**Spark of genius**

**Nikola Tesla could have gone down in history as the man who invented the 20th century. Instead his theories were ridiculed and he died alone in a hotel bedroom. Robert Lomas recalls the lost prophet of electrical science.**

*The spread of civilisation may be likened to a fire; First, a feeble spark, next a flickering flame, then a mighty blaze, ever increasing in speed and power.*

Back in the 1960s, all young electrical engineers habitually practised walking around with one hand placed in their pocket. This was not because they were slovenly or making an anti-establishment statement, but because of a warning they were always given in the first practise labs they attended: 'If you get an electric shock across your chest, it will kill you; get the same shock down one side of your body and it will just give you a jolt'. Thanks to this advice, electrical engineers who want to stay alive, automatically put one hand in their pocket whenever they are near live electricity.

Nikola Tesla's Colorado Springs notes reveals that he was the first engineer to advise this safe working practise and, as a result, many electrical engineers owe him their lives. He also invented the automobile speedometer, the mechanical rev counter, radio broadcasting, AC power and the bladeless turbines.

How was such a versatile talented man, whose inventions make our modern civilization possible, forgotten? The names of his contemporaries, Edison, Marconi, Westinghouse and even JP Morgan, all became legends and live on, but Tesla is largely unknown to a public who still benefit from his works.

The scientific community has honoured him, and his name has been given to a unit for measuring magnetism. In one way, this is a fitting memorial, because he has been placed in the same hall of fame as Volta, Ampere, Gilbert, Henry, Hertz, Ohm and Faraday, great scientists who have all had electro-magnetic units named after them. But, although he has achieved this recognition by the informed, I can't help thinking that he would also have liked a more popular accolade.

After all, the quality of our modern life depends on a constant supply of electricity and it was his vision that made this possible. Yes, some engineers know his name, are taught it as a unit for measuring magnetic flux, but few know the story of the man who invented our twentieth century, and most hardly remember our debt to him.

I was a small boy, fascinated by electricity and desperately wanting my own wireless set, when I first heard about Nikola Tesla. I didn't want just any old wireless, I wanted an ex-navy AR88 radio receiver for my very own and spent many Saturday afternoons haunting the numerous second-hand radio shops of Manchester, searching for this coveted instrument.

I had friends who had their own wireless sets and was sometimes allowed to use my parents' large radiogram in the sitting-room, but that was not the same as having my own set. Tuning the radiogram to the very bottom of its tuning dial, right down below Radio Luxembourg, I could hear people who had their own wireless stations, talking to each other about the vast distances their radio short waves could go and bragging about the distant operators they could talk to. I wanted to know more - and curiosity drove my quest for an affordable short-wave radio of my own.

Wandering from shop to shop, carefully guarding the pocket that held my small savings, I sifted through pile after pile of junk and spent hours looking longingly at unaffordable new radios. Late in the day of one Saturday's unsuccessful search, I saw something that looked out of place on a dusty shelf - a gleaming polished lid of a wooden box which I just had to open and investigate. And this was how I came to spend all my carefully hoarded pocket-money on a Tesla Therapeutic Electrotherapy Machine.

As I carefully opened the lid, an accumulation of dust tickled my nostrils and made me sneeze. Looking inside, the machine, protected by a red velvet lining, seemed to be complete. There was a gleaming coil of enamelled wire, two copper cylinders connected to flexible wire leads, a brass switch and the empty space where a big battery went. The faded label on the underside of the lid praised the virtues of the high-frequency currents that this strange contraption had obviously once produced:

*The currents furnished by this apparatus are an ideal tonic for the human nervous system. They promote heart action and digestion, induce healthful sleep, rid the skin of destructive exudations and cure colds and fever by the warmth they create. They vivify atrophied or paralysed pails of the body, allay all kinds of suffering and save annually thousands of lives.*

The wireless set, I decided, could wait a while. Here was a real piece of electrical magic! Riding home with it on the electric train, I dreamed of the experiments I would do and, in the event, that crude but effective electric-shock machine was the source of much childish satisfaction. Once I had a new battery, a large six-volt lantern battery that had to be specially ordered at the local radio shop, the coil buzzed and sparked in a spectacularly satisfactory manner, and, holding the copper cylinders, one in each hand, produced a strange tingling.

