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BOOK REVIEWS

E. HAHNE and U. GRIGULL (Editors) **Heat Transfer in Boiling.** Hemisphere, Washington (1977). 486 pp. U.K. Price £28.05.

THE DEMAND for a deeper knowledge of the phenomena related to boiling is greater today than ever before. In order to make optimum use of our resources we have to understand the interrelations of the pertinent parameters governing the boiling process so that accurate predictions are possible.

Against this background, the Deutsche Forschungsgemeinschaft provided the financial background to a five-year research program on "Heat Transfer in Boiling" carried out at university institutes of the Federal Republic of Germany and Switzerland. This book is a handsome, well-written and informative account of the results of that program. In his preface one of the editors (E. Hahne) states that he is setting out to present the compilation of the above original experimental work in a form useful to the specialist in both experiment and theory, the researcher starting in the field of boiling, and the practicing engineer encountering a special problem; also to avoid the scatter of information on a special program among a variety of journals, and the shortcomings of publication in a journal due to limited space there.

The task thus defined by the editor has been adequately achieved. The book gives, in a text of 486 pages, easy access to information. It is divided into 19 chapters each presenting a separate paper. The above chapters are grouped into three parts.

Part One deals with Pool Boiling. Stephan (Stuttgart) covers bubble formation and heat transfer in natural convection boiling; Beer *et al.* (Darmstadt) deal with nucleate boiling, viewed with a laser interferometer; W. C. von Ceumern-Lindenstjerna (Braunschweig) presents a study on bubble departure diameter and release frequencies during nucleate pool boiling of water and aqueous sodium chloride solutions. Körner and Photiadis (Berlin) present a brief paper on pool boiling heat transfer and bubble growth on surfaces with artificial cavities for bubble generation; Bier *et al.* (Karlsruhe) present two papers (using the same experimental apparatus) on heat transfer at burnout and Leidenfrost points for pressures up to critical and pool boiling heat transfer at saturation pressures up to critical.

Diesselhorst and Grigull (München) and Hahne (Stuttgart) present a well documented paper on the hydrodynamic and surface effects on the peak heat flux in pool boiling and Hahne and Feurstein (Ravensburg) provide experimental data for the near-critical region in pool boiling as a function of pressure and of heater geometry. The last paper of this first part by Happel (Bochum) gives account of the author's tests for binary mixtures from the beginning of nucleate boiling, over the point of maximum heat flux density, to the beginning of film boiling.

Part Two of the book covers flow boiling. Lung *et al.* (München) deal with boiling heat transfer to subcooled water in turbulent annular flow, whilst the influence of flow velocity on surface boiling heat-transfer coefficient is studied by Lemmert and Chawla (Karlsruhe). The increase of nucleate boiling heat transfer with pressure is treated by Vaihinger (Zurich), and the heat transfer and pressure drop for boiling nitrogen flowing in a horizontal tube by Steiner and Schlünder (Karlsruhe). Forced convection boiling of neon flowing in horizontal tubes is the subject of the experiments by Mohr and Runge (Stuttgart), and systematic measurements of local heat-transfer coefficients for evaporation in horizontal tubes of an air–water system that of Ruppert *et al.* (Karlsruhe). The boiling of liquid mercury, a subject of great interest to nuclear reactor technology and in particular to the fast breeder reactor program, is investigated by Schmücker and Grigull (München).

The final series of papers deal with effects of properties, subject of particular interest to engineering applications, for example in boiling and condensation problems as well as in the theoretical treatment of phase transition and critical phenomena; they are presented in Part Three of the book. The effect of liquid viscosity on bubble formation and heat transfer in boiling is treated by Mayinger and Hollborn (Hannover) using various autoclaves, holographic interferometers and high-speed motion pictures. Rathjen and Straub (München) investigate the temperature dependence of surface tension, coexistence curve and vapor pressure, with special emphasis on the critical region; the substances used were CO_2, Freon 13, Freon 13B1 and SF_6. In the last paper of the book metastable states of special interest to boiling phenomena are investigated by Gerum *et al.* (München) for the liquid–vapor phase transition.

On the whole, the included papers are of high quality and all of them have adequate bibliographies to permit an overview of the field. Abstracts of the papers are collected at the end of the book. The publication is excellent as regards presentation, length and quality of all papers (there are only a couple of insignificant typographical errors).

This book has certainly provided us with a comprehensive and valuable compendium of high quality experimental information for practising engineers, research organizations, consulting engineering offices, and students at higher academic levels. The only slightly unhappy aspect of this volume is the price, a steep £28.05 in the UK. Whilst this may fall within organizational library budgets, I fear it may prove excessive for the individual.

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M. A. STYRIKOVICH, A. A. ZUKAUSKAS, J. P. HARTNETT and T. F. IRVINE, JR (Editors) **Heat and Mass Transfer Source Book.** Scripta/Wiley, New York (1977).

THIS book includes all the abstracts and a selection of papers from the Fifth All-Union Conference, held at Minsk in May 1976. The majority of the 580 papers presented at the Conference described Soviet research in the fields of heat transfer and fluid flow. Readers who therefore expect to find a predominance of translated Soviet papers will be disappointed, as the selection is entirely made from the small minority of non-Soviet papers presented. A result of this is that the apportionment of the 36 selected papers over the subject areas does not reflect the spread at the Conference or the range of Soviet research generally. For example, conduction analysis is represented by over 40 papers at the Conference but none in the book.

