Thermometry, edited by T. D. BANSAL. National Physical Laboratory, New Delhi, India (1967). Price 35*s*.

IN FEBRUARY 1967 Dr. T. D. Bansal, Scientist-in-Charge of the Heat Division, N.P.L., India convened there a "Get-Together on Thermometry" which was attended by invited specialists as well as by Indian scientists, industrialists and users. These included several medical men, for half a section was devoted to clinical thermometry.

The meeting was inaugurated by J. A. Hall of the Bureau International des Poids et Mesures and formerly of the Temperature Measurement Section, N.P.L., England. The book contains the fifty-seven presented papers together with discussions and information on many associated problems, for instance: "How to pack thermometers", "How to measure skin temperature" and "Will quality control help the industry?" "Thermometry" differs from normal conference proceedings in the degree of attention it gives to the troubles India has met, and is overcoming, in the manufacture, standardization and use of various types of thermometry equipment. However, the more usual review papers are included, as well as accounts of recent research developments.

Hall reviews platinum-resistance thermometry and predicts that within three years a satisfactory reference table, continuous from —260° to 1063°C, should be available. Thomas (P.T.B.) details gas-thermometry measurements made since 1937 and shows that, at the gold point, the measurements of PTB and VNIIM differ from the IPTS (International Practical Temperature Scale, 1948) value of 1063°C by several times the accuracy now available. This Russian work is also described by Izrailov *et al.*; their value is 1064·38 ± 0·06°C, compared with the PTB value of 1064·48°C. Oishi *et al.* (NRLM) in 1956 obtained a lower value, namely 1063·69 ± 0·05°C, but Oyama's report indicates that further measurements from that laboratory are planned.

For low temperatures, another VNIIM paper by Brodsky *et al.* presents several modern methods. Nuclear quadrupole thermometry is one; the use of potassium chlorate as the thermometric substance allows the thermodynamic scale to be realised with an accuracy of 0·002 degK in the range 20°–273°K, and 0·01 degK from 273° to 473°K. This technique requires neither repeated calibrations nor skilled operators; it is already being used as a secondary standard for the IPTS.

Bansal describes the calibration equipment and methods of NPL India, and reveals how a satisfactory system can be developed without the high-precision equipment considered essential by wealthier laboratories. An ice-point apparatus, described by Bansal and Wasan, successfully overcomes difficulties associated with environmental temperatures as high as 43°C, and allows a temperature constant to less than 0·01 deg to be maintained with minimal attention for days.

Papers on liquid-in-glass thermometers, thermocouples and optical pyrometers as well as such diverse subjects as dew-point and molten-steel temperature measurement are also included.

These few selected topics should serve to show that NPL India has made available a volume that can be recommended to those concerned with thermometry and its applications in both developing and developed countries.

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ALFRED WALZ, **Strömungs und Temperaturgrenzschichten.** 260 pp., 122 Figs., 3 Tables. G. Braun, Karlsruhe (1966).

PROFESSOR WALZ'S monograph is the outcome of the author's many years of fruitful research on the theory of the boundary layer, both laminar and turbulent. Its purpose is to describe the method of calculation which Walz and his co-workers have developed, and to illustrate its use by example. There is a scholarly historical introduction, and a sufficiently elementary explanation of the important physcial ideas; but the aim of the book is a narrow one; and it is successfully attained.

The value of the book depends inevitably on the value of the method; and this will take time to determine. My personal view is that the method will not prevail; its merit is computational simplicity; but, now that digital computers are so widely available, this feature cannot compensate for limitations of accuracy and application. For laminar boundary layers, the point is particularly easy to see: the exact differential equations are not in doubt; so, since general computer programmes exist for solving them numerically, there is little incentive to bother with integral methods, employing frequently invalid assumptions about the profile shapes. Walz uses at most two ordinary differential equations, those governing the momentum and the kinetic-energy integrals; the enthalpy distribution is taken to be linked with that of velocity. The complexity of practically interesting boundary layers cannot be comprehended in so narrow a frame.

It might be argued (and Walz gives some support to the view) that integral methods can provide exact solutions to the differential equations, when the number of free parameters in the profiles is made large enough. About this there are several things to be said. First, we must choose the weighting functions carefully; in disproof of the relevant statements in the book, it is possible to show that, if the velocity profile exhibits a maximum, an infinite set of profiles can be found, all of which possess the same values of $\int_0^\infty \{1 - (u/u_\infty)^n\}\,dy$, for all positive values of n. [Here u stands for velocity, y for distance from the wall, and u_∞ for u where $y = \infty$.] Secondly, even when satisfactory weighting functions are employed, matrix singularity interrupts the integration with increasing frequency when the family or allowable profiles is enlarged. Thirdly, if, as in Walz's procedure for turbulent flow, matrix inversion is replaced by the appeal to empirical information, even a modest increase in the number of free parameters makes demands for experimental data that are disproportionately and unattainably large.

Yet, even if few people find it profitable to adopt Walz's method of calculating boundary layers, there are many who