J.C. Clarke
Westwood School and
P.R. Clothier
Robert Clack School

Young Engineer for Britain

Editor's Note
The Young Engineer for Britain contest attracted the attention of schools throughout Britain and in this article we present accounts by teachers and students of two of the successful schools, The Robert Clack School at Dagenham and the Westwood School in the London Borough of Bexley.

Work at Westwood
J.C. Clarke
Before I describe this year's Young Engineer Winning Entry, I would like to explain the events that led up to our present success. When I joined Westwood School, a number of years ago, the Metalwork room was not equipped with a Power Hacksaw machine, so I decided to get a group of boys together, during the lunch hour and perhaps after school, so that we could possibly consider building one.

At a car brakers I managed to acquire a heavy fly-wheel, some old front-wheel bearings from a motor car and also some large pulleys and belts. Later, we picked up a motor from a washing-machine.

In the store we had some heavy-duty angle-iron and also an old machine vice. Over a period of about 2 years, the boys and myself, produced the machine which, in fact, worked for a number of years, until the Health and Safety at Work Act came into effect when this made it difficult to insure against injury.

The Council showed an interest in the machine and quickly produced a factory built one to replace it. Although a Power Hacksaw machine is more useful to a teacher than to the boys, the boys had some pleasure when we dragged the couple of hundred-weight machine out into the open and took a movie film of it working with boys setting it up and so on.

By this time a group of about half a dozen boys attended the Workshop regularly at all spare times – after school, lunch hours, etc., and they showed a lot of interest in what was going on in the Workshop. It was then necessary to find a project with which to continue in order to keep their interest in the school workshop. I should point out that at this school we have a Day Release system with the Local Technical College and they offer them many trades and excellent facilities that leave ours looking very depleted. As in most schools, a go-kart was mentioned and, I thought, well, this is a suitable project, although it would be very expensive. The boys would have to be prepared to pay for the parts out of their own pockets. I would try to keep the costs to a minimum.

As we had no welding equipment the frame was our first problem and the boys decided that some gas pipe and fittings offered by one of their fathers would be a suitable material to make a start on the frame. I borrowed some gas dies and we soon completed the frame and were looking around for wheels. A small sports steering wheel was produced and this proved very suitable as we built the steering unit. The four wheels were the next problem.

Although we had no casting facilities we were able and to cast a couple of hubbs by melting aluminium on a crucible on the brazing hearth and turned them up on the lathe, only to find the high cost of inner tubes, tyres and bearings for go-kart wheels were beyond our budget. This method was then squashed.

After some searching and saving we purchased two wheels that were used on a boat launching trolley. These were to be used for the front part of the kart and for the rear a boy acquired two scooter wheels, one of which had a braking unit. These took about a year to fit and then we started to look round for an engine. We were given about 3 or 4 different types of lawn-mower engines, most of them completely worn out, but we made an effort to use them. I was pleased about this because it delayed the day when I would have to stand in the middle of the playground and watch them going round and round – a very chilly pastime.

I mentioned our problem to the Headmaster, Nigel Heaven, and he said that he would match half and half anything the boys paid towards an engine. For £35.00 we purchased a Honda 90 engine. This included the exhaust pipe and the odds and ends that make the engine work. Although this go-kart, or fun-cart if you like, did not go very fast, it could go into The Guinness Book of Records as being 'The Heaviest go-kart ever made'. To give you an idea, it takes 3 boys to lift it out of the store, but I must say it certainly is very strong and safe!

I have our Headmaster, Nigel Heaven, to blame for the next event that took place. He placed Entry Forms for the Young Engineer of Great Britain 1980 into my pigeon hole in the Staff Room and that lunch hour, 3 of my best boys sat down and immediately thought and sketched ideas that could be used to enter the competition. After many false starts, the boys, in fact, went on to design an umbrella to cover a Rotary Washing Line when it rained. These 3 boys, Iain Hunter, Mark Thomson and Paul Boreham, had all worked on the go-kart and were quite competent at Heat Treatment, Lathework, Benchwork, etc. They experimented with many different sensory devices, the last of which won them second place in The Young Engineer of Great Britain Competition 1980. This sensor simply worked by pegging, under tension, a piece of blotting paper round a spring-loaded plunger. When rain fell on the blotting paper the blotting paper tore because of the tension on the spring, the plunger shot in allowing a heavy ring to fall. This ring supported the umbrella stave in a vertical position. The whole unit was mounted on top of a Rotary Washing Line. Perhaps in Victorian times the gadget would have caught on, but as people now have Tumble Driers the umbrella did not get on the market. These boys were later asked to appear on Blue Peter and many housewives and

children wrote to the boys saying what a good idea they thought it was.

