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ENGINEERING HISTORY PAPER #52

"The History of Engineering: An Introduction"

by Andrew H. Wilson
(previously produced as Cedargrove Series #25/2013 – May 2013)

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Abstract

This paper was presented originally as a talk by the author to the SAGE Group of the Kiwanis Club of Ottawa on 27 June 2012. It was designed for an audience whose senior-age members included few engineers and had had no previous exposure to engineering and its history. It was not seen originally as part of the Cedargrove Series. Also, much of its content has been included in other papers in the Series. However, second thoughts about its usefulness as introductory 'stand alone' - yet substantive - material for other non-engineering groups changed this view.

The paper deals first with some definitions and some ancient history, and moves very quickly through the centuries, paying particular attention to Canada. It then has some things to say about engineering history in different regions of the world, again with special reference to Canada. The original talk was illustrated with slides, some of which have been reproduced at the end of the paper.

About the Series

Principally, the Cedargrove Series is intended to preserve the research, writing and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, a modern-day variant of the privately-published books and pamphlets written by his forebears, such as his paternal grandfather and grandmother and his grandfather's brother John.

About the Author

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired over 25 years ago.

He became actively interested in the history of engineering on his appointment to chair the first history committee of the Canadian Society for Mechanical Engineering in 1975 and has been active ever since in research, writing and editing historical material on behalf of that Society, the Engineering Institute of Canada and the Canadian Society for Senior Engineers. He has also served as president of CSME and EIC.

To those of you who are engineers, my apologies in advance. I may not mention your favourite piece of engineering history. But there's always the question period!

I brought my own piece of engineering history with me today. The slide rule I started with 67 years ago. But I haven't used it in over 30 years!

It seems that, these days, the study of history, generally, is being largely ignored - and the engineering part of it even more so. Not many professional historians are working in the field, and the amateurs are very few indeed.

But actually, evidence of the *Canadian* engineering part is all around us for all or most of the 24 hours of any day.

For example, as well as what you can actually see, there are the books written by the likes of Robert Legget, Norman Ball and Robert Passfield. (I have brought a sample of such books with me this morning; please feel free to browse.) There are also biographies of people like Sandford Fleming, the Shanly brothers and C.D. Howe. There are several about the building of the CPR and about Canadian aviation. There are company histories of, for example, SNC and the Montreal Engineering Company. And the *Canadian Encyclopedia* has sections on the history of engineering and technology. There are articles in magazines and in publications by engineering societies and museums. But you won't get much help from the movies. However, there are several TV channels - such as TVO, Discovery and History - that have engineering shows. But there are no such fictional shows to match the medical ones, except perhaps MacGyver - although his exploits are erroneously attributed to 'science.' And if all else fails, you can appeal to the Internet.

When I speak of *engineering* I am not speaking of science and/or technology. To me, these are bodies - storehouses, if you like - of knowledge, of information. Engineering, on the other hand, is an activity that results in the building of the likes of the Parliament Buildings here in Ottawa, or the Welland Canal, the CN Tower, and the Lion's Gate Bridge, the manufacture of automobiles, aircraft and paper, and the processes that produce food, pharmaceuticals and gasoline. Engineering has a number of sub-activities, such as design, development, construction, research, operations and education. It has a lot to do with experience, safety, and risk. It also needs customers and sources of finance, and it needs to be marketed.

The activity of engineering is a lot older than the use of its name. The earliest manifestations of it - very many thousands of years ago - were the discovery that some materials are harder than others and could be used to make tools and weapons, the discovery of fire, and the discovery that fire's heat could turn iron and lead ores into usable materials. Along the way, our forebears developed uses for wheels, levers and wedges. They learned to dig canals for irrigation and the supply of water for other purposes, to use horses, oxen, camels and other animals to draw ploughs and to do other kinds of work for them.......and to make glass, and sails for boats.

Closer to our times - only a *few* thousand years ago - the Sumerians drained the marshes along the Euphrates River and the Egyptians built their pyramids. A little later, the Romans built bridges, aqueducts and water systems and the Chinese built their Great Wall. Speaking of the Romans, around the first century BC, they discovered that possolana volcanic ash made excellent concrete that could even be used under water. And in the first century AD Emperor Vespasian ordered the construction of the enormous Colosseum in Rome.

The Middle Ages lasted from the 11^{th} to the 14^{th} centuries AD. In Europe, at this time, living was not easy. Disease decimated populations and wars took further tolls on human life. Yet these were times during which some magnificent structures were built - principally fortresses and houses of worship. These were the days of the master builders, who were both engineers and architects, as well as the first use of the term *engineer* in association with the design and construction of fortresses and weapons of war. They also saw the development of water-driven mills, flying buttresses, large mechanical clocks and printing.

Then came the Renaissance, which might be regarded principally as an Italian phenomenon. It coincided with the disappearance in Europe of slave labour and the development of mechanical devices to replace it. Its best-known *engineering* name is perhaps Leonardo da Vinci, but there was also Brunelleschi, Pallidio, Vauban and Galileo. And Georg Bauer wrote, under the pen-name of Agricola, his famous book, *De Re Metallica*. It was also the age of discovery - in particular, of North and South America - and the beginning of the transfer of technology to them from Europe.

Speaking of this transfer, it is important to remember that people who were not living in Europe or in the Near East before these times - in Asia and Africa as well as the Americas - had to develop their own engineering and engineers.....and they did so.

The next significant period in the history of engineering is the Industrial Revolution, which I prefer to divide into three and to bring it up to the present time.

The First Revolution lasted from around 1750 until 1850. It was mostly a British phenomenon, based on the increased and more efficient use of steam and the beginning of railroads. It was the time during which a lot of canals were built in Europe. The use of iron was also prominent. The first iron bridge was completed at Coalbrookdale in Shropshire, England, in 1779. Then there was the development of machine tools by Maudslay, Whitworth, Nasmyth and others. France made a special contribution to this Revolution through developments in engineering education. And John Smeaton, an Englishman, is usually credited with being the first to call himself a *civil* engineer, in contrast with a *military* one.