call the force exerted by the cord, because it produces centripetal acceleration, an "unbalanced force."

What is the average student to make of it when he is told in one of our best texts that "force is exerted only while the motion is changing," and yet on the next page reads "a locomotive pulling a train with uniform velocity along a level track exerts force" on the train?

Or when in another text he is told that to *every* action there is *always* an equal and contrary action, and is then informed that an *unbalanced force* acting on a mass produces acceleration?

Or when he reads in one of the very best of our first-year texts that "forces always occur in pairs, one of the pair being equal and opposite to the other," and yet is told a little farther on that "by an unbalanced force we mean more push or pull in one direction than the other"?

Why can not we frankly admit that inertia-reaction acts in one respect like a force, and is actually a kind of force, even if we continue to use the term "unbalanced force" in the sense of *a force opposed only by inertia-reaction?* A porter pushing a heavily laden truck at uniform speed feels the reaction due to friction; if the friction suddenly vanished, he would feel the reaction due to the inertia of the truck. He might not know the difference, except that in the latter case he would succeed in giving the truck a small acceleration. But he would doubtless be greatly astonished to learn that in the first case his push was balanced by an equal counter-force, while in the second case his push was an "unbalanced force"!

The writer finds that the clearest (if somewhat tautological) definition of force for the average student is *that which produces motion, change of motion, compression and tension.* Under this definition the inertia-reaction of the ball revolving at the end of the rubber cord is a force, because it produces tension in the cord.

Inertia-reaction can oppose other forces, it can in that sense balance them, but it can not hold them in equilibrium, because a force opposed only by inertia-reaction always produces acceleration, positive or negative, and may for that reason be called an unbalanced force.

If the drawbar pull of a locomotive is 1,000 pounds, and the sum of the opposing forces due to the friction of the wheels, journals, wind, etc., is 600 pounds, we may say that the unbalanced force exerted by the engine on the train is 400 pounds, and this produces acceleration. *But the pull on the drawbar is the same in both directions*—it is manifestly impossible for it to be otherwise—and the backward pull is made up of 600 pounds of frictional forces and 400 pounds of inertia-reaction.

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SCIENTIFIC BOOKS

Diseases of Occupation and Vocational Hygiene. Edited by G. M. Kober and W. C. Hanson. P. Blakiston's Son & Company. Philadelphia, 1916. Octavo. Pp. xxi + 918. $8.00.

Ten years ago there was no such thing as a science of industrial hygiene in the United States. During the last half of the decade Dr. Alice Hamilton, Dr. G. M. Price, Dr. E. R. Hayhurst, Mr. F. L. Hoffman and others have conducted fundamental and important investigations in this field; the American Association for Labor Legislation has organized an educational campaign which has resulted in unparalleled legislative advances; and during the past two years three good textbooks have appeared dealing with the subject —Dr. G. M. Price's "The Modern Factory," Dr. W. Gilman Thompson's "The Occupational Diseases," and the volume under discussion—besides a wealth of monographs on accident prevention and other special phases of the subject.

"Diseases of Occupation and Vocational Hygiene" is the most ambitious of these works, having been prepared under the editorship of Drs. Kober and Hanson by thirty-one American and foreign specialists in various branches. Many of the topics are so treated

as to make noteworthy contributions to the science of industrial hygiene. Dr. T. M. Legge's section on Arsenic Poisoning is the best brief treatment of this subject known to the reviewer. Dr. E. R. Hayhurst's discussion of brass and zinc poisoning, Dr. G. L. Apfelbach's treatment of carbon monoxid poisoning, Dr. Hamilton's review of lead poisoning in the United States and Dr. Louis Casamajor's section on manganese poisoning all embody in compact form original researches of the authors which have been made under American conditions and with such thoroughness as to be of substantial and permanent value. Professor F. S. Lee's chapter on Fatigue and Occupation is a notable contribution to the subject, and Dr. J. T. Bowen's discussion of occupational affections of the skin contains much valuable material. Dr. L. Devoto's account of his famous clinic for occupational diseases at Milan, Professor G. C. Whipple's brief discussion of the use and the fallacies of statistics, and the sections on factory legislation by Mr. John B. Andrews, by the late Professor C. R. Henderson and by Mr. C. H. Crownhart, are deserving of specially favorable mention.

With the virtues of an encyclopedic work prepared by many authors there necessarily goes a certain lack of balance and proportion, aggravated in this case by the somewhat artificial separation of the diseases themselves from their etiology and prophylaxis which leads to the discussion of arsenic poisoning, brass poisoning, etc., in two different places in the book and often by different authors, with some consequent repetition and confusion. The sections on etiology and prophylaxis, as a whole, show a painstaking study of the literature but do not suggest an intimate first-hand contact with the inside of a factory.

Perhaps the most striking evidence of this academic attitude is the small amount of space devoted to dust, ventilation and general factory sanitation as compared with the industrial poisons. The most serious problems of industrial life are accidents and tuberculosis, the industrial poisonings (except plumbism) being by comparison relatively unimportant. Accidents presumably fall outside the scope of this work but certainly industrial tuberculosis does not; yet dust removal and factory ventilation are scantily treated, while pages are devoted to rare intoxications, of interest only as medical curiosities.

Dr. Gilman Thompson's "Occupational Diseases" while preeminently medical in its viewpoint, includes excellent chapters on factory sanitation and dust removal, is in general far better balanced and should prove more valuable for the physician and the average worker in industrial hygiene; Dr. Price's "Modern Factory," while much more elementary and necessarily superficial in certain details, gives by far the clearest picture for beginning students of the entire subject, including accident prevention, and remains the best text-book for social workers, factory superintendents and others who may be interested in the general aspects of the question. "Diseases of Occupation and Vocational Hygiene" contains much material which will make it a valuable reference book for the specialist; but it is not likely to supplant either of the two earlier works, each of which so well fills its special field.

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PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

THE twelfth number of Volume 2 of the *Proceedings of the National Academy of Sciences* contains the following articles:

The Origin of Veins of the Asbestiform Minerals: Stephen Taber, Department of Geology, University of South Carolina. Cross-fiber veins are formed through a process of lateral secretion; the fibrous structure is to be attributed largely to the mechanical limitation of crystal growth through the addition of new material in only one direction.

A New Test of the Subsidence Theory of Coral Reefs: Reginald A. Daly, Department of Geology and Geography, Harvard University. Existing coral reefs are new upgrowths on platforms which have been formed before, and independently of, the reefs. The sub-