George Frederick Charles Searle, 1864-1954

George Thomson

Biogr. Mems Fell. R. Soc. 1955 1, 246-252, published 1 November 1955
George Frederick Charles Searle was born on 3 December 1864 at the village of Oakington in Cambridgeshire, of which his father, the Rev. W. G. Searle, was vicar. He was the eldest of five children, three boys and two girls. His schooling was limited to six days at the village school, otherwise he was taught by his father, who though a Wrangler was more interested in languages, and taught him Hebrew as well as more usual subjects. G.F.C. retained enough Hebrew in later life to impress the custodian of a synagogue at Gibraltar. He taught himself the use of tools, which was a lifelong pleasure. He constructed a dynamo while a boy. At the age of 14 he was taken by Clerk Maxwell round the Cavendish Laboratory, which deeply impressed him, and seems to have turned his thoughts to the direction of physics. He was a tall, well-built man of a little under six foot in height. As an undergraduate he gained a half-blue for cycling, then an important sport, and continued to bicycle for pleasure and utility to an advanced age, but he was not interested in games, nor did he greatly care for walking.

After a period of private coaching lasting about 18 months with a Mr Barrel, Searle came up to Cambridge with a foundation scholarship to Peterhouse. He read mathematics and was placed 28th Wrangler in the Tripos of 1887. He then studied for Part II of the Natural Sciences Tripos in which he took a second class next year.

In 1888 he began research at the Cavendish under J. J. Thomson, who had then been professor for four years, thus starting a connexion with the laboratory which lasted, with a short break in World War I, and another before World War II, for fifty-five years. In 1890 he was appointed University Demonstrator, and in 1900 University Lecturer, an office he held till 1935, coming back to his old laboratory in World War II, and finally retiring in 1947.

He was made a Fellow of the Society in 1905, and took a Cambridge Sc.D. in 1912.

His early research falls into several heads. First in time comes the work he did with Thomson on the ratio of the electrostatic and electromagnetic units of electricity, published in the Philosophical Transactions for 1890. The value obtained $2.9955 \times 10^{10}$ cm s$^{-1}$ agrees with modern values to 1 in 1000. The method was to calculate the capacity of a condenser in e.s.u. from its dimensions and determine it in e.m.u. by repeated charging and discharging when it was in one arm of a Wheatstone bridge. Searle took the observations.
The second line he took up was a more practical one, the testing of magnetic properties of iron and steel. He invented a magnetometer method, and later a ballistic one. This he developed, with the help of T. G. Bedford, into a means of measuring magnetic hysteresis ballistically, using an electrodynamometer. In this instrument specimens of shapes that could conveniently be prepared could have their hysteresis quickly measured, and experiments were made on the variation of hysteresis with stress and other physical conditions. He also published papers dealing with the calculation of self and mutual inductances, and allied problems in applied mathematics.

A more important line of work is first described in a paper in the Philosophical Transactions of 1896, which deals with the motion of charged bodies, especially spheres and ellipsoids. In this work he was influenced partly by Thomson, whose original paper on the subject appeared in 1881, but more by Heaviside. Searle had reviewed a paper by Heaviside and pointed out an error which the latter was quick to acknowledge. This led to a friendship which lasted till Heaviside died. Searle had a great admiration for Heaviside's rather wayward genius, and was one of his few intimates. Searle followed up the 1896 paper with several others, and returned to the subject as late as 1942, but perhaps the most important results were in the original paper. He showed that in a moving conducting sphere the normal to the surface would not coincide in direction with the electric force at the point, but with a resultant compounded of this and what is now called the Lorentz force, though in fact it was introduced by Heaviside in 1889, three years before Lorentz's paper. This work is of importance as being on the line which led up to the special theory of relativity by way of the Fitzgerald–Lorentz contraction first put forward in 1892. Searle showed that the moving charged conductor which produces the same effect as a point charge at its centre is not a sphere as in electrostatics, but an oblate spheroid with its axis reduced in the direction of the velocity in the ratio \( \left(1 - \frac{u^2}{c^2}\right)^{1/2} \).

Searle's mathematics were perhaps more effective than elegant, but he used them well throughout his long life. His paper of 1946 on the location of interference fringes is remarkable for a man of 82. During World War I he worked at the Royal Aircraft Factory, now R.A.E., at Farnborough, and developed a recording accelerometer for use in aircraft on lines suggested by Lord Cherwell, then F. A. Lindemann.

