position of another distinct variation having two maxima and two minima in the twenty-four hours, like the barometer variation; and he supports his views by a reference to the variation of the east components of the wind in the months of July and August, when the land- and sea-breezes have almost disappeared. This is found to exhibit a decided *double* period. The north components of the land- and sea-breezes are then approximately eliminated from the north components of the whole variation, and the variation which then remains exhibits a very decided *double* period in this direction also. These variations with double periods are regarded as indicative of the existence of a double diurnal variation in the general movements of the atmosphere. Upon this hypothesis typical diurnal variations of the wind are deduced for north and south low latitudes—that for north latitudes exhibiting a double diurnal right-handed rotation, and that for south latitudes a double diurnal left-handed rotation; and from these the diurnal variation of the barometer is deduced.

The movements of the wind-vane at Bombay are then analyzed; and the writer concludes that the greater part of the excess of "direct" over "retrograde" rotation of the vane at Bombay is due to the *diurnal variation* of the wind.

Extracts are given from observations made at St. Helena, Toronto, and Falmouth, showing the character of the diurnal wind-variations at those places, and their greater or less agreement with the deduced typical curves. The writer maintains that these variations afford independently a possible, if not a probable, explanation of that movement of the air which Dové had called the "Law of Gyration;" and, in conclusion, he points to the extent of their applicability in deducing weather probabilities, and to the method of discussing storms.

A postscript is added, giving the mean diurnal variation of the wind at Sandwick Manse, Orkney, and pointing out its general conformity with the results deduced from the Bombay wind-observations.

VII. "Researches in the Dynamics of a Rigid Body by the aid of the Theory of Screws." By Robert Stawell Ball, LL.D. Communicated by Professor Cayley. Received May 29, 1873.

(Abstract.)

This paper contains some developments of a theory sketched in the Transactions of the Royal Irish Academy, vol. xxv. p. 157.

Part I. discusses the quantity of energy necessary to give a body a twist about one screw while acted upon by a wrench about another screw. The expression *virtual coefficient* is defined, and application is made of the reciprocal character of the virtual coefficient to solve the problem of resolving a wrench along six given screws.

Part II. Six screws of reference can be chosen, such that each screw is reciprocal to all the rest; the group is said to consist of *coreciprocal screws*. The analogy between the convenience obtained by referring the twist coordinates of a rigid body to a group of coreciprocal screws, and the convenience obtained by referring the coordinates of a point to rectangular axes, is pointed out. The important theorem that one screw can be found which is reciprocal to five given screws is discussed.

Part III. The *sexiant* is a function of six screws, which can be expressed as a determinant. The property possessed by six screws when their sexiant vanishes may be enunciated in several different ways; *e. g.*, wrenches of appropriate magnitudes equilibrate when applied about the six screws to a free rigid body. If seven twist velocities about seven screws neutralize, then each twist velocity must be proportional to the sexiant of the six remaining screws.

Part IV. If a quiescent rigid body receive an *impulsive wrench*, then the body commences to twist about an *instantaneous screw*. It is shown that if four impulsive screws lie on a cylindroid, the four instantaneous screws lie on a cylindroid, and also the four impulsive reactions caused by the constraints. The anharmonic ratios of each of these groups of four are all equal. Several special properties of impulsive and instantaneous screws are also considered.

Part V. When a body has k degrees of freedom, it is shown that k *principal screws of kinetic energy* can be determined. When an impulsive wrench is imparted about a principal screw of kinetic energy, the body commences to twist about the same screw. These principles are illustrated by detailed examination of the cases of two and three degrees of freedom.

Part VI. Miscellaneous propositions. The principal questions discussed are:—the *locus plane* of a point for twists about the screws on a cylindroid; the equilibrium of a body under the action of gravity for the different cases of freedom; remarks on Professor Sylvester's theory of lines in involution; generalization of a theorem due to M. Chasles.

VIII. "On the Fossil Mammals of Australia. Family Macropodidæ. Genera *Macropus, Pachysiagon, Leptosiagon, Procoptodon,* and *Palorchestes*.—Part IX." By Prof. Owen, F.R.S. Received April 19, 1873.

(Abstract.)

In this Part the author concludes his descriptions of the fossils on hand relating to the family of Kangaroos (Macropodidæ). He gives additional evidence of the characters of *Macropus Titan*, evidence of a larger species of *Macropus* proper (*M. Ferragus*), and of two subgeneric modifications of that type (*Pachysiagon* and *Leptosiagon*). The characters of