation of the moving iron repulsion type instruments



# Objectives

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

- Classify types of moving iron instruments
- Explain the construction and principle of operation of the moving iron attraction type and repulsion type instruments



# How do poles attract each other?

- According to coulomb's 1<sup>st</sup> law of magnetism

**“Unlike poles attract each other and like poles repel each other”**



# Construction of MI Instruments

- Consists of a hallow cylindrical coil or solenoid.
- Spindle is supported between two jeweled bearings and is nearer to the coil.
- Oval shaped soft iron and a pointer are attached to the spindle.

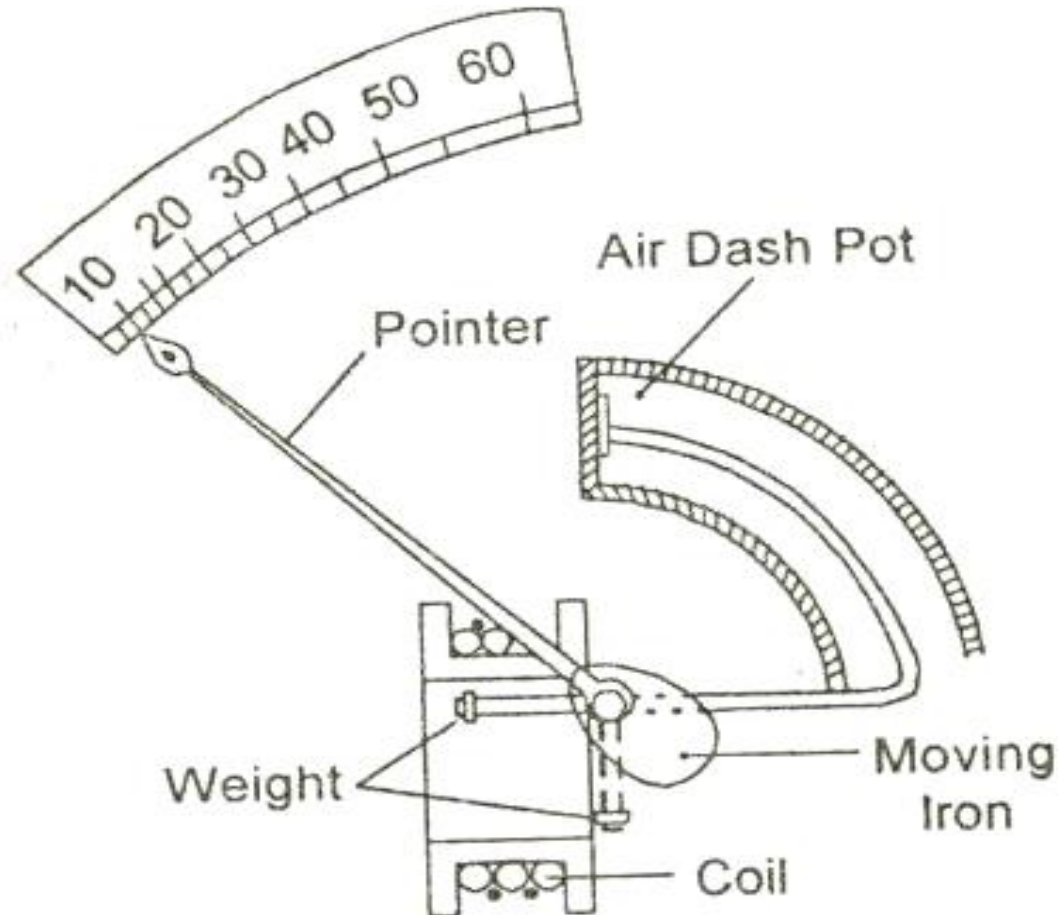


# Construction of MI Instruments

- Oval shaped iron is freely to move inside the coil
- Pointer moves on a graduated scale
- Instrument is provided with spring control
- Instrument is provided with Air friction damping system.



# Working of Attraction Type MI Instrument



# Principle of Operation

- When current passes through the coil ,it magnetizes.
- Coil attracts the soft iron piece in side the coil. As the iron is attracted to the spindle ,spindle also rotates
- Pointer moves on a calibrated scale, which indicates strength of the currents through the coil




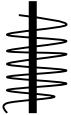


# Principle of Operation

- If the current reverses in the coil, the coil establishes magnetism in opposite direction
- Iron is attracted inside the coil.
- Deflection torque is remains same
- Instrument can be used for both AC and DC



# Identification of M.I Instrument

- Scale is cramped at starting and at the end portions
- suitable symbol(  or ) on the dial.



