

Ancient Engineers' Inventions

HISTORY OF MECHANISM AND MACHINE SCIENCE

Volume 8

Series Editor

MARCO CECCARELLI

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Ancient Engineers' Inventions

Precursors of the Present

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Preface

We live in an age in which one can easily think that our generation has invented and discovered almost everything; but the truth is quite the opposite. Progress cannot be considered as sudden unexpected spurts of individual brains: such a genius, the inventor of everything, has never existed in the history of humanity. What did exist was a limitless procession of experiments made by men who did not waver when faced with defeat, but were inspired by the rare successes that have led to our modern comfortable reality. And that continue to do so with the same enthusiasm.

The study of the History of Engineering is valuable for many reasons, not the least of which is the fact that it can help us to understand the genius of the scientists, engineers and craftsmen who existed centuries and millenniums before us; who solved problems using the devices of their era, making machinery and equipment whose concept is of such a surprising modernity that we must rethink our image of the past.

But there is an even more important reason to study the History of Engineering: the authors believe that it is impossible to have a true technical culture if the ideas and the work of those who came before us are ignored. Culture, in whatever field, consists in understanding and not simply in know-how. For this reason it is essential to learn how a certain phenomenon was understood and how the application of that knowledge evolved through the centuries. For the same reason it is important that the scientists of our generation transmit an interest in and taste for the accomplishments of ancient engineers. Young engineers should be familiar with the knowledge of the past if they are to understand the present and perceive the future. Moreover, engineering must be considered that discipline that tries to give to man the possibility to outperform his body's limits.

This book describes the inventions and designs of ancient engineers that are the precursors of the present. The period ranges mainly from 300 B.C. to A.D. 1600 with some exceptions belonging to ages before and after these years.

As for the very ancient inventions, in the book there are descriptions of inventions (documented by archaeological finds mainly from Pompei, Herculaneum and Stabia) of which often very little is known.

Some of the inventions are in the military field since (unfortunately) many inventions and technological innovations were conceived starting from military applications.

In this volume the authors have considered several important fields of engineering; in each of these fields, they highlight the first examples of the inventions (and constructions) accomplished by scientists and engineers.

Although many of these inventions are extremely old, the ones presented in this book are precursors of the knowledge and inventions of our era. In addition, many of them reveal a surprising modernity in their conception, in their scientific and technical design and even in their shape and function.

The book is divided into six parts.

The first four parts pertain to specific fields and present inventions conceived up to the late Roman Empire. These are inventions that are representative of the engineering genius of the ancients and that may be considered as milestones, each in their respective field.

The fifth part also refers to separate fields of engineering innovations (such as textiles and automation), but concentrates on more recent centuries.

The last part, consisting of Chapter 16, deals with building construction techniques and not devices. These building techniques, in the authors' opinion, can also represent inventions.

For each of the inventions presented, even the ancient ones of many centuries past, the authors provide three elements of research and reference:

- Written documents (the classics)
- Iconic references (coins, bas-reliefs, etc.)
- Archaeological findings

The only exception is when an exhaustive and detailed treatise by the inventor himself is available (e.g., Vitruvius).

Many devices and building constructions described in the book pertain to the age of the Roman Empire; it could be presumed that this is so because the authors are Italians, but this is not the reason. Undoubtedly the Roman Empire was a society of great accomplishments (probably even today not yet completely understood) in many fields of science, technology and law; they started from the Italian peninsula but they do not belong just to the Italians. First of all, most of the inventions and

the technology of the Roman Empire were not invented by Latin inventors; in fact, one of the merits of the Romans consisted in recognizing, appreciating and using the intellectual abilities of other peoples. In addition, the quality of organization and the “sense of a State” has been retained more by the German and Anglo-Saxon peoples than by the Latin ones; hence the heritage of the Roman Empire, today, belongs to people who study and appreciate those ages and those men. Moreover, living in Italy, the authors have had more chance to see and investigate Roman relics. However, certainly a large number of the inventions that are precursors of the present were developed at that age.

As a point of reference, the authors think that the first industrial revolution started during the Roman Empire. Many aspects suggest this hypothesis: the Romans had a strong incentive to make great progress towards unification and standardization in the production of goods. At certain periods, the Roman Armed Forces had up to 500,000 men, all of whom had to be equipped with everything they needed to live, clothe and shelter themselves and fight. The army needed unified and interchangeable equipment because its military units had to be able to go anywhere in various sized units; this meant that unified industrial production systems were crucial to fulfil the army’s needs.

The resulting standardization, that probably was devised for those military uses, was subsequently extended to civil applications: many of the components used in the various systems, such as hydraulic valves and pipes (see Chapter 8), cart wheels and gauges (see Chapter 10) and so on, had standardized dimensions and were interchangeable throughout the Empire. This history was clearly delineated by Vitruvius, the most famous Roman engineer.

Finally, the authors did not write this book for engineers only; hence they describe the devices in details that do not assume wide technical knowledge. The authors’ main aim is to try to communicate their enthusiasm for the inventions and the inventors of the past and, possibly, to make their contribution to the fascinating study of the History of Engineering.

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