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## THE ADVANCEMENT OF ENGINEERING IN RELATION TO THE ADVANCEMENT OF SCIENCE<sup>1</sup>

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THE term engineering is employed with many different shades of meaning. Tredgold's famous definition of civil engineering, which appears in the charter of the Institution of Civil Engineers (London), dating from 1828, commences with the excellent phrase—"the art of directing the great sources of power in nature for the use and convenience of man." In Tredgold's time, there were only two recognized types of engineering—*i.e.*, civil and military. At the present time, nearly forty different branches of engineering have been itemized in technical literature. For the purpose of this discussion, the following broad definition is suggested to cover all types of non-military engineering: *the economic application of the sciences to construction, production or useful accomplishment, especially on a large scale.*

From this point of view engineering manifests itself as the activating principle in the industrial world. Engineering, in this sense, must not only be coeval in antiquity with civilization; but the degree of engineering attainment in any age must also necessarily be an index or criterion of its civilization, judged from the material aspect.

If, as has been claimed by many writers, the acquisition and first permanent maintenance of fire marked the dawn of civilization in the early history of mankind, it would have been the province of the nascent engineering of that time to make a study of the laws of heat and combustion towards the maintenance and distribution of fire in tribal communities. To primitive man, the science of combustion may well have seemed extremely difficult, elusive and complex. The first rational notions on the subject were probably mingled with many errors and superstitions. These psychological stumbling blocks may have hampered and hindered, for many centuries, the attainment of the degree of thermal scientific knowledge appropriate to man's mental and moral development of that period.

Coming down to early historic times in ancient Egypt, we find a considerable increase in scientific knowledge and its application by engineering, confined to a priestly caste. The sciences were assidu-

<sup>1</sup> Address of the vice-president and chairman of Section M—Engineering, American Association for the Advancement of Science, Kansas City, Mo., December 30, 1925.

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