

its molecules, as when a body is heated; or by a strain or twist of its structure, as when steel is magnetized." * * * "We have no experience of its independent existence."

Later in the book we find the following remarkable ideas advanced, viz.: "We cannot make or destroy electricity—" * * * "When we rubbed glass, we produced positive electricity on its surface. Was not that a creation of electricity? No; for an exactly equal quantity of negative electricity was produced in the rubber." Here the author is decidedly at fault; we can both make and destroy electricity; that is, we can convert every variety of energy into other forms of energy; and so also we can convert electrical energy into other forms of energy. The argument used by the author to prove his assertion, that electricity was not created, because an equal amount of opposite electricity was produced, leads us to infer that he has the fluid hypothesis in mind when using the illustration. His idea appears to be that nothing has been created; the positive and negative fluids existed previously; the mechanical action of rubbing has simply separated the two fluids; therefore there has been no creation, but merely a separation.

He also makes the following remarkable assertion, "If this were possible (the production of a single kind of electricity without the production of its opposite kind, which of course is impossible), we might actually increase the quantity of electricity in the world. Experiment shows us that we cannot do this." Here again the meaning is ambiguous. If electricity be a species or phase of energy, he is at fault, since nearly all the energy in the universe might be converted into electrical energy, in which case the quantity of electricity in the world would be largely increased. If, however, he regards electricity as a kind of matter, and here we see indications of a lingering belief in a fluid hypothesis, he is right: since of course we can neither increase nor decrease the quantity of matter in the universe. Does the author believe that electricity is a kind of matter?

E. J. H.

A TEXT BOOK OF ELEMENTARY MECHANICS for the use of Colleges and Schools. By Edward S. Dana, Assistant Professor of Natural Philosophy in Yale College. 12mo. New York: John Wiley & Sons. 1881.

"For we have done those things which we ought not to have done,

and we have left undone those things which we ought to have done," applies to many things other than our moral transgressions.

Certainly, if an elementary mechanics should have any one virtue, that virtue should be clearness of conception and accuracy of expression.

Glancing through the book, on page 220 we find the following statement: "A toothed wheel is a circular disc provided with teeth on the circumference; such a wheel, turning on one axis, interlocks with a second, turning on another axis, and in this way the *force* applied at the first is communicated to the second. There may be a *mechanical advantage* with a corresponding loss of speed, or a gain of velocity and a consequent *mechanical disadvantage*."

Would it not have been much clearer to have said the *work* applied at the first is communicated to the second there may be a *gain in force* with a corresponding loss of speed, or a gain in velocity and a consequent *loss in force*.

"A mechanical advantage" may be gained from a given quantity of work in either direction; that is, you may gain greater speed or greater force at will, and a loss in force may prove anything but a mechanical disadvantage in many cases.

The use of the word "power" (see page 222) in the sense of force is also confusing. The power of a machine is the number of foot-pounds of work it will do in the unit of time taken. Prof. Dana is not alone in this erroneous use of language, but takes this word from others, who make far greater pretensions as mechanicians than he does in his modest preface.

Although we have four chapters on dynamics or kinetics, it is impossible to find in them any reference to the moment of inertia, or to the radius of gyration. There is the trouble with many of our elementary mechanics: the students read them, and it is true, too, that the great majority forget what they have read as rapidly as possible afterward; but they have also gained the false impression that they at least know the names of the fundamental conceptions of mechanics.

All who have in after life been obliged to work beyond the elements of any science know how very hard it is to get rid of youthful impressions and modes of thinking; it is, like speech, almost an incorrigible fault if acquired from an incorrect model.

Quoting from the preface, "The study of elementary mechanics is one of very great value in a course of liberal education;" but it had a great deal better be left out altogether than be wrongly taught.

In many cases it can at once be perceived that the writer has used a work on elementary mechanics as a thread on which to string hundreds of ingenious and elegant but *utterly useless* mathematical problems—useless to the mechanic we mean, not to the mathematician.

The amount of mathematics which can be used in an elementary mechanics, adapted to the capacity of the average collegian, is extremely small, and they must, too, be of the simplest kind. Why do not our writers endeavor to give, in intelligible language, a clear conception of what the fundamental ideas of mechanics are? Those who take an interest in the study will naturally have more than the average of mathematical acquirements in after life, and will be in a position to start from clearly defined ideas and thoroughly understood premises.

We are told that “momentum is equal to the product of the mass and velocity,” and, in other words, that “the moment of inertia is equal to the mass multiplied by the square of the radius of gyration.” What more do these statements convey to the mind of the student than the statement that two times two is four? Why not say that the momentum is equivalent to that constant force which, acting for one second, will bring the moving body to rest, and that the moment of inertia is equivalent to the statical moment of the sum of the momentums of all the particles of a revolving body? We then have at least some grasp of the subject.

We regret also to see that the part devoted to machines has been divided up into seven parts, each devoted to one of the so-called elementary machines. The lever, the cord and the inclined plane would have been all sufficient and covered every case. For instance, the screw is but a modification of the inclined plane, and although six pages are devoted to its consideration, we are nowhere informed of what is known to every machinist, that square-threaded screws must be used when the screw is intended to impart motion to its nut, and that V-threaded screws are used for the purpose of clamping two bodies together.

The reviewer does not wish to give the impression that Prof. Dana's little work is any more in error than the books from which he has compiled his manual, but has seized this opportunity to enter a protest against the writing of works which mislead by inaccurate language and by causing the student to believe that he has at least had a glimpse of the whole field of mechanics.

W. D. M.

INTERMEDIATE LESSONS IN NATURAL PHILOSOPHY. By Edwin J. Houston, A.M., Professor of Physical Geography and Natural Philosophy, Central High School of Philadelphia, etc. 12mo. Philadelphia: Eldredge & Brother. 1881.

This volume is the latest addition to the very useful series of this author's school books. As announced in the preface, it is intended to fill the gap between his "Easy Lessons in Natural Philosophy" and his "Elements of Natural Philosophy." Prof. Houston's long experience as a teacher stands him in good stead as an author. He has no difficulty in placing himself *en rapport* with his pupils. He appreciates their difficulties and anticipates them. The work here noticed is characterized by the same clearness of explanations that we have had occasion to praise in noticing the author's earlier volumes; but while the text of his book is lucid and adapted for the comprehension of partly advanced students, it is at the same time strictly accurate.

The book is liberally illustrated, many of the engravings being new to works of this grade; some of them have been specially prepared for the work, while others are excellent reproductions from more elaborate French and German works. By lending attractiveness to the subject they add materially to the educational value of the book.

The publishers have issued the work in very creditable style; it is well printed and substantially bound, and has the look of serviceability that a school book should have.

W. H. W.

Franklin Institute.

HALL OF THE INSTITUTE, April 20th, 1881.

The stated meeting was called to order at 8 o'clock P.M., the President, Mr. William P. Tatham, in the chair.

There were present 129 members and 43 visitors.

The minutes of the last meeting were read and approved.

The Actuary presented the minutes of the Board of Managers, and announced, that at their last meeting 15 persons were elected members of the Institute; he also read a preamble and resolutions with regard to the creation of a Trust for a Building Fund for the Institute, offered by the Committee on Stocks and Finance, and adopted by the Board of Managers at their meeting on April 13th, 1881.