# Advantages of M.I. Attraction Type Instruments

- Cheap
- Robust
- Reasonable accuracy
- Simple in operation
- Simple construction
- High operating torque
- Momentarily overload capacity
- Used for AC and DC



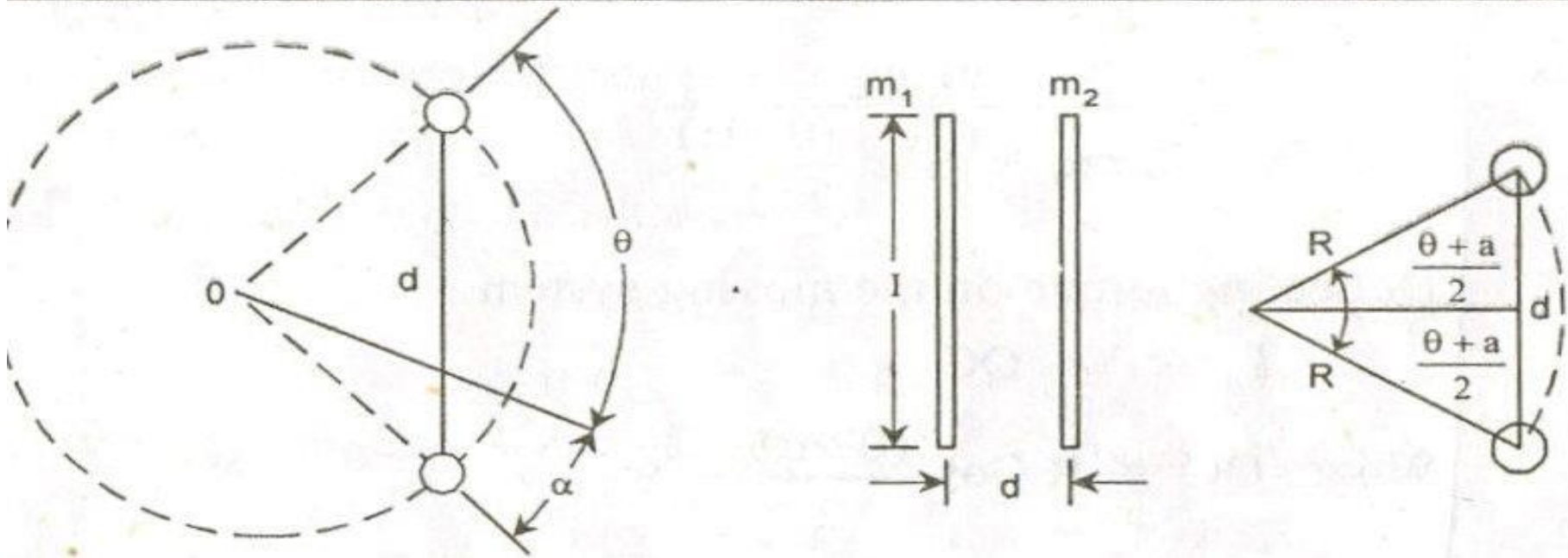
# Disadvantages of M.I. Attraction Type Instruments

- Not uniform scale
- Power consumption is more
- Errors are introduced due to hysteresis & stray magnetic fields
- Errors also introduce due to change of frequency in case of AC

