APPENDIX.

Sine and Tangent Galvanometers.

As was stated in § 148, when an electrical current passes through a galvanometer the needle is acted upon by two couples, one caused by the electrical current, the other due to the magnetic attraction of the Earth, and of any magnet sufficiently near to have a sensible influence on the needle. These two attractions together produce the magnetic field* in which the needle is lying, before the current passes, and the lines of force in this magnetic field are parallel to the initial position of the needle, if the directing magnet be not too close. Hence, if M be the intensity of magnetism of each pole of the needle, H the strength of the field, l the length of the needle, and δ the angle of deflection, $HMl \sin \delta$ is the moment of the couple due to the magnetic field.

Each force of the couple produced by the current is bCM, where b is a constant depending on the construction of the galvanometer, and its direction is perpendicular to the coils. Therefore, in a sine galvanometer, the moment of the couple due to the current will clearly be $bCM.l$, and in a tangent galvanometer, $bCM.\ l \cos \delta$.

Hence in a sine galvanometer

$$HMl \sin \delta = bCMl$$

or

$$C = \mu \sin \delta$$

And in a tangent galvanometer

$$HM\ l \sin \delta = bCMl \cos \delta$$

or

$$C = \mu \tan \delta$$

To show that the work done by an instantaneous current on the needle of a galvanometer varies as Q^2.

The current is nearly instantaneous, it will therefore have entirely ceased before the needle commences to move sensibly. Hence the deflecting couple may be taken as acting impulsively, and at right angles to the needle. Now the strength of the current

*See § 689, Ganot's Physics, 9th Edition.