By the time the next Entry Form arrived for 1981 there were many boys wishing to enter the competition with lots of different ideas. Some had to be persuaded that it would be a waste of time even trying to make what they intended. This did not seem to deter their enthusiasm and some joined groups and some decided to stay as individual entries.

It may sound as if everything was going very smoothly but I had my disappointments. One boy's parents decided that he would not be staying at our school and took him off to a new home at the coast. This was quite a setback as I had given the boy a lot of my time and was hoping to make him the individual entry. I decided the best group entry would be Harvey Bellchamber and Colin Collier. They had invented a Crack Movement Gauge and to my knowledge and their research, at that time, there were none on the market. These two boys did, in fact, come third in this year's Young Engineer of Great Britain Competition. I think you can see in the pictures how their work developed. First, working in metal, i.e. steel for cheapness, then aluminium, the finished product was, in fact, produced in plastic. The boys did a lot of experimenting and research and in the end decided to use a twin strip magnifying device. The principle was invented by a Mr. Eden of N.P.L. during the great war, a mechanical optical method of measuring slip gauges.

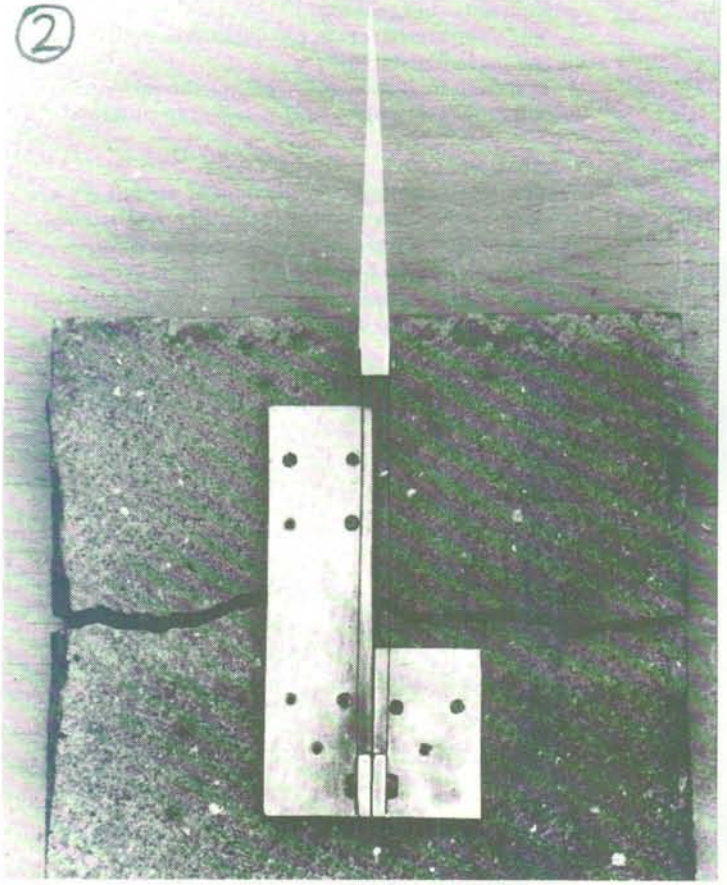
When applied to the boy's measurement of crack movement, it was found they could measure easily eight of the twelve movements of a crack, and for each movement an amplified reading would be given. It has been brought to my attention that a gauge that does not amplify can be purchased now for about £2.50 and I think it has just come on the market.

