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A Turbine to Convert wave power to electricity

Whilst the CDT Department of Durham Johnston Comprehensive School had always been aware of the Schools Design Prize Competition, no previous entry had ever been made. When Richard Marsh proposed his idea for a turbine to produce electricity from wave power, it was decided that this may form the basis for an entry.

The project arose because Richard was present in his father's office when discussion was taking place relating to the design of a turbine to extract power from an oscillating flow of air, such as the flow which is produced by certain types of wave energy device. Since the discussion was to specify a problem the description was entirely oral and no diagrams were drawn, and no suggestion was given as to possible solutions. The following morning Richard produced a sketch of his turbine, which he subsequently produced at school during his CDT lesson. From his very basic sketch ideas it was clear that it would work, although at this stage I was not sure about its efficiency. It was therefore decided to produce a prototype which could be tested.

This in itself posed a problem. The Durham Johnston Copmrehensive School is a split-site school and Richard was in the first year at the lower school, some two miles away from the main site. Whilst good facilities exist for CDT at the lower site, no Technical Studies Club existed at that site at that time. The club has for many years operated at the upper site every Thursday evening, and Richard's father readily agreed to act as chauffeur. With this arrangement he managed to attend many sessions, and with modifications to his design so that the turbine could drive a small dynamo he mounted the device on a cofee tin so that it could be tested over water.

Even at this stage, it was still not apparent how Richard had arrived at this solution. However, he is familiar with the lecture demonstration to show that a lighted match can be blown out, but it cannot be sucked out. The simple fact that blowing produces a jet, whilst sucking produces a diffuse flow from all directions is something which he knew. He applied this to the design of a simple turbine which is simply a four bladed rotor revolving in a perspex case, with two inlet/outlet tubes. The wave, rising inside the coffee tin creates air pressure, which in turn, drives the rotor. When the wave falls, the partial vacuum sucks air into the turbine and cotinues the direction of rotation. Many of Richard's classmates could not accept this theory, and Richard delighted in confounding them by sucking and blowing into his turbine to prove them wrong! Problems were encountered with the mounting of the small generator, (a very small electric motor) in that it created too much resistance to the air pressure, but this was easily overcome by the fitting of small bearings. Further testing also found problems with the drive from the rotor shaft to the generator, and after much experimentation, flexible rubber tubing was used.

Testing of the turbine was done by plunging it up and down in a small water-tank and a measurable amount of electricity was produced which was recorded on a voltmeter mounted on the coffee tin. It produced 0.009 Watt = 9 m W by this method and Richard was disappointed at the low output, but soon cheered up when it was explained that by increasing the size by a factor of 10 would increase the output by a factor of 3100.

Having now developed the idea to a working stage, we turned our attention to the rules and conditions for the Schools Design Prize. As each entry should consist of a concise description of the design and include working drawings and photographs our attention turned now to the wiring of the report.

Richard's home background is that his father is a professional engineer, so that Richard is familiar with technical drawings, workshops, computers etc. At the age of ten, he had a drawing board and a simple set of drawing instruments and has a computer. The report was written by Richard and since he is familiar with a computer he asked if he could do the typing himself and use a word processing package. The report was therefore entirely Richard's own work and the description of how the turbine actually worked was based on a short note that he wrote in December 1982. The effect of using the word processor and a binder has been quite dramatic since he realised it was possible to produce a very professional looking report. Richard also produced his own drawings and took his own photographs with his father's twenty-five year old Voigtlander, as his initial attempts at photography with an instant camera was not a success.

Having now met the deadline laid down by the organisers of the competition our entry was finalised and submitted.

With the intervention of the summer school holidays attentions were obviously turned elsewhere! When we returned to school however, we were informed that we had been shortlisted and a member of the Design Council and a judge would be visiting the school to interview Richard and see his turbine in action. Richard produced for this visit a video recording he had set up on his computer to illustrate the theory of his turbine, and this formed a good support to his demonstration.

In due course, after the judges deliberations we were delighted to learn that we had won one of the prizes and that we were invited to London for the presentation by H.R.H. Princess Alexandra.

A very enjoyable day was spent in the splendour of the Institute of Civil Engineers with the attention of many notables and members of the press. It was also very pleasing to see that further tests had been made by the Design Council by placing the turbine in a wave tank, and a film of this was shown

