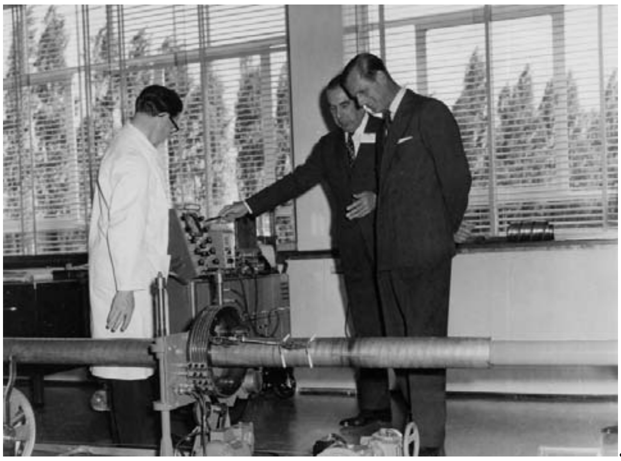
British Insulated Callender's Cables (BICC)

My search for a change of employment took me south as I realised that salaries in south-east England were higher. I was interviewed for a post at a Reed paper mill in Kent but turned it down. The post was not as advertised, they wanted a manager of maintenance on call 24 hours a day with responsibility for developing the instrumentation and also training the instrument engineers. All this for the wages of a senior foreman. Elliotts of BorehamWood were making early computers at that time and I had an interesting day there and saw their last valve computer being completed. It became apparent in the interview that the post available and my skills and inclination did not match. When I was interviewed for a post in the Control Laboratory of BICC's research laboratories, in Wood Lane London, I knew I had found work that I would like. Such was the market in those days that I was able to push the offered salary up by £50 per year to £1150. Ferranti whose pay rates were high for Scotland had been paying me £870 pa.

I moved south in October 1959, but left my wife Pamela with her mother until I could sort out accommodation. This was necessary as she was pregnant with our first child. BICC had trainees who spent periods in the research laboratories and had a list of landladies who provided a place for them to stay. I lived with a Mrs. Hewertson in Stonebridge Park, Wembley while I searched for a house. I found a typical three bedroom suburban semi-detached house in Hayes, Middlesex which, at £2600, we could just about afford. I moved in and camped in the house to get it ready as it needed some rewiring and other improvements. It was near a direct trolleybus route to Shepherd's Bush, a short walk from the labs. On the 15th December our son Mark was born and soon after Pamela brought him south. It was very difficult at first particularly for Pamela, looking after a small child in a partly furnished house in an area where we knew nobody. A coal shortage that winter did not make it easier. With all the necessary expenditure on Mark and the house we were very hard up.

The work in the Control Laboratory was concerned with the development of automated machinery for the manufacture of electrical wires and cables in all sizes from the fine wires used in instruments to the high voltage power cables for the electricity supply companies. About a year after I arrived the big new laboratory block was completed and we moved in from temporary accommodation on the site which had been a Victorian power station. In May 1961 a new research block, The McFadzean Laboratory, was officially opened by HRH Prince Philip.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It is a magnificent air conditioned building, well designed for its function. It also had very good catering facilities and the whole top floor was designed for social activities as well as its official function of large and small lecture theatres. The main hall had a very high ceiling with special lighting fittings and a sprung dance floor in maple wood which was covered except for social occasions with a rubber matting marked out for badminton. Galleries were located at each end, one of which was fitted with the lighting and sound controls and the other with seating. A small demountable stage could be place at one end or the centre of one side and connected to the amplifiers in the control gallery. The smaller lecture room had shutters at one end. The lower shutters opened to reveal a bar complete with beer pumps etc. while the upper shutters were for a projection room above the bar, housing both slide and film projectors. This lecture room/bar was named "The Office" so that one could honestly say that one had been kept late at the office.