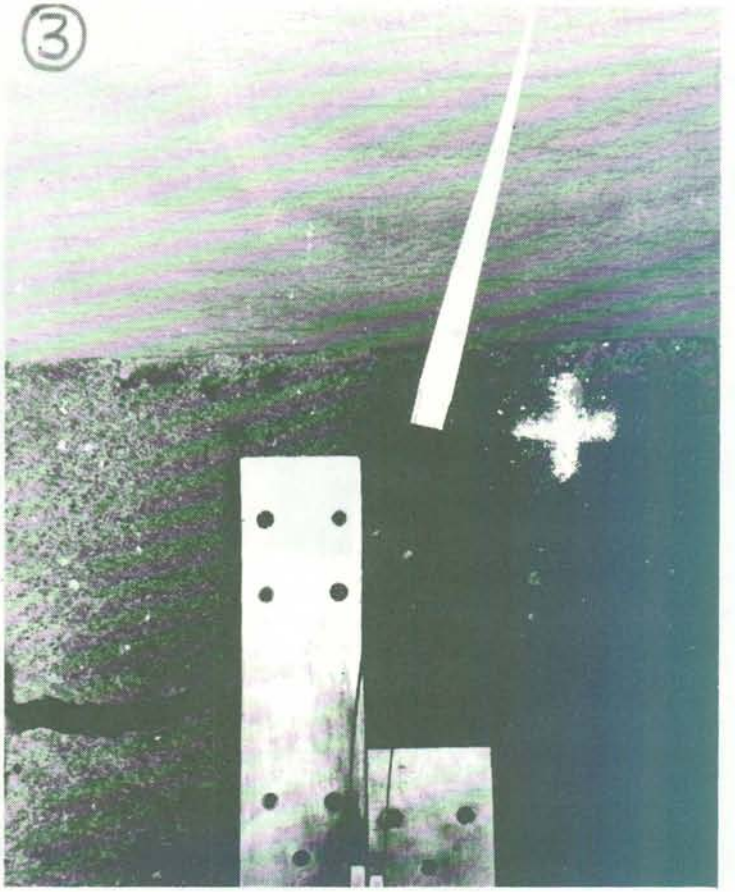
It is at this point that teachers should pause if they are thinking of entering boys for this competition. Should they encourage the boys to go ahead and try to get the product produced or should they forget all about it and encourage their boys to give all their concentration to their examinations? My own experience in this matter indicates that the matter is best left with the boys' parents to deal with on the boys' behalf.

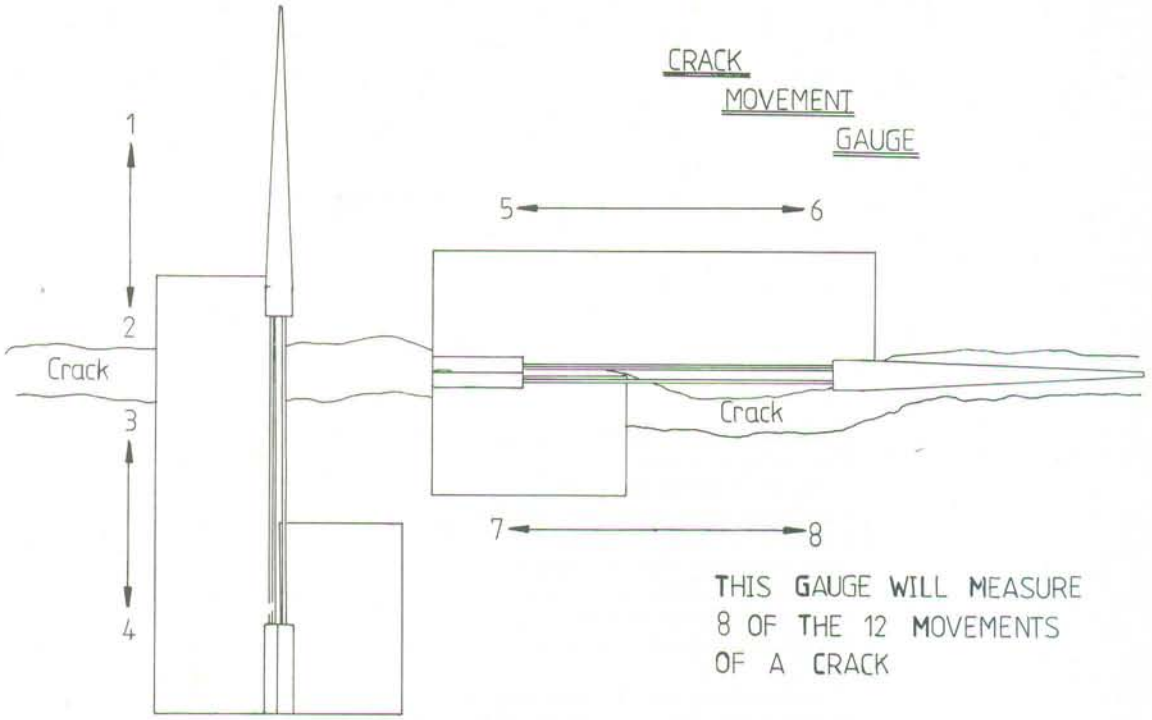
Lastly, I would like to add that work of this nature cannot possibly be carried out without the full backing and encouragement of your Headmaster.

