The subject of interference receives more detailed treatment in chapter v., the interference of direct and reflected waves, and the theory of Newton's rings, being specially dealt with. It is not till we come to the sixth chapter that we are introduced to the main subject of the *brochure*. The principle which guided M. Lippmann in his experiments is well and tersely given. Imagine a plane metallic mirror with its reflecting surface coated with a transparent, homogeneous film of a silver haloid in albumin or collodion. Supposing a coloured ray of definite wave-length to fall on such a film, the undulations would traverse the transparent sensitive film, and being reflected from the polished surface of the mirror, and meeting the incident waves, would produce interference. The space in front of the mirror would thus be occupied by parallel planes alternately light and dark, and separated by half wave-lengths, *i.e.* by spaces of 1/4,000,000 of a millimetre. There is therefore ample space, even within the thickness of the film, for several of these planes of interference. On development, the planes corresponding to the light intervals would alone give films of metallic silver, while the dark intervals would remain unaffected. On fixing, there would thus be left in the film a series of parallel films of metallic silver separated by half wave-lengths. Any pair of such films constitute a thin plate in the Newtonian sense, and will give by interference a colour corresponding to that which produced the original deposition of the films when viewed by reflected light.

To realize the foregoing principle experimentally, M. Lippmann has found it necessary to use dry films of collodion, or albumin, or gelatine sensitized by immersion, as in the old wet collodion process: emulsions are granular and opaque, and contain particles which are gross in comparison with the half wave-length of a spectrum colour, and cannot be used. Moreover, it has not been found practicable to coat the reflecting surface of the mirror directly with the sensitive film, because the free iodine tarnishes the silver and destroys its reflecting power. This difficulty has been surmounted by making the coated glass plate one side of a shallow trough with parallel sides filled with mercury, the coated side being inwards, and in close contact with the mercury. The conditions for reflection and interference are thus fulfilled. The image of the spectrum is focussed on a glass plate with a ground surface, which is temporarily fixed to the side of the cell or trough in the same position as that occupied by the sensitive plate, *i.e.* with the ground surface inwards. After focussing, the ground glass is removed, and the sensitive plate substituted for it in the position described.

The spectrum was produced by an electric arc light of 800 candle-power, and the time of exposure for the different parts of the spectrum was regulated by interposing cells with coloured solutions, beginning with a solution of helianthin which transmits only the red and yellow, then replacing this by a cell of potassium dichromate which transmits the red, yellow, and green, and then finally exposing for a few seoonds without any screen, so as to impress the blue and violet. The whole time of exposure varies, according to the sensitiveness of the film, from half an hour to two hours. The details of development and fixing are given by M. Berget, and do not differ fundamentally from the ordinary methods. The finished image, *when dry*, shows the spectrum colours by reflected light with metallic brilliancy, and as the colours are purely optical, depending only on reflection and interference, they are permanent. As the author points out, it is certainly a marvellous tribute to the fidelity of the photographic method that a series of laminæ of metallic silver separated by intervals of only about 1/4,000,000 of a millimetre should retain their positions with optical accuracy during the processes of fixing and development.

There can be no doubt—as will be admitted by all who have seen the results—that M. Lippmann is to be congratulated on having made a most important advance in the methods of photochromy. How far his experiments go towards the realization of the great problem of photographing objects in their natural colours is a question quite distinct from his present achievement. M. Berget tells us that satisfactory reproductions of coloured glasses illuminated from behind by the electric light have been obtained, but this is only a very little step in the desired direction.

"Que reste-t-il à faire pour rendre *absolument usuel* le procédé photochromique de M. Lippmann?" There remains a great deal! Not the least of the requirements is a transparent sensitive film equally sensitive to every colour of the spectrum, and sufficiently sensitive as a whole to enable the impression to be secured with a moderate exposure, instead of 30 to 120 minutes. Till this is accomplished we are not much nearer the solution of the problem of photography in natural colours than we were before. M. Berget speaks hopefully of the prospects in this direction, and we wish every success to his anticipations. But it is no detraction from the merit of M. Lippmann's results if these have no immediate bearing on practical photographic processes. As a triumph of physical science these experiments will live.

"C'est aussi un triomphe pour la science française, car ce mode de reproduction des couleurs du spectre à l'aide des lames minces limitées par des plans d'argent constitue une matérialisation, réalisée par un savant français, de ces ondes lumineuses conçue pour le première fois par le puissant génie d'un autre Français illustre: j'ai nommé Augustin Fresnel."

With this patriotic outburst M. Berget concludes his pamphlet, and the compatriots of Niepce and Daguerre may well be gratified with this latest emanation from the physical laboratory of the Sorbonne.

R. MELDOLA.

OUR BOOK SHELF.

Geometry of Position. By R. H. Graham, Author of "Graphic and Analytic Statics." (London and New York: Macmillan and Co., 1891.)

THIS work essays to fill an existing want by providing an English text-book on the important subject of geometry of position in relation to graphical statics.

The author gives an introductory chapter on anharmonic pencils and ratios, followed by an interesting chapter on projective conics, and devotes the remainder of the book to the application of graphic methods to statical problems, including, amongst others, the discussion of Maxwell's theory of reciprocal figures.

The chapter on anharmonic pencils and ratios would have been considerably improved by the introduction, at the beginning, of more definitions and explanations of the

nomenclature adopted. The proofs of Desargue's theorem and its converse, given on p. 3, are unduly compressed, considering the early stage at which they are introduced; and the student's preliminary difficulties will be increased by the fact that the enunciations have been given in succession, while there is nothing to indicate which is to be treated first.

