A chance encounter with William Sturgeon

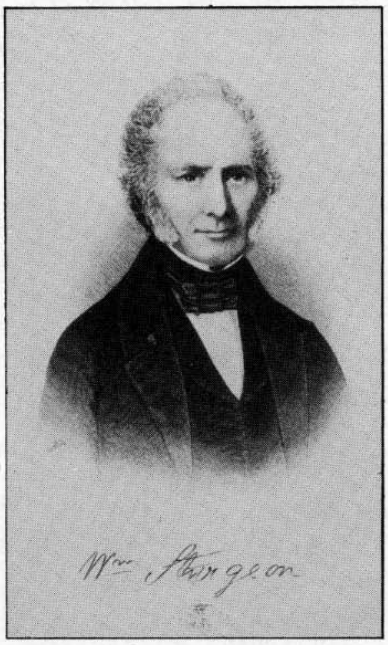
What would the 18th centry pioneers think of today's technology? Read here an exclusive interview with one of the 'forgotten men'

by A.F. Anderson

From the other side of time he came: a tall, well-built man, whose strong features, keen gaze and twinkling eyes underscored his youthful appearance. He introduced himself as founder and secretary of the Celestial Society of Greater and Lesser Electromagneticians and Experimentalists. No one on earth had remembered his 200th birthday, or his 201st birthday for that matter. The society had therefore decided that he — the inventor of the electromagnet — should return in person to find out the present state of electromagnetic science. And so here he was, after much wandering, a few miles from his birthplace. He had been waiting unobserved, for some time, he told me, to see whether his name meant anything to the passers by but, except for me, no one had raised their eyes to read the inscription set high up on the stone wall; this had made him sad, for he feared that the science he cherished might be falling into neglect.

So this was Bombardier William Sturgeon, ex-gunner-driver Royal Artillery, lecturer in science at the East India Company's Military Academy, Addiscombe etc. etc., inventor, lecturer and writer.

Now he soon digressed from arcs, sparks and those many applications of electromagnetic power that had been his passion in former times. 'I find that artillery batteries are equipped with electromagnetically guided missiles and you have found many ways of exploiting materials, yet in mundane matters you have made no progress at all. After all these years, army boots still let in water. Progress? Hah!' Whereupon the late Falklands War, its logistics and the deadlier aspects of electronic blind man's bluff — not to mention leaky boots and trench foot — became a springboard that launched him into reminiscences about his own life in the Army of Wellington's time. In graphic detail he brought alive a tour of duty guarding the misty coast of Newfoundland against the French; miseries of marching across Europe after Napolean Bonaparte; and experimental use of Congreve rockets at



1 William Sturgeon, 1783-1850

the Battle of Leipzig. Although we touched on many fascinating topics, most of which seemed, shall we say, somewhat loosely connected, it became apparent that the uniting thread was a love-hate relationship to boots and the cobbler's trade, or 'cordwaining' as he called it.

'How do boots and the army link to electromagnetism?' I inquired, fearing he was senile and we would lose the subject: magnetic properties of soft iron. 'Why, everything!' he exclaimed incredulously, 'Let me explain . . .'

His father, ingenious, idle John Sturgeon, Scot by birth, cobbler by trade and salmon poacher by inclination, had apprenticed him to a cobbler in Old Hutton, a moorland village near Kirkby Lonsdale, in what is now Cumbria. He was misused by the master; seeking better prospects he enlisted first in the Westmorland Militia in 1802 and then joined the Royal Artillery in 1805 at the age of 22. France under Napoleon was a dangerous threat and the Artillery needed scientific and engineering skills in its troops; although it was argued that *too* much education in a fighting man leads to weakening discipline.

'I certainly knew hardship, but I felt at home in the Army,' he told me. 'That rogue of a father of mine taught me to observe nature and I found that I needed the same skill in following the trajectory of a cannon ball as I did the flight of a bird . . . The senses are much sharpened by standing waist deep in the cold waters of the River Lune at night, luring fish with a lantern . . . I recommend a little poaching early in life, it increases the power of scientific observation.

'Well, the regiment needed my cobbler's skills (even though I disliked the trade) and ability to mend clocks and such. Some officers and senior non-commissioned officers would lend me books for mending shoes; I read these books after lights out, putting a blanket over the window to conceal the rush light. I studied everything: Greek, science and mathematics. One night at Newfoundland, a thunderstorm raged, seemingly for hours. It was spectacular! Its brilliance is with me to this day . . . and I said, there and then, I would study the mysteries of electricity. The easiest way to do this was by imitating Benjamin Franklin: in suitable weather, send a kite with conducting string up in the clouds. The electric charge passes down the wire and collects in a Leyden jar for experimental use . . . or so I hoped!