2. Crack Movement Gauge. Crack opening showing magnified movement of the pointer.

3. Crack Movement Gauge. Prototype in Aluminium angle. Hacksaw blades (springs) stainless steel pointer. Rawplugged to a paving stone for demonstration purposes.







This gauge was designed to help the Builder or Handyman measure subsidence and the consequent movement of structures. Two flexible parallel strips are rigidly fixed at one end to a parallel faced spacing block. The other ends of the strips are fixed to plates which are rigidly attached to either side of the crack to be measured. When forced to move by the crack opening or closing a pointer attached to the spacing block gives a positive or negative reading.

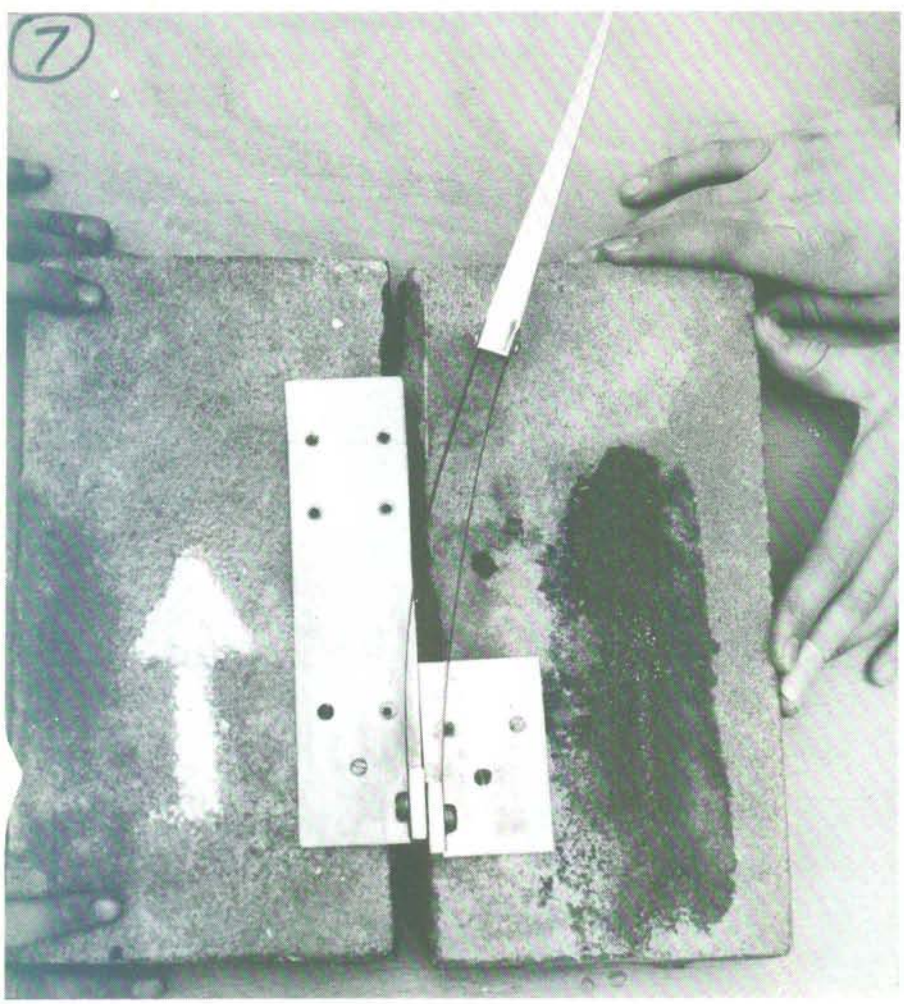
The Movement and Cracking of Buildings
C. Collier & H. Bellchamber

Introduction
The movement and cracking of buildings can be caused by a number of different reasons. The most common being the failure or incorrect use of materials used in construction, followed by the movement of land, which again can be caused by a number of factors – i.e. subsidence due to loose and sandy soil, underground springs, or the general drying out of the soil following a long dry summer.

