

around the base of the neck for additional support. The air from the vacuum space is extracted through a lead tube G of about $\frac{1}{4}$ -in. bore. When evacuation is complete this lead is pressed flat, and is then burned off with a small Bunsen flame. The lead seal is protected by a cup-shaped cap filled with wax or bitumen. The surfaces of the globes which face each other across the vacuum space are very highly polished to reduce the transmission of heat by radiation to the liquid air.

The charcoal maintains the vacuum by absorbing the gas that leaks into the vacuous envelope through the porous metals. The remarkable absorptive power of charcoal at low temperatures, discovered by Sir James Dewar in 1905, has made possible the use of metallic vacuum flasks and is contributing most to the rapid expansion that is now taking place in the application of liquid air and oxygen for industrial and scientific purposes. Major Lambert found from experiments he carried out for the Oxygen Research Committee that British palm-nut charcoal was capable of abstracting the residual air from a vessel, which had previously been partially exhausted, to such an extent as to reduce the pressure from 0.0575 mm. to 0.00005 mm.

If it be assumed that the pressure-reduction factor—initial pressure/final pressure—is directly proportional to the amount of adsorbent used, then with the usual charge of 200 gm. of charcoal in a 50 lb. metal container, an initial pressure of 0.1 mm. in the vacuum space will be reduced to a final pressure approaching 0.00002 mm., at the temperature of liquid air. At this exceedingly low pressure the loss of heat by conduction across the vacuum space is negligible in comparison with the loss by radiation. For this reason it is

not necessary to reduce the pressure in the envelope of a Dewar metal flask to the very low value required with the glass flask in the preliminary operation of pumping.

In order to determine the decay of the vacua of Dewar metal flasks, Dr. Briggs, a member of the Research Committee, has conducted a series of valuable experiments on 3-litre flasks. The apparatus used enabled the outer wall of a vessel to be punctured, the pressure inside the envelope to be measured, and the puncture sealed without damaging the flask or destroying the vacuum. These experiments showed the average rate of decay of the vacuum to be about 0.011 mm. per month. This slight, though continuous, deterioration of the vacuum, due to leakage of air through the excessively minute pores of the metal, necessitates periodical re-evacuation of the envelope, an operation which is performed at certain English rescue stations by the simple hand-driven Geryk pump.

Very interesting particulars concerning the cost of making liquid air have been supplied to the Research Committee by the chief English liquid-air stations. At Station A the 10-years-old plant was run for 477 hours, during which time 8705 lb. of liquid air was produced with a power consumption of 0.78 k.w.h. per lb. The cost, including power, repairs, chemicals, oil and water, but not including depreciation, establishment charges and labour, was 14.6*d.* per lb. At Station B, 8837 lb. was made in 440 hours with a power consumption of 1.17 k.w.h. per lb. The cost, including power, repairs, chemicals, oil and water, was 2.7*d.* per lb. Depreciation on the plant at 10 per cent. per year amounted to 4.3*d.*, and establishment charges to 4.2*d.* per lb., giving a total cost of 11.2*d.* per lb.

Obituary.

DR. S. H. C. MARTIN, F.R.S.

SIDNEY MARTIN, the second son of the late John Ewers Martin, was born in Jamaica in 1860, and he entered University College, London, in 1876, where he was a fellow-student and contemporary with Victor Horsley, Halliburton, and Frederick Mott. At this time many medical students at University College laid a sure foundation for their subsequent medical studies by following an extended course of instruction in biology, chemistry and physics, and Martin was one of these. He took his degree in science at the University of London in 1878, being especially attracted to biology, largely owing to the stimulating influence of that inspiring teacher, Sir E. Ray Lankester. Afterwards, during his medical studies, he came under the influence of the late Sir John Burdon Sanderson, then Jodrell professor of physiology, who was not only a physiologist but also an experimental pathologist.

After graduating in medicine in 1883, Martin began working, at the instigation of Burdon Sanderson, as an investigator in the Jodrell Laboratory, then under the control of Prof. Schäfer, who had succeeded Sanderson on the latter's appointment to the chair of physiology at Oxford. This period of the early 'eighties was one of great activity in physiology and pathology in Great Britain, and Martin devoted himself to what was then a new field, namely, the investigation of the chemical side of vital processes, and more

especially to an inquiry into the nature of the so-called toxic proteids. At this time the number of workers in this branch of knowledge was extremely limited, especially in Great Britain, and Martin carried out a series of researches not only on abrine and ricine but also during a number of years on the wider question of the nature and mode of action of the toxic substances elaborated by the activity of micro-organisms in infective diseases, more especially diphtheria, tetanus and enteric fever. He developed this subject in a long series of investigations recorded in his Goulstonian and Croonian lectures delivered before the College of Physicians in 1892 and 1898.

Although Martin's main work as an investigator was in the domain of chemical pathology, and he was one of the earliest workers in Great Britain on this subject, he was a recognised authority on pathology and pathological questions in the widest meaning of the terms. Thus he had an accurate and extensive knowledge of gross morbid anatomy and was professor of pathology at University College from 1895 to 1907 and the author of a text-book on pathology. Further, all his work, both as an investigator and as a teacher of pathology, was directed to the furtherance of clinical medicine and towards increasing the power of the physician to cope with disease, and Martin was a practising physician throughout his career. He was a teacher at University College and Hospital throughout

his life, from his appointment as assistant physician in 1891, to the time of his very sudden death whilst in active work. In addition to the posts he held in his old school, he had occupied numerous other appointments, as curator of the museum and pathologist to the Middlesex Hospital, pathologist and assistant physician to the City of London Hospital for Diseases of the Chest, and physician to the Hospital for Consumption, Brompton.

