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BOOK REVIEWS

Thermal Energy Storage

Ed. G. Beghi

(Lectures of a Course held at the Joint Research Centre, Ispra, Italy, June 1981)

I am somewhat cynical about published 'summer course' Proceedings which are expensive to buy and usually contain a 'mixed bag of goodies'. These Proceedings are no different; too many of the papers have the air of déjà-vu and seem no more than non-critical, somewhat superficial overviews of the work of others, perhaps were only written as a means of obtaining travel funds to a geographically more interesting location than the author's domicile.

There is the usual, expected coverage: storage of sensible heat and of latent heat; storage by chemical and by physical means; district heating; materials for heat storage; working fluids for heat transfer; and a discussion of where the heat (thermal energy) sources are.

Of all 18 papers in this 506 page volume, I found the following papers of value and worthy of mention:

- **Abhat: Low temperature latent heat thermal energy storage.** This contains a discussion of the ideal properties of appropriate materials and a review of what is actually available, of the experimental techniques used for determining their thermal properties, and of the problems that arise, as a consequence of low thermal conductivity, in heat exchanger construction.
- **Van Velzen: Chemical heat pipes.** These use the bond energies of reversible chemical reactions (including thermal dissociation) that are endothermic for charging and exothermic for discharging. Although sensible heat losses during transportation are avoided, there are availability and separ-

ation losses that, combined with over-riding economic factors, give unacceptably low efficiencies.

- **Tabor: Short and long term storage in solar ponds.** A theoretical analysis of both short and long term storage in the suppressed, ie non-converting, pond using pond bottom storage allowing for heat transfer between pond and ground.
- **Wood: Thermal energy storage for recovery of industrial waste heat.** This contains a useful review of the industrial scene with respect to waste heat sources: working fluids, temperature levels and temporal mis-match of supply and demand. Specific consideration is given to the energy profiles of eleven industries and their potential for waste heat recovery using either high temperature regenerators, steam accumulators or hot water storage.
- **Gilli/Beckmann: Thermal energy storage for Peaking Power Generation.** An interesting overview of using steam accumulators for subsequent steam generation or feed water heating, or both, in the steam turbine cycle or compressed air energy storage for use in gas turbines. Surprising omission of key references.
- **Hadvig: Transmission of heat using hot water pipes.** Essentially a theoretical analysis of heat losses from district heating pipeworks, with both simple and complex network geometry, as a function of their insulation and the annual variation of the surface temperature of the ground. In addition economic considerations of construction

costs, effects of fuel price increase and labour charges are incorporated into the analysis. Interestingly, there is a comparison between the theory and measurements made on an existing district heating network that gives reasonable agreement.

- *Bernauer/Buchner: Metal hydrides for heat storage of combustion and reaction processes.* Contains a very useful summary and review of the applicability of metal hydrides over the full range of both industrial and domestic waste heat sources for both open and closed hydrogen cycles, with a full compilation of physical, chemical and

thermal properties. Possible applications are discussed in power plants, automobile air conditioners together with a range of heat pump uses.

The book finishes with two detailed listings of the thermal energy storage programmes in the EEC and in the USA.

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Published, price DM140.00/\$59.50, by D. Reidel Publishing Company, PO Box 17, 3300 AA Dordrecht, Holland.

Flow Measurement Engineering Handbook

R. W. Miller

When asked by the Foxboro Company to write a new edition to bring L. K. Spink's book on the Principles and Practice of Flowmeter Engineering up to date, R. W. Miller took up the rather daunting challenge. Spink's book, first published in 1930 was of a very different era and so Dick Miller has produced not a series of visible transplants onto an old framework but a completely fresh and highly commendable *tour de force*.

The book can be considered roughly to comprise four main sections. The first is a comprehensive review of the information on fluid properties and on the flow phenomena which the user needs to assess before even considering which flowmetering device to use. The author is concerned only with measurements in pipelines and with industrial situations, open channel devices and research equipment are excluded. This section ends with an extremely useful chapter on flowmeter selection.

The second and third groups of chapters deal with the metering devices themselves while the fourth part of the book is a series of nine appendices listing mainly liquid and gas properties. In this, the book is like the 1964 version of BS 1042; it gives the reader virtually all the information he needs in a single volume.

This is a practical book copiously sprinkled with worked examples—an outlet for the author's experience with technical teaching. These are of great value to the user who can learn so much more by seeing how to calculate the answers. Indeed, once grasped, the author's concept of sizing factors makes computation straightforward.

A 'Handbook' originally meant a small treatise which could be held in the hand and by 1836 had come to be used to describe a book with concise information as a guide for the tourist. Similarly the word compendium was originally used to describe an abridgement of a larger work. This Handbook of Dick Miller's, weighing 1.5 kg, would more justifiably be called a treatise in its own right on the subject of differential producers, the name which the author uses to describe the genus of pressure difference devices such as the orifice plate, nozzle, etc.

The author concentrates on these devices, classifying the rest of the flowmeters commonly used

in process measurement and control as the genus of linear flowmeters. Thus turbine, vortex, electromagnetic, ultrasonic and the rest are dealt with in a fifth of the space which the author requires to deal adequately with differential producers. This balance is his critical assessment of the present day and how far we have really come since the 1930's. Associated developments in pressure transducers, computers, etc, make the task easier, or more difficult depending on attitudes, but I agree that fundamentally we still have a long way to go before we can assure the user the reliability and predictability which have been established for the pressure difference devices such as the ubiquitous orifice plate. Improvements are on the way with major research investigations in Europe and the USA into orifice plate coefficients.

The warning which the reader must take to heart though, from the size of this book if from nothing else, is that 'good' measurements are only achieved by the observance of great care and honesty. I would have liked to see a more detailed examination of the assessment of uncertainty than given in the 18-page chapter on accuracy. Loy Upp's comment that accurate measurement needs equal measures of good instruments, good installation and good maintenance coupled with an element of faith is a sound maxim to which the reviewer would add only that there is invariably some unsuspected source of error which makes the overall estimate of uncertainty an under- rather than an over-estimate.

This Handbook, however, is a most worthwhile acquisition for the instrument engineer who may find the page numbering by chapters difficult to use at first and the quaint transference of the chapter/page numbers from top corner to bottom corner for pages of Tables unnerving, but who will be rewarded by his perseverance with the wealth of material contained within its covers.

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Published, price \$59, by McGraw-Hill Book Co., New York