Experimental screens at the Power Station, Pitlochry (Perthshire)

tailrace. Reactions are seen in sea trout when they are about 2-4 ft. (depending on their size) from the inner row of electrodes. Experimental work with this screen was first carried out in 1950, was repeated in 1951 and again repeated, with improved electrical equipment, during the spring of 1952. During the last period, constant observation was maintained on the movements of fish. No fish were seen to penetrate far into the tailrace, and all the fish seemed to behave normally after leaving the electrified zone; no signs of distress were seen and there was no inclination to remain inactive.

The success of this screen at Morar has led to the installation of similar screens at other sites. The accompanying photograph shows a screen which has recently been set up on the tailrace from the power station at Pitlochry, which is situated at the lower end of Loch Faskally.

Experiments on the use of electric screens to divert descending salmon smolts have been carried out, over the past three years, at Dunalastair Dam on the River Tummel in Perthshire. Here the screen consists of two parallel rows of aluminium tubes strung diagonally across the lower end of Dunalastair Reservoir immediately above the dam. The downstream row is made up of 272 tubes one foot apart, and the upstream row, which lies 6 ft. from the downstream row, consists of 34 groups of tubes spaced at 8-ft. intervals. As at Morar, a pulsed current is applied across the screen. The purpose of this screen is to divert the downstream-migrating smolts from the entrance to the aqueduct, which conveys water from the reservoir to the power station at Tummel Bridge, into the fish pass. Though this device has not been so successful as the tailrace screen at Morar, it has shown sufficient promise to warrant a continuation of this experiment.

As well as carrying out tests on the use of electric screens, the North of Scotland Hydro-Electric Board has also devised an automatic electrical counter which has been installed in the fish ladders at Clunie and Pitlochry Dams. Its operation depends upon the

difference in resistance to electrical currents between a salmon or sea trout and the water in which it is swimming; the passage of a fish through the submerged pipe linking two chambers of the fish pass can thus influence an electrical bridge, and this disturbance can be made to work a counter. The apparatus can be adjusted so that only fish greater than a certain size are counted, and refinements make it possible to operate this equipment in waters of widely varying chemical content. The passage of salmon upstream and the passage of kelts downstream are recorded separately; but if a fish does not complete its journey through the pipe, its passage is not recorded. Branches of trees, logs of

wood, empty tins and other debris passing down the fish pass do not affect the counter. This equipment was in operation at Pitlochry during 1952, and daily checks have shown the electrical counter to have an accuracy approaching 100 per cent.

The future development of all these devices will be followed with great interest by all who are concerned, professionally or privately, with the welfare of salmon fisheries. The importance of the electric fish screens needs no emphasis, and the counter, though it plays no part in controlling the movements of migratory fish, should produce records the value of which will increase as the years pass. It is to be hoped that the fullest possible records will also be kept of environmental conditions, since in these circumstances the records from the electric counter could prove valuable additions to what is known of the characteristics of the upstream migration of salmon.

¹ Lethlean, N. G., "An Investigation into the Design and Performance of Electric Fish-screens and Electric Fish-counters", paper presented to the Royal Society of Edinburgh on February 2, 1953.

OBITUARIES

Prof. G. D. Hale Carpenter, M.B.E.

GEOFFREY DOUGLAS HALE CARPENTER, professor emeritus of zoology (entomology) in the University of Oxford, died at the Radcliffe Infirmary on January 30 at the age of seventy. He came of a distinguished academic family and was a grandson of William Benjamin Carpenter, F.R.S., one of the most eminent physiologists of his time. His father was an assistant master at Eton, and his mother the daughter of another; but although born in the College itself his early education was received at the Dragon School and Bradfield. He then passed to St. Catherine's, Oxford, where he took his B.A. in 1904, obtaining second-class honours. Throughout this period he took a wide interest in natural history, and especially ornithology, conchology and entomology, so laying

firm foundations for his future career. His first paper was an unpublished one on the mother-of-pearl moth (*Sylepta ruralis* Scop.) and its parasites which he read, while still an undergraduate, to the Ashmolean Natural History Society of Oxfordshire, one of the many societies of which he later became president, and which he always regarded with much affection. From Oxford he passed with a University Entrance Scholarship to St. George's Hospital, London, qualifying M.R.C.S., L.R.C.P., taking the degrees of B.M. and B.Ch. in 1908, and eventually holding the appointments of house-surgeon and house-physician.

Hale Carpenter's interest in entomology led him to specialize in insect-borne diseases, and in 1910 he entered the Colonial Medical Service. The following year found him in the Sesse Islands in the north-west part of Victoria Nyanza, where he had been sent to study the bionomics of the tsetse fly, *Glossina palpalis*, which had recently appeared in Uganda and within a few years had caused more than two hundred thousand deaths from sleeping sickness. The results of his researches were published in the Reports of the Sleeping Sickness Commission of the Royal Society (1912, 1913 and 1919) and were presented as a dissertation for his D.M. degree at Oxford.