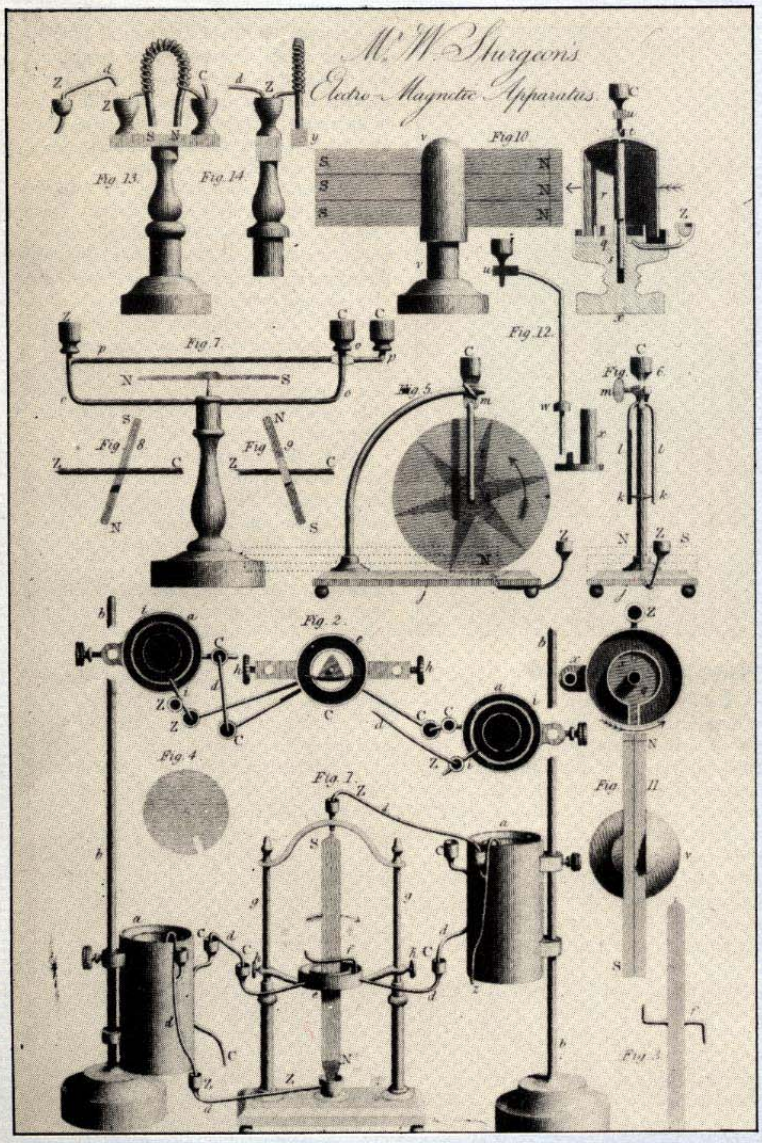
'In my life, I did over 500 kite experiments, some with spectacular results. So I thoroughly understood the transient aspects of electromagnetic induction on a grand scale. Once I raised a kite in a thunderstorm, and saw a shower of sparks discharge from the string at each lightning flash; a phenomenon which, I suggest, follows from every lightning flash disturbing the electrical fluid around it and thus producing an *electrical wave* which, in some instances, reaches to great distances . . .

'Now suppose that someone had followed up my observations, you may have enjoyed wireless telegraphy much earlier than you did! But then, most people thought my kite flying eccentric . . .!' As an afterthought, he added: 'You'd better read my "Caution to experimenters with the electrical kite". In my enthusiasm, I once forgot to insulate myself from the kite string and nearly got killed: very nasty. So I *always* warn people of the dangers.'

Speculation

We were digressing. He had a scheme: investigating ball lightning by kite, and was relieved when I said nobody has yet explained the phenomenon. 'Too much speculation, not enough observation,' he emphasised. 'There were no research grants in my day; experiments were simple, if done at all. So the mind concentrated on essentials. But we didn't squander imaginative effort in writing lengthy research applications; it's a wonder any of you do useful work at all! Maybe you will produce ball lightning with those big-science, high-voltage generators, but it'll be expensive. So why not put up a kite in a storm? From time to time, a ball will zoom down the string and pass close enough for comfort! Use Nature, man, to help you; it's cheap!'