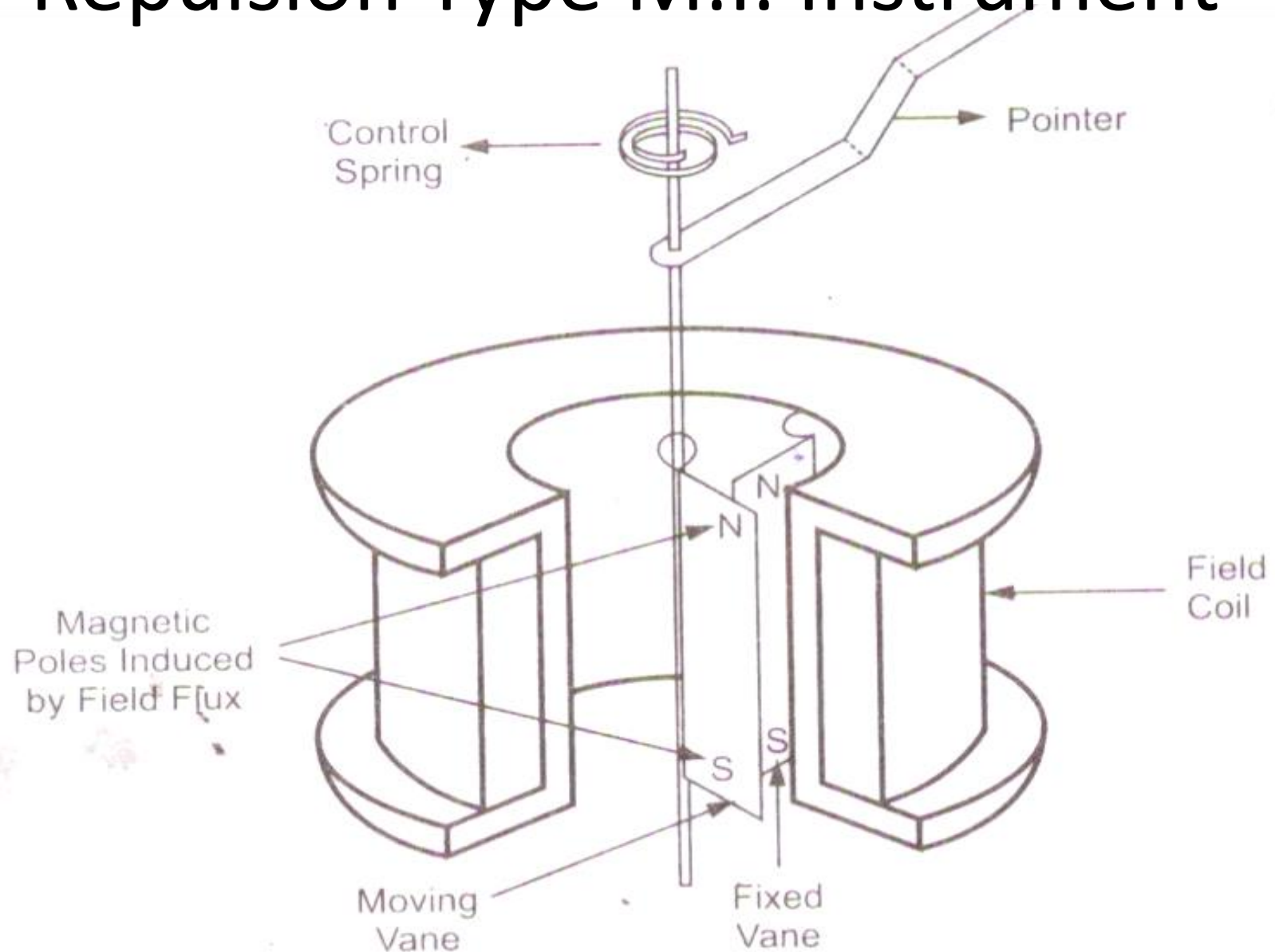


# Repulsion Type M.I. Instrument

- In the repulsion type, two pieces of iron situated in the coil,
- produce a force of repulsion between each other



# Repulsion Type M.I. Instrument



# Principle Operation of Repulsion type MI Instrument

- When the current through the coil is zero the pointer is in initial position showing zero
- The fixed and moving irons are close to each other
- When operating current is passing through the coil, it produces the magnetic field
- Two vanes within the coil are magnetized similarly (same polarity)



