the bitter injustice of the English writer and the calm impersonality of the American optician, who was in the right, is skilfully woven into a tribute to Tolles's character. There follows a short appreciative memoir of Mr. Tolles by Dr. George E. Blackham.

The remainder of the volume is occupied by the papers and proceedings, and contains exceedingly little original matter. There are articles which repeat in detail perfectly familiar modes of work, and others which deal with those vague and worthless generalities of commonplace which characterize half knowledge. Of the latter, the essay by Dr. J. Redding is a too perfect example. It is on the extra-vascular circulation, and is largely formed of commonplaces, the rest being half truths and total errors. For example: Dr. Redding says (pp. 85, 86), "Bile, gastric juice, in fact all of the so-called secretions, together with the worn-out and effete tissue-detritus, are the result of physical disintegration of the outermost substance of the cells." What can one do to help the author? Perhaps print the whole sentence in italics, to point out the parts of it which are erroneous. We find, however, several articles of real interest. Some new appliances for convenient work are described. Gundlach's suggestion of a new method of construction for objectives of low power, with increased angular aperture, by changing the crown glass of an achromatic lens, and adapting the flint glass to it, is noteworthy, and may lead to a valuable improvement. Attention should also be called to the very deserved criticism, by Edward Bausch, of the English 'society screw,' which is every thing save a good standard. It is much to be regretted that the volume contains so very little of results of original research.

THURSTON'S METALLIC ALLOYS.

IN this volume are brought together the results of the author's work[1] on metallic alloys, with an introductory chapter on the history and characteristics of metals and their alloys, which is in the main the same as that to part ii., and two chapters, one containing an enumeration of the uses of the non-ferrous metals, and a statement of the location and reduction of their various ores; and the other, interesting descriptions of the newer methods of working hot and cold metals.

The scientific value of the experiments, whose record and discussion constitute the principal features of the book, and which were confined to the mechanical properties of commercial copper, tin, zinc, and their alloys, — attention being chiefly given to the strength and elasticity of these alloys when subjected to tensile, compressive, bending, and twisting forces, — is diminished by the failure to exercise due care in the preparation of the alloys. The need of great care in this matter is recognized and emphasized by investigators, for most alloys exhibit phenomena of liquation; that is, they tend, when melted and about to solidify, to separate into their constituent metals, or into several masses composed of different alloys. Special precautions with respect to purity of the metals, rate of cooling, oxidation, temperature during melting, frequency of agitation, etc., must therefore be taken, if the resultant solidified mass is to be homogeneous.

Professor Thurston is fully aware of this liability to liquation; but on "assuming charge of a series of experiments on the characteristics of alloys, and an investigation of the laws of combination," the duty assigned him by the U. S. board, we find him holding the following view of the work: —

"The intention in the work here to be described was, not to determine the character of chemically pure metals, melted, cast, and cooled with special precaution, but to ascertain the practical value of commercial metals, as found in the markets of the United States, melted in the way that such alloys are prepared in every foundry for business purposes, and cast and otherwise treated in every respect as the brass-founder usually handles his work; and to determine what is the practical value to the brass-founder and to the constructor of commercial metals, treated in the ordinary manner, and without any special precaution or any peculiar treatment."

The book will be acceptable to the engineering public; for, besides the author's own work, it contains the views and results of other investigators, extensive tables on the physical and mechanical properties of bronzes and brasses, and Bolley's compilation of the technically useful alloys, the author increasing this rich collection still further by recipes from French and American sources. The determination and topographical representation of 'the strongest of the bronzes' will also be found of decided interest.

The materials of engineering. Part iii. *Non-ferrous metals and alloys.* By Prof. R. H. THURSTON. New York, *Wiley*, 1884. 14+575 p., illustr. 8°.

[1] Reports of U. S. board to test iron and steel, etc., vol. i. 1878, and vol. ii. 1881.