

and that there is concealed within it, as a sacred mystery, the true value of the precession of the Equinox.

Chapter I.—On the revolutions of the celestial bodies; their mean sidereal and synodic periods, as compared with the same elements in modern tables. Mean places at a given time. On the Earth's diameter, &c. On the Moon's horizontal parallax and distance from the Earth.

A theory deducing the orbits of the planets and the extent of the Universe, or Brahmanda, from the Moon's daily rate of motion in her orbit.

Theory regarding the causes of the planetary motions, &c.

Chapter II.—On trigonometrical formulæ known to the Hindoos. The construction of their tables of sines and versed sines. On the epicycle and its deferent, and on the eccentric and concentric, used for calculating the "true" place of a planet from the mean place.

Chapter III.—Problems in astronomy, on time, ascensional difference, declination, celestial longitude, horoscope, &c.

Chapters IV, V, VI.—The calculation and projection of lunar and solar eclipses.

Conjunctions, heliacal risings and settings, stars of the Zodiac, &c.,
The lunisolar year, &c.

The cycle of Jupiter of 60 years.

V. "Repulsion and Rotation produced by Alternating Electric Currents." By G. T. WALKER, B.A., B.Sc., Fellow of Trinity College, Cambridge. Communicated by Prof. J. J. THOMSON, F.R.S. Received November 5, 1891.

$\frac{1}{2}$ (Abstract.)

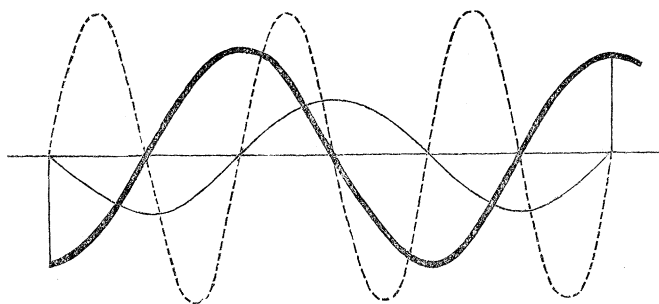
In the 'Electrical World,' May, 1887, p. 258, or the 'Electrical Engineer' (New York), June, 1887, p. 211, "Novel Phenomena of Alternating Currents," may be seen an account of some experiments by Professor Elihu Thomson on the mechanical force between conductors in which alternating currents are circulating.

In the case of a ring of metal in the presence of an electromagnet, in the coils of which an alternating current is passing, a force of repulsion is experienced by the ring, which may be explained as follows:—

Were the induced currents in the closed conductor unaffected by self-induction, the only phenomena exhibited would be alternate equal attractions and repulsions.

This may be illustrated by fig. 1. Here the strong line represents the primary and the thin the secondary, while of the dotted line any

FIG. 1.

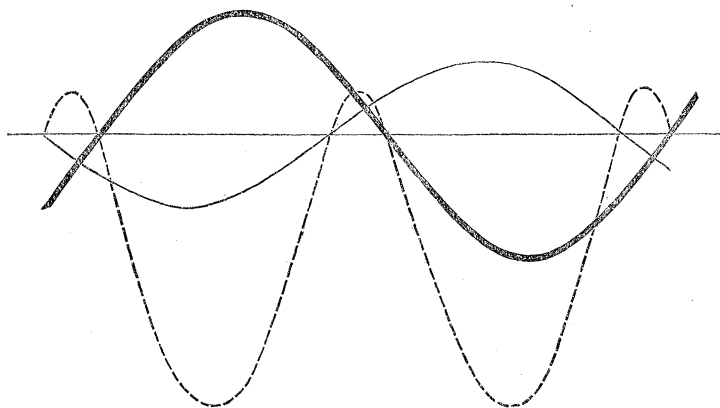


ordinate represents the product of the ordinates of the other lines, and hence represents the mechanical force of attraction or repulsion.

In the case of self-induction causing a lag, shift, or retardation of phase of the secondary current, there is a repulsion due to the summative effects of strong opposite currents for a lengthened period against an attraction due to the summative effects of weak currents of the same direction during a shortened period, the resultant effect being a greatly preponderating repulsion.

The diagram for this is fig. 2. Professor Thomson has shown, experimentally, that two circular coils, whose planes are perpendicular

FIG. 2.



to the line joining their centres, repel one another when an alternating current traverses one of them, and that if they be placed with their centres coincident and planes making an acute angle, there will be a couple tending to increase that angle.

As these results have been used as means of measuring alternating

currents, I have calculated in § 1 expressions for the intensities of the force and couple respectively.

Another experiment is the following :—A sheet of copper is placed so as to half cover an alternating magnetic pole. Upon this, near the pole, is laid a hollow sphere of copper. The electromagnetic action produces a couple so powerful that the friction of rotation is overcome, and the sphere spun round.

