gets to grips with the actual problem; the equations which are presented are not solved, the designer being recommended to make use of some empirically constructed graphs for the determination of the packing area, etc. Of course, if the graphs displayed the influence of all the important variables, such a method would be quite adequate; unfortunately they do not, so it is hard to see how design improvements can be effected by their use. It should be mentioned that methods for the complete calculation of natural-draught towers do exist, that of Chilton (*Proc. Inst. Elec. Engng, London*, **99**, Pt. II, No. 71, October 1952) being perhaps the simplest and most satisfactory; this method, which appeared after the first edition of the present book but before the second, is not referred to by the author.

The problem of distributing up to 7×10^7 lb of water per hour to the packing of a tower of, say, 250 ft diameter, without causing excessive obstruction to the air flow or a prohibitive pumping cost, is a formidable one. The book under review describes a great many arrangements for doing this which the designer can study with profit; as indicated above, however, he will have to work out for himself procedures for calculating which arrangement is cheapest. There are also descriptions of sprayers (with regrettably few data on their characteristics), a discussion of de-icing methods, and many pages on maintenance problems such as the combatting of organic growth.

Judged by the first of the two standards mentioned above, the book must be held to be but partially successful; the text is annoyingly and unnecessarily incomplete in many matters of detail; and designers are left without quantitative guidance in several matters of substance. When the book is judged by the second standard however, far more favourable remarks are in order; indeed the author knows of no single volume which contains so much sound and varied information on cooling-tower design. The drawings of actual installations, and the author's unusual grasp of both the theoretical and experimental aspects of the problem, are particularly to be commended. The translation is excellent.

D. B. SPALDING

Non-Newtonian Fluids. Fluid Mechanics, Mixing and Heat Transfer. W. L. WILKINSON, Pergamon Press, 1960, 138 pp. 37*s*. 6*d*.

THIS is an elementary and lucidly written textbook on those aspects of non-Newtonian fluid flow presently of primary interest to the chemical engineer. The book is subdivided into six chapters: Classification of non-Newtonian fluids; Experimental characterization of non-Newtonian fluids; Flow of non-Newtonian fluids in pipes and channels; Heat transfer characteristics of non-Newtonian fluids; Mixing characteristics of non-Newtonian fluids; Viscometric measurements and apparatus. Each contains a clear presentation of the subject matter and includes most of the pertinent literature references.

It is of course recognized that the field of non-Newtonianism embraces all the many possible deviations from the simple Newtonian proportionality between stress and rate of strain. It has, as a consequence, developed into a broad and complex discipline with many branches which often are treated as distinct topics. One such area is concerned for example with the problem of how the rheological equation of state of a substance is dependent upon its molecular structure, and to what extent slight changes in the chemical composition of a fluid can affect its rheological properties. Another is the important question of the possible influence of viscoelasticity on the state of motion of a non-Newtonian fluid and the conditions under which viscoelastic effects become the primary cause for the unusual rheological phenomena which are sometimes observed with such substances. And clearly there is always the intriguing problem of determining, for a three-dimensional flow, the most general form of a rheological equation of state which would also be compatible with the rather obvious but absolutely essential restrictions of invariance with respect to rotation of the co-ordinate axes.

In a field then which is so vast, it becomes quite necessary for the author of a short and elementary textbook to drastically limit himself to a small segment of this sprawling subject. Dr. Wilkinson has elected to remain for the most part in an area which may be termed fluid flow and to dwell upon the engineering aspects of the field while, by necessity, omitting some of the more peculiar and fascinating topics such as those mentioned above. The one-dimensional model is used exclusively and, although a few things are said about viscoelasticity, the bulk of the book is restricted to an equation of state which expresses the stress as a function only of the rate of strain. In this manner, for example, the well-known Poiseuille equation for the laminar pressure drop in a pipe is extended to non-Newtonian fluids and a similar generalization is presented for the familiar friction factor plots.

In some respects this book is an extension of an earlier article by A. B. Metzner in Volume I of *Advances in Chemical Engineering*, and emphasizes the engineering approach to the subject. It is indeed a pleasingly well written and readable introduction to this topic which will appeal to not only many a practising engineer but also to those students who, having been exposed to some of the elements of Newtonian fluid flow, would want to obtain a glimpse of this increasingly important and fascinating area of non-Newtonianism.

A. ACRIVOS

Mollier-*i,x*-Diagramme für feuchte Luft. H. D. BAEHR. Springer-Verlag, Berlin, 1961, 22 pp. + iii. DM12.

THE Scientific Subcommittee of the Institution of German Engineers (VDI) has recently recommended the introduction of the international system of units (the MKS-system). The extent to which this recommendation can be put into practice depends largely on the availability of

charts and tables of thermodynamic properties expressed in the new units. The reviewed book aims at filling one part of the gap by presenting three Mollier enthalpy–humidity charts for humid air at the total pressure of 1 bar. The diagrams cover the following temperature ranges: −34 to +35°C, −10 to 60°C and 0 to 250°C. They are thus suitable for use in refrigeration practice, air conditioning and drying practice respectively.

The new diagrams differ from the existing ones in two respects: firstly, the enthalpy of humid air is expressed in kilojoules per kilogram of dry air (humidity is still expressed in grams of water vapour per kilogram of dry air and not in kg/kg) and secondly, use is made of the most up-to-date values for average specific heats of water vapour for the calculation of enthalpies. Some applications of the charts and their use in determination of other parameters of humid air is clearly described in the text. The text also contains a table of saturation vapour pressures, densities, humidities and enthalpies for the temperature range from −40 to 70°C at one degree intervals.

H. SAWISTOWSKI