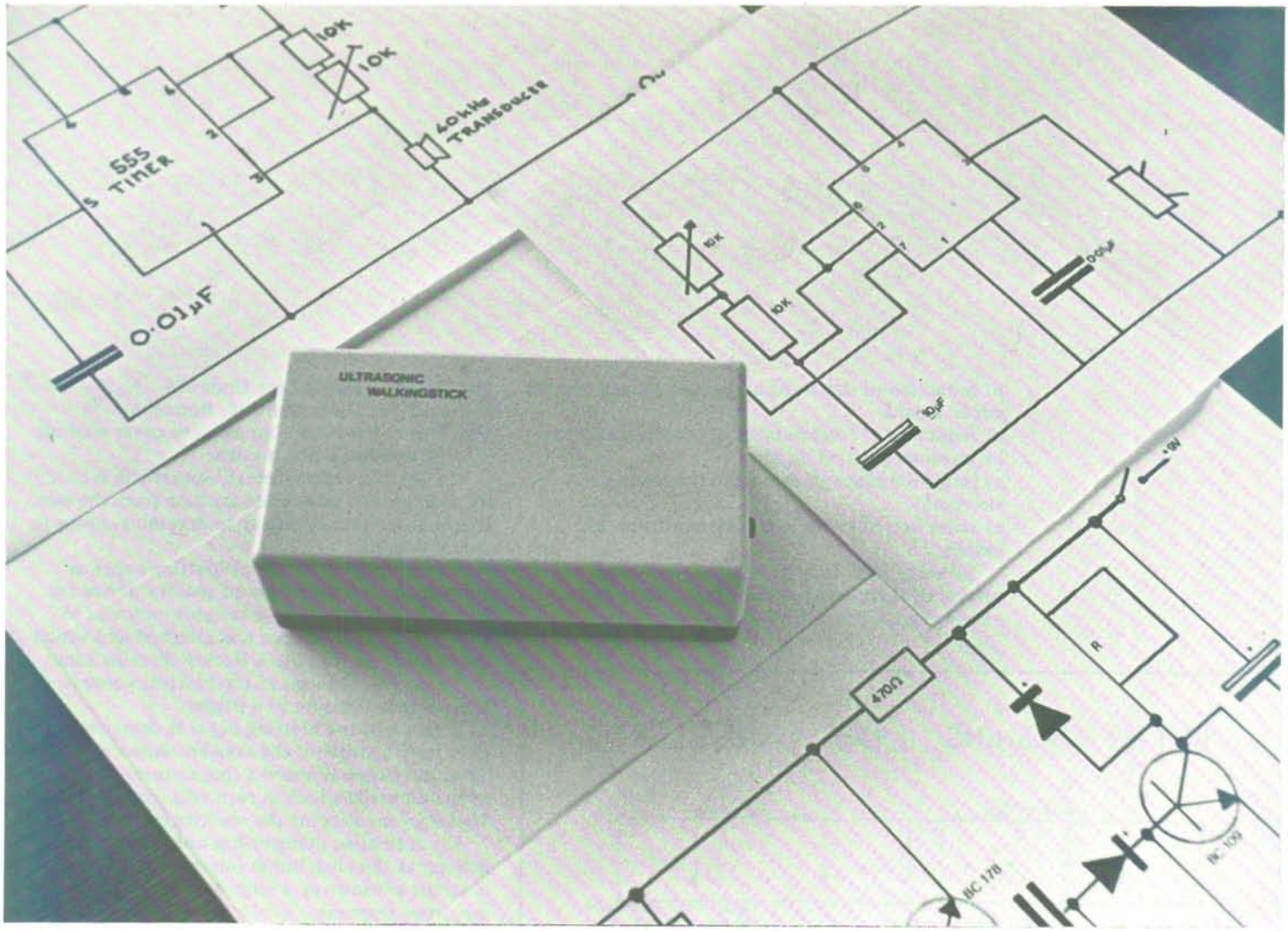
Diagnosis
Before any corrective repairs can be undertaken the following points should be given consideration.
1. The cause of cracking
2. The possible effect on the current or future use of the particular building.
3. It should be discovered whether the movement or cracking is complete or if it is still in progress.

Conclusion
The cause of cracking and movement cannot always be determined with absolute certainty, but we feel that the Crack Movement Gauge that we have developed is a step forward in the monitoring of the movement of cracks in buildings, and that it is more accurate than some traditional methods. methods.

A Patent has been applied for and it is hoped then we can interest manufacturing companies.



This illustrates the movement each way.

