present 7 tons an hour. The new method of flame-proofing nylon net devised by the Lace Research Association is now being used on almost all nylon net placed on the market by the industry. The British Launderers' Research Association has found that 'Polythene' is suitable only for low-temperature washing, but that some 'Terylene' garments will stand processing of the type suitable for white cotton. A dominant feature of the work of the British Leather Manufacturers' Research Association has been the study of methods of producing leathers with specific properties, such as hard wear, water-proofness and flexibility. Investigations by the Motor Industry Research Association point to the possibility of virtually eliminating brake squeal at small cost, and the Association has also sponsored a study of the mechanism of oil consumption by the engine piston and rings. The non-destructive thickness gauge for metallic coatings invented in the British Non-Ferrous Metals Research Association's laboratories has now been developed to measure the thickness of duplex coatings, particularly nickel and copper coatings on steel and on zinc die-castings, while progress is reported in the production of thick uncracked chromium deposits, using conventional plating plant and procedure. Oil-less water-based cutting fluids containing non-proprietary corrosion inhibitors developed by the Production Engineering Research Association have offered important savings to manufacturers of such fluids, and work of the Research Association of British Rubber Manufacturers on the prevention of deterioration due to traces of copper, manganese and iron using sequestering agents has added greatly to our knowledge of these oxidation processes and how these trace metals and sequestering agents work.

SCIENCE IN SCHOOLS

A SESSION of Section X (Corresponding Societies) of the British Association for the Advancement of Science was held on September 10 in the Great Lecture Theatre of the Science Buildings of University College, Dublin. The audience, which was large, included Prof. P. M. S. Blackett, president of the Association, and Mrs. Blackett; Dr. Henry St. John Atkins, president of University College, Cork; The Rev. Prof. J. McConnell, of Maynooth; Dr. A. C. Williams, senior chief inspector of the Ministry of Education of Northern Ireland; Mr. P. McGeown, inspector of the Department of Education in Eire; Prof. J. Doyle, Prof. T. Murphy and Prof. F. Hackett, of University College, Dublin. Prof. D. A. Webb, of Trinity College, Dublin, president of Section X, was in the chair.

The Rev. Dr. M. T. Casey, lecturer in general science at Maynooth College and senior science master at Newbridge, opened the session with an address on "Science in Our Irish Schools". He said that only 60 per cent of the boys and less than 50 per cent of girls take an academic science subject at Leaving Certificate level. In girls' schools generally—with some very notable exceptions—academic science is much neglected. Very few take physics or chemistry. Some take botany, but the majority select physiology and hygiene as a kind of 'soft option'. In the absence of physics and chemistry, this subject loses a great deal of its value. All this is to be deplored, especially as there is no valid reason why girls should not reach a degree of proficiency in science comparable to that attained by boys.

The great difference between the attitude of Irish and British schools to science is to be explained by the difference in industrial conditions. Britain, heavily industrialized, is only with difficulty able to meet the demand for scientists, whereas in Ireland industry is not so insistent and the supply usually exceeds the demand. This has its repercussions in Irish schools, where the arts subjects tend to dominate the curriculum. Now, modern science, apart from its being a major force in world affairs, has a very definite and unique cultural value, for it discovers in an ever-increasing measure the beauty of form and function that abounds in Nature which itself is the handiwork of the Creator. If the study of the arts—the mere artefacts of man—is cultural, how much more so the study of Nature itself. Science has a very definite and irrefutable claim to be taught even for its own sake and in all schools, for it forms an essential part of a liberal education. A person who knows nothing about science must be regarded as only partially educated. In Ireland specialization at school level is not envisaged, hence it follows that the exclusive study of physics and chemistry as the only science subjects at this level is unsound in principle, since it narrows down the outlook of the young mind. Biology must form an integral part of every school science course. To neglect biology is to neglect at least one half of natural phenomena. In Ireland, where the basic industry is agriculture, the teaching of biology becomes a national necessity.

In Ireland there is a scarcity of science teachers owing to the absorption of science graduates by industry. This could be remedied by asking the teaching priests, nuns and brothers to take up science teaching in greater numbers.