In 1895 Martin was elected F.R.S. and he served on the council in 1919-1921. He was elected F.R.C.P. in 1891, served on the council 1909 to 1911, was censor in 1915-1916, and gave the Lumleian lectures in 1915. He did a considerable amount of public work and was a member of the Royal Commission on Tuberculosis, in the work of which he took an active part. During the War he served on the staff of the 3rd London General Hospital, and was a member of the Committee of Reference that carried out important work in connexion with the provision of medical officers for service overseas. He was also a member of the Executive Committee of the Imperial Cancer Research Fund from its inception in 1902, and had recently been appointed chairman in succession to Sir William Church.

MR. F. H. BRADLEY, O.M.

IN Francis Herbert Bradley, who died on September 18 in a nursing home after a short illness, mainly the result of an accident, British philosophy has lost its most distinguished representative. Born in 1846, his life covered a period of unexampled activity in this department of thought, of which his may be said to have been the central influence. Himself profoundly influenced by Kant and Hegel, and having the advantage of the stimulus which the earlier expounders of their philosophy, notably Caird and Green, gave, his method and his achievements were entirely his own, and he stands out as one of the great line of Locke and Berkeley and Hume.

It is difficult in an obituary notice to indicate the ground of this claim. We have heard of a poets' poet. Bradley was a thinkers' thinker. He never lectured and was under no temptation to popularise his thought. On one occasion of controversy with a distinguished opponent, he complained of him that he lectured instead of writing philosophy. What gave Bradley a unique position among his contemporaries was, in the first place, the vigour and incisiveness with which he put an end to old ideas, and in the second place, the splendid lucidity of the statement, and the thoroughness in the detailed application of the ideas which he believed had to be put in their place.

It was thus in his "Ethical Studies," "the most readable work on serious philosophy in English," as it has been called, which appeared in 1876, that Bradley gave the *coup de grâce* to Hedonism, and in the celebrated chapter on "My Station and its Duties" provided the concrete foundation on which the best ethical thought of our time has since been content to build. Unfortunately, this book has long been out of print. Bradley had the intention at one time of reprinting it with notes and additions, as has recently been done with the "Principles of Logic," and it is greatly to be hoped that it will be found he had carried out part of this intention.

The "Logic," which appeared in 1883, occupies a similar place. On one hand, the theory which, as in

Bain and Mill, attempted to found inference on the association of ideas, is subjected to annihilating criticism; on the other hand, for the old idea of the syllogism as linear inference from isolated elements of identity, was substituted the idea of continuity with the organic system of experience as the principle of the forward movement of thought. The fertility of Bradley's work in these fields is familiar to students of philosophy in the brilliancy with which the underlying ideas of the "Principles of Logic" have been applied in logic by Bosanquet, and in psychology by Prof. G. F. Stout.

It is, however, in his last great work on "Appearance and Reality" (1893) that Bradley's originality is most conspicuous. As in the previous books he had waged relentless war against abstract ideas in logic and ethics, so here in metaphysics—or the search for ultimate reality. The goal here is not to be found in any of the forms (space-time, quality, soul or self) in which philosophers have sought it. Even the worlds of thought and will give us only partial aspects of the complete experience which alone can satisfy. Taken in themselves they are the products of abstraction—*res rationis*, as Spinoza would have said. The ultimate reality is something at once simpler and more complex. It is simpler because it is something present with us all in simple or again in exalted feeling; it is more complex because it must be conceived of as containing all the subtleties of difference and relation that science and philosophy find in it.

The dialectical form of this work, the deadly thrust with which the claim of each category is transfixed, has given the impression, even to philosophers, that it is mainly destructive. It has been called the *disappearance* of reality. What Bradley, on the contrary, was asserting was the growing fulness of the world in which we live as we rise from the more abstract and more obviously inadequate and relative forms of reality, such as space-time or matter, to the more concrete of human personality and its life in art, morality, and religion. Bradley was a relativist before Einstein. But his relativism differed from Einstein's in being universal and in being balanced and outweighed by his sense of the necessity of presupposing an absolute as at once the criterion of the degree of relativity of any particular form of reality and the source of its significance and value.

Taken along with the volume of collected articles "Essays on Truth and Reality" (1914), and the notes and "Terminal Essays" in the new edition of the "Principles of Logic" (1922), the essential constructiveness of Bradley's work is unmistakable. But it is not by his contribution to idealistic philosophy alone that his influence on his generation has to be measured. It was the clearness and uncompromisingness with which the main principle of idealism was stated in his chief work, that, more than any other single influence, was the source of the violent reaction against it which marked the end of last century and the beginning of this under the forms of pragmatism and the new realism. The battle is still hot, and this is not the place to enter into the issues that are there being fought out. When one of the contributors to the recent volume on "Contemporary British Philosophy" suggested that it should be dedicated to F. H. Bradley as a tribute to "the chief," among the representatives of every school, there was no dissentient voice except Bradley's own to forbid it.

J. H. MUIRHEAD.