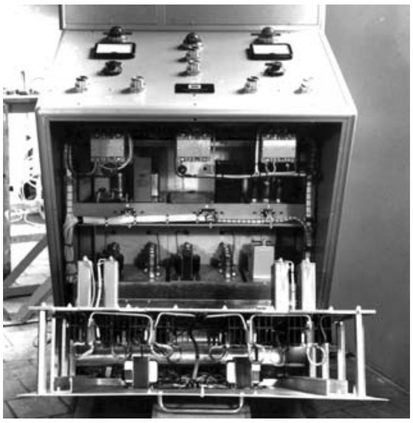
In the three years I was there I worked on a number of projects. The simplest was to improve the measurement of domestic wiring cables as they were wound from the big production reels on to the small cardboard reels the electricians used in houses. BICC reckoned that enough cable could be saved by not putting too much on each reel to pay the cost of the improved measuring equipment. An interesting marketing situation was revealed when I went to the Slough factory to see the measuring equipment commissioned. There were two piles of cardboard reels; brown ones marked BICC and green ones marked St. Helens Cable and Rubber Co. Querying this I was told that some customers would never buy from BICC.

The measurement philosophy was continued with the last project I worked on to measure standard 11kV power cables. BICC at their Erith works kept the machinery working full time by making standard HV cables whenever the machines were not being used for special orders. This built up a stock of about £1M of these cables. Then they announced a 48 hour delivery service which proved very popular and expanded their share of the market. Many Electricity Area offices were authorised to call for any length they required for repairs and extensions. We had to develop a means of measuring these lengths quickly and accurately. The means chosen was to produce an accurately measured length of strong paper tape on a reel. The HV cable was taken from the production reel of say 1000 yards straightened on a short section of roller conveyor. There it passed under a mechanism which dispensed the paper tape on to the surface of the cable as it was wound on to the customer reel. A hole near the end of the tape rang a bell so that the reels could be slowed down until a second hole indicated the required length had been dispensed. A machine like a very large reel to reel tape recorder was developed to measure the paper tapes accurately. It wound a short length of paper on to the take up reel punched a hole to indicate the end of the length required then 7 metres on punched the warning hole. It then speeded up to measure the tape before slowing down to punch another hole which indicated the start of the measurement.

Though the operator only had to dial in the length and press the start button, the machine was really a fixed program transistor logic system - a primitive computer - which controlled the starting, speeding up and stopping of the reels of paper while maintaining constant tension round the measuring drum, controlled the punching of the holes and the measurement. The measuring drum was a light precisely dimensioned wheel with a pinch roller to prevent tape slippage. Beneath the deck a light emitting diode and photo transistor monitored a radial graticule to measure the length dispensed. Elliott were producing their first transistor computers built from transistor logic circuits cast in resin in boxes about 2 cm. square and 3 cm. long. I obtained these and designed the computer control board.

I also had the pleasure of designing the first solid state speed and tension controls for a polythene extrusion line (see below). The problem was that to extrude polythene on to a copper wire to make the inside of a coaxial cable a very tight control of speed is needed to keep the diameter of the polythene constant. As hot polythene is very soft the coated wire cannot be touched until it has been slowly cooled. This is done by passing it through a long bath of warm water followed by a long bath of cold water. They are long because the polythene must not be cooled too quickly or its properties would be affected. The take up reel is therefore a considerable distance from the extruder and the wire sags between them. If the tension in the wire changes the amount of sag changes and the wire is no longer in the centre of the extruder nozzle. In this machine the wire was pulled off the supply reel with a drive which clamped the wire between two tank tracks with rubber treads. This was driven by a DC motor at constant speed. A similar tractor pulled the coated wire to the take up reel with a DC motor driven ideally at constant torque.

The old system used a Ward Leonard Ilgner rotary generator set with a control panel in a 6ft Post Office rack. This system depended on setting the take up drive at a slightly higher setting than the supply drive so that there was tension in the cable. It was less than ideal since the smallest variation in the supply drive speed could change the tension and a marginally too high setting on the take-up drive could create stick/slip conditions in the tractor mechanism.