The first of the juvenile lectures was given by Mr. John D. Gallivan, of the sixth form at Newbridge College. He read a very interesting paper, illustrated by lantern slides, on "The Reverend Dr. Callan of Maynooth, pioneer of electrical research". Callan was born in Co. Louth about 1799 and spent the greater part of his life in St. Patrick's College, Maynooth, where he held the chair of natural philosophy from 1826 until his death early in 1864. Attracted by the researches of Faraday and Sturgeon, he built a giant horse-shoe magnet, some 7 ft. high and weighing 210 lb. When supplied with current from his battery, this magnet could lift two hundred times its own weight. Before 1836, Callan had investigated the principle of the electric motor and had built three. In the earlier forms, he employed a wheel having horizontal soft-iron bars attached to its rim. This was made to rotate by an intermittently energized electromagnet placed under it, the interruptions of current being made by the rotating wheel. A later model using forty electromagnets was able "to

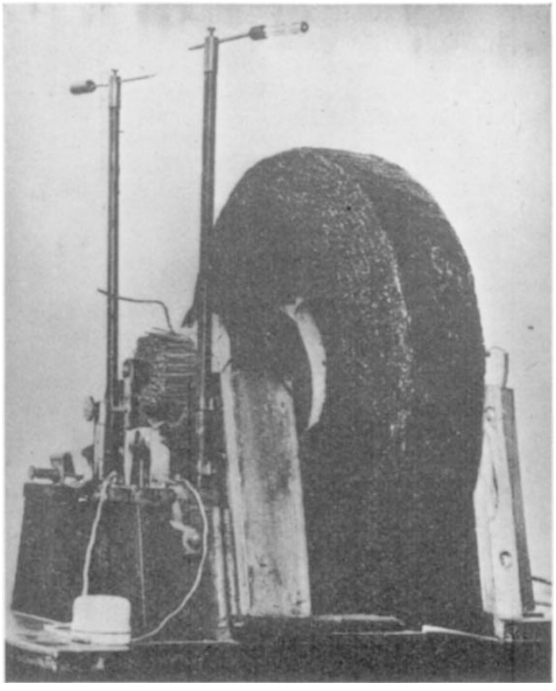

Fig. 1. Callan's medium-sized induction coil, now in the College Museum, Maynooth

propel at eight miles per hour, a thirteen hundred-weight carriage". Callan also experimented with various types of primary cell and eventually arrived at one which was manufactured commercially by E. M. Clarke, of The Strand, London, and called the "Maynooth Battery". The positive plate was a cast-iron container, holding a porous pot with the zinc plate enclosed.

Callan's most important invention was the induction coil. When repeating some of Faraday's experiments on electromagnetic induction, Callan found that the shorter the interval at break, the higher the voltage of the induced current. From the escapement mechanism of an old clock, he constructed an interrupter which gave several thousand interruptions per minute. Using this apparatus coupled to his horse-shoe magnet on which he wound a secondary coil over the primary, he found that the machine would give prodigious shocks. He sent the whole apparatus to Sturgeon, who demonstrated it at the London Exhibition of 1837, where it attracted much attention. Callan now constructed his 'medium-sized' coil. This had a bundle of soft iron rods as core on which he wound the primary coil. Over this he wound a secondary coil of very fine wire very carefully insulated. The interrupter was of the trembler type devised by his contemporary, Prof. McGaulay, of Dublin. This apparatus gave very considerable sparks. Callan still continued and made his giant induction coil, which was built on the same principle as the medium one. The core is 42 in. long and the primary coil is made from copper wire, $\frac{1}{4}$ in. in diameter, insulated with thread and wound in three layers. The whole is enclosed in an insulating paste made from wax and gutta percha. The secondary consists of three coils each containing about ten miles of very fine iron wire all carefully insulated with his paste. Callan had a large condenser across the interrupter, and using three cells of his Maynooth battery to feed the primary coil, he got sparks 16 in. long from the secondary terminals.