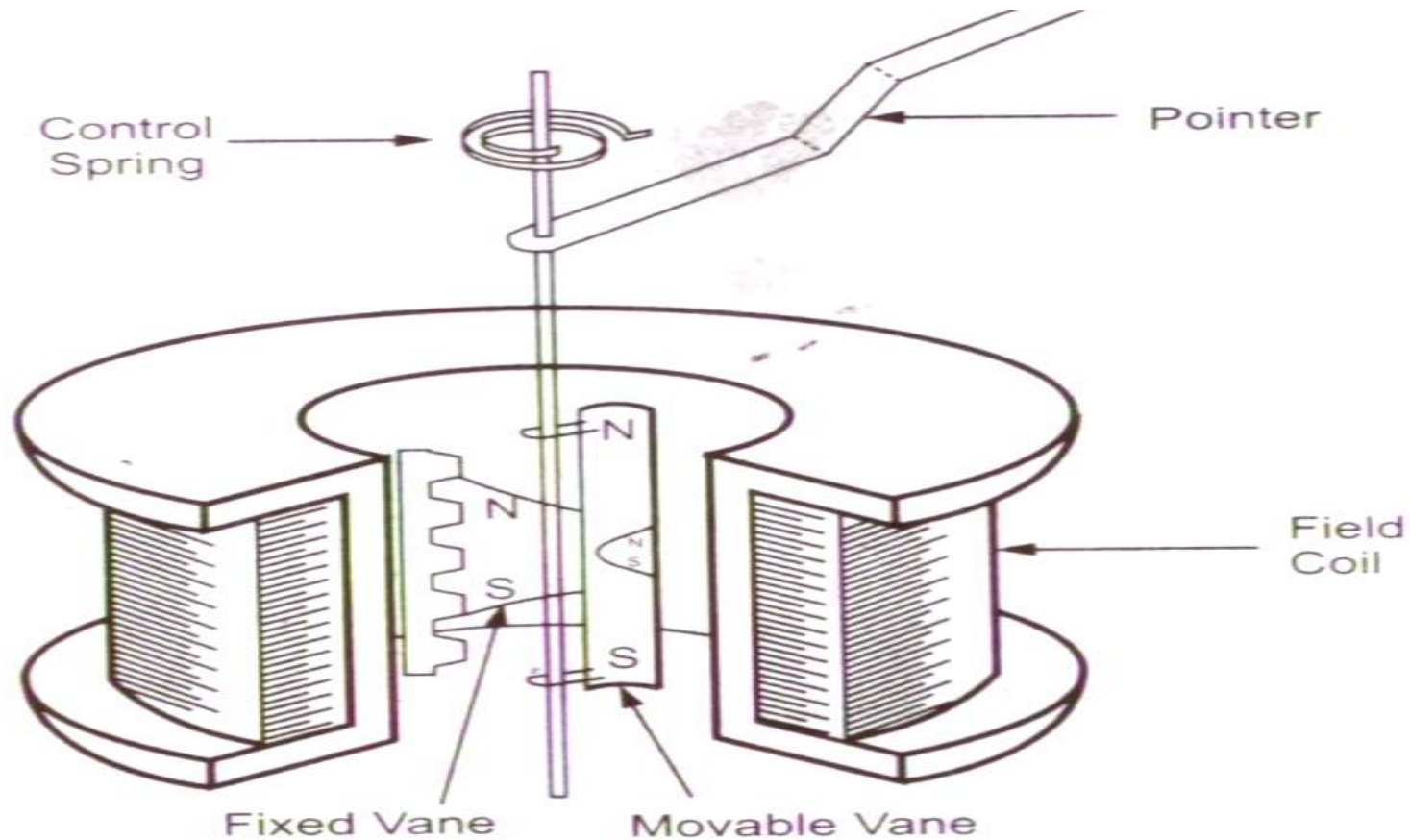
# Principle Operation of Repulsion type MI Instrument Cont...

- Hence two magnets repel each other
- Movable vane is mounted on the spindle moves away from the fixed iron
- The movement of the moving iron depends on strength of the current through the coil
- The pointer moves on a graduated scale along with spindle
- Thus the current flowing through the coil can be read directly





# Repulsion type MI Instrument



# Advantages of MI Repulsion Type Instrument

- Cheap
- Minimum maintenance
- Simple in operation
- Robust
- Used for AC as well as DC
- Reasonable accuracy



# Disadvantages of MI Instruments

- Scales are not uniform
- Power consumption at low voltage is high
- Stiffness of the spring decreases with increase in temperature
- Hysteresis in the iron of the operating system and stray magnetic field causes errors.
- Change in frequency of operation causes serious error



# Summary

In this Lecture, we will be able to

- Classify the types of MI instruments
- Explain the construction and working of attraction type MI instruments
- State the advantages and disadvantages of attraction type MI instruments
- Explain the construction and working of repulsion type MI instruments
- State the advantages and disadvantages of of repulsion type MI instruments