In the chapter on reciprocal figures, we would suggest that the proof given of Theorem I., Art. 50, might with advantage have been dispensed with. In Art. 52 it is erroneously assumed that OB′ is equal to force (1); this assumption mars a proof which would be otherwise good.

The work exhibits evidence of originality, and it is, perhaps, to be regretted that the proof-sheets have apparently been revised only by the author himself. Their revision by one who had no part in compiling them would probably have contributed to a better arrangement, and to the exclusion of much that is vague.

The carefully drawn diagrams of different problems contained in the book form admirable illustrations to the non-technical reader of the nature of the operations involved in the application of the graphical calculus, and of the character of the results obtained by it. They are the more welcome as such information is not readily available in English text-books, while in foreign treatises it is often developed in such minute detail as to make the foundations nearly inaccessible to the general reader.

A word of praise is due to the interesting collections of examples at the ends of the chapters, which are, it seems, mostly original, but partly drawn from sources not often laid under contribution in the ordinary text-books.

ALEX. LARMOR.

The Species of Epilobium occurring North of Mexico. By Dr. Trelease, Director of the Missouri Botanic Garden. From the Second Annual Report of the Garden, issued April 1891. 48 pages, 48 plates.

EPILOBIUM is not a very large genus, but is spread universally through the north temperate zone, both amongst the plains and mountains, and reappears in plenty in New Zealand. The species are very difficult of delimitation and definition, and great diversity of opinion has prevailed as to their number, and the validity of the characters which have been used to characterize species. It is evident, moreover, that many of them hybridize freely in nature. Passing over the earlier well-known writers, such as Pursh, Muhlenberg, Hooker, and Gray, in 1876 Barbey contributed a monograph of the Californian species to Brewer, Watson, and Gray's "Flora of California," and later published excellent figures of the new species which he there described. In 1884, Haussknecht published a monograph of the whole genus. Of the 38 species dealt with in Dr. Trelease's paper, 13 have been proposed by Haussknecht, 3 by Barbey, 4 by himself, and one by Parish, so that more than half the 38 have been lately described for the first time. Dr. Trelease describes fully all the species known in Temperate North America, gives an octavo plate of each of them, and a detailed account of their geographical distribution, citing the numbers of all the recent collectors. Of the 38 species only 9 extend their range beyond the American continent. The paper will be a very acceptable contribution to our knowledge of a difficult genus, and will no doubt be incorporated in the new "Flora of North America," of which the second volume is already published, and the first and third of which we anxiously wait for. J. G. B.

A Guide Book to Books. Edited by E. B. Sargant and Bernhard Wishaw. (London: Henry Frowde, 1891.)

THERE are so many books of all kinds that ordinary readers may be excused if they are sometimes at a loss as to the works which they ought to select for study. The editors of the present volume have come to the aid of such readers, and may be congratulated on the manner in which they have accomplished a useful but most troublesome task. They make no attempt, in a philosophical sense, to classify the various subjects with which authors have dealt; they simply take these subjects one after the other, in alphabetical order, and set down what seem to them the best books relating to each. Taking into account the amount of space at their disposal, they probably could not have chosen a plan that would have been more readily intelligible. Of course opinions will differ about the value of the works included in the several lists. Everyone who consults the volume will be of opinion that the editors have omitted some things which they ought to have noted, and that they have noted some things which they ought to have omitted. But there cannot but be a general agreement that, upon the whole, the selection has been made on sound principles, and that it is likely to be of real service to very many of those who may have occasion to refer to it. A large number of eminent writers have helped the editors, not only by drawing up lists of books, but by giving them much valuable advice.

Tasmanian Official Record, 1891. By R. M. Johnston, F.L.S. By Authority. Second Year of Issue. (Tasmania: William T. Strutt, Government Printer, Hobart, 1891.)

ANYONE who may wish to obtain information about Tasmania will be hard to please if he does not find what he wants in this elaborate volume. It begins with an account of the general physical outline of the island, and then we come to Tasmanian history, and to the Tasmanian constitution and government. After a chapter on Crown lands we are invited to consider the geology and mineral products of Tasmania, its flora and vegetable products, fauna and animal products, population, vital statistics, trade and interchange, accumulation, finance, production, law, crime, and protection, and "intellectual and social provision." The work is wound up with a view of the progress of Australasia, and a summary of general statistics. In the present issue some important additions have been made to the book as originally published, and by devoting attention to classification the editor has tried to "obviate any difficulties that might arise from the necessity of bringing together in one volume such a variety of subjects."

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Albert University.

PROF. LANKESTER, in the interesting letter published in NATURE for May 28 last (p. 76), expresses his desire to have "a genuine professorial University set on foot in London, not because it is London, but because University and King's Colleges are there, and respectfully petition Her Majesty to do for them what the monarch has done in past days for other Universities."

I have not seen the petition of the Colleges. But I have before me the draft charter adopted by their Councils, which I presume is intended to give effect to the prayer of the petition. I can hardly imagine that Prof. Lankester was acquainted with its contents when he penned the sentence which I have quoted.

If the Albert University is called into existence—and it seems very probable that its charter will be granted—it will be an institution very similar to what the University of London was in the early years of its existence, when it drew its candidates only from the so-called affiliated Colleges.

The charter commences by reciting "that it is expedient there should be constituted in and for the London district (defined as