ex-servicemen. Nor does an apprenticeship come to an end merely with the passage of time; in some trades an apprentice has to pass certain tests of competence before proceeding to further training or passing out as qualified.

What can be done by a determined nation has been shown by France. Before the Second World War the training of skilled workers was not in a very satisfactory state. The need for rebuilding a shattered economy exposed the extreme shortage of skilled workers; and as employers were afraid to commit themselves to a long period of training for young people, the technical section of the Ministry of Education undertook to provide a complete craft training in a full-time course lasting three years and covering a wide range of skills. The result has been to create a system of craft training which makes the British method one which the economy can no longer afford. The story is the same in Germany, Holland, Switzerland and other industrial countries.

Lady Williams's book should help to loosen some of the smugness and complacency which bedevils some sectors of British industry. It should be placed on the agenda for consideration of every board.

T. H. HAWKINS

FOUR-DIMENSIONAL GAS

The Relativistic Gas

By Prof. J. L. Synge. (Series in Physics.) Pp. xi + 108. (Amsterdam: North-Holland Publishing Company, 1957.) 15 guilders.

THIS book is valuable, both in itself and as an addendum to the author's recent "Relativity: the Special Theory". That excellent treatise was remarkable for its combination of breadth and single-mindedness. All was based on four-dimensional space-time as a geometrical entity; and we were skillfully persuaded that flat four-dimensional geometry is as natural for non-gravitational theory as curved space-time is for general relativity. We may have qualms, however, when now we meet a direct four-dimensional approach to gas theory; for when the equations are automatically Lorentz-invariant one hesitates to enclose the gas in a three-dimensional bottle. A Lorentz transformation would send the bottle flying. Thus we should be happier if we fixed the bottle in our own space-frame, and merely examined the statistical effect of the relativistic variation of the masses of the gas particles with their individual velocities. F. Jüttner in 1911 and R. C. Tolman in 1914 had treated the equilibrium distribution from this point of view. Jüttner, coming closer to Synge, had transformed the distribution integral into a modified Bessel function, and also had noted incidentally the relevance of four-dimensional momentum-space to his transformation.

Prof. Synge begins directly with space-time and four-vector momentum. The 'points' of space-time are 'events', and the 'lines' the histories of free particles. Thus we have in a single picture the history of a gas of particles displayed as a 'broken discrete complex'—line fragments concurring in fours in collision-events. (It is suggested that this picture supports the notion that point-particles manage to collide because they are 'fated' to.) The gas is *not* bottled, and attention is concentrated first on the momentum distribution near some general point-event *A*. This is calculated by assuming that the

4-momentum has the most probable distribution for an assigned total flux over an elementary null-cone at *A*. The energy tensor then serves to identify the pressure of the gas (as a perfect fluid), and by its space-time conservation laws to give the equations of motion. Temperature is identified primarily as a common parameter in a gas mixture; but more thermodynamics appears in the last chapter, which treats the theory of shock-waves. This is of great interest, and the four-dimensional picture here is perspicuous. The mathematics of the shock velocity and temperatures involves the modified Bessel functions characteristic of relativistic distributions, rather awkwardly; but the author (assisted here by Mr. H. F. Sandham) completely overcomes the obstacles.

A basic tool in the earlier part is the "absolute 2-content of a 3-cell" on the pseudo-sphere of momentum of a particle. This 2-content is, rather strangely, proportional to the product of three differentials (being dimensionally the ratio of a 3-volume element to a length), but has the vital property of retaining significance when the rest-mass tends to zero and the pseudo-sphere to the null-cone. This concept enables the author to transfer the whole theory to zero-mass particles, which may be described as Maxwell-Boltzmann photons; the results are, as he says, too attractively simple to leave out. This characteristic lightness of touch serves as a foil to the solid achievement represented by the book, which provides a strong stimulus towards relativistic procedures and modes of thought. N. B. SLATER

GUIDE TO ARCHÆOLOGY

Archæology and Society

Reconstructing the Prehistoric Past. By Prof. Grahame Clark. Third edition, revised. Pp. 272 + 24 plates. (London: Methuen and Co., Ltd., 1957.) 25s. net.

"ARCHÆOLOGY AND SOCIETY" was first published as long ago as 1939 and a second edition appeared in 1947. It is not surprising that ten years later a third edition has been called for. The first two-thirds of the volume are concerned with accounts of how discoveries can be made and what sort of direct evidence as to the life and outlook of our remote forerunners and ancestors can be deduced from them. This section has been entirely brought up to date and should be read and digested by every would-be prehistorian. The last third of the book attempts to probe deeper into the daily lives of prehistoric man. Unfortunately only certain materials can survive and only objects made of these materials can help us. Again, whether on the economic plane or on that of religion, some of the evidence that has survived can often be interpreted in many different ways. It is all too easy tacitly to assume that our modern outlook on things, or even that of modern primitive man, is the same as that of these prehistoric folk. It is all-important, therefore, that anyone who tries to tackle these problems should himself have the widest possible knowledge and, living as it were with them, should have almost come to see life through their eyes. No one could be found better qualified for this purpose than Dr. Grahame Clark, and his conclusions on these matters can, therefore, be accepted as very reasonable. The book is illustrated with line blocks and full page illustrations. It is very satisfactory that a third edition of this well-known work is now available. M. C. BURKITT