

## — *Book Review* —

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### DRIVING FORCE: THE NATURAL MAGIC OF MAGNETS

James D. Livingston

Harvard University Press, London, England, 1996, 310 pp, £16.50

"Wonderment Revisited" could also be a title for this unpretentious book on magnetism. James Livingston, a research physicist for General Electric for 30 odd years, is at pains to point out that his book was not written for children. Perhaps it is because he is concerned that his childlike sense of wonder at science and magnetism in particular be interpreted as childishness. I found his book refreshing and felt a rekindling of my old fascination with science that had been dulled by years of plant operation. Livingston illustrates the history of man's interaction with magnetism with anecdotes including Einstein, James Bond and World War II secret weapon.

He begins by exploring the properties of magnetism and electromagnetism for those unfamiliar with his subject. The laws of magnetism are introduced as ten "facts", presumably to make them more palatable for those without a scientific background. The applications of magnetism are then explored through the great adventures and military conquests of history.

Apparently the Chinese invented the compass around the time of Christ, but used it for superstitious purposes rather than navigation. Columbus' compass was made of a material that continually lost its magnetism and had to be re-magnetised using a magnetite block which he "guarded with his life". Livingston reckons that the deviation of magnetic north from true north may have saved Columbus' voyage of discovery from a brewing mutiny as he hit the Bahamas a few days sooner than the mainland for which he was navigating.

Rare earth metals were a by-product of atomic bomb research and their chemical properties were investigated after the Second World War. The history of the development of rare earth permanent magnets is covered in some detail, as Livingston himself was part of this research effort. His General Electric research laboratory in Schenectady, New York developed the first commercial rare earth magnets based on samarium and cobalt.

Superconducting magnets and their application in particle accelerators and the more mundane theories of magnetic domains are all dealt with consummate ease in his fireside story telling style. The story of the "battle of the currents" which was finally won by Westinghouse and his AC proponents is told with light hearted humour including the untimely demise of some cats and a horse.

Computer memory devices and video cassette recorders as well as ATM cards are today's largest and fastest growing use of magnets and it all began with a Danish

engineer, Valdemar Poulsen and his "telegraphone" which used steel piano wire as its recording medium in 1898. Germany had the best recording technology during the War and a conquering American commander took home some booty in the form of a plastic tape covered with fine iron oxide and formed the Amplex Corporation producing magnetic tape for the entertainment industry.

A chapter is devoted to the principles of magnetic levitation and the maglev train and how America lost out to the Japanese and Germans in the race to develop the first commercial maglev line. "Magnets at war" deals with the frantic rush to stay ahead of the enemy in World War II. Hitler having boasted of his "secret weapons" unleashed his magnetically activated mines on British waters with devastating effect. A brave bomb disposal expert saved the day when, suspecting magnetism as the trigger mechanism, dismantled a mine with non-magnetic tools. The development of radar during the war and invention of the magnetron to improve the performance of radar not only helped defeat the Third Reich but the magnetron is the basis for modern day microwave oven.

Glimpses of the brain at work as we think, feel, dream and imagine have been made possible by modern medical imaging, and MRI is explained in some detail. These machines have given new insights in the development and functioning of the human brain. However, a whole chapter entitled "Mesmerism and Magnetic Theory" is wasted on New Age type mumbo jumbo, which I felt, had no place in a scientifically sound and informative book.

Livingston has obviously had fun in his career with magnets and in writing his book and I found his dry sense of humour enjoyable. Be warned: his playfulness is infectious.

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