In the First World War, Hale Carpenter served as a captain in the Uganda Medical Service, his duties taking him into many interesting parts of Africa that he would otherwise never have visited and providing him with rich material for his book "A Naturalist in East Africa" (1925) and for many scientific papers on insect bionomics, polymorphism and mimicry. For his war services he received the M.B.E. On demobilization he resumed his work on tsetse fly, becoming specialist officer for the control of sleeping sickness in Uganda. He retired from the Colonial Medical Service in 1930; but at the request of the Secretary of State for the Colonies undertook a special investigation into tsetse fly in Ngamiland during 1930-31.

While in Africa, Hale Carpenter kept up a voluminous correspondence about his observations on insects with Sir Edward Poulton, Hope professor at Oxford, and on returning to England he built a house on Cumnor Hill, just outside that city. For a year or two he visited the Hope Department of Entomology, Oxford University Museum, daily, studying the vast stores of African insects, many of which he had collected himself, and helping Sir Edward Poulton. When Sir Edward retired in 1933, Hale Carpenter succeeded him, occupying the chair for the next fifteen years, and so qualifying for the title of emeritus professor on his retirement in 1948. During this period he continued his studies on mimicry and geographical distribution, and paid special attention to the vexed question of the attacks of birds on butterflies and its significance for evolutionary theory. At the same time he was deeply concerned about the future of his Department, and not only did all he could to enhance its value, but also appealed to the University for a new building and an increased staff.

During the Second World War, Hale Carpenter lectured on camouflage and tropical medicine to troops in training near Oxford, prepared special booklets for the African campaigns and served as head warden of the air-raid precaution service for Cumnor.

He frequently attended and spoke at scientific meetings in London, was president of the Royal

Entomological Society during 1945-46, vice-president of the Linnean Society during 1935-36 and was an ardent supporter of the British Association.

His writings included "A Naturalist on Lake Victoria" (1920) and "Mimicry" (1933). His study of the genus *Euplaea*, a genus of butterflies found on many Pacific Islands, was completed shortly before his death and is to appear in the *Transactions of the Zoological Society of London*.

Hale Carpenter was a tall, distinguished-looking man with white hair, easy of address and with a keen sense of humour. His chief recreation was gardening, the varied soils at his home at Cumnor Hill enabling him to grow a wide variety of plants. He was an ardent churchman, secretary of the Parochial Church Council, and chairman of the Cumnor branch of the Oxford Preservation Trust. His holidays were often spent in Cornwall, where he would walk, watch birds and collect insects.

He married in 1919 Amy Frances Thomas-Peter, of Treviles, Cornwall, who survives him.

B. M. HOBBY

Prof. N. A. V. Piercy

In the passing of Prof. N. A. V. Piercy, on February 1, the profession of aeronautical engineering has lost one of its ablest teachers and a pioneer in the teaching of aeronautics.

Norman Augustus Victor Piercy was born in London on August 10, 1891, and after being educated at Hampton Grammar School he was apprenticed to Yarrow and Company, Scotstoun (1908-13). He obtained an honours degree (London) in engineering at East London College (now Queen Mary College) in 1913 and immediately became engaged at Shoreham on the Cedric Lee aeroplane, known as the 'Doughnut', which had a circular ring for its wing plan-form. The period until 1919 found him engaged at East London College in researches on this novel wing, as well as special investigations for the Admiralty. During this time he designed his own 4-ft. wind tunnel, which was built of steel plating obtained from a destroyer. This tunnel is still in use.

In 1919 he was appointed head of the Department of Aeronautics at East London College and started the first university course with aeronautics as a recognized subject. In 1920 he obtained his D.Sc., for his work in connexion with the flow behind aerofoils. His subsequent researches in aerodynamics included flow in pipes, heat flow from moving bodies and aerofoil theory from which the 'Piercy aerofoil' was developed.

As a teacher Piercy inspired his students, and in consequence he soon gathered a small team of research workers around him. In 1934 he was appointed reader in aeronautics in the University of London, and in 1949 his work was officially recognized when the title of University professor of aeronautical engineering at Queen Mary College was conferred upon him.

During the Second World War Piercy was in charge of the Aeronautical Department in the University of Cambridge, in addition to his work at Queen Mary College.

Piercy was the author of "Aerodynamics", which was published in 1937 and revised in 1947, "Elementary Aerodynamics", published in 1944, as well as various papers read before learned societies. At the time of his death he was engaged in a third edition of "Aerodynamics", incorporating more recent advances in supersonic flow. He was a man of amazing energy