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Result : We observe a sinusoidal waveform trace.

Explanation : Technical alternating voltages and currents from the power mains supply possess a sinusoidal waveform with respect to time. The deflection of the luminous spot is always proportional to the instantaneous voltage applied to the solenoid coil. Thus the luminous spot follows a simple harmonic motion up and down. Rapid shaking of the head or the use of a moving mirror introduces a timebase for the horizontal axis (X-axis), along which the simple harmonic motion of the luminous spot is thus extended to produce the visible sinewave.

#### Experiment No. 8    In-Phase AC Voltages applied to both coils

From the same output jacks of the transformer unit, connect the 2 V AC voltage in the same sense to both coils.

Result : We obtain a luminous trace in the form of a straight line inclined at  $45^\circ$  with respect to the horizontal axis (X-axis).

Explanation : The energising voltages for the two coils are identical in frequency, phasing and amplitude. Thus the vertical and the horizontal linear components of deflection of the spot are always equal. Both components are simple harmonic motions and it follows that the resultant of these equal horizontal and vertical motions is the observed line inclined at  $45^\circ$ .

#### Experiment No. 9    Other Phasing

Reverse the two connections to one of the two coils.

Result : The straight line trace shifts to a new orientation which is at right angles to the former one.

Explanation : The vertical and horizontal deflection components are still of equal magnitude at all instants, but the signs are now opposite. The resultant is thus still a straight line. Expressed mathematically, this means that the the resultant of two linear simple harmonic motions (sinusoidal with respect to time) is another linear simple harmonic motion whenever the phase difference between the component motions is zero or an even integral multiple of  $\pi/2$ .

#### Experiment No. 10    Phase Shift by introducing an Iron Core into one Coil

Use the same experimental set-up as previously. Insert a suitable iron object, such as a key or pocket knife into the bore of one of the two coils.

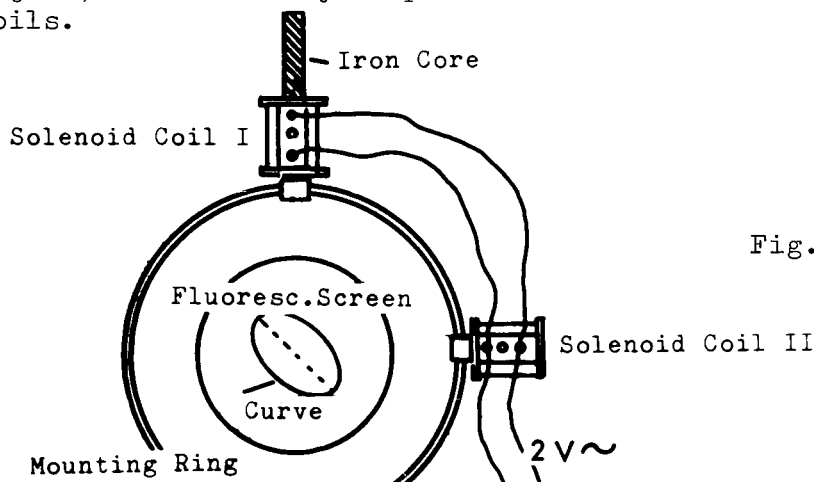


Fig. 7: Phase Shift by introducing an Iron Core into one Coil