Enthusiastic about the benefit of Mr Tesla's high-frequency therapeutic currents, I persuaded some of my friends to form a circle. We all then linked hands with the two copper electrodes of the machine closing our loop. The electric tingling spread from hand to hand round the ring, evoking squeals of surprise as it passed through our twitching limbs.

This early success was the start of my life-long interest in the hidden workings of all things electric. Electricity, which has only become important to society fairly recently, is still a comparatively new thing. My generation was probably the first to take it for granted. For instance, in the south-west of Ireland there is a small valley still known today as the Black Valley because, until a few years ago, it was the only place left in Ireland without a public electricity supply. Only 100 years ago, the simplicity of lighting our homes by pressing a switch would have seemed impossible magic - and without electricity the world would have remained a much harsher darker place.

Ask any well-informed person 'Who invented Electricity?' and they will probably answer 'Michael Faraday'. Visit any power station and do the children's quiz in the reception hall, and you will be convinced that this must be the case. But Faraday didn't invent our electrically powered world of today. He simply carried out experiments that showed that electricity and magnetism always appeared together and wrote an important book *Researches in Electricity*. The man who gave electricity to the world was Nikola Tesla - the man who made the electric-shock machine that so intrigued me as a boy - the man whose story this book celebrates.

How then did he come to die alone and poor in an hotel room? Why was his body not found for two days, so that the date of his death is as uncertain as he considered the date of his birth? Why do most of the beneficiaries of his inventiveness not know his name?

Partly, his lack of fame was his own creation. Unlike Edison, Westinghouse, Marconi and Morgan whose companies preserve their names and keeps their achievements in view, Tesla left no such monuments. The general public, if it remembers him at all, only remembers him as an outrageous contributor to newspaper columns. Look at of some of the titles of his later writings:

*Tesla's Tidal Wave to Make War -Impossible. Sleep From Electricity. How to Signal Mars. Mr Tesla on The Future. Nikola Tesla Plans to Keep 'Wireless Thumb' on Ships at Sea. - Wonders of the Future. Famous Scientific Illusions. Nikola Testa Tells I-low We May Fly Eight Miles High at 1,000 Miles an Hour. Can Radio Ignite Balloons? Signals to Mars Based on Hope of Life on Planet. Interplanetary Communication. Chewing Gum More Fatal Than Rum, Says Tesla. Breaking Up Tornadoes. Nikola Tesla Tells How He Would Defend Ethiopia Against Italian Invasion. Sending Messages to planets Predicted by Dr Tesla on Birthday.*

In the twenty-six years between getting the Edison Medal and his death in 1943, the public's view of Tesla changed completely. He ceased to be regarded as a serious engineer and became a 'wild' old man who predicted miracles. The fact that most of these miracles eventually happened never seems to have counted in his favour. He never understood how to deal with people, either as individuals or in a crowd. His wildest statements were always based on theoretical reasoning. Sometimes he explained his thoughts, at other times he played the 'Great Man' and expected his readers to accept everything he said. He often moved on to a new idea without ever completing his work on an earlier one, and this gained him a reputation as a 'butterfly' mind. Occasionally, however, the world did remember and honour him.

On his seventy-fifth birthday, for example, he made the cover of *Time* magazine when he was traced to the Grosvoner Clinton Hotel where he was living on the goodwill of the manager after having been evicted from previous hotels for non-payment of his bills. Soon after this, he left the Grosvoner Clinton without paying his bill and had to forfeit his luggage. The Great Depression had clearly not helped his finances, and he only found a 'home' for the rest of his life when the Yugoslavian Government, taking pity on its most famous son living in poverty, awarded him a small pension of $7,200 per year. Even so, he still had to change hotels regularly because he encouraged pigeons into his room by feeding them on his desk.

He often claimed that he had taken a vow as a child to devote himself to work and never to waste time on marriage. But, as he got older, more garrulous and less respected, he must have regretted the lack of a close family to provide him with an audience. His sisters all died before him, and the only member of his family he saw in his final years was a nephew, Sava Kosanovich, whom he did not seem to get on well with. Obviously lonely, he took to befriending young male science reporters and ringing them up to talk for hours at all times of the day and night.

