Single phase Induction type Energy meter

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Schematic Diagram

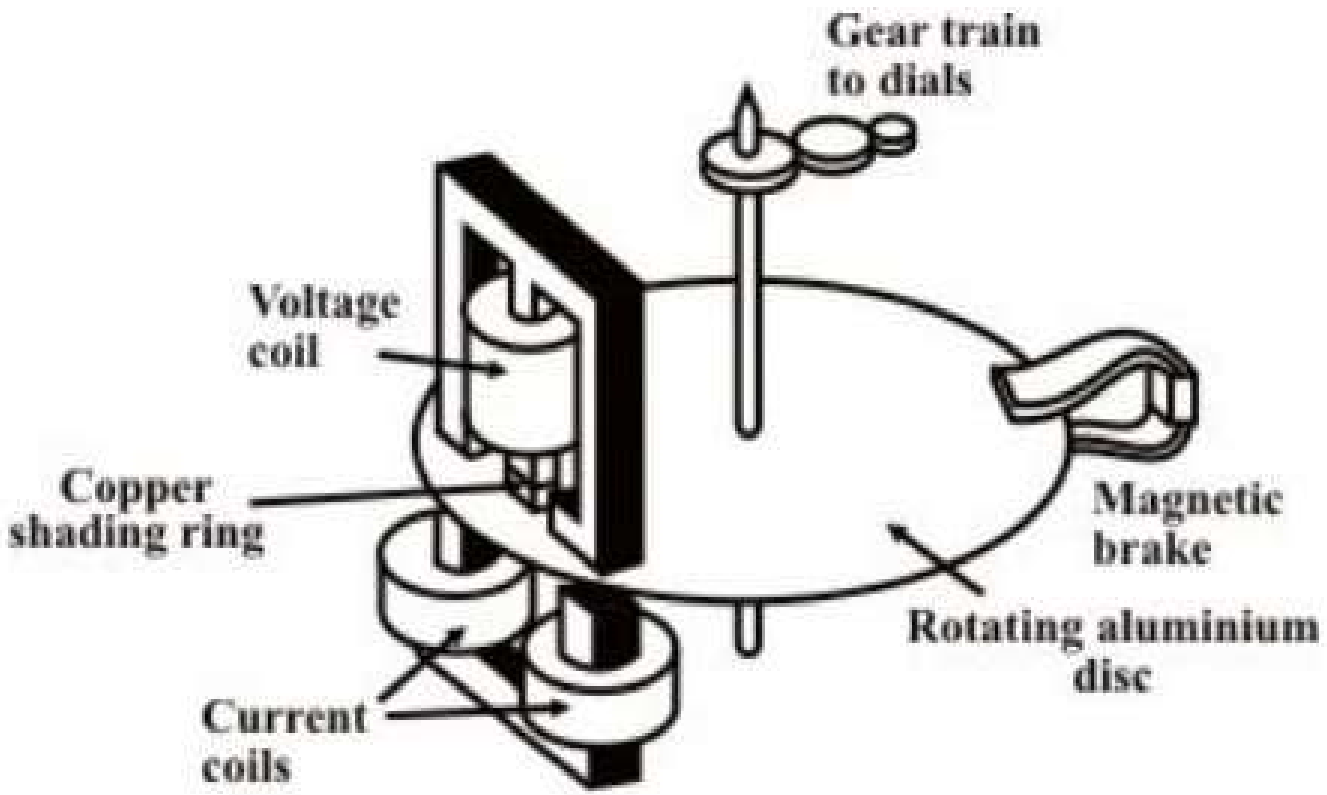
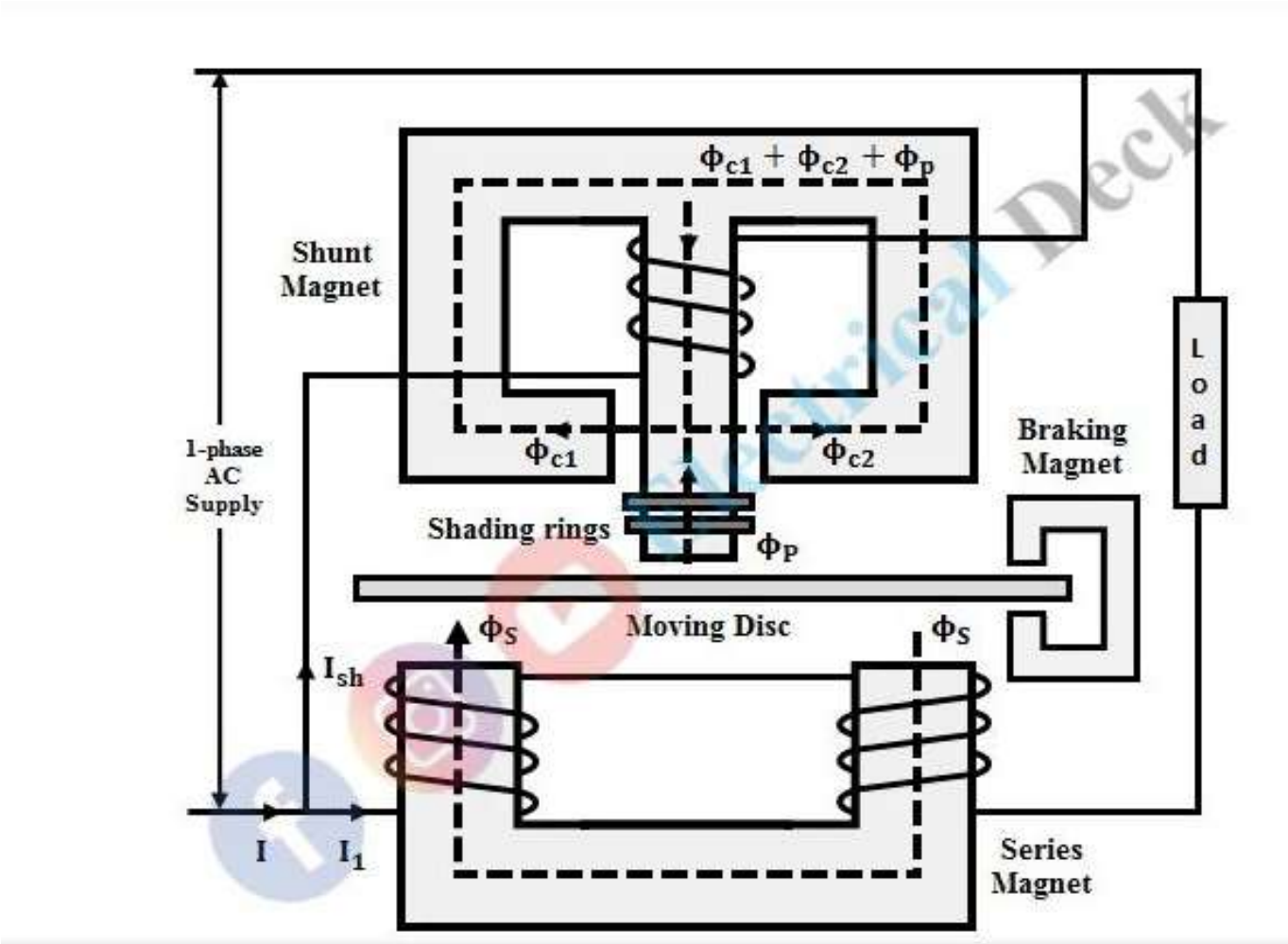


