

## **Invention of Computerized Tomography.**

I started my Engineering career as an Electronic engineering trainee working for EMI Electronics. At that time there was an engineer also working there called Godfrey Hounsfield. He was a typically long haired, moustached and rather eccentric genius. Like many clever people he was anxious about his work, suffered from stomach trouble and took indigestion pills.

I had an assignment as his assistant in those early days when he was designing the display system of a military radar called Red Indian.

He would sketch out a circuit for his latest bit of invention and it was my job to solder the resistors, capacitors and inductors together with, in those days, some valves or vacuum tubes and then to try to adjust the values to make it all work.

Typical of the way Godfrey worked was the environment we worked in. In those days parts of the bare circuit were up at plus 300 volts while others were down at minus 300 volts. All this was often on a little circuit board of a few inches square. So as you adjusted the values (of course while it was all switched on) your fingers were often low down in the bare terminals and many a time got their richly deserved shock and sometimes much remembered holes in the skin.

I lost track of Godfrey after that for a few years while I think he was developing computers for EMI Electronics. Godfrey was a graduate of a London Institute called Faraday House an institution I personally had never heard of until Godfrey told me about it.

The next time we met was after EMI had sold its computer interest. Godfrey had been transferred to EMI's Central Research Laboratory and I was deputy to the Director of Research there and responsible for reporting progress on all projects and trying to obtain finance for whatever we wanted to do, in particular making sure that we did not spend money that we had not got.

The Director, Len Broadway, had been recruited by EMI when it was developing the British Television System. He came from the atom splitting Cavendish Laboratory where he got his doctorate on developments in cathode ray tubes. Len was really only interested in the science so he was more than happy to rely on me to deal with staff levels and particularly the overspends.

Since the EMI group was really no longer interested in computers, a research project led by Godfrey Hounsfield, which was bleeding our money away was a real problem. Godfrey was all fired up on developing his then novel computer storage system.

Little girls in Hong Kong were threading wires through tiny bits of ferrite and so making computer stores for next to nothing. So there was no future in the computer storage system anyway.

Len and I discussed our problem. We had already told Godfrey to stop the computer job but the costs kept going up. He clearly needed another interest. He had not taken any holiday for a year or two and looked a bit pale so we sent him on six weeks holiday break, and told the policeman on our gate not to let him in if he came to work. He went to stay on his brother's farm.

Six weeks later he returned to work and came and sat in my office for a chat. "You know Don," he said, "I've been thinking of an interesting idea." "Suppose you took a single page of a book and imagined that it was possible to shine a very bright light through the edge. Then you collected the light that came out from each position across the bottom of the page. And suppose you did the same thing along the side from one side to the other, and then from the brightness values that came through the edge of the page, given enough information, you could calculate what was written on the page!"

Of course Godfrey was a very good mathematician and I had no doubt that he could have set up the necessary mathematical matrices to solve such multiple equations as necessary. At that time it was just a concept and so far as I remember we did not, in that first chat, even discuss an application. But it was something to get a new line of thinking going, -- anything to steer away from those wretched computer stores!

Not long after that Godfrey came up with the application that we all know about today. Len Broadway's first reaction was that EMI had absolutely no interest in the medical market so there would be no group company money to fund it. At that time our Central Research Laboratory was supported mostly by projects done for subsidiary companies and funded by those companies. However, fortunately, there was a small percentage group levy on all the operating companies, of which in those days the record company was only a small part. This levy was spent at the discretion of the Director and monitored on a quarterly basis by the main EMI Board.

We kicked this new project idea of Godfrey's around for a while and eventually Len Broadway said, "I'll tell you what I'll do. You two go up to the Department of Health head office in London with Godfrey's idea. If you can persuade them that

the idea is good enough to give you any money for research I will authorize you to open a project on company funds.

So up we went by train from Hayes where we were based. The London office of DHSS in those days - 1968 - was a bit tatty. I remember it a bit like a kitchen table with lots of samples of equipment littered around. I think there were some new designs of stretchers in the corner. Godfrey did a great presentation but all by word of mouth, no props, and I did my bit. Somehow or other the discussion gravitated down around a sum of £2,500. I don't really remember the negotiations to that figure but I do remember the DHSS officer saying they would have to forego a hell of a lot of bandages and things like stretchers for that!

We came back to Hayes not realizing that we had made such a momentous achievement.

Next day Len Broadway called me in, "Well? Get anywhere?"

"£2,500 ", I said.

There was a silence, and then, "Oh well I did say I'd authorize it if you got **any** money I suppose!"

So that was it. We opened a works order and for a few weeks Godfrey worked alone and then with a young assistant. A month or so later I was going home late one night and noticed Godfrey's lights on near 8pm. So I went up to his lab to try to persuade him to go home and take a rest. On the bench was a Perspex box full of formaldehyde.

"What's that in there Godfrey?"

"Oh it's just a human brain<sup>1</sup>."

"And what's the lump in it?"

"Oh that's a tumour!"

It was all so casual. (I never did find out how he managed to get someone to lend him a human brain!)

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<sup>1</sup> Godfrey's obituary says he used pig's brains, but I am sure he told me that evening he had borrowed a human brain.

Spread around the bench were an X-ray tube source, scintillation counters, photomultipliers. All good things that might come in handy for such a series of experiments. God knows in those days whether all the proper safety precautions were being followed. I think Godfrey was sensible and knowledgeable enough to use the necessary shielding but he was also very keen to make progress.

From that point a great deal of work was needed to get the project from the concept to a working model that could be demonstrated with safety. Large quantities of values of transmissions through the sample were contained in the surrounding detectors all of which needed mathematical computation. Matrix equations were an established branch of mathematics but computer power was not as great as it is today. Godfrey spent a long time improving his handling of the matrices. The doubters in our management board needed to be kept convinced that it would all work. As a result of the DHSS involvement Godfrey got some medical supervision and advice from a neurosurgeon James Ambrose at Atkinson Morley's Hospital, Wimbledon. He was a great enthusiast and was also honoured for the invention.

I left the Central Research lab around this time for a promotion, but we had done enough and the group Central management in the form of John Powell had noticed and been convinced of the potential. . Rumours exist that the money from the Beatles funded all this. It's a good story but certainly it did not up to the point when I left.

By this point the machine was undergoing successful clinical trials with the DHSS. It was a great decision for John Powell, an embryo product of completely unknown potential in a market in which EMI had no presence and no experience.

The patent position was thought to be strong. EMI possessed a very good patent department for its background. The possibility of licensing was considered. Courageously however, Powell decided that EMI should create a completely new business.

In five years, he directed the effort which resulted in the manufacture and sale of over 700 scanners worldwide, selling at a peak rate £100M per annum, and generating some £38M of profit for the company.

From virtually a zero base, EMI Medical Electronics had grown to employ 2,500 people and were represented in over a dozen countries.

USA that home of free trade found that so many of these machines were being purchased that President Carter introduced a special certificate of need for which any American organization wanting to purchase one had to seek permission from the authorities. This temporarily strangled our USA export market.

Godfrey Hounsfield was knighted for his invention and awarded the Nobel Prize.

Don Tyzack