

Tesla: Inventor of the Electrical Age. W. Bernard Carlson. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2013. xiii + 500 pp. Price: US\$ 29.95/£19.95.

The author Bernard Carlson has put a herculean effort in presenting a detailed biographical study of one of the greatest engineer–scientists of human history, Nikola Tesla. Carlson is a professor of Science, Technology and Society in the School of Engineering and Applied Science and also a Professor of History at the University of Virginia, USA. The book may be treated as a benchmark by future biographers of inventors and scientists.

In his own words, Carlson has ventured to address three questions – ‘How did Tesla invent? How did his inventions work? And what happened as he introduced his inventions?’ The task Carlson set for himself was unenviable. This is so in terms of the volume of work, the complexity of technical subjects dealt with, the challenges of cleaving through the cultural background and social setting around Tesla in an effort to set up a perspective of the difficulties he faced and most importantly, the immensely prosaic target of explaining the nearly insurmountable financial and legal threats faced by the ‘wizard’. A long life of 87 years, an eventful boyhood and adolescence, changes of home, then homeland and finally continent, possession and repeated demonstration of unparalleled intellectual power, relentless success in breakthrough inventions, repeated recovery from near-fatal health conditions, choking financial and legal distress situations of an extremely original thinker, an egotist, a rare precocious talent, a rest-

less genius, a true visionary and a weird, over-daring showman with a deep spiritual bent of mind – all these complex combinations provide too much on the platter for any biographer of this maverick inventor – often considered second only to the legendary Leonardo da Vinci. Even though Carlson’s effort has been successful, to say the least, there are a few gaps left by this very capable science historian, for a technical reader like an electrical engineer.

The author has chosen an attractive style to welcome the reader into his introductory chapter entitled ‘Dinner at Delmonico’s’. He sets up an enthralling backdrop of Tesla, a 38-year-old young electrical wizard at the zenith of his glory and fame in 1894, with the entire world thirsty about the on-goings during each day in the life of this star. Hereafter one is led to the family background, in Serbian setting, and then the arrival of Nikola into this world with the stroke of lightning and thunder – a significantly ‘electric’ entry. In an Indian perspective, one is reminded of a similar birth of one of its greatest scientists, Meghnad Saha.

A maiming blow to a very talented Tesla family came in the form of a fatal accident of the eldest son Dane, ‘an intellectual giant’ in the making. This, as the narrative clearly holds out, put all expectations and overcautious care on the other son Nikola. The family’s life changed and so also that of Nikola after an ‘ideal childhood’. After regular instances of extraordinary inventor-like temper, follows a story of gripping days of ups and downs in the family. During a miraculous recovery from a life-threatening illness, Nikola blackmailed his father into agreeing to send him for an engineering course at the Joanneum Polytechnic School in Graz, in the then Austrian Empire. It was during his incomplete but dazzling initial days in the engineering course that Nikola differed with one of his favourite teachers regarding what appeared to him as a basic error in existing concepts and explanation of principles of electric motor operation. This initiated an intense but original intellectual pursuit. It is here that he started ‘Dreaming of motors’ (chapter 2). In an against-the-run-of-the-story development, Nikola goes astray for some time with Djuka, the extremely active and intellectual mother, never losing belief in the special powers of yet another immensely gifted son. The death

of the heart-broken father Milutin, sobers down a restless, confused but daring Nikola as he decides in favour of ‘Learning by doing’ (chapter 3). The author minutely tracks young Tesla chasing an ‘electrical dream’ and looking for subsistence. All along, one true friend, Anthony Szigeti, stood rock solid behind a wavering Tesla. Thanks to Szigeti, Tesla regained in health and in confidence to clinch his first major intellectual victory in the form of conceptualizing the entire theoretical details of a novel concept of the rotating magnetic field and its logical conclusion – the induction motor. We find Tesla getting employed in a number of establishments like Telephone Exchange, Paris, works of Ganz and Company, Budapest and S. E. Edison, Paris before finally landing up at the Edison Machine Works, New York. Irreconcilable differences between Edison and Tesla – an aged, established and seasoned American inventor rising from a telegraph message-boy on one side and a barely 30 year old, technically brilliant, daring, talented hardworking Serb from the continent on the other – led to Tesla leaving Edison’s company and even trying ditch-digging for subsistence. Yet amidst this hardship, ‘Tesla mastered the energy needed to’ try out his experiments and file a patent on a thermo-magnetic motor and try his own methods of ‘Mastering the alternating current’ (chapter 4). Incidentally, he met Peck and Brown, who would soon pave the way to his technical stardom. Tesla had got his breakthrough and the world, unlimited access to electrical energy for ever after. With their financial and legal guidance, and magnanimous funding from Westinghouse, Tesla unleashed the AC motor (chapter 5) followed by AC power generation and transmission technology (chapter 9). Tesla filed patents and secured inventions in hordes as he soared to international repute. He followed up each of his scientific visions by an experiment and that by an invention, in a continuous chain for 10 long years. He won reverential acclaim among scientists and engineers in Europe and in America, received honours from a host of universities, royalties from his patents, funds and logistics support from Westinghouse and respect from the public at large. Tesla was invited on lecture tours throughout USA and Europe (chapter 8). He became the first engineer–scientist to be thus worshipped by a large cross-section of



