

together. No other of equal originality is equally easy to understand. The intellectual pleasure which is compounded of mathematical exertion and the interest in human affairs is here enjoyed must purely. F. Y. E.

PROFESSOR VON "CRANK."

Richtigstellung der in bisheriger Fassung unrichtigen Mechanischen Wärmetheorie und Grundzüge einer allgemeinen Theorie der Aetherbewegungen. Von Albert R. von Miller-Hauenfels, Professor a. D. in Graz. Pp. 256. (Wien: Manz'sche k.k. Hof-Verlags- und Universitäts-Buchhandlung, 1889.)

IT is quite refreshing to come across a real "crank" among the sober Germans. As might be expected, there is a good deal of irregular metaphysics involved in the lucubrations of a German "crank." One would not, however, expect an entire ignorance of the first principles of the mathematics involved. The author of this hardly sufficiently ingenious to be even curious work begins by objecting to the well-known thermodynamic equation for perfect gases—

$$J(C - c) = p \frac{dv}{dt} = R = \frac{pv}{T},$$

because, forsooth, it is not identical with the general differential equation—

$$R = p \frac{dv}{dt} + v \frac{dp}{dt};$$

forgetting that the definition of C, as he himself gives it, assumes that, in the first equation, p is constant. In order to escape this invented difficulty, he loads himself with an equation—

$$JQ = Jcdt + vdp + pdv,$$

which involves the remarkable result that the heat required to warm a gas at constant volume is $JQ = Jcdt + vdp$, while by definition it is $= Jcdt$. It is not necessary to remark that the author carefully neglects to draw this conclusion. His equation is founded on the interesting principle that, when any event produces two different effects on the same organ of sense, each effect must be due to a separate flow of energy. When a mass of gas is warmed at constant volume, and one resists its expansion, one feels two effects with the same organ of sense: (1) the increase of pressure, and (2) the increase of temperature; and it is argued that each must be due to a separate flow of energy. This interesting principle leads to the startling conclusion that the heat required to change a body from one state to another, is independent of the states through which the body passes, and depends only on the initial and final states; and this startling conclusion involves the equally startling inference that the internal energy of a body is a function of the states it has passed through. It would be very interesting to study the difference between water that had frequently passed through some cyclic process, and water which had not: no chemist has yet detected the difference.

It would be multiplying words without wisdom to go through the elaborate bolstering of hypothesis by assumption and unreason required to deduce any semblance to fact from these beginnings. It may however, be

worth while to notice something in the second part of this work on the nature of the ether. It is assumed that Fresnel has conclusively proved that an ether consisting of molecules which repel one another would transmit transverse vibrations like light; and, in order to turn the difficulty of the existence of longitudinal vibrations to useful account, it is assumed that these latter exist and are heat. It is hardly necessary to investigate a theory of electric and magnetic forces founded upon such an ether, and upon some curious ideas as to forces flowing from place to place.

And what is the use of spending time looking into such a work as this? It is by studying extraordinary and startling departures from reason, and not the ordinary and familiar ones, that we learn the causes of our aberrations and how to avoid them. It is the same unreasoning prejudice for "I can hardly believe it otherwise," the same neglect to study the meanings of symbols, whether words or letters, the same satisfaction with a theory that leads to some true conclusions, which bristle upon every page of this book, and which are some of the most important factors in the prejudice that ignores the necessity for verification, the muddle-headedness that is content with vague notions, the clinging to an incomplete hypothesis that stands in the way of a true theory, all and each of which are in all and each of us such bars to progress. If the study of Prof. Miller-Hauenfels' errors leads to even a state of preparedness to look out for similar errors in our own work, the study will have been fruitful. G. F. F. G.

OUR BOOK SHELF.

Traité Encyclopédique de Photographie. By Charles Fabre. Vol. I., Part I. (Paris: Gauthier-Villars, 1889.)

THIS is the first part of an encyclopædic work on the history and development of photographic methods. Its general object is to set forth, not only full particulars of the methods now in actual use, but also a complete story of the gradual improvements which have led up to them. There is little doubt that the rapid progress which has been made in photography has been largely due to the fact that the whole subject is so new, that every investigator who sets himself to work soon becomes familiar with what has gone before, and is thus in a position to consider what further advances are possible. It is certainly not too much to expect that such a work as is contemplated by M. Fabre will do a great deal towards simplifying the acquirement of this knowledge.

It is proposed to issue the work in twenty monthly parts, of which five parts will constitute a volume. The first volume will treat more particularly of the general history of photography and photographic apparatus, special attention being given to the subject of lenses. The second volume will deal with the production of negatives, and the third with positives of every description. The fourth volume will first treat of the methods of enlargement, and then of photographic chemistry and theories of the formation of photographic images. This comprehensive scheme, if well followed out, as no doubt it will be, if we may judge by the excellence of the first part, will obviously constitute a valuable addition to photographic literature.

In the first part the whole subject of lenses is considered, from the chemical composition of the various kinds of glass employed in their construction to the various combinations now used. Spherical aberration, distortion,