EXPERIMENT NO 1

NAME OF EXPERIMENT: TO DETERMINE MAGNETIC MOMENT OF THE GIVEN BAR MAGNE USING DEFLECTION MAGNETOMETER BY TAN-A POSITION

APPARATUS REQUIRED

1) Deflection magnetometer
2) Bar magnet

THEORY

Tangent A position of Gauss

In this position, the centre of the needle is on the prolongation of the axis of the bar magnet. Hence the intensity F due to magnet is

$$F = \frac{2Md}{(d^2 - l^2)^2} \quad \text{--- (i)}$$

Where M is the moment of the magnet, d is the distance of the centre of the needle from the centre of the magnet, l is the semi-magnetic length of the magnet.

Since the needle is under the influence of two mutually perpendicular fields F due to the magnet and H due to the earth, the

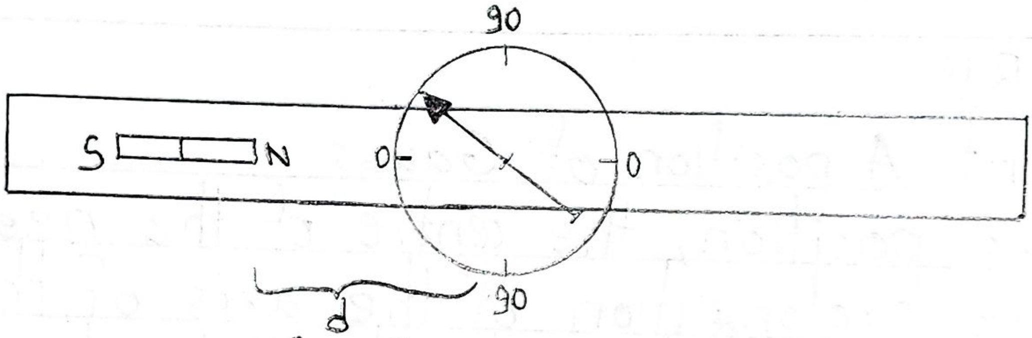

fig. Tangent A position of gauss

tangent laws holds good.

$$F = H \tan\theta \quad \text{—— (ii)}$$

from (i) and (ii)

$$F = \frac{2Md}{(d^2-l^2)^2} = H\tan\theta$$

$$\text{or, } M = \frac{H(d^2-l^2)^2 \tan\theta}{2d}$$

$$\therefore m = \frac{H(d^2-l^2)^2 \tan\theta}{2l \times 2d}$$

PROCEDURE

1. First of all, the magnetometer was adjusted so that its arms were perpendicular to the magnetic meridian, when the pointer reads 90° - 90° in the scale.
2. The bar magnet NS was placed on one of the arms with its axis perpendicular to the magnetic meridian i.e. placed along the arms with its center at a distance 'd' from the centre of the pivoted needle was say with its n-pole pointing towards the needle. The distance 'd' was adjusted such that the deflection θ should be between 30° and 60°. The deflection of the needle was read from both the ends of the pointer. That gave two readings.
3. Next the magnet was placed on the same

arm at the same distance with its s-pole pointing towards the needle. The deflection was again noted. This gave two more readings.

4. Operations (2) and (3) were repeated on the other arms at the same distance. This gave 4 more readings. Thus we had 8 readings, the mean of these gave θ.

OBSERVATIONS

Real length of the magnet $(x) = 15.1$ cm

$$\frac{x}{2} = 7.55 \text{ cm}$$

Effective length of the magnet $(2l)$ = 85% of real length (x)

$$\text{or, } 2l = \frac{85}{100} \times 15.1$$

$$\text{or, } 2l = 12.83 \text{ cm}$$

$$\therefore l = 6.415 \text{ cm}$$

Horizontal component of earth magnetic field at lab (H) = 0.34 orsted.

OBSERVATION TABLE

No of Obs.	Distance of the magnet in cms.	Position of the magnet in arm	n-pole pointing	Deflection End I	Deflection End II	Mean (θ)	$M = \frac{H(d^2-l^2)^2}{2d} \times \tan\theta$	Mean (M)
1)	30.5	East	East	36°	40°			
			West	41°	42°	~~71°~~ 35°	3085.14	
		West	East	31°	30°			
			West	30°	30°			
2)	29.5	East	East	41°	44°			3457.72
			West	42°	43°	43°	3693.98	
		West	East	40°	41°			
			West	46°	47°			
3)	28.5	East	East	45°	47°			
			West	46°	52°	45.38	3594.05	
		West	East	41°	43°			
			West	44	45°			

CALCULATION

1. $M = \frac{H(d^2-l^2)^2}{2d} \times \tan\theta = \frac{0.34(30.5^2-6.415^2)^2}{2\times30.5} \times \tan 35°$

$= 3085.14$

2. $M = \frac{H(d^2-l^2)^2}{2d} \times \tan\theta = \frac{0.34(29.5^2-6.415^2)^2}{2\times29.5} \times \tan 43°$

$= 3693.98$

3. $M = \frac{H(d^2-l^2)^2}{2d} \times \tan\theta = \frac{0.34(28.5^2-6.415^2)^2}{2\times28.5} \times \tan 45.38$

$= 3594.05$ c.g.s unit

But, $M = m \times 2l$

$$m = \frac{M}{2l}$$

$$= \frac{3457.72}{2 \times 6.415}$$

$$= 269.5$$

$\therefore$ Magnetic moment $= 3457.72$ c.g.s. unit

Pole strength $= 269.5$

RESULT

Magnetic moment of the given bar magnet using deflection magnetometer by tan-A position was determined.

PRECAUTIONS

1. Reading should be done accurately.
2. Magnetometer should be placed properly.
3. All the glassware should be handled with care.

07/29