For some time Callan's claim to the invention of the induction coil was in dispute, but it has long since been vindicated beyond all controversy. The principal evidence is to be found in Callan's own papers published in Sturgeon's *Annals of Electricity* (1, 493; September 11, 1837), where we have the first known reference to the modern induction coil, and also in the *Philosophical Magazine* (1836). Noad's "Treatise on Electricity" (1857) and Prof. J. A. Fleming's "The Alternate Current Transformer" also pay tribute to Callan as the inventor of the induction coil. Furthermore, French writers no longer claim Ruhmkorff (who constructed his first coil in 1851, fourteen years after Callan's) as its inventor. Mr. Gallivan concluded his paper by paying a tribute to Prof. McLaughlin, vice-president of Maynooth, whose researches had rescued Callan from oblivion.

Miss Valerie B. Poynton, of Alexandra College, Dublin, read a very interesting account of a year's practical work in the realm of marine zoology, entitled "Round Dublin in the Steps of a Marine Biologist". The undertaking of the actual work was inspired by the book "Life of the Shore and Shallow Sea", in which Douglas Wilson urges the would-be naturalist to see the inhabitants of the sea-shore in their natural surroundings. Miss Poynton agreed that while the preserved specimen had undoubted reference value, it could never replace the living animal. "The graceful undulating movement of the planktonic worm *Tomopteris*, as it flashes through the water, provides an unforgettable sight; while the symmetry and beauty of the delicate comb-jellies and the geometric precision with which they move their cilia can never be visualized by those who have not

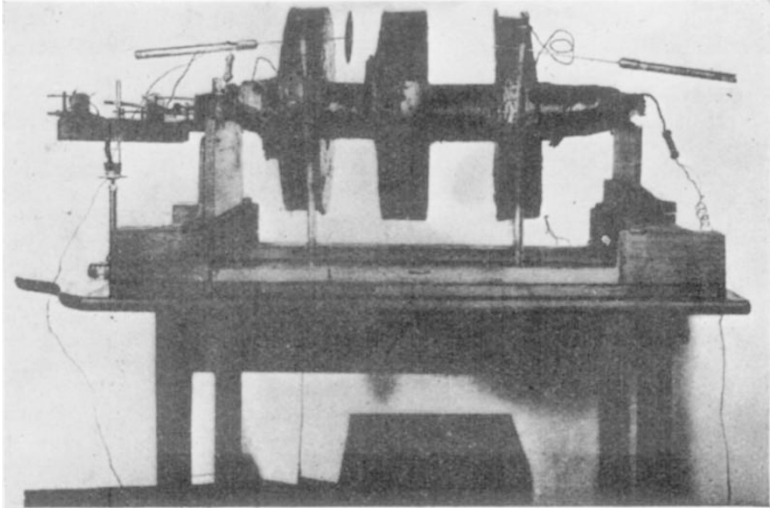

Fig. 2. Callan's 'giant' induction coil, now in the College Museum, Maynooth

had the good fortune to have seen those animals alive." Although the survey extended all around Dublin Bay from Malahide on the north side to Dalkey on the south, Dalkey Island itself formed the background of Miss Poynton's paper. The island has an area of 21 acres and is separated from the mainland by a narrow Sound. It is nine miles south of Dublin and owes its name to Danish invaders. 'Dalkey' comes from the Gaelic 'Deilginis', which means 'Thorn Island'. The area has granite for its underlying rock —it lies at the extreme tip of the Leinster granite chain—and Dalkey Sound may have been due to glaciation.

Methods of collecting and preserving material were described. Dredging was mentioned as the 'most exciting' method, since each new dredge held unlimited possibilities; there was always the chance that something new and long-sought might appear, while plankton-hauling could be described as most fascinating.

A short account was given of the environment of marine animals and of the hazards which they must overcome in order to survive and reproduce. Life in the rock pools differs from both life in the open sea and life under the boulders of the shore, so that the environment of the fauna in the immediate vicinity of Dalkey is quite complex. It is a series of environments rather than one well-defined habitat.

The commonest members of the fauna were discussed so vividly that the speaker seemed to communicate some of her enthusiasm to her audience. Her subjects ranged from the lowly sponges to the larger fishes and they were aptly illustrated by living specimens in aquaria on the bench. Very clearly, Miss Poynton's "year's work became something in the nature of a treasure hunt which was very well rewarded".

