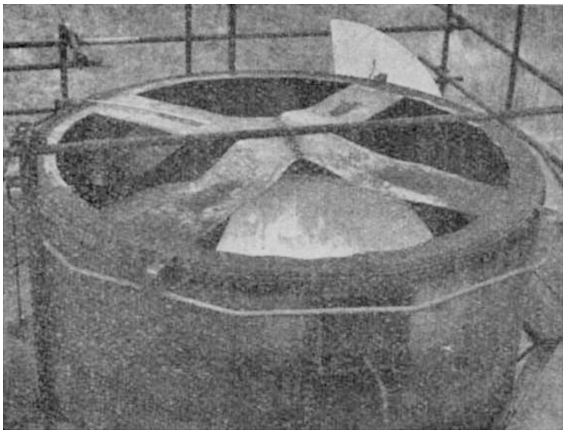

Fig. 3. Last stages of extinction in petrol fire by foam injected at the base of a tank 30 ft. high. By courtesy of the Director of the Fire Research Station. Crown copyright reserved

to the surprising conclusion that very sloppy foams, with an expansion of about three times, are effective even with petrol (Fig. 3).

Two other types of extinguishing agents are used for special fires. The first are known as vaporizing liquids, the commonest being carbon tetrachloride. They operate in the vapour phase by absorbing heat, and possibly also by inhibiting combustion. Research has been devoted to seeking to understand the reactions involved, and to seeking the most effective of a wide range of reagents. Taking into account cost, convenience, toxicity of the agent or its decomposition products, chlorobromomethane has come to be regarded as the best of the available materials.

D. J. Rasbash recently made the bold suggestion that the principle of controlling the atmosphere might be used on the grand scale even for such fires as that at Covent Garden. A large jet-engine was specially modified by the National Gas Turbine Establishment, and the exhaust gases from this engine are being used experimentally in a large building to see how far practical use can be made of the principle. The inert, exhaust gases do not cool the fuel, but it is hoped that they will prevent the spread of combustion long enough for a fireman to be able to approach with his hose.

The other type of medium is known as 'dry-powder', the commonest form being sodium bicarbonate. Research has not yet fully elucidated its mode of action, but experience has thrown considerable doubt on its superiority over other cheaper and better-known methods.

Fire as a Social Problem

Fire is a social problem. An example will illustrate the complications that are encountered in applying the results of research. A few years ago D. I. Lawson and his colleagues studied the occurrence of casualties through the ignition of clothing. Fire brigades and a number of hospitals co-operated by sending reports on a large number of incidents, and when possible they sent samples of the fabrics which were first ignited. The researches involved studies of a large range of fabrics in the laboratory, and a simple equipment was developed as a standard measure of their flammability. Statistics showed that nearly a quarter of the fatal casualties were children, and of those a large proportion were wearing nightdresses. Very few occurred between the ages of about 10 and 60, and the vast majority were elderly people and often old ladies. It became clear that the practical solution was not to aim immediately at the prohibition of all but flame-resistant fabrics ; there was need for special care of the young and old, who might wear such materials, and increased attention to the control of sources of ignition such as electric fires, gas fires, and the domestic fire. It was considered important that the public should be informed about the special hazards of certain fabrics and that means should be provided for them to be able to recognize the ones which presented the least hazard.

Fire touches practically every aspect of life, and deliberations of this kind call for wide collaboration. Some fourteen Government Departments in Britain have special concern in fire protection : the Home Office is responsible for the safety of the public where they assemble in buildings and other places, and for ensuring that the efficiency of the fire brigades is maintained : the Ministry of Transport for safety in ships : the Ministry of Aviation for aircraft, and so on. The Fire Research Board gives opportunity for members of industry and of the universities to consider their problems and, with assessors from the Government departments, to ensure that the research programme is balanced and co-ordinated.

The Joint Fire Research Organization itself is believed to be the only example of complete and equal partnership of Government (through the Department of Scientific and Industrial Research) and industry (through the Fire Offices Committee) in arranging at national level for research to deal with a social problem.

OBITUARIES

Prof. Erwin Schrödinger, For.Mem.R.S.

Erwin Schrödinger, who died on January 4, was a man with outstanding ability to apply abstract mathematical reasoning to the advancement of physical theory. His great discovery, namely, Schrödinger's wave equation, as the basis of the description of atomic processes, was one of the most surprising of all the sudden advances that have occurred with the development of scientific knowledge.

Schrödinger was born in Vienna in 1887. He was a student at the University of Vienna during 1906–10, and then acquired a mastery of eigenvalue problems in the physics of continuous media, so laying the foundation for his great work. He became assistant at the University of Vienna, and later served as an artillery officer during the First World War.

In 1920, having married Annemarie Bertel, he went to Jena to take up an academic position. This was followed by positions at Stuttgart (extraordinary professor), Breslau (ordinary professor), and then the University of Zurich, where he settled for six years. Throughout this period he was very actively engaged in research in theoretical physics and published many papers, mostly on the specific heats of solids and other questions of thermodynamics, and on atomic spectra.