Fig. 44.1(a): Watt-hour meter.

Schematic Diagram



Introduction

- Single phase energy meter are used for measurement for electrical energy in AC circuit.
- Energy meter is an integrating instrument which measures the total quantity of electrical energy supplied to the circuit in given period.

Operating mechanism

- Driving system
- Moving system
- Braking system
- Recording mechanism

Driving system

- Two electromagnets are used series magnet & shunt magnet.
- The series magnet consists of number of U-shaped laminations of silicon steel together to form a core.
- A coil of thick wire having a few turns is wounded in both legs of U-shaped magnet.
- The coil is known as current coil which is connected series with load.
- The shunt magnet consists of number of M-shaped laminations of silicon steel assembled together to form a core.
- A coil of thin wire having large number of turn is wound on central limb of the magnet & is connected across the supply.
- Thus it is excited by current proportional to the supply voltage & known is potential coil.

Moving system

- The moving system is the aluminium disc is mounted on the spindle.
- The disc is placed in the air gap of the two electromagnets.
- The **eddy current** is induced in the disc because of the change of the magnetic field.
- This eddy current is cut by the magnetic flux.
- The interaction of the flux & the disc induces the deflecting torque.
- When the devices consume power, the aluminium disc starts rotating, & after some number of rotations, the disc displays the unit used by the load.
- The number of rotations of the disc is counted at particular interval of time.
- The disc measured the power consumption in kilowatt hours.

Braking system

- This system is required to control the speed of rotation of the disc and also to bring the disc to an idle state when the load is disconnected, which is done by a permanent magnet called a braking magnet.
- The permanent magnet is used for reducing the rotation of the aluminium disc.
- The aluminium disc induces the eddy current because of their rotation.
- The eddy current cut the magnetic flux of the permanent magnet & hence produces the braking torque.
- The braking torque opposes the movement of the disc, thus reduces their speed.
- The permanent magnet is adjustable due to which the braking torque is also adjustable by shifting the magnet to the other radial position.

Registering System

- The main function of the recording mechanism is to record the number of rotations of the aluminium disc.
- Registering system (a mechanism) is also known as the counting system (a mechanism).
- This system is engaged with the pinion, which is a gear mounted over the shaft of the disc. The mechanism consists of a train of gears.
- Since the number of rotations of the disc is proportional to the power consumption, the gear-turn ratio is selected so as to rotate the indicators on the panel to indicate the total energy consumed.
- Their rotation is directly proportional to the energy consumed by the loads in the kilowatt hour.
- The gear-turn ratio between the adjacent indicators will be 10:1 so that the energy consumed is integrated up to thousands of kWh.

Working of Single Phase Induction Type Energy Meter :-

- When single phase energy meter connected in the circuit to measure the consumption of electrical energy.
- The current passes through both the magnets or coil.
- The magnetic field produced by series magnetic in phase with the line current
- The magnetic field produced by **shunt magnet** is in quadrature with the applied voltage
- Thus, a **phase difference** exists between the fluxes produce by the two coils.
- This setup rotating **magnetic field** which interacts with disc & produce a driving torque & thus , disc starts rotating the number of revolutions made by the disc depend upon energy passing through the meter.
- The spindle geared to the recording mechanism so that energy consumed in the circuit is directly registered in kWh.

Advantages of induction type energy meter :-

- Cheap in cost.
- Simple construction.
- Low maintenance.
- More accurate on a wide range of loads.
- Good damping.
- The moving element has no electrical contact with the circuit.

Disadvantages of induction type energy meter :-

- It can be used for AC circuits only.
- They have non linear scales.
- They consume a considerable amount of power.