prevent the general use of Dr. MacDougal's book.

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De praktische toepassing van Stoomschuif- en Schaarbewegingen bij Stationaire, Locomobiel-, Locomotief- en Scheeps-machines door C. STEUERWALD; Mit eene voorede van H. A. RAVENEK. By W. S. AUCHINCLOSS. Leiden. A. W. Sijthoff. 1899. Pp. 108. Many illustrations.

This book is a translation, into the Dutch, of Auchincloss' well-known treatise on valve-motion, of which a German version has long been in type. The translator is a member of the Faculty of the Polytechnic School of Delft; the introduction is written by Professor Ravenek of the same institution. There is no lack of such works in the English, German and French languages; but the work of Auchincloss excels in the simple and very clear manner in which the graphical constructions are made, "without preceding calculations, simply by outlines on the drawing-board," as Professor Ravenek says in his introduction. The treatise is adjudged 'very suitable to be placed in the hands of apprentices and draughtsmen' as well as of students in mechanical engineering.

The British measures of the original are replaced in the translation by metric.

This reproduction of the American work in Dutch is one of the most gratifying testimonials to the value of the work which has yet appeared. The book is unusually well-printed and its illustrations are exceptionally well-made.

R. H. T.

Mesure des température élevées. Par. H. LE CHATELIER et O. BOUDOUARD. Paris, G. Carré et C. Naud. 1900. Pp. 1–220.

In these few pages Le Chatelier and his assistant have given a terse and useful account of the principal methods of cotemporaneous pyrometry. Measurement of high temperature has, as a rule, referred to the comparison of different temperature functions, and the results obtained have therefore differed enormously. The confusion has gradually subsided however, in proportion as the air thermometry of high temperatures has been more fully mastered. Le Chatelier makes a judicious selection of standard temperatures in the introductory chapters of his book and estimates the probable error to be 1° between 200° and 500°, 5° between 500° and 800°, 10° between 800° and 1100° and upwards 50° above 1100°. In the list of pyrometers which follows I should have referred the calorimetric pyrometer to Pouillet and perhaps included the viscosity pyrometer.

The brief account given of normal temperatures as defined by Kelvin and their relation to the air thermometer is intelligible, well digested and practical in character, though these corrections at high temperatures are of small moment. An account is also given of the standard (hydrogen) air thermometer of the Bureau International at Sèvres, which may be taken as a preliminary model, since the normal air thermometer for high temperatures has not yet been constructed. The authors might have added that very definite steps are being taken in this direction by Holborn and Day at the Reichsanstalt. It has been shown that the platinum-iridium alloy is impervious to nitrogen rigid up to the highest industrial temperatures. Nothing now stands in the way to prevent high temperature measurements from attaining the full precision of low temperature measurements.

The errors usually encountered in high temperature thermometry make up Chapter III. of the book, after which various historical pyrometers are described from figures, and critically discussed. It is interesting to note that the errors of Pouillet were largely due to the high value of the coefficient of expansion then in vogue. Among the whole series the interferential pyrometer of D. Berthelot may be singled out as being peculiarly promising, both on account of the simple and apparently correct principle on which it is based, and on account of its indefinitely high temperature limit of application.

In preference to platinum which is expensive and iron which behaves anomalously, nickel has been recently proposed for calorimetric pyrometry. The authors give a series of appropriate data, and figures of available apparatus, together with the probable inaccuracies of this

somewhat unsatisfactory method of pyrometry. Incidentally it may be appropriate (as for instance in the case of Violle's famous experiments) but it now has little general laboratory value.

The resistance pyrometer, introduced by Siemans and perfected by Callendar and Griffiths, is for shorter ranges of high temperature (0°–1000°) now without a rival in accuracy. It has the additional advantage of continuous registry almost as far down as the absolute zero of temperature. Calibrated with reference to Callendar's equations by aid of the specially determined boiling point of sulphur (an error was detected in Regnault's value by this very instrument), it is also a convenient instrument in practice.

The chapter on thermoelectric pyrometry, in which Le Chatelier is specially interested is naturally very full, at least in relation to the D'Arsonval method of measurement. This is obviously the more practical though the zero methods give a permanent record. Figures are abundantly inserted of the galvanometers, furnaces, crucibles, and the other necessary paraphernalia of the pyrometric laboratory.

The chapter on radiation pyrometry is antiquated and meagre, inasmuch as nothing is said about the remarkable results of Wien, Lummer, Kurlbaum, not to mention Planck and others who are remodeling the whole subject. So also the mention made of the bolometer is altogether inadequate. On the other hand Le Chatelier enters at length into photometric radiation pyrometry which is of secondary interest by comparison.

The final chapters contain interesting information on Wedgewood pyrometry and on Seeger cones, recipes being given in detail. The book closes with the remarkable work which Roberts-Austen is now doing with his self-registering pyrometer and the new differential method of observation.

The book as a whole is obviously an outgrowth of the laboratory and is supplemented by personal observation. As such it needs no further recommendation.

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SOCIETIES AND ACADEMIES.

GEOLOGICAL SOCIETY OF WASHINGTON.

THE 99th regular meeting was held at the Cosmos Club, March 14, 1900.

Under informal communications, Mr. J. A. Taff exhibited some asphalts from Indian Territory, and briefly described their occurrence.

On the regular program the following papers were presented:

(1) 'Glacial Sculpture in the Bighorn Mountains,' by Mr. F. E. Matthes.

The glacial cirques on the Bighorn Range are exceptionally well preserved and complete in outline. The crests and spurs separating them have remained unglaciated, and are remnants of pre-glacial topography. The cirques do not necessarily develop at the heads of the pre-glacial alpine valleys. In numerous cases the upper ends of the latter have remained unglaciated while cirques have formed lower down. This raises the question: What are the conditions necessary for the formation of a cirque; or, since a cirque is essentially the product of frost-action in the bergschrund, what determines the location of the bergschrund?

It was shown that the unglaciated areas above the bergschrunds were covered by *quiescent névé* during the period of glaciation. They were *nivated*. The effects of *nivation* are the accentuation of abrupt slopes and the effacing of the pre-glacial drainage lines by deposits of powdered rock produced by frost-fracturing along the edges of the névé sheets. The bergschrunds constitute the boundary between the *nivated* and *glaciated* areas.

According to the evidences gathered in the Bighorn Mountains the location of the boundary line is intimately connected with the depth of the valleys, or, more strictly, with the depth of the névé. That the spheroid of the mean annual temperature of 32° F. does not influence its location is demonstrated by the fact that cirques and nivated areas exist side by side at all elevations from 10,000 feet up to 13,000 feet.

The conclusion is that névé may remain stationary or acquire motion at any of these elevations, regardless of the altitude of the spheroid of 32° F. The only factor which determines whether a body of névé shall have motion or not is its depth.