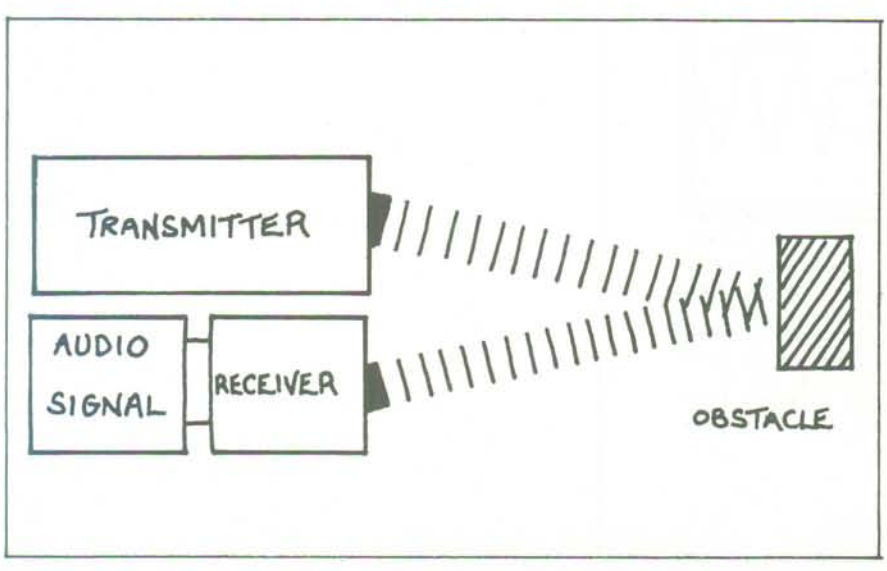


Ultrasonic Walking Stick

P.R. Clothier, Robert Clack School

Towards the end of 1980 two of my 14 year old third form pupils showed an interest in entering the NELEX schools project competition. (NELEX is the North East London and Essex SATRO). As 1981 was the 'Year of the Disabled' the pupils thought it would be appropriate if their project was in some way useful to the disabled.

After much thought and discussion they came up with the idea of a small hand held device which would replace the conventional walking stick so that a blind person could carry it in a pocket or handbag and which would not be bulky, awkward, or obstructive to other pedestrians.



The idea was to transmit some type of signal such that it would reflect from obstacles (and) be picked up by a receiver and then turned into an audio signal, so that when the user pointed the device towards an object that was within about one metre a sound would be heard.

The next step was to decide which type of signal would best be used to reflect from objects and be picked up by a receiver. There seemed to be two alternatives open to them, either that of 'ultrasonic' or 'infra red' signals.

They settled for ultrasonics mainly because infra red wavelengths would not reflect easily from transparent materials such as glass and this was of course quite important to a blind person.

A standard circuit for both ultrasonic transmitter and receiver were used with the output of the latter adapted to control an audio signal such that the greater the amplitude of the received signal (i.e. the nearer the obstacle) the louder the audio signal.

Most of the design, construction and development was carried out during lunchtimes and after school in the Electronics room and by April the pupils had completed and cased their prototype.

After gaining a place at the finals of the NELEX competition the project made its way to the 'Young Engineer for Britain' finals and the two lads succeeded in gaining second place in their group, with a prize of £150 and an industrial visit to IBM at Christmas.