I admit difficulty in resisting Mr. Sturgeon's enthusiasm — even though he was wrong and right. But he expressed such refreshing candour that it seemed that there were still fresh ways to see the world. Yet more speculative ramble — this time on possibly investigating the Northern Lights by using two overhead powerlines — then I redirected him to 1820 Woolwich, where he and his wife lived after the army.



2 Sturgeon's improved electromagnetic apparatus. Top left: horseshoe electromagnet; upper middle left: Sturgeon's version of Oersted's experiment; upper middle right: Sturgeon's disc version of Barlow's wheel; bottom: magnet rotating about its own axis

'Hans Christian Oersted has just discovered a connection between electricity and magnetism; this set the scientific world agog. I was lucky to find myself with a small band of keen experimentalists following up his discoveries. Unlike others, who had paid appointments at the Arsenal or the Military Academy, I supplemented my small army pension by cobbling, instrument-making and lecturing.

'My demonstration equipment was as cheap and light as possible, because I was poor and transported it from town to town by cart, over muddy, bumpy roads. My electromagnetic demonstrations needed to be spectacular, so all in the audience could see, otherwise they'd never come to hear me again! So rather than a bigger battery or more delicate instrument, like my contemporaries, I chose augmenting the feeble magnetic effects of the electric current with soft iron.

'Others knew a steel needle is magnetised by a coil carrying electric current, but said it was mere scientific curiosity. *To me* it was a point of departure, an indication of possibilities . . . I saw that if I wound some copper wire around an insulated iron rod, then passed current through the wire, I produced magnetic effects of greater magnitude than had ever been seen. With a small horseshoe electromagnet I lifted a nine-pound weight and switched the force on, or off, at will. So, it was *necessity* that led me from my contemporaries' dead-end approach to inventing improved electromagnetic apparatus.

Electronic age

'Then I felt the electromagnet would become important, and that the powers of the magnetic electrical machine might be so exalted by future improvement as eventually to supersede the voltaic battery. But now, in your so-called "Electronic age", I find large generators, driven by "steam windmills", your washing machines, sound recorders and analytic engines, all have electromagnets! But here's a funny thing: there's a natural limit to size of any one inventive step, and I didn't think of the advantage to be had by increasing the number of layers of turns in my electromagnet.

'On the other side of the Atlantic, Joseph Henry took this step which looks so obvious in hindsight! His magnets — dare I say it — were better proportioned than mine, and *much* more powerful. One he made lifted a weight of over 2 t, and it demonstrated the potent energies in electromagnetic power. Mind, I took the next step: making a subdivided core from a bundle of insulated iron wires. This limits flow of eddy currents in the iron, and was important because electromagnets could then be used in motors and telegraph equipment, where the current must be switched on many times a second. But again, I must give credit to George Bachoffner of the London Poly-

William Sturgeon

Born 22nd May 1783 at Whittington, Lancs., near Kirkby Lonsdale. Died Prestwich, Lancs., 4th December 1850. Pioneer investigator of electromagnetic phenomena, lecturer, writer and inventor. Apprenticed to a cobbler in Old Hutton 1796. Enlisted in Westmorland Militia in 1802 and as a private in the Royal Artillery at Hull in 1805. His scientific career began when he left the army in 1820 and settled in Woolwich. In about 1823 he invented the soft-iron electromagnet, which forms the basic element of nearly all electromagnetic machines and electromechanical devices. In 1825 the Society of Arts awarded him its silver medal and a premium of 30 guineas in recognition of his achievement. He made important contributions to thermoelectricity, batteries, motors, generators and induction coils. His oscillating plate, a development of Arago's rotating disc, played a part in the discovery of electromagnetic induction by Faraday. He was an unrivalled experimentalist, but sometimes inclined to long-winded speculation.

From 1836 to 1843, he published *Annals of Electricity*, the first journal in the world devoted specifically to the dissemination of electrical science. The early volumes contain much original material and include papers on electromagnetism by the Manchester physicist James Prestcott Joule, who later became a collaborator and a close friend of Sturgeon.