Starting to celebrate the birthday, he claimed not to have, he hosted dinners he could not afford, taking over popular New York restaurants to feed reporters and then making them 'pay' dearly for their dinner by forcing them listen to his long speeches about the future. He remained physically active until his eighty-first year when, struck by a New York taxi cab while crossing the street, his health started to decline.

On this birthday, instead of speaking at a dinner party, he issued a written statement. Although this was soon after the auto accident, his mind was obviously still capable of mounting an attack on Einstein's theory of relativity:

*I have worked out a dynamic theory of gravity in all details and hope to this give to the world very soon. It explains the causes of this force and the motions of heavenly bodies under its influence so satisfactorily that it will put an end to idle speculations and false conceptions, as that of curved space. According to the relativists, space has a tendency to curvature owing to an inherent property or presence of celestial bodies.*

*Granting a semblance of reality to this fantastic idea, it is still self-contradictory. Every action is accompanied by an equivalent reaction and the effects of the latter are directly opposite to those of the former. Supposing that the bodies act upon the surrounding space causing curvature of the same, it appears to my simple mind that the curved spaces must react on the bodies and, producing the opposite effects, straighten out the curves. Since action and reaction are coexistent, it follows that the supposed curvature of space is entirely impossible - But even if it existed it would not explain the motions of the bodies as observed. Only the existence of a field of force can account for them and its assumption dispenses with space curvature. All literature on this subject is \_futile and destined to oblivion.*

It is a great pity that Tesla never published his dynamic theory of gravity. Modern thinking about gravity suggests that when a heavy object moves it emits gravitational waves that radiate at the speed of light. These gravity waves behave in similar ways to many other types of wave. Tesla's greatest inventions were all based on the study of waves. He always considered sound, light, heat, X-rays and radio waves to be related phenomena that could be studied using the same sort of maths. His differences with Einstein suggest that he had extended this thinking to gravity.

In the 1980s he was proved to be right. A study of energy loss in a double neutron star pulsar called PSR 1913 + 16 proved that gravity waves exist. Tesla's idea that gravity is a field effect is now taken more seriously than Einstein took it. But, unfortunately, Tesla never revealed what had led him to this conclusion, never explained his theory of gravitation to the world. The attack he made on Einstein's work was considered outrageous by the scientific establishment of the time, and only now do we have enough understanding of gravity to realize that he was right.

Tesla subsequently went on to make another outrageous claim, and the following statement helped to consign him to total obscurity after his death:

*I have devoted much of my time during the year to the perfecting of a new small and compact apparatus by which energy in considerable amounts can now be flashed through interstellar space to any distance without the slightest dispersion. I am expecting to put before the Institute of France an accurate description qf the devices with data and calculations and claim the Pierre Guzinan Prize of 100,000 francs for means of communication with other worlds, feeling perfectly sure that it will be awarded to me. The money, of course, is a trifling consideration, but for the great historical honour of being the first to achieve this miracle I would he almost willing to give my life.*

He didn't get the prize and never explained the work. The French Government never heard from him as events overtook them both. Hitler was starting to expand his influence in Europe and France was invaded by 1940.

The device Tesla was talking about was either an early laser or a plasma gun to produce high-energy particles in the upper atmosphere. His Colorado notes show that he was aware of both possibilities, and these devices would have been a logical consequence of his lightning experiments.

In 1940, just after his eighty-fourth birthday, he gave an interview to the *New York Times* that was published on 22 September:

*Nikola Tesla, one of the truly great inventors, who celebrated his eighty-fourth birthday on July 10, tells the writer that he stands ready to divulge to the United States Government the secret of his 'teleforce' with which he said, airplane motors would be melted at a distance of 250 miles, so that an invisible Chinese Wall of Defence would be built around the country.*

The article passed without comment by fellow scientists. By now his reputation for seeking publicity far out-weighed his ability to be believed, and with Hitler's advances in Europe causing concern there were other things to worry about.