He has told me how he came to make his great discovery. With his work on spectra he was using, of course, Bohr's orbit theory, but he always felt that the quantum conditions in this theory were unsatisfactory and that atomic spectra should really be determined by some kind of eigenvalue problem. In 1924, de Broglie published his work on waves associated with the motion of free particles. This influenced Schrödinger profoundly, and he set to work to try to generalize de Broglie waves to bound particles. He finally obtained a neat solution of the problem, leading to the appearance of the energy-levels as eigenvalues of a certain operator. He immediately applied his method to the electron in the hydrogen atom, duly taking into account relativistic mechanics for the motion of the electron, as de Broglie had done. The results were not in agreement with observation. We know now that Schrödinger's method was quite correct, and the discrepancy was due solely to his not having taken the spin of the electron into account. However, electron spin was unknown at that time, and Schrödinger was very disappointed and concluded that his method was no good and abandoned it. Only after some months did he return to it, and then noticed that if he treated the electron non-relativistically his method gave results in agreement with observation in non-relativistic approximation. He wrote up this work and published it in 1926, and in this delayed manner Schrödinger's wave equation was presented to the world.

A short time previously Heisenberg had discovered his matrix mechanics, another formalism for dealing with atomic processes. The theories of Heisenberg and Schrödinger were soon found to be equivalent, there being a mathematical transformation that converts one into the other. Two independent and apparently entirely different lines of thought thus led to the same foundation for atomic physics.

Schrödinger published a series of papers in quick succession, developing his ideas. For this work he shared the Nobel Prize in Physics for 1933.

In 1927 he unfortunately moved to Berlin, where he became Planck's successor. In consequence his life became disturbed by political developments, and with Hitler's coming to power in 1933, he decided he could not continue in Germany. He came to England, and for a while held a fellowship at Oxford. In 1936 he was offered a situation at Graz. He was well aware of the uncertain position of Austria at that time, and it was a difficult decision for him to make; but the attraction of returning to his native country outweighed his caution and he accepted.

With the German annexation of Austria in 1938 Schrödinger was immediately in difficulty, because his leaving Germany in 1933 was taken to be an unfriendly act. He was forced to express his approval of the Nazi regime, and he did this in as ambiguous a way as he could (see *Nature*, **141**, 929; 1938).

He soon found life with the Nazis intolerable, and, profiting by the fact that they had neglected to take away his passport in the first place, he was able to slip across the frontier to Italy. He proceeded to Princeton University and after a short stay there moved to Dublin, to the newly created Institute for Advanced Studies, where he became director and remained until his retirement in 1955.

All this time Schrödinger continued his research and published many papers on a variety of topics. Some of them were concerned with unifying gravitation and electromagnetism, the problem which absorbed Einstein for many years and which is still unsolved. Schrödinger remained greatly interested in the foundations of atomic physics. He did not like the generally accepted dual description in terms of waves and particles, with a statistical interpretation for the waves, and tried to set up a theory in terms of waves only. This led him into controversy with other leading physicists.

Schrödinger was unconventional in his way of life. When he went to the Solvay conferences in Brussels, he would walk from the station to the hotel where the delegates stayed, carrying all his luggage in a rucksack on his back and looking so like a tramp that it needed a great deal of argument at the reception desk before he could claim the room that had been reserved for him.

After his retirement he returned to an honoured position in Vienna. He died after a long illness. He is survived by his wife, who was his faithful companion throughout their marriage.

P. A. M. DIRAC

Dr. Sidney Marsh

DR. S. MARSH, who was head of the Physics Department of Battersea Polytechnic from 1919 until 1950, died on December 14, at the age of seventy-six.

After completing a double first in physics and mathematics at University College, Cardiff, he went to Munich and Göttingen, where he obtained his Ph.D. on work on discharge tubes under Prof. E. Riecke. He joined the staff of Battersea Polytechnic in 1909 and, except for the two years 1917–19, when he was head of the Mathematics and Physics Department at Rutherford Technical College, Newcastle on Tyne, he remained there until his death. He was appointed head of the Department in 1919, and, after his retirement in 1950, he continued as a part-time lecturer giving more than part-time service. He gave his last lecture on December 12, 1960, two days before his death. The way he continued to adapt himself to the rapidly changing conditions of work in the post-war period was very remarkable. Old regulations and new regulations, general and special degree, polytechnic and college of advanced technology, he took it all in his stride.

His research interests lay in electrolysis and gas discharges, but the passion of his life was teaching, and, while this goes unrecorded in the proceedings of learned journals, it lives on in the hearts and minds of all those that passed through his Department during his long stay there. With immense energy he also threw himself into the examination work of the University of London, and for many years right up to his death he was the mainstay of the external examinations in physics. Marsh must have been a name to countless students, the world over, who never knew of the immense pains he took to be fair to them and the compassion with which he carried out his duties as an examiner.

As a young man taking over what had been his Department for so long, I might have expected to find him a little difficult as a colleague. Far from this being so, he was a most kindly and considerate person who was never obtrusive with his advice, though always willing to give it. He had that true humility that is a token of true greatness, and those who have known him and have worked with him mourn his loss greatly.

L. R. B. ELTON