My control circuits used the most powerful silicon controlled rectifiers (SCRs now called thyristors) then available in bridge circuits to supply the DC motors. Transitron gave us the first SCRs for development trials. We bought some at £37.50 each for the prototype. Spares bought just before we put the equipment into the factory cost £12.50. Now the equivalent can be bought for less than £5 in spite of inflation. Each drive was fitted with a tachometer giving a linear DC output related to speed. With a simple precision potentiometer controlling a negative feedback loop the supply drive speed was kept constant at any preset speed, the field supply being stabilised. At the take-up drive the armature supply was kept constant and a similar potentiometer controlled loop set the field current and thus the torque. Control logic provided security so, for instance, a cable break or slippage would not overspeed the take-up and the supply would stop if the take-up failed. All this fitted into a custom cabinet only 4 ft. high. Additionally the clamping of the cable in the tractors was improved by using hydraulic rams to control pressure instead of the manually set mechanical clamping which was so dependent on operator judgement.

A project my colleagues worked on was intriguing. Traditionally the enamel insulation on instrument wire was tested by passing the wire through a bath of mercury to which a voltage was applied. Pinholes were detected by a current flow to the earthed wire. A limited number of pinholes per 100 yards is permissible. The problems with the mercury bath and increasing awareness of the dangers of mercury started the hunt for an alternative. Passing the wire through a ring held at high voltage from a high impedance source creates a non-destructive corona discharge at a pinhole. With a resistor chain across the voltage source a signal could be picked off which would drop in voltage as the discharge occurs. A 6 volt signal fed into a transistor amplifier would drive the counter and provide the needed quality control. Unfortunately they could not get it to work as the input transistor though rated at 30 volts was punctured. The available oscilloscopes showed ringing on the pulse exceeding 30 volts but even an RC damping circuit which appeared to reduce it to 12 volts did not protect the transistor.

A new project required a specialist high performance oscilloscope but in the lab we argued that it would be better to buy a general purpose oscilloscope of sufficiently high performance so that it would be useful after the completion of the special project. I was given the job of sorting out the competing needs for the oscilloscope and finding one. I sent a request to all the major British manufacturers for information on their top of the range oscilloscopes and a visit from a technical person to discuss our needs. All of them sent salesmen who had not enough knowledge to answer my questions beyond what was in the glossy brochures. Two manufacturers loaned oscilloscopes for us to try on the applications. The Tektronix 555 oscilloscope from USA seemed much better than any of the British designs. Their agents in London invited us to their laboratory where they had two engineers demonstrate with an array of signal generators the full capabilities of their offering. After a struggle with the Board of Trade (dollars were in short supply) we were allowed to import the one we wanted. The oscilloscopes we had been loaned proved useful as we used them to show that we could not buy what we needed from a UK source. Within an hour of its delivery the Tektronix oscilloscope showed that the ringing on the pulse from the corona discharge was not 30V lasting a few milliseconds as shown on the British oscilloscope but about 200V and lasted about 0.5 microsecond. What we had been seeing was the response time of the British oscilloscope. A gold-bonded diode in a clipper circuit cured the problem permanently.

Though I enjoyed BICC it became clear after three years that I should move on. I had noted that there were others only slightly older than me who would naturally fill any promotion vacancies for the foreseeable future. A new Director of Research helped me to reach the decision by his Victorian attitudes. He found that people were coming in to work any time between 8:45 am and 9:30 am while the official starting time was 9 am. The previous director had understood this as he had an academic background and also a knowledge of London’s transport problems while the new director came from industry in the North. He instituted a regime where you had to sign in at the gate if you arrived after 9:00 and it was made clear that this would affect salary reviews. The result of this effort to improve the performance of the staff was that staff arrived on time but also left precisely on time, shutting down equipment early so that they would be ready to leave. Under the old regime they had worked until the natural completion of a task; averaging a few more than the scheduled weekly hours.