

rotary motion acquire properties which they do not possess otherwise—viz., rigidity—*i.e.*, reaction against change of shape (the stiffness of a travelling rope thrown off a pulley is a familiar illustration); stability—*i.e.*, reaction against change of position and motion, as in a spinning-top or a bicycle; elasticity—*i.e.*, tendency to revert to the same position, if violently disturbed. The gyroscope¹ had been invented in 1852 by Foucault, and used by him and other physicists in France and Germany to illustrate the rotation of the earth. It was now shown that portions of a perfect fluid—*i.e.*, of a body which possesses neither rigidity, nor stability, nor elasticity—when in a state of rapid rotational motion, acquire these gyrostatic properties; that whirling portions cannot be naturally created, but that if once in existence they preserve their identity, being permanently differentiated from the surrounding fluid, which may be at rest or in the state of flow. These differentiated portions of the liquid were called by Helmholtz vortex filaments; he showed that in a liquid without a boundary they must run back into themselves, forming rings which might be knotted and linked together in many ways.

41.
Earlier
researches
on vortex
motion.

¹ A much older invention was that of Bohnenberger (1817), known by his name. The name "gyroscope" was introduced by Foucault; and that of "gyrostat," as defining an apparatus which acquires stability through rotational (whirling or gyrating) motion, was used first by Lord Kelvin. An extensive treatment of the subject is to be found in the first part of Thomson and Tait's 'Natural Philosophy' (2nd ed.), pp. 314-415. It is mainly through the influence

of this work, and through the inexhaustible wealth of experimental illustrations contained in many of Lord Kelvin's addresses (see 'Popular Lectures and Addresses,' vol. i. pp. 143 *sqq.*, 218 *sqq.*; iii. 165 *sqq.* 245), that gyrostatic and vortex motion has become in this country a favourite study of mathematicians and natural philosophers, and forms an important feature in almost every recent attempt to describe the properties of matter and ether.