By 1941, the US had entered World War 11 and Tesla must have been concerned when his native land also fell to German invaders about this time. What was he to do about his 'Death Ray', as the popular paper had dubbed his 'teleforce' weapon? He wanted to give it to the US Government to help support both his adopted country and his homeland.

On 5 January 1943, Tesla rang the US War Department and spoke to a Colonel Erskine, offering him the secrets of his 'teleforce' weapon. Erskine, not realizing who Tesla was, assumed he was crazy, promised to ring him back and forgot about him This was Tesla's last message to anybody. Quite ill by this time, his weak heart causing regular dizzy attacks, he was living in the Hotel New Yorker. On the evening of 5 January, he gave orders that he was not to be disturbed and went to bed. He often told staff to leave him undisturbed for two or three days at a time, but this was to be the last time he would be seen alive.

The story now unfolds like a bad thriller. Tesla died of heart failure some time between the evening of Tuesday, 5 January and the morning of Friday, 8 January. He was found by a maid on the Friday morning. His only known relative, his nephew Sava Kosanovich, a refugee from Yugoslavia who had fled to the US to escape the German invasion, was, like many other refugees, under observation by the FBI as a possible spy.

On the night of 8 January, Sava Kosanovich and two other men, George Clark, and Kenneth Sweezey (a young science reporter) went to Tesla's hotel room with a locksmith to open his safe. Kosanovich told the other two men he was looking for Tesla's will. Three assistant managers of the New Yorker Hotel and a representative of the Yugoslavian Consulate were present as witnesses. Sweezey took a book from the safe, and the safe was then re-closed with a new combination that was given to Sava Kosanovich. If Kosanovich found a will he never produced it because Tesla is recorded as dying intestate. (Kosanovich did, however, eventually collect together all Tesla's remaining writings and equipment, which is now housed in the Tesla Museum in Belgrade.)

On the same evening, Colonel Erskine called the FBI to tell them that Tesla had died and that his nephew, Kosanovich, had seized papers which might be used against the US Government. The FBI made an immediate inquiry in New York, confirmed that Kosanovich and others had entered Tesla's room with the aid of a locksmith and contacted the Alien Property Custodian to retrieve the items seized on behalf of the Government.

Mr Fitzgerald of Alien Property Control then went to the hotel and took away all Tesla's remaining property, which consisted of about two truckloads. The articles were then sealed and transferred to the Manhattan Storage and Warehouse Co. NY, where other Tesla effects, a further thirty sealed barrels and bundles, had been stored since 1934. The Alien Property Custodian then seized all Tesla's effects on Saturday morning, and called in naval authorities to make microfilm copies of all his papers.

The FBI also discovered that Tesla had stored an invention in a safe deposit box at the Grosvoner Clinton Hotel in 1932, but when the agents tried to claim it, the hotel refused to release the contents of the box unless Tesla's unpaid bill was paid The hotel did agree, however, to notify the FBI if anybody else tried to get at it.

FBI records state that Sava Kosanovich was trying to gain possession of Tesla's effects, and that it was concerned that Kosanovich might make this information available to the enemy. The FBI consulted the scientific advisor to Vice President Wallace, and was told to lose no time in doing whatever. was necessary to preserve Tesla's effects. It was were also told that Tesla had completed and perfected his experiments in connection with the wireless transmission of power and had developed a new torpedo. The plans and a working model that cost $10,000 to build, were in the safety deposit box of the Grosvoner Clinton hotel. The model was connected with Tesla's Death Ray or the wireless transmission of electrical current.

The Bureau, ordered to keep the Vice President informed of what actions it took, decided to approach the State's Attorney concerning the possibility of arresting Kosanovich on a burglary charge and therefore getting back the papers he had taken from the safe. At that point, the Alien Property Custodian took over responsibility for the securing of Tesla's property and the FBI record ends.

A Memo was sent out from J Edgar Hoover instructing that 'all matters connected with the late Nikola Tesla are to be handled in a most secret fashion in order to avoid any publicity in respect to Tesla's Inventions and that every precaution be taken to preserve the secrecy of those inventions'.

So Tesla's life's work was declared TOP SECRET and discussion of it forbidden.

