J. Fluid Mech. (1972), *vol.* 51, *part* 1, *pp.* 206–208
Printed in Great Britain

REVIEWS

The Scientific Papers of Sir Geoffrey Ingram Taylor, Volume IV.

Cambridge University Press, 1971. 579 pp. £12.00.

This volume completes the reprinting of Sir Geoffrey Taylor's scientific papers. It appeared on his 85th birthday, and its frontispiece is a colour photograph of the portrait, painted five years ago by Ruskin Spear, that hangs in the Department of Applied Mathematics and Theoretical Physics at Cambridge. The book is given the heading "Mechanics of Fluids: Miscellaneous Papers", and it contains 49 papers, the last of which is dated 1969.

Once again the G.O.M. of fluid dynamics treats us to an amazing demonstration of skill, for problems, obviously so difficult that no one else would dream of attempting them, are stripped of superfluous elements and solved with simplicity. Here there are no "brazen images that the instrument maker hath set up" nor large assemblies of capricious electronic gear, and traces of a computer are hard to find. The theoretical analysis, too, is not involved; indeed, the author occasionally appeals to professional mathematicians to try their hand. In the contents list one notices the celebrated 1923 paper on the stability of a liquid contained between rotating cylinders, which made it abundantly clear that a new star had risen in the scientific firmament.

A number of papers have a highly practical context. For example, the action of bubble breakwaters is examined. In these devices a perforated pipe laid on the sea bed is supplied with compressed air, and the ascending sheet of air bubbles is found to have a marked damping effect on surface waves. The success of the arrangement is shown to be due to the water entrained by the bubbles, which spreads out near the surface into a horizontal stream. Again, in certain oilfields the oil removed may be replaced naturally or artificially by water. If the process is too rapid, the wells yield a mixture of oil and water. Hence the stability of the interface between the two liquids in the porous medium is of importance, and it is found that long fingers of water can penetrate into the oil in a manner analogous to the instability of an accelerated interface between two liquids of different densities. Liquid flow through porous surfaces is a feature of various industrial processes. Thus porous rollers are used in painting walls and in printing, and on a large scale paper is made by placing pulp on a long porous band moved horizontally over numerous rollers. The remarkable feature of the process is that nearly all the drainage of water from the pulp is produced, not by gravity, but by hydrodynamic suction under the band where it passes over the rollers. The breakdown due to cavitation of the oil film in a cylindrical bearing can have serious consequences. By means of ingenious apparatus Taylor shows that two kinds of trouble can occur. One is the well-known release of gas bubbles due to reduced pressure. The other, which is better described as separation, is surprisingly caused by surface tension, although this can of itself give rise to stresses that are exceedingly

feeble compared with the pressure variations in the liquid. Another paper on viscous flow is concerned with the peeling off of a flexible strip stuck on to a rigid surface. Here the problem is solved by treating the adhesive as a Newtonian viscous liquid. These examples will serve to give some idea not only of the difficulty of the topics in the book but also of their astonishing range.

An account is also given of the development of the C.Q.R. anchor, which by its lightness has reduced the exertions of yachtsmen. Moreover, it has no stock to foul the jib sheets so that "one continuously acting source of blasphemy is removed". (Some confusion has arisen in the reprinting, for a photograph is mentioned that is not there; figures 1 and 2, originally in that form, are now line diagrams.) The book ends with two lists, one in chronological order of the papers in the four volumes. The other gives the publications that for one reason or another have not been reproduced.

It is a reproach to engineers that Lord Hinton should say of them that they learn by their mistakes. Instead, they should study these volumes, for in these days when advances are usually difficult and costly, help from all sources is of value. Thus, Taylor's shortest paper, to be found in volume III, is concerned with the observation that a toasting fork, moved through the air with its plane in the direction of motion, makes much more noise than when its plane is perpendicular to the direction of motion. Had this remark been read and understood by the designers of the ill-fated cooling towers at Ferrybridge, a catastrophe might have been avoided.

The thirteenth Willard Gibbs Lecture, under the auspices of the American Mathematical Society, was delivered in 1939 by von Kármán, who chose the title "The engineer grapples with non-linear problems". He concluded: "Some gaps were shown and frontiers indicated beyond which the safe guidance of the mathematical analysis is for the time being lacking. I would consider the lecture a great success if it would induce mathematicians to volunteer for pioneering work in pushing those frontiers farther west." He must indeed have considered his lecture a great success for it caused Southwell to provide numerical solutions of all the topics treated, together with others thrown in for good measure. In the much wider field that we are now considering, perhaps Taylor, finding himself in expansive mood, would tell us something of the problems, if such there be, that have baulked him. The consequences might be very interesting.

Some learned presses have not contained costs, and they are in danger of pricing themselves out of the market. Volume I was published in 1958 at £3.75, II in 1960 at £3.75 and III in 1963 at £5; the price of each has now been raised to £10. At this rate even bibles will soon be beyond the purse of ordinary folk. The assertion that Barabbas was a publisher is traditionally attributed to an author; readers will echo his remark.

A. M. BINNIE

Shock Tubes: Proceedings of the 7th International Shock Tube Symposium, Toronto, Canada 1969. Edited by I. I. GLASS. Toronto University Press, 1971. 827 pp. £12.00.

The reviewer of this collection of nearly fifty papers is not impartial. Having just helped to organize the Eighth Symposium in the series of biennial meetings I am somewhat more sympathetic to the difficulties involved in producing a worthwhile record of the Seventh.

The *Proceedings of the Seventh Symposium* breaks new ground in being the first to be published as a bound volume. The volume is very well produced, very thick and very expensive. However, there are at least two good reasons for welcoming its appearance. First, the shock tube is now used for such a variety of scientific and engineering investigations that the papers cover a much wider range of disciplines than is usual and this greatly enhances the interest of the book. Second, the meeting was arranged around a number of invited papers, most of which are valuable surveys likely to retain their usefulness for many years to come.

The book opens with a summary of the commemorative Paul Vieille Lecture by Professor Hertzberg and we must all share the editor's regret that the complete manuscript was not available. This is followed by a reprint of Vieille's original paper on shock tubes published in 1899 plus an English translation of his historic two-page document. The rest of the book reflects, the meeting which was divided into six sessions entitled basic flows, high-performance driving techniques, explosive drivers, spectroscopy and kinetics and finally diagnostics and data. Each session had a substantial invited lecture as a nucleus with about half a dozen contributed papers of varying degrees of brilliance surrounding it. If I select just two of the invited lectures it is purely on the grounds of personal interest. The critique of high-performance shock tube driving techniques prepared by W. R. Warren of the Aerospace Corporation and C. J. Harris of G.E.C. does illuminate the galaxy of shock tube devices now under development and describes the limitations of some of them to offset the enthusiastic claims sometimes made by their inventors. The survey of shock tube diagnostics, instrumentation and fundamental data by R. I. Soloukhin (University of Novosibirsk) is particularly useful as details of experimental work within the U.S.S.R. have been sparse indeed. His article contains 171 references about 50 of which are of Russian origin.

The meeting deliberately chose to emphasize hardware and instrumentation which, though it somewhat narrowed the variety of topics, has resulted in a book cataloguing the wide range of shock tube performance now available. The use to which this research should be put is one of the questions considered in the last paper in the book – Professor Patterson's stimulating banquet address "Modern Trends in Science Policy". The age of 'relevancy' and 'cost-effectiveness' is upon us and it will be interesting to look at future Proceedings in the series to see how the shock tube community has responded to this challenge.

J. L. STOLLERY