(p. 34) it may be said that the data are not sufficient to draw conclusions of a very definitive character, beyond the fact that the method gives results of very satisfactory accuracy. The azimuth constants for the evening (two in number) and the collimation constant have been derived from the fifteen observations themselves. Their values are stated to be the "most probable" ones. If they have been obtained by a least-square reduction in which the clock-rate was ignored, it is not remarkable that the final residuals show no evidence of a clock-rate (p. 35).

In conclusion, we may accord to the authors of this book the credit of having invented and made public a photographic method by which meridian transits may be observed with high accuracy, and with a complete freedom from personal equation. If there is a weak point, it will be found in the determination of the instrumental constants. The many other important purposes for which the photochronograph is very well adapted we shall not touch upon in this place. Some of them have already been described in print, and many others will doubtless shortly come into prominence.

HAROLD JACOBY.

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NOMENCLATURE OF MECHANICS.

BY T. W. WRIGHT, PH.D.

THE nomenclature of mechanics is in a somewhat confused condition. There is some excuse for this because the science is one of the oldest, and at the same time one of the most progressive, as it certainly is the most comprehensive. New terms are being introduced, others are being suggested to take the place of old ones; but the naturally conservative cling to the old, and hence we have a duplication, and in some cases a triplication of names for the same thing. At the threshold we are met by a difficulty. How shall we define mechanics? Originally the science of machines, it is by some defined as the science of matter and motion. By others the term dynamics is applied to the science of matter and motion, and the term mechanics is discarded. The tendency at present seems to be in the direction of the latter method. The science is founded on three principles or laws laid down by Newton. These laws were originally enunciated in Latin, and the number of translations is very great. Here is a source

of confusion. With a new translation come in new terms or a change in the meaning of old ones. For example, Newton's first law is called by some the *law of inertia.* What is inertia? Is it inertness, a mere negative property, or is it a property admitting of measurement, a quantitative property? When we come to the second law we have the idea of mass prominently brought forward. Since the second law includes the first, why introduce the term inertia at all? Is not mass sufficient? Call the first law the *law of mass* and the second the *law of mass-acceleration.* The reformers who drop inertia in the first law would have us call centre of gravity centre of mass, and moment of inertia moment of mass. The first of these changes, centre of mass for centre of gravity, is well under way and will probably prevail. The change from moment of inertia to moment of mass meets with less favor. Indeed, the new name seems as objectionable as the old, for the moment is not a simple moment, but a second moment.

Next in importance to a proper translation of the laws of motion is the settlement of the question of how *weight* shall be defined. One school use it in the sense of mass; another in the sense of force, it being the attractive force of the earth on mass; while a third contend for its use in both senses. The question was debated by some of the ablest physicists in England two or three years ago but no definite conclusion was reached. This and the relation

$$W = m\,g$$

form probably the center of greatest confusion in elementary mechanics. The perplexity of a beginner as to whether in a given problem he shall multiply or divide by g is extreme, and the mournful thing is that this is not owing to his own stupidity. The pit has been dug for him and is persistently kept open waiting for new victims.

The nomenclature is deficient in several respects. We have no single term for the unit of velocity, the *foot per second,* nor for the unit of acceleration, *the foot per second per second;* but must use these long phrases where a monosyllable ought to suffice. The most satisfactory suggestion I have seen is to use *f.s.* for unit velocity and *f.s.s.* for unit acceleration. Nor have we any name for the absolute unit of force in the British system. It is true that some recent writers use Prof. James Thomson's term the *poundal* for unit force. If we say poundal shall we say ouncal, tonal, etc.? Consistency would seem to force us to do so. The terms sound odd enough. Is the gain in simplicity in the dynamical formulas expressed in absolute units over that of the gravitation system a sufficient excuse for introducing terms that will probably never be used

outside of the lecture room? What engineer would use foot poundal for example? The nomenclature is also redundant. A single instance will suffice. Shall we say vis-viva, living force, or kinetic energy? All three are used to denote the same thing to the mystification of the beginner. All three can be found in text books of recent date. To my mind there is no doubt but that kinetic energy is the proper term.

Now, the confusion, deficiency, and redundancy being granted, what can be done? No one writer can do much to effect a change. But an association such as the *New York Mathematical Society* can do much. Expressions of opinion through the pages of this journal would probably lead to some more definite understanding than now exists. At least some of the more glaring absurdities and contradictions of our present system might be abated. Besides, it might tend to curb the ambition of writers to introduce ill-considered terms such as "heaviness" or "centre of weight" for centre of gravity and the like.

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A TREATISE ON LINEAR DIFFERENTIAL EQUATIONS. Vol. I. Equations with uniform coefficients. By THOMAS CRAIG, Ph.D. New York; John Wiley & Sons, 1889. 8vo, pp. ix. + 516.

THE appearance of Fuchs's two memoirs in 1866 and 1868 respectively, gave an impetus to research on linear differential equations which has resulted in the development of an enormous literature on the subject, consisting of articles and memoirs scattered through mathematical journals and the proceedings of learned societies. The systematization and presentation in a body of the principal methods and results developed in these isolated papers, is the work which has been undertaken by Professor Craig, and which has successfully issued in the first volume of the most advanced treatise on pure mathematics ever published by an American author. Whilst the presentation of the subject as a whole must prove of advantage to those few mathematicians who have access to the memoirs whence it draws, upon the many to whom the original sources are not open it confers an inestimable boon. To the English-reading student further it manifests in his own language the substance of what is for the most part in the original in French or German. Praise is due the author for the scrupulous care with which he credits every writer