Sturgeon was one of the moving spirits behind the short-lived London Electrical Society (1837-43), open to all, which had as its objective 'the experimental investigation of electrical science in all its various branches and its advancement, not only by pursuing original paths of investigation, but also by testing the experiments of other enquirers'. The members were, with one notable exception, outside the established scientific community of the day. Several later became well known telegraph engineers. Charles V. Walker, Secretary to the Society, later became President of the Society of Telegraph Engineers. The society died a premature death in 1843 and the idea of a specialised society for electricians was not revived until the founding of the Society of Telegraph Engineers (1871), later to become the Institution of Electrical Engineers.

Sturgeon's later years were spent in extreme poverty and only near the end of his life did his friends succeed in obtaining a small Government pension for him. A memorial to his work is in Kirkby Lonsdale Parish Church. Unfortunately his personal papers do not survive, having been lost during a bombing raid during the Second World War.

technic Institution, who simultaneously but independently came up with the same idea.

'So you see', mused Mr. Sturgeon, 'no invention is totally the product of one man's imagination, and interplay between minds in a common field is essential to progress. It's so easy to stifle that intercourse . . . But don't think our generation was any less capable of lateral thinking than you are; it's just that we had no name for it.'

In our conversation, his contemporaries' names had surfaced often and I surmised Mr. Sturgeon had a knack of upsetting them. I discreetly avoided his damaging argument with Sir William Snow Harris on fitting lightning conductors to Her Majesty's ships. This spanned a year, Sturgeon accusing Sir William of 'electrophobia' and 'unelectro-invective'. But for Joseph Henry, he had the highest praise. 'Did you ever meet Henry?' I queried. 'Most certainly!' he boomed. He was on a grand tour of Europe in 1837. A friendly man, you know. One day, we breakfasted together: he, a great natural philospher in America, eating with me at 9 Artillery Row, Woolwich. After breakfast, he saw some of my experiments and described his to me. I won't say we *always* agreed, but our minds did meet. He saw me as "at the head of the second-rate philosphers of London" and sent American philosphers to see me. So I'm better known in America that I am here!

'Well, one shouldn't talk ill of the great, and Sir Humphry Davy of the Royal Institution *was* a great man, but when I showed him some of these same experiments some years earlier, he said I "had better mind my last than be dabbling in science". These hurtful jibes made it difficult for those of us who had come up the hard way: dividing the scientific community and holding up advance of practical application of science in Britain. It was more surprising in a man whose father was a woodcarver. Was making a cheap battery, or the first generator used for electroplating, dabbling in science; or a motor that lifted weights and drove a lathe? Is it "dabbling" to predict steam-driven generators replacing the battery, or publishing early papers of that great physicist James Prestcott Joule? Even Ohm's law was largely unknown in England until it was stated in a translation of Moritz Herman von Jacobi's paper on electromagnetic machines, published in my *Annals of Electricity*.

Support

'Woolwich and provincial cities like Manchester (where I lived for a while) accepted my work and myself for what I was. But not London. Was I too direct in speech, too set in bluff Northern ways, too impatient with those I believed to be misguided, for polite society? Now, we Celestial Electromagneticians — good, bad, indifferent — laugh at the past treatment of each other; but we all agree that emotion, prejudice and science are too closely intertwined for anyone's good! Just supposing Faraday and Wheatstone, Babbage and Fox Talbot, Grove and Daniell had supported our fledgling London Electrical Society way back in 1837 — why the whole course of electrical history might have been speeded up by a generation.

'It was my conviction that the cultivation of electricity would ultimately confer the most important benefits on mankind and that its advancement would be more rapid by the co-operation of experimentalists than by the insulated position in which they had hitherto been permitted to labour. Those who thought of themselves as the scientific establishment thought there were enough societies already and never joined. Nevertheless, of the members of the London Electrical Society, none of whom was of much importance at the time, nine later became Fellows of the Royal Society, one laid out the telegraph system of India, and another showed current in a vacuum discharge to be varied by an applied magnetic field — a reasonable achievement for a small society, you will doubtless agree.'

It was growing late, we had walked for several hours. He showed me old fishing haunts on the Lune, and his birthplace at Whittington. We climbed up the limestone crags at Hutton Roof and headed westwards over fells. Below us we saw the electrified West Coast Railway. One train passed, and then another. 'I wish', he said wistfully, 'I had time to travel in a train pulled by an electromagnetic locomotive.' But too late! A lightning flash lit up the sky and, before the ominous rumble of thunder reached me, Mr. Sturgeon was gone. Strangely, I was back inside the ancient Parish Church, Kirkby Lonsdale, gazing at the white marble plaque, high on the wall. The final sentence read: 'His name will be perpetuated as long as the science he cherished continues to exist.'

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