he finds the present first volume of Professor Gray's new treatise to include a large part of the theoretical text of those volumes. This has been entirely recast, however, (much, *if not all*, being entirely rewritten,) printed in larger and better type, with many important additions, and the whole so treated as to constitute an entirely new and delightful book. This is especially true of the parts relating to dynamical, and general electro-magnetic, theory. In the latter, Heaviside's treatment is adopted, which will greatly recommend it to the rapidly-increasing number of the admirers of that splendid electrician. Besides, more and weightier things of the same sort are promised in the second volume.

Chapter viii, consisting of 63 pages on Fluid Motion, is what might be considered an innovation in a treatise on electricity; but of its great utility there can be no doubt. Those most familiar with theoretical physics will admit that the reasons given by the author, in §270, p. 212, for the insertion of so long a chapter on *hydro-dynamics* are abundantly justified.

The book is singularly free from misprints and inadvertencies, especially when the number and difficulty of the formulæ contained in it are considered. There is what seems an inadvertence on p. 99, in the 18th line from the bottom, where it would seem that "compass *needle*" should read "compass *card*." We look forward to the second volume with a great deal of interest.

JOHN E. DAVIES.

UNIVERSITY OF WISCONSIN, November 28, 1898.

COMPARISON OF MAGNETIC INSTRUMENTS.

MOUREAUX, TH. *Comparaison des Appareils Magnétiques de Voyage de L'Observatoire du Parc Saint-Maur Avec Ceux de Divers Observatoires Magnétiques Étrangers.*

Acting upon a resolution of the Meteorological Conference, convened in Paris, in 1896, to the effect that the comparison of the magnetic surveys of different countries necessitates that the instruments that have been employed in the different surveys should be compared, M. Moureaux repaired to London and to Brussels, during the summer of 1897, to compare the portable instruments used in measuring the magnetic elements in the magnetic survey of France with those used in determining absolute values in the Magnetic Observatories of England and Belgium. In the preceding year he had made a like comparison with the instruments in the Russian Magnetic Observatory at St. Petersburg, and Lieutenant Kesslitz, of the Austrian Navy, had come to France to compare the instruments of the Hydrographic Bureau at Pola with those of the Parc Saint-Maur Observatory.

Some years before Dr. van Rijkevorsel had made series of observations at the French Magnetic Observatory at Parc Saint-Maur with instruments brought from Rotterdam, and likewise Solander had made a comparison between Stockholm and Parc Saint-Maur. In the meantime an exhaustive discussion of the instrumental constants of the French instruments led to the deduction of a formula for computing the horizontal intensity which gave values 0.00067 of a C. G. S. unit less than those previously deduced and published. In the following tabular statement of all the comparisons that have

been made of the instruments of neighboring countries with those of France, the differences in the values of the horizontal intensities assigned by van Rijckevorsel and Solander are reduced by 0.00067:

Name of Station compared with Parc St. Maur	Year of Comparison	Mean values of the observed differences		
		Declination	Horizontal intensity (C. G. S. units)	Inclination
Kew	1897	-0'.5	+0.00012	-2'.0
Pavlovsk	1896	+1'.3	-0.00013	-0'.8
Pola	1896	-2'.4	+0.00006	-1'.5
Rotterdam	1889	+1'.1	+0.00004	-5'.6
Stockholm	1891	. . .	-0.00027	. . .
Uccle (Brussels)	1897	-1'.5	-0.00002	

VAN RIJCKEVORSEL. *Comparison of the Instruments for Absolute Magnetic Measurements at Different Observatories.* Amsterdam, 1890.

In the spring of 1897, Dr. van Rijckevorsel visited in succession the magnetic observatories at Kew, Wilhelmshaven, Potsdam, and Utrecht, carrying with him to each place a Kew unifilar magnetometer and a standard dip-circle, with which he made series of observations of the magnetic declination, horizontal intensity, and inclination, to be compared with simultaneous values of these elements as deduced for the readings of the standard instruments of each of the observatories. In 1889 he had obtained comparative sets of observations, at some of these stations, with the same instruments and in the same manner. The mean values of the differences between the readings by his instruments and the instruments for the observation of absolute values at the observatories are as follows:

	Kew	Wilhelmshaven	Potsdam	Utrecht
		Declination		
1897	+ 0'.46	+2'.43	+0'.35	-0'.42
1889	+ 2'.82	+1'.22		-0'.84
		Horizontal Intensity (C. G. S. units)		
1897	+ 0'.000108	-0'.000023	-0'.000092	
1889	+ 0'.000080	+0'.000425		
		Inclination		
1897	+1'.30	-0'.16	+2'.65	-3'.78
1889	+1'.36			-0'.85

The conclusions are: (1) That all the declination instruments have probably undergone slight changes, which may, in some cases, have amounted to as much as 2', or even a little more.

(2) That the differences between the instruments for the observation of horizontal intensity do not seem to be a constant quantity.

(3) That readings from the dip-circles of the best makers show differences of as much as 6', and these differences do not seem to be constant.

G. W. LITTLEHALES.