Ironically, Tesla's Death Ray was real, and it is only in the last few years that science has caught up with him. On 18 October 1993, the US Department of Defence announced it was starting to build an experimental ionospheric research facility in Gakona, Alaska. This facility, known as HAARP (High Frequency Active Auroral Research Program) was built by the Raytheon Corporation and involves the Universities of Alaska, Massachusetts, Stanford, Penn State, Tulsa, Clemson, Maryland, Cornell, UCLA and MIT in its program of experiments to study the resonant properties of the earth and its atmosphere. The link with Tesla's work is clear. HAARP is studying exactly the same phenomena which Tesla first considered nearly 100 years ago in Colorado.

HAARP is based on the ideas of Bernard Eastlund, who holds three US patents (4,686,605 - 4,712,158 - 5,038,664), all of which have been issued as improvements on the patents-first issued to Tesla after his Colorado tests. The titles of the patents, which have to be shown to be practical before a patent is issued, are: method and apparatus for altering a region in the earth's atmosphere, ionosphere and/or magnetosphere; method and apparatus for creating an artificial electron cyclotron heating region of plasma; and method for producing a shell of relativistic particles at an altitude above the earth's surface.

This last patent, which describes an anti-missile shield which could destroy the electronics of hostile missiles or satellites, is the realization of Tesla's Death Ray. It works by creating a plasma packet of high energy particles - Tesla's Colorado ball lightning on a large scale.

So, on two counts, Tesla had the last laugh: his 'teleforce' has finally been built and he won a patent battle with Marconi, after he had been dead for six months, the US High Court confirmed it was Nikola Tesla who really invented radio! This was, however, a hollow victory. Both patents had expired, both men were dead and nobody could talk about it because there was a Top Secret order forbidding all talk of Tesla's work.

The end result of this sad chain of events is that one of mankind's greatest benefactors is almost forgotten. Tesla died as he lived, alone, lonely and Top Secret, consigning himself to years of obscurity because of his last alarming offer to the US Government.

He was a scientist of dazzling brilliance, a prophet who really did see into the future but was unrecognized in his own time. He was such an individualist, so self-centred that he never formed a close relationship with anybody, man or woman. Yet he was an enormously cultured: spoke many languages and was very well read. In his later years, he partly made his living by translating literature into Eastern European languages. But he never formed any lasting businesses or links with institutions which would have preserved a record of his achievements. The Tesla Museum in Belgrade was only established long after his death.

Any chance of celebrating his life's achievements was lost by the panic that his death caused in wartime USA - his life's work filed as Top Secret by the FBI, US Navy and Vice-President Wallace, and it is only now, almost 100 years later, that we can remember him openly. He must have been difficult man to work with, his workaholic attitude and his failure to suffer fools gladly would have meant that lesser engineers suffered from his tongue. But what a splendid companion he must have been at the dinner parties that he held in his prime.

I sit here surrounded by this man's legacy: my electric-powered computer at my side in my study, lit by fluorescent electric light, heated by water pumped by an AC induction motor, listening to music broadcast on my mains-powered radio. As my scanner and Internet modem sit on the desk, ready to send and receive pictures and messages round the world, I am using Tesla's legacy.

As the sun sets over the Pennine hills, I look out on an array of Tesla's monuments carrying electricity around the country. In the distance I can see the megavolt cables of the National Grid strung between their high pylons as they hiss and crackle in the damp evening air. Across the valley runs a twin-stranded 11,000 volt local distribution line strung between its T-shaped wooden poles, and I can just see the transformer which drops the voltage to a safe 240 volts for the short cable run into my house.

When you next see a line of electricity pylons carrying the power that grants you a civilized life, put one hand in your pocket and spare a moment to thank Nikola Tesla, the lonely, forgotten, long-winded, obsessive, brilliant man who gave this to you.

Tesla summed up his own life in these few words:

*I continually experience an inexpressible satisfaction from the knowledge that my polyphase system is used throughout the world to lighten the burdens of mankind and increase comfort and happiness, and that my wireless system, in all its essential features, is employed to render a service to and bring pleasure to people in all parts of the world.*