Hence

$$C_x = \frac{10,000+7+0.2}{0.2} \cdot \frac{7000}{7} \cdot \frac{1}{500,000}$$
$$= 100 \text{ webers.}$$

METHOD OF VIBRATIONS.

240. If a magnetic needle be set vibrating, it will oscillate about its position of equilibrium, and would continue to do so were it not for the resistance of the air and the friction of the pivot. The case is strictly analogous to that of a simple pendulum, and hence it can be proved* that, when the amplitude of the oscillations is small, the time of an oscillation is independent of the amplitude. In fact

$$t^2 = \frac{\chi}{F}$$

where F is the force producing the oscillation, applied at each pole of the needle, and χ is a constant depending on the mass and on the shape of the needle.†

Now an alteration in the strength of the magnetic field‡ will alter the value of F, and hence that of t; so that t^2 becomes a measure of the strength of the magnetic field.

If the coils of a *tangent* galvanometer be placed east and west, so that the needle is at *right angles to the coils*, the force due to a current passing through the coils will be in the direction of the magnetic attraction of the Earth, and further, will be constant.

When no current is passing

$$F = MH$$

where H is the horizontal component of the Earth's magnetism and M is the magnetic intensity of each pole of the needle.

Therefore when a current C is passing

$$F = MH + bCM$$

where b is a constant depending on the galvanometer.

Hence if t be the time of an oscillation when under the influence of the Earth's magnetism alone, t' when the magnetic effect of the current, C'_x is added, and t'' when the current C'' is added, then

$$t^2 = \frac{\chi}{MH}, \quad t'^2 = \frac{\chi}{MH + bC'_xM}, \quad t'' = \frac{\chi}{MH + bC''M}$$

or

$$C'_x = \frac{t'^2 - t^2}{t''^2 - t^2} \cdot C''$$

*See § 55, Ganot's Physics, 9th Edition.

†See Appendix.

‡See § 698, Ganot's Physics, 9th Edition.