

Title **Development of Power Generation Systems and Related Thermal Engineering Problems**

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Abstract

Technology development on the steam power actually started with the Newcomen engine in the beginning 1770s. In the middle of 1770s, highly-improved efficient Watt's engine appeared, while taking over from the Newcomen engine was not drastic but rather gradual. Such a feature is quite normal in the large infrastructure, e.g. in the power engineering field. In reality, up to around 1820 waterwheels dominated the large-power field. The general belief that the industrial revolution was accelerated by such steam engines may be misunderstanding of the technology development. At the beginning, the steam-engine technologies were grown up by the the circumstances, i.e. socio-economic environment including the development in agriculture, trading, mining and steel-making and so on. Political interaction between the nations played also an important role. After the expiry of Watt's patent, 1800, the steam pressure and the heat release rate, i.e. unit power output, increased highly and very rapidly, which accelerated the technology revolution, but caused frequent boiler explosions. To prevent explosions and/or to reduce risks, two kinds of approaches were conducted: the first one was, of course, researches on the strength of materials, heat transfer, boiling, and various auxiliaries, and the other was the development of social system of the third-party periodical inspections of boilers. The first approach reviled an importance of the water circulation for high-temperature wall and steam generation. This approach led to further R&D in boiler technologies, i.e. developments of water-tube boilers, forced-circulation boilers and once-through boilers. The latter approach was rather effective even at the present time. The success and survive of steam power owes to the intrinsic characteristics of the steam power, i.e. being suitable to large unit-power, and a variety of efforts to overcome accidents including above-mentioned social systems. In other words, the technology in general does not stand still alone but is moving in accordance with or with interaction between surroundings, which is indispensable principal concept for engineers. This lecture focuses on such development of steam power, especially boiler technology, and the discussion will be extended to the technology in general.

About the Speaker

Professor Mamoru Ozawa has performed engineering activities focused mainly on thermal engineering problems of power plant including flow instability problems in boilers and nuclear reactors, boiling heat transfer and critical heat flux, reflooding, fluidized-bed thermal hydraulics and combustion. Since April 2010, he has been vice-dean and dean of the newly founded faculty, Societal Safety Science, and is now focusing on safety issues of boiler and nuclear reactors. He is author and co-author around 27 books, around 160 journal papers and also 160 international conference papers. He served as a president of Heat Transfer Society of Japan (HTSJ) in the period 2015-2016. He is a fellow of JSME, a member of ASME, HTSJ and so on.

Host: Prof. Yasuyuki Takata

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