Mr. Jonathan R. Tinker, of the sixth form at Charterhouse, delivered a lively address on "Bird Reserves". He briefly discussed the various kinds of reserve, which ranged from small sanctuaries in private gardens to the great national reserves such as the Yellowstone National Park in the United States. As a result of the Wild Birds Protection Acts, special areas had been set aside in the wintering, feeding or nesting grounds of certain species. He classified these reserves as being fourfold in type. First, there are those which aim at the preservation of a particular species threatened with extinction, for example, the red-necked phalarope sanctuary in Co. Mayo, and Havergate Island in Suffolk which protects the unique avocet colony. Texel in Holland protects a large colony of spoonbills, and there is a large area set aside in Canada for the whooping crane. The second type of reserve protects a small number of species like the Humber Wild-fowl Refuge in Yorkshire with its large areas of mud-flats for the protection of wild geese. Within this type, too, are the islands off the Pembrokeshire coast. The third type comprises those large tracts known as national parks which are maintained for their plant and animal communities. Lastly, there are various city parks, such as Phoenix Park in Dublin and Regent's Park in London, where birds are treated as just another amenity to be enjoyed by visitors. In Regent's Park there are some extremely rare wild fowl, including the mandarin duck. An important study of the breeding habits of the tufted duck has been recently carried out in the London parks. These sanctuaries have been quite successful in increasing the stocks of rare birds, but many problems arise in this matter, as, for example, that of the nightly destruction of large numbers of eggs in the ternery at Dungeness in the early post-war years. This was eventually traced to hedgehogs, and wire netting solved the problem. In the larger reserves the aim is to preserve the community, and it has been found that even a slight interference with the natural habitat may have profound ecological repercussions. The question of access to bird sanctuaries is always a thorny one. Normally, ornithologists and the interested public should have access to the reserves provided their presence will not have any disturbing effects. If such effects are serious, then even the ornithologists should be excluded.

Mr. Tinker said that in shooting birds sportsmen were selfish, for the dead birds were no longer available to others. Bird-watchers, on the other hand, enjoyed themselves and left the birds to be enjoyed by others.

Miss Christabel Smyth, of Alexandra College, Dublin, read to the meeting an account of "A Geological Tour in the Neighbourhood of Dublin". The area covered by this study extends north and south from Dublin to Rathdrum in Co. Wicklow and east and west from the coast to Poolaphuca in the Blessington Lakes. It falls into two main divisions: (*a*) a highland area—the Leinster chain—and (*b*) a lowland area to the north of the Leinster chain including the extreme eastern limit of the central plain of Ireland.

The rocks of the region are nearly all sediments of the Lower Palæozoic period, while the igneous intrusion of granite is associated with the Caledonian movement in Ireland. The sedimentary rocks include the Cambrian Bray series, the Ordovician shales and schists lying to the east and west of the granite intrusion and aureole, and the Carboniferous limestone north of the Leinster chain. This stratum is rich in fossils, especially around Malahide. The igneous rocks of the Ordovician period include dykes and sills of andesite, lavas and ashes. The volcano which lay east of Lambay Island radiated out dykes which may be seen on Howth and on Bray. The Leinster chain is the longest granite intrusion in the British Isles.

It is noticeable that the relief has been influenced by two main factors, namely, the rock type and glaciation. The different rock types have caused the characteristic shapes of the mountains, as the typical conical appearance of the sugar loaf quartzites and the smoothly rounded profile of Djouce Mountain, which is a granite formation. Glaciation has left many of the usual features. The district of Glendalough contains a number of these, U-valleys being numerous, the Lugduff brook culminating in a hanging valley and Lough Nahanagan in the Glendasan valley being a well-formed corrie. Boulder clay has been deposited thickly in many places. Moraines in many of the valleys form quite prominent features and glacial lakes have also been formed, as in the case of the lakes at Glendalough and at Blessington. The lecture was illustrated by coloured slides.

These papers on such diverse subjects point to great possibilities. The enthusiasm of the young authors was infectious, and they were greeted with warm applause. The generous Press notices of the session should be of great help in the campaign for more science in the schools. MICHAEL T. CASEY