Newspaper sketch showing how Tesla planned to demonstrate his radio-controlled boat at the Paris Exposition.

the common society too. Carlson has held all these out in great detail. In his book here onwards, wherever the scope rose, Carlson has dealt with legal and financial complexities in excessive detail. However, to this reviewer, these lengthy accounts of legal/financial processes that either propped up Tesla in his heydays (1886–1895) or sunk him (1896–1905), appeared irrelevant at times. The same may be felt by some readers also with purely technical background, especially for an Indian mind.

As a celebrity, Tesla was now amongst the lords of the American society. Mark Twain and Joseph Jefferson were now among his close friends and admirers. So were many more stars of the then American society. The next major turning point was soon to follow in Tesla's life. Though his talent promised to become all the more productive, ironically the circumstances had turned around for the worse. Carlson holds out facts establishing that Tesla believed in his technical powers so much that he overlooked the signals of failing circumstances. He ventured upon a revolutionary wireless power and signal transmission concept (chapters 12 and 13) fired on by startling experimental success in the initial stages (chapter 10). In 1899, it is clear from the details (chapter 12) that Tesla spent one of the most productive R&D years of his life – deep and original scientific thinking, followed by precise calculations, setting up of insightful experiments, intense experimental verification and above all, boundless satisfaction of corroboration of one's own hypothesis – at

the Pikes' Peak, Colorado Springs. He took up building one of the most futuristic and expensive technological apparatus that any lone scientist-engineer has ever dreamt of. It was that of wireless transmission of electrical power throughout the globe, using stationary waves at around 6.6 Hz through earth. Few years back, this reviewer had the fortune of going through Tesla's diary of the work he did that year (*Notes from Colorado Springs: 1899–1900*, Nolit Publishers, 1977). With advanced understanding and technology, mankind is now reconsidering those plans. Tesla was clearly hundreds of years ahead of his time in his vision and technical skill.

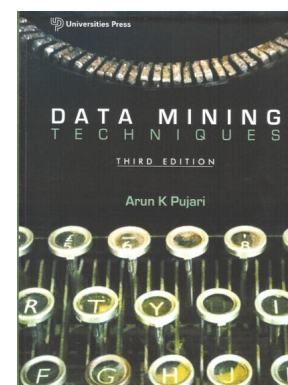
Tesla's technological apparatus required huge financial and logistic support. In the meantime both Peck and Brown, who assisted his meteoric rise, were no more. The magnanimous financier of those early years, Westinghouse, had also left this world. That these were indications enough for not venturing on, was one thing that Tesla never seemed to accept. Hence he relied on new-age promoters and financiers – J. J. Astor, the aristocrat, and the famed J. P. Morgan of Wall Street. No wonder, in spite of their track record in promoting/financing daring projects, they could hardly sense the expanse of Tesla's vision and hence remained apprehensive about the venture. To add to their apprehension was one of the greatest drawbacks of Tesla – ranting narcissism. Thus, after a promising start financed by Morgan, the 'Wardenclyffe' project (chapter 14) had to be rejected (chapter 15). Tesla remained a 'Vision-

ary to the end' (chapter 16) till his death in 1943, a debt-ridden almost penniless man: ever over-optimistic, reciting ump-teen novel technical contraptions. It appears from the book, that apart from lack of finance and his over-confidence, the two World Wars were the other culprits for cutting short his technical career.

Barring the use of a few technically erroneous terms at a few places, maybe due to simple oversight or common malapropism, Carlson has done an eminently admirable job in authoring this book. A co-author in the form of an electrical engineer would have surely made this book a masterpiece for all ages. Else, the numerous technical drawings remain unutilized. Carlson's reverence for Tesla, though skillfully concealed in language, is writ large all over the book in terms of the painstaking effort he has put behind this work. The way Carlson has presented the facts, instead of forwarding his personal views, has made his tenderness for Tesla, the architect of a new electrical age, subtly evident. The book is an essential asset for any library, particularly for universities and institutions of science, engineering and technology.

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Data Mining Techniques. Arun K. Pujari. Universities Press (India) Private Limited, 3-6-747/1/A and 3-6-754/1, Himayatnagar, Hyderabad 500 029. 2013. 3rd edn. xxii + 366 pp. Price: Rs 350.

The book under review provides an excellent introduction to data mining. Currently, there are several initiatives on