

The Ancient Engineers

One must endorse a book* which begins, "Civilization, as we know it today, owes its existence to the engineers. These are the men who, down the long centuries, have learned to exploit the properties of matter and the sources of power for the benefit of mankind." It is a pleasure to recommend this excellent and important book to readers of the *A.I.Ch.E. Journal*.

The author's review of engineering and engineers from early Egyptian times to the Renaissance is encyclopedic, and the short biographies introduced enliven the story. Many of the ancient engineers would be classified today as inventors, but engineering and invention were inseparable throughout much of history.

The author traces the course of civilization from its beginning with the domestication of plants and animals in Syria and Iraq. The importance of water in this development led to the first river-valley civilization and to the first engineering enterprises—irrigation projects. The wealth and power thus generated and their concentration into the hands of chieftains and priests led to the next engineering ventures—the construction of palaces, monuments, and temples and the development of military engineering for the protection of such structures and of the people.

The account of Egyptian engineering is devoted in considerable part to the story of the pyramids and the remarkable construction methods involved. The Egyptian origin of ribbed stone columns in carved representation of bundles of reeds or saplings which were used in the earliest construction is a fascinating story.

Irrigation canals were essential in the Mesopotamian civilizations, and the collapse of these centers was due in large part to the failure of these canals. It is not yet known, however, whether this failure was due to destruction in war or to the gradual salination of the irrigated land from the underlying salt beds through capillary action. Bucket pumps, stone bridges, and road paving probably were developed first in Mesopotamia.

That Greek engineers were not particularly distinguished, may have been due in part to the Greek disdain for matters of utility. All the world knows of their artistically magnificent structures, but they were, for the most part, the consequence of the perfection of existing methods and not of invention. For example, they could have done greater things with the arch, since they presumably had as much opportunity to learn of the arch as did the Romans, but they did not do so. On the other hand, the later

Greek peoples, the Hellenes, particularly those in Alexandria, initiated many new and radical departures. At this stage of history there were many records, and men's names may be associated with certain developments. Thus, Ktesibios invented the force pump and the metal spring, Philon the water wheel-driven bucket pump, and the great Archimedes discovered many mathematical and physical laws and invented an imposing array of devices of great utility. The oldest known engineering textbook, *Mechanics*, written by Aristotle and/or Straton, is of the Hellenistic period.

Roman engineers were in some ways the most remarkable of all. It is often charged that the Romans lacked inventiveness, but they took at least two giant steps forward. The first was the discovery of concrete, the second the invention of central heating. The Romans' extension and improvement of the arch and vault, their dwellings and apartment houses, baths, sewers, tunnels, aqueducts, public water supply, and roads were remarkable. The Roman roads were the best transportation system in Europe until the coming of the railroads. One of the greatest of ancient engineers, Heron of Alexandria, of steam turbine fame, is of the Roman era.

Oriental engineering began, as did engineering elsewhere, with irrigation, monuments, and engines of war. Probably the most imposing structure ever raised by man is the Great Wall of China, the only man-made object that may be seen from the moon.

The closing chapter is devoted to European engineers, those builders and inventors who lived after the fall of Rome. This is, to a considerable extent, an account of medieval warfare with its castles, armor, and siege engines—all outmoded by the later development of cannon and small arms. The great Gothic cathedrals and a few bridges represent achievements of a more peaceful nature. Leonardo da Vinci, one of the most interesting and inventive men of all time, was the giant of this period.

There are two details about this book which are particularly worthy of note. The index is excellent, and the dating system is very sensible and one particularly suited to this sort of book. The author uses + or - to denote A.D. or B.C., certainly a simple and rational system free of inconsistencies in language.

As the author points out, the evolution of religion throughout history has been discordant, that of science erratic, and that of the arts capricious, but the "one progressive, consistent movement" is the growth of technology. We must be proud of our ancient and honorable profession.

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*DeCamp, L. Sprague, *The Ancient Engineers*, Doubleday and Company, Garden City, New York (1963).