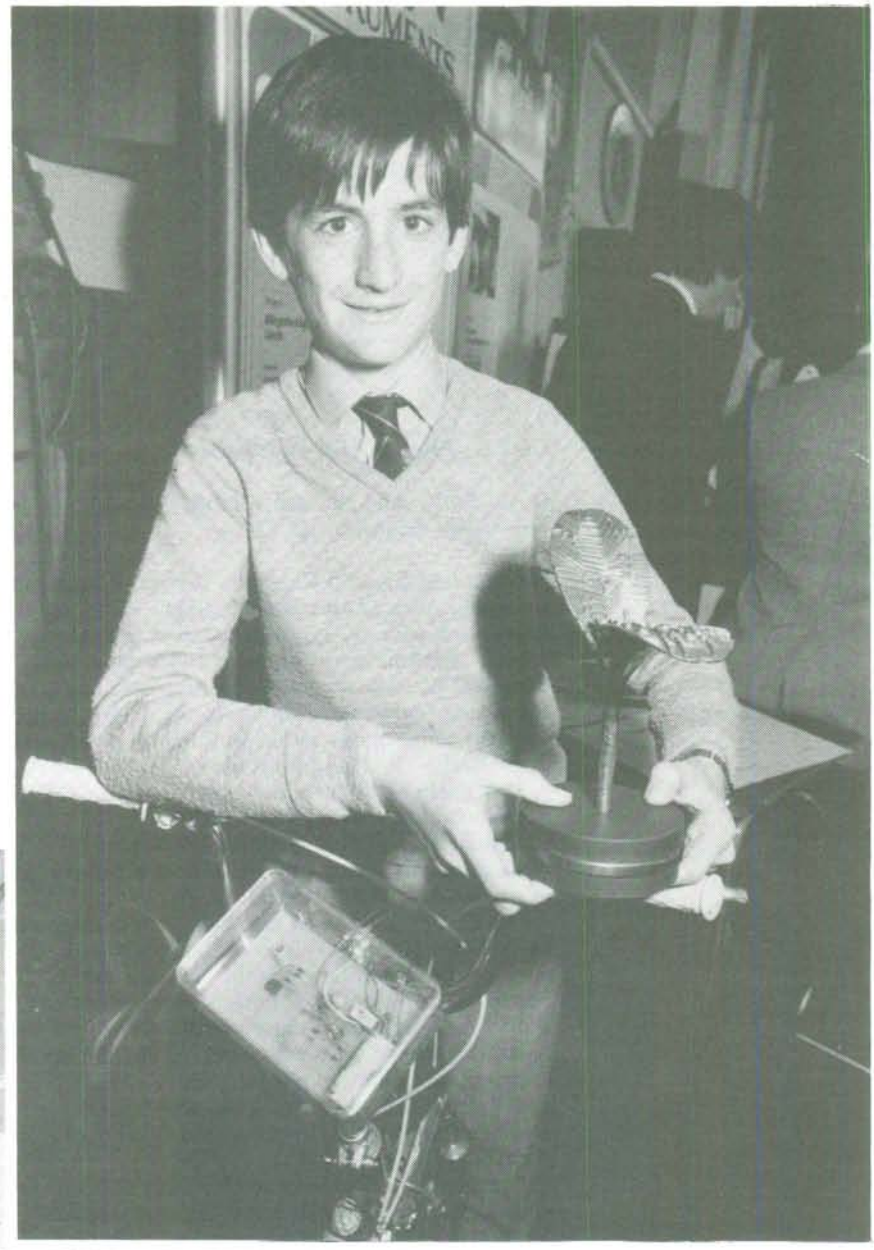
With the prize money won for the school by Richard's project, it has been decided to purchase much needed equipment for the CDT Department, and the Certificates presented to the school now takes pride of place in the headmaster's office.

With this success behind us, we further decided to enter into the Young Engineer for Great Britain contest, and, after some minor developments and modifications to the turbine, Richard was fortunate to also win this competition.

Brian Dooley (13) of Great Sankey County High School with his electronic "guide dog" designed to help people adjust to sudden blindness, has reached the British finals of the European Contest for Young Scientists and Inventors sponsored by Philips Electronics.

Below: Robb Wilmot CBE, Chairman of European Silicon Structures (far left) congratulates Stephen Osborne, aged 24 (2nd from right) and Howard Mitchell, aged 21 (far right) of the University of Essex, along with the Rt. Rev. Michael Ashley Mann, The Dean of Windsor (2nd form left), at the final awards presentations of The Young Electronic Designer Awards at Westminster School, London. Stephen and Howard were placed first in the Senior Section (aged 19-25) with their project, a Netball Umpire's Electronic Scorer.

Right: First place winner of the Junior Category (under 15 years of age) of the Young Electronic Designer Awards, Gareth Arthurs, 13, of the Bryn Offa School, in Wrexham, Clwyd is pictured with his specially designed trophy following the final awards ceremonies at Westminster School, London. Gareth won first place for his design of a bicycle lighting unit.



Following the final presentations of the Young Electronic Designer Awards at Westminster School, London, Tim Price, aged 18 is pictured with the special trophy awarded to him for his winning design, an audio processor in the Intermediate Category of the competition. Formerly attending Dauntsey's School, Devizeš, Wilts., Tim now attends Oxford University.