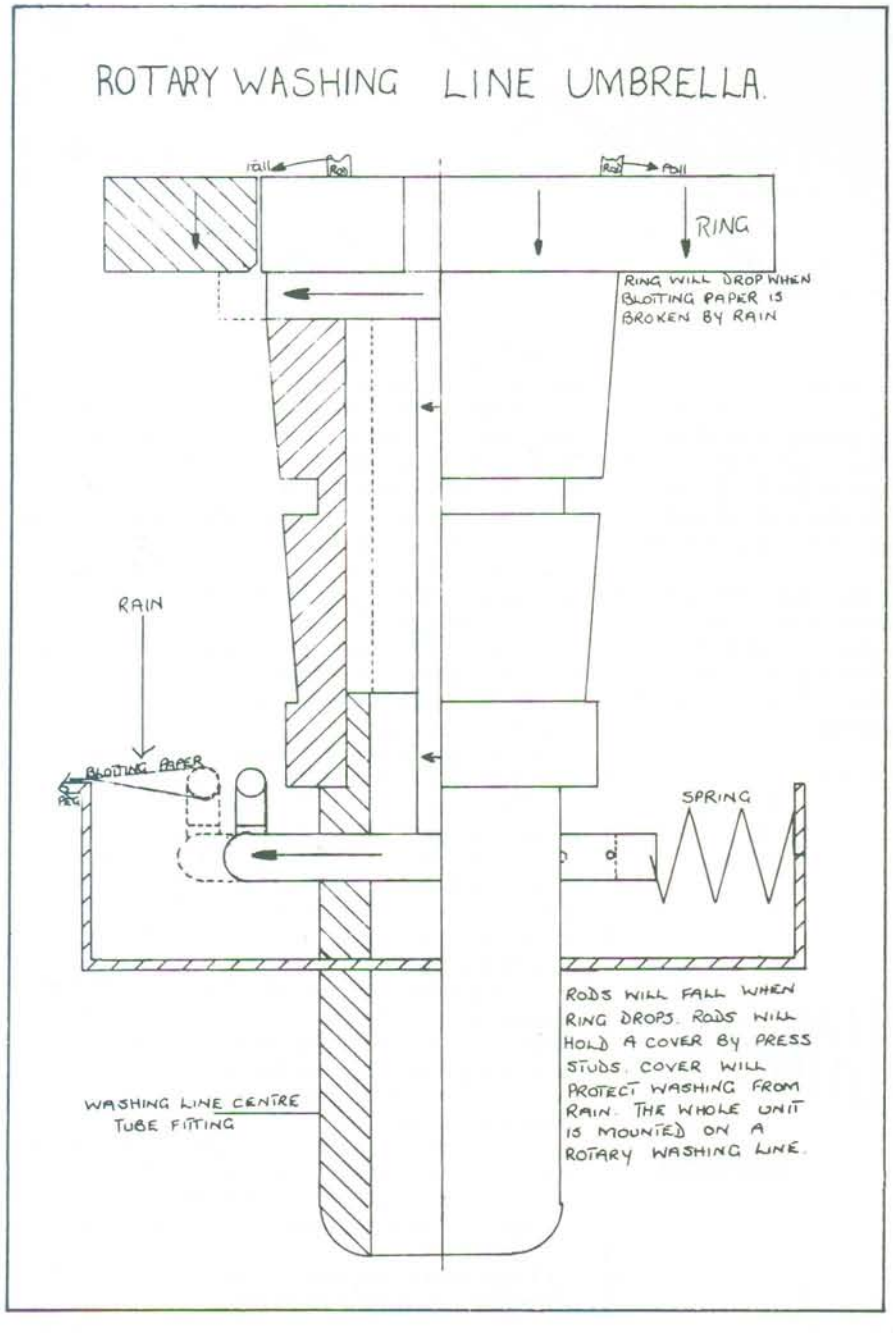
Soon after their brief period of notoriety and self satisfaction and when the two of them had returned to earth they set about improving the device.

The main areas they are at present working on are as follows:

a) Improved directionality, reducing signal divergence from the transducers.

b) reduction of size using a specially shaped printed circuit board.
c) reduction of total number of components used by improving circuit design.
d) improved shape of case from the ergonomics viewpoint.
e) reduction of power consumption from the battery.

By early 1982 they hope to have an improved version of their device which they wish to enter once again for the competitions.



The Rotary Washing Line Umbrella
I. Hunter, M. Thompson & P. Boreham

This idea evolved from the need to cover washing on a clothes line when it rains.

If it starts to rain when the housewife is out, it automatically covers the washing from the rain. It was, therefore, necessary to develop a sensor to detect rainfall.

We decided on the use of blotting paper as a cheap and efficient form of sensory device for rain. We then developed a suitable umbrella to which the sensory device was attached and which could easily be fitted to a Rotary Washing Line.

To operate the sensor, the blotting paper is pegged under tension to a trigger.

If rain falls the blotting paper is dampened and then tears because of the tension caused by a spring. Then the trigger released a ring securing the staves of the umbrella which in turn falls over the Rotary Washing Line keeping the washing dry.

Up until now, industry has not shown much interest in the idea, but in our market research amongst housewives, a large percentage showed a positive response.

I might just add a final note regarding such competitions as I believe them to be a rewarding experience for the pupils. By being encouraged to discuss problems, design and develop an artefact and by having to make economic decisions as to the marketability of a product, the pupils have gained an understanding which they would not have experienced within the bounds of the school curriculum. On a more personal note the pupils began to form the attitude of mind and develop the confidence necessary to tackle many new problems.