In order to throw light on this, after a theorem in § 2 as to the kind of currents set up in a conductor, I have considered a number of cases. A thin circular infinite cylindrical shell lies in an alternating field of currents parallel to its axis, and the couple upon it is found. The result is applied to give the couples on two such shells in the presence of a parallel current and of a pair of currents forming an electromagnet.

The couple in action upon a thin spherical shell in a general periodic field, has next been found, and is applied to give the couples on two thin shells under the influence of—

- (i.) An alternating current in a straight infinite wire.
- (ii.) A pair of such currents forming an electromagnet.
- (iii.) An alternating magnetic pole.
- (iv.) An alternating electromagnet of very short length.

It transpires that, whatever the field in action upon the cylinder and sphere (the former consisting of currents parallel to the axis), there will be no couple if the field be completely in one phase. Thus, the sphere of Professor Thomson is made to spin because the currents induced in the copper plate do not coincide in phase with those of the magnet, and not (as has been stated) because it acts as a screen and renders the field unsymmetrical. Were the plate a perfect conductor, it would be a perfect screen, but there would be no couple.

Presents, December 10, 1891.

Transactions.

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FIG. 1.

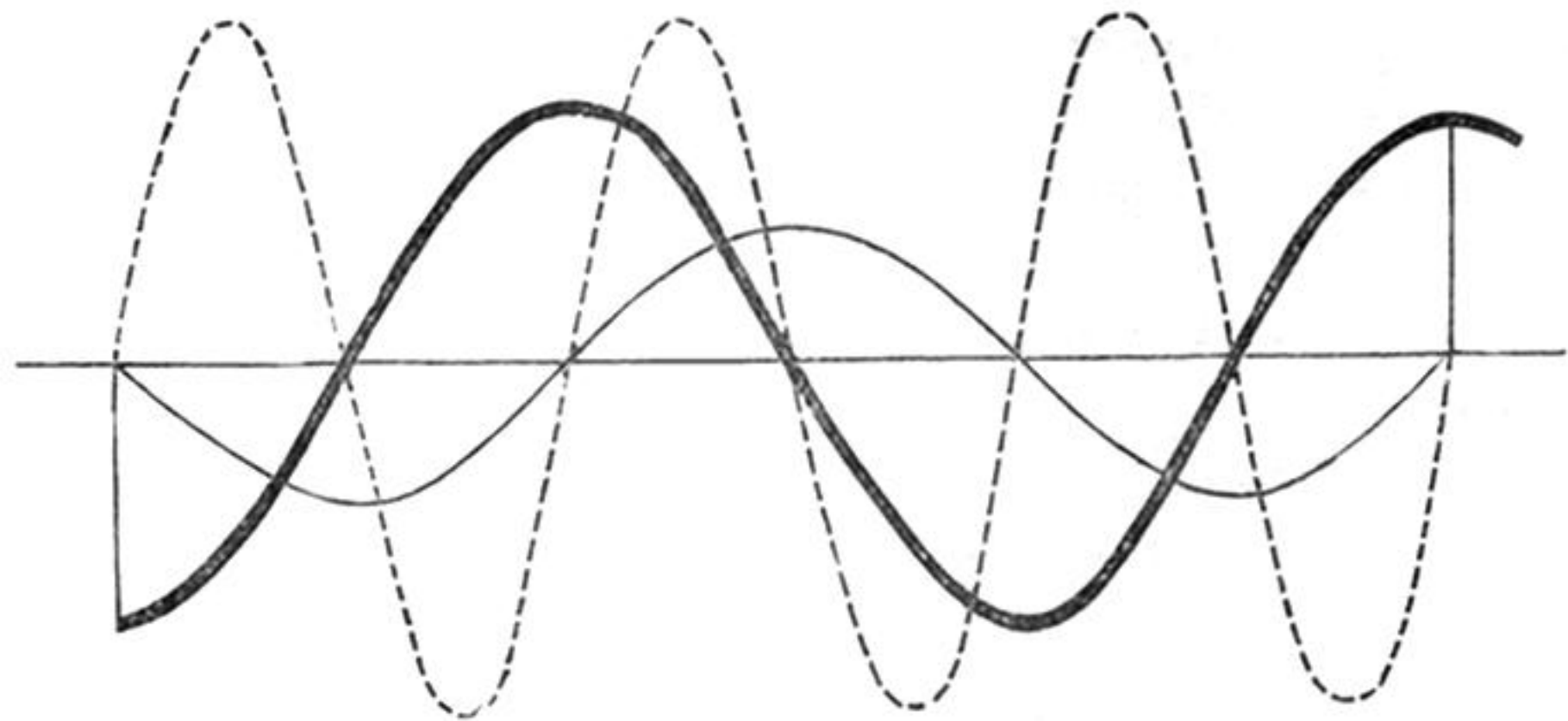


FIG. 2.

