and from Dunkirk to Ostend. The Bruxellian and Laekenian systems form superficial hills in the neighborhood of Brussels, Gand, etc. The oligocene system shows two principal divisions (tongrian, rupelian), which stretch across the lower part of the river Escaut, where it leaves the eocene districts, through which it flows in the western part of the country. The pliocene formations overlap irregularly the underlying tertiary beds, and extend from Antwerp to Louvain. Many fine fossils have been found in these beds, where Mourlon admits several divisions, — Diestien (in part), Anversien, and Scaldisien. The last chapters of the work treat of the quaternary (diluvien, hesbayen, and campinien) and recent periods.

Though special attention has here been given to the stratigraphical extent and disposition of the beds, the author has treated with equal care of their lithological and paleontological characters, their minerals and fossils, and the useful products they furnish to Belgian industry. It will be enough, to indicate what amount of documents are included in the book, to state that the lists of fossils occupy 240, and the bibliographical lists 144 pages.

DU MONCEL'S ELECTRO-MAGNETS.

Electro-magnets. The determination of the elements of their construction. By Th. Du Moncel. From the second French edition. New York, *Van Nostrand*, 1883.

The same. Translated from the French by C. J. Wharton. London, *Spon*, 1883.

The great interest in the practical applications of electricity demands simple treatises on the most economical methods of making electro-magnets. Count Th. Du Moncel has endeavored to supply this want, and has added another treatise to the long list he has already published upon electricity. He disclaims any endeavor to make a treatise on electro-magnets which shall embody scientific theories upon that most difficult of subjects, theoretical magnetism. His desire is to give the mechanician a *vade mecum* by means of which he can construct electro-magnets for operations outside the laboratory. Indeed, this treatise is intended to stand in the same relation to the maker of dynamo-electric machines as a treatise on the practical construction of boilers, minus theories of elasticity, would stand to the constructor of steam-engines. There is need for such a treatise, undoubtedly; for much expense can be saved by a little knowledge where to put the material to the best advantage. Most of the dynamo machines which are before the world at the present time are defective in the arrangement of the wire of the field electro-magnets. Does the treatise of Du Moncel supply this want? The author follows the antiquated French fashion of expressing the resistance of a wire in terms of the length and diameter, without specifying, in many cases, the specific resistance. Thus, instead of ohms, we read so many metres of telegraph-wire; and one must enter into a troublesome arithmetical drudgery to ascertain what is meant. The English edition, published by Spon, states in the preface the relation between Du Moncel's units and the commonly received units of resistance and electro-motive force; but the American edition, published by Van Nostrand, leaves the reader to find out this relation after he has plodded some distance through the treatise.

The two imprints, one by Spon and the other by Van Nostrand, are carelessly edited. Thus, on p. 43 in Van Nostrand, we find an inconsistency between the values of t^2 and A.

On p. 47, Van Nostrand gives

$$ab = \frac{\rho}{e^2}\, 0.000506 \sqrt[3]{\sqrt[3]{P^4 f^8}}$$
$$= \frac{\rho}{e^2}\left(0.0225 \sqrt[3]{\sqrt[3]{P^2 f^4}}\right)^2,$$

while Spon gives, on p. 34,

$$ab = \frac{\rho}{e^2}\left(.0225 \sqrt[3]{\sqrt[3]{P^2 f^4}}\right)^2$$
$$= \frac{\rho}{e^2}\, .000506 \sqrt[3]{\sqrt[3]{P^4 f^8}}.$$

We give this as an example of similar mistakes which meet the eye. The question arises whether a more carefully prepared treatise, which would start with the fundamental system of electrical measurements, is not still needed. It is useless for any one to endeavor to become a practical electrician to-day, without a sound training in mathematics as far as the principles of the differential and integral calculus. A genius may arise, but he will know enough to employ a steady plodder who has been steeped in the principles of the calculus. Most constructors who desire to build electro-magnets will find that the exigences of space and material will demand a certain form. Unless they understand the theory of magnetic measurements, they will find the treatise of Du Moncel of little value; for so many and so large approximations must be made, that the final result would not differ much from those obtained by a thumb-rule. We commend to the practical

electrician a study of the fundamental magnetic measurements rather than the perusal of treatises of this nature.