'Searle's Class', as it was universally called, was the practical class taken by undergraduates reading for Part I of the Natural Sciences Tripos. It included, therefore, a large proportion, indeed a majority, whose primary interest lay in some other subject. In the 1920's and 1930's the numbers were about 100, perhaps 60 in the mornings and 35 to 40 in the afternoons, on three days a week in the Michaelmas and Lent terms. In the Easter term the numbers fell off a little. This class occupied most of his time and efforts during the most important part of his life. It is primarily on his teaching of experimental physics that his fame rests. The majority of his numerous papers are descriptions of teaching experiments, and his books are textbooks based on
manuscripts used in his practical class, but it is certain that he would not have been so good a teacher but for his early researches in electromagnetism, to which, as has been said, he returned quite late in life. Without this, the physics of the practical class might have been presented too much as an end in itself. As it was, in spite of his interest in detail, one always felt that he was thinking of physics as an ideal entity of which the laboratory was only the outward and visible sign. It was this that gave his teaching its inspiration. He showed a combination of the practical and the ideal which seems odd to the normal modern man, and perhaps unusually so to the normal physicist, but which is, one is told, characteristic of the mystic.

His experiments aimed at illustrating principles. They did this, but they also showed a good deal of ingenuity in design. It may be claimed that an experiment to teach a principle in theoretical physics should do so in the most obvious way possible. From this point of view some of Searle’s experiments could be criticized as too elaborate, but it is also fair to claim that a course in practical physics should prepare men to design their own apparatus, and for this purpose examples of successful ingenuity are valuable. Certainly Searle’s apparatus and methods have been adopted very widely and have influenced the teaching of physics all over the world.

He was probably a better teacher for the relative beginners of Part I, than he would have been in Part II. His lectures for Part II, though very thorough and competent, were not particularly exciting, and he never seemed quite so much at home in the lecture theatre as in the practical laboratory. To the average freshman new to Cambridge physics ‘Searle’s lab.’ came as an exciting opening up of new ideas and methods. Perhaps in the later years this may have become less true, but mostly because the school from which the freshman had come had by then adopted a number of Searle’s ideas. It was to manufacture apparatus for schools following Searle’s design that Pye, till then chief mechanic at the Cavendish, set up the firm of W. G. Pye & Co., which afterwards formed the well-known radio and television firm as an off-shoot.

In the Cavendish he was a figure that generations had known with a curious mixture of awe, amusement and affection. He boasted that he had taught both father and mother of the present holder of the Cavendish Chair, and he claimed to have had more Nobel prize-winners as his pupils than any other man.

He was brusque in his manner with students, and was reputed to have reduced to tears a fair proportion of those from Girton and Newnham. He had a characteristic dry wit, as when he remarks in some hints on practical work ‘In some cases the student adds the letters C.G.S. in much the same way as grocers add “esq.” to customer’s names.’ He had a power of illustrating truth in pithy sayings—’You can speak of a clockwise rotation because you can’t see through the back of the clock’, or the shorter and better known ‘every length has two ends.’

He was severe on those who failed to see the implications of what they said or wrote, and quoted the story about the lady who attended a course of
lectures by Sir Robert Ball, and after displaying some knowledge said ‘You know, Sir Robert, I can easily understand how you discover how far away the stars are, how fast they move, and their composition; what I have never been able to understand is how you discovered their names.’

Searle was an entertaining guest to take in to dinner in a College Hall. In addition to his staccato remarks and sometimes slightly embarrassing questions, he usually had some little parlour trick to show. One of these was to hold a penny horizontally between thumb and forefinger, and by moving the forefinger allow the penny to drop with constant angular velocity. By catching the penny in the other hand, he was able to show that it reversed its ‘polarity’ at distances in the ratio 1 : 4 : 9. He would then show a newspaper cutting from his wallet with the headline: ‘Scientist shows how to win the toss.’

In addition to stimulating students he produced a marked and lasting impression on those who were fortunate enough to be his demonstrators for any length of time. He was a very hard task master and expected a very great deal from them, but nothing was too much trouble for him if he felt that a young man was anxious to learn.

Searle was for many years a lay-reader in the Church of England, visiting churches in the villages near Cambridge, and his religion was of great importance in his life. He believed strongly in the influence of mind on bodily health, and of religion on mind. He believed that he himself had derived benefit from spiritual healing, and had given it to others. This belief did not prevent him from doing his best to help the sick in more material ways, and he did many deeds of kindness to ill people of which one only learnt by accident. As a very young man he was struck with a desire to teach the history of the church, and used a small sum of money he had received to buy a magic-lantern with which he went about the Cambridge district giving lectures on this subject.

He married in 1904 Alice Mary, née Edwards, widow of Thomas Parsons of Wimbledon. There are no children. When convalescing in 1911 from an illness which he suffered in 1910 he and his wife visited the West Indies and Canada.

Searle was a strong opponent of vivisection and experiments on animals, and made his views known in University discussions.

A fortnight before his death on 16 December 1954, he attended a tea-party given in honour of his 90th birthday at the Cavendish, and spoke very movingly of his beliefs and experiences, both in physics and religion.

George Thomson
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