The selected papers are not listed under subject headings, but may be divided into three roughly equal parts; convection, two-phase heat transfer and other areas. Papers of particular interest in the first part include three involving roughness effects, a study of the effect of large temperature differences on air flow in a tube and the outline of a model

of turbulent combustion. The second part includes details of a model of two-phase annular flow, a further development of work on bubble growth in binary mixtures and two papers each on peak boiling heat flux and condensation. Papers in other areas include two on fluidized bed heat transfer, and studies on non-Newtonian flow in pipes and combined heat transfer from extended surfaces. There is also a short paper on measuring devices for heat transfer in buildings and a study of radiation on Jupiter and Saturn.

The latter section of the book contains the English abstracts of the Conference papers. (A total of 580 papers according to the Contents and the Editors' Preface, but only 476 according to the reviewer's arithmetic.) Indication of whether an English translation is likely to appear in *Heat Transfer – Soviet Research* or *Fluid Mechanics – Soviet Research* is also given. In summary the book contains an interesting (but non-representative) collection of papers from the Conference, which together with the many abstracts make it a useful reference work.

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New Heating Systems – Decentralised Heat-Power-Coupling by Combustion Engines, VDI Report No. 287.
(Neue Heizsysteme – dezentrale Wärme-Kraft-Kopplung mit Verbrennungsmotoren, VDI-Bericht 287). VDI, Düsseldorf (1977). Price DM41.

TO THE engineer accustomed to think in terms of entropy and reversibility the modern oil- or gas-heating must always have been a nuisance. It may have been the reasonable answer to the low cost fuel of past years, but times have changed and the matter has to be thought over again. Taking the waste heat of big power plants for heating purposes involves the problem of distribution, not solved so far. This problem decreases however with decentralised small plants, for which the internal-combustion motor is the appropriate thermal engine.

The "Verein Deutscher Ingenieure" (VDI) has organized two meetings confined to this subject, the first in 1976 in Stuttgart and the second in 1977 in Amsterdam. The VDI-Report No. 287 to be reviewed here contains the papers of the second meeting, which was arranged commonly by the VDI-Societies for Power Engineering and Automotive Engineering under the auspices of Prof. F. Pischinger (Aachen).

In four sections eleven papers were presented. Section 1, "Alternative energy supply models", contained fields of application from an economical point of view, new concepts such as total-energy-systems, and the application of automotive engines for small units. The papers of Section 2, "Available plants (experiences, reports)", reflect the main field of application, i.e. public open-air and indoor swimming baths also large buildings with centralised heating and cooling facilities such as universities and hospitals. In Section 3, "Motor and plant components", gas engines for stationary use in big and medium units are described. For small units car-engines may easily be converted to stationary gas-operation. The somehow predominant role of legal constraints compared with technical and economical considerations is dealt with in Section 4, "Legal and economic problems", taking as an example the unequal taxation of fuel oil and gas in West Germany, when used for internal combustion engines.

The report, containing numerous pictures and tables, gives on 76 pages a good insight into state and development of its subject and demonstrates that the application of internal combustion engines in decentralised systems of power–heat coupling is in certain domains already profitable and that its realisation is state of the art.

E. L. SCHMIDT

M. VAN DYKE, J. V. WEHAUSEN and J. L. LUMLEY (Editors); **Annual Review of Fluid Mechanics,** Vol. 10. Annual Reviews, California (1978). 475 pp.

THIS volume is the latest in an annual series which reports contemporary developments in fluid mechanics, although it begins with interesting historical notes by A. M. Binnie on fluid mechanics studies at Cambridge, England, by Stokes, Rayleigh, Darwin, Farren, Dean, Melvill Jones and G. I. Taylor, together with those of Binnie himself. The topics covered elsewhere are wide-ranging and, as might be expected in a collection of nineteen articles by different contributors, somewhat disparate and difficult to classify. However, a fair balance is preserved between those dealing with liquids and those concerned with gases; among the former are reviews of river meandering and river ice, the hydrodynamic problems of ships in restricted waters, turbulence and mixing in stably-stratified waters and numerical methods in water-wave diffraction and radiation. There are also discussions of drag reduction by polymers, flows of nematic liquid crystals and the magnetohydrodynamics of the earth's dynamo.

Presentations in compressible fluid mechanics include articles on viscous transonic flows, the Monte Carlo simulation of gas flows, flow through screens, dust explosions and objective methods for weather prediction. Perhaps of more general interest are the sections dealing with oscillations of long-period Rossby waves in oceans and atmospheres, the structure of vortex breakdown and turbulence generated-noise in pipe flow. This may also be said of the contributions on relativistic fluid mechanics and numerical methods in boundary-layer theory which, together with those earlier referred to on water-wave diffraction and radiation and weather prediction, could with advantage have been co-ordinated with the review of prospects for computational fluid mechanics. Other possible groupings come fairly readily to mind.

One is left after detailed scrutiny with the feeling that in a number of instances contributors have been inhibited by space limitations from presenting as complete an account as they would otherwise have wished. If the objective of the Editorial Committee is the publication of authoritative reviews on currently-important topics, this might be better achieved by a reduction in the number of contributions in a volume of predetermined size.

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