LEDGER'S SUN AND ITS PLANETS.

The sun, its planets, and their satellites. By Rev. EDMUND LEDGER, M.A. London, *Stanford*, 1882. 432 p. 12°.

OF late a considerable number of semi-popular works have appeared on astronomical subjects. They seem to meet a felt want of the community, and have been very successful. We call them *semi*-popular; because, while they are not written for professional astronomers, they are adapted, in their style and mode of treatment, less to the great masses of the business and laboring population than to the educated people who are engaged in various professional occupations. Those, for instance, who are busy in teaching, or with the practice of medicine or law, or who are pursuing geological or biological research (in short, pretty much all who would naturally subscribe for SCIENCE), generally wish to keep *au courant* of what is going on in other than their own special lines of work, and are delighted to find what they want, when they can get it in an attractive form.

Mr. Ledger's book is an excellent one of this class. It is less diffuse than Mr. Proctor's essays, and not quite so imaginative. It is narrower in its scope than Professor Newcomb's Popular astronomy, but easier reading, and fuller of detail in respect to the subjects of which it does treat. It makes no special claims to originality, but is accurate and clear, and the style is unpretentious and agreeable. The book is nicely gotten up, and very well illustrated. Altogether, we have no hesitation in pronouncing it a volume well worth reading and possessing.

It is made up of fifteen lectures read in 1881 and 1882 in Gresham college, London. Two are upon the sun, two are devoted to the moon, two to the earth, and two to Jupiter and his satellites. Each of the other planets has a chapter to itself (counting the group of planetoids as one), and there is a chapter entitled 'Ptolemy *versus* Copernicus.' Naturally, the lectures are not all of equal interest and value; but none of them are poor, or could be well dispensed with. The chapters upon Mars and the planetoids strike us as particularly good, and contain information not otherwise very easily accessible. The chapters on the sun and moon are also excellent, though naturally enough, in the main, only an abridgment and compilation from the recent books on these subjects; to which books the author handsomely acknowledges his obligations.

There are remarkably few mistakes in the work: in fact, in reading it over for this notice, we have found none at all, unless we count as such, a blunder in the illustration on p. 147, representing the comparative size of the sun as seen from Mercury at perihelion and aphelion; the difference being represented very much greater than the truth. Speaking of illustrations, the fine Woodbury-type of the eclipse of 1871 deserves special mention, and several of the pictures of Mars and Jupiter are unusually excellent. It is rather a pity that a few pages of tables were not appended, containing the numerical statistics of the planetary system. They would have greatly increased the value of the book for those who wish not merely to read it once, but to keep it on their shelves for occasional reference.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Flexure of the broken transit. — Professor C. A. Young, after alluding to the fact that the flexure-correction of this peculiar form of transit is not treated of in any of the common text-books on practical astronomy (not even in Sawitsch, who specially describes and discusses the instrument itself), states the theory of the correction to transits of stars observed with the 'broken transit,' which is often so great as to amount to a large fraction of a second of time at the zenith. The constant of flexure must be known, and its effect eliminated, before the collimation error can be determined by reversal of the instrument on a circumpolar star. The correction has the same coefficient with the level-error; and denoting this latter, as usually obtained, by b, the flexure-constant by f, and the pivot-correction by p, the complete formula for the 'level-constant' is $[b \pm (f \pm p)]$. Thus, by flexure, the time of transit of a star is affected by $f \cos z \sec d$. The sign of f changes with the reversal of the instrument, being always plus for eye east, and minus for eye west. Prof. Young gives several methods of determining f: by observing zenith stars in reversed positions of the instrument, by means of the collimating eye-piece and mercury-basin, or a vertical collimator supported above the instrument, and by least-square treatment of equations given by repeated observation of suit-