



ACOUSTICS IN THE CZECH LANDS DURING THE 20TH CENTURY

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ABSTRACT

Above all, it must be said that during the 20th century, the Czech lands were part of various state arrangements, which influenced the development of all branches of science and industry. The development of acoustics already dates back to the turn of the nineteenth and twentieth centuries and is particularly associated with the name of Vincenc Strouhal, the author of studies on wires experiencing vortex shedding and singing in the wind. In the period between the wars, the main development of acoustics was connected with the creation of radio and cinematography. At that time, the first companies focused on electroacoustics were founded. The real development of acoustics came after the Second World War, despite being hampered by the existence of the Iron Curtain, when the exchange of information or equipment between West and East was very difficult. In addition to the creation of a number of state-owned enterprises for the development of radio, television, and machine diagnostics, this period is also characterized by active associational activity, which after 1989 came under the Czechoslovak or Czech Acoustic Society. The article summarizes the historical development of acoustics in the twentieth century both in the field of research and in the field of industry and practical applications.

Keywords: *history of acoustics, Czech lands, Czechoslovakia, societies*

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1. INTRODUCTION

First of all, the author must admit that he is not old enough to remember the main moments of the history of Czech acoustics in the twentieth century. He is also not a historian to be able to analyze in depth all aspects of the development of acoustics. Therefore, this text is only his view of what he heard, read or looked up. During the 20th century, the Czech lands were part of various state arrangements from Austria Hungarian Empire through the First Czechoslovak Republic between the wars, the Protectorate of Bohemia and Moravia, the Czechoslovak Socialist Republic to the current Czech Republic and Slovakia. This influenced the development of all branches of science and industry including acoustics. In the text, we will try to look at the field of science and research, at the development of production companies connected with acoustics and finally at professional societies and organizations focused on acoustics.

2. SCIENCE AND RESEARCH

Research into phenomena related to acoustics is associated with a number of famous names in the Czech lands. During the period of the Austro-Hungarian Monarchy, Prague was an important center of science. The famous Charles University was located here, as well as today's Czech Technical University in Prague (which was called the Deutsche Technische Hochschule in Prag in 19th century) founded by Emperor Joseph I in 1707. For example, on May 25, 1842, a lecture "About the colored light of binary stars and some other heavenly bodies" was given by Christian Doppler (1803–1853) at a meeting of the Royal Society of Sciences in Prague. The first experiments confirming the Doppler phenomenon in acoustics were carried out with



locomotive whistles on the then-newly developing railway in the second half of nineteenth century, and due to the impossibility of directly recording and analyzing the changing sound, musicians with absolute hearing were engaged. Other scientists connected with acoustics who found their way to Prague are, for example, the Czech-German physicist Ernst Mach or, for a short time, Hermann von Helmholtz.

The most important Czech scientist was Vincenc (Čeněk) Strouhal (1850-1922), who was a student of the aforementioned Ernst Mach. In 1878 in Würzburg, he defended his habilitation thesis entitled *Eine besondere Art der Tonerregung* (A special kind of toner excitation). In his habilitation thesis, he achieved original results in the physics of fricative tones. He also derived a physical formula for the pitch of the vortex shedding tone (the tones produced by wind flowing over a cylinder or wire), using a constant that was later named after him the Strouhal number and usually denoted St . His most famous period is associated with the construction of the Institute of Physics of the Charles University. At that time he also published a number of textbooks on experimental physics, including a work entitled *Acoustics* (1902). In the years 1903 to 1904 he worked as rector of the university.

After the First World War, acoustics was not systematically taught or studied anywhere. The only exception in the twenties were the lectures of Václav Dolejšek on musical acoustics, who however became famous mainly for his works on the subject of X-ray spectroscopy [1]. At the same time, research work was being carried out at the Czechoslovak Radio, which was focused on the field of spatial acoustics and recording. The first anechoic room was also built in the radio laboratories in Prague [2].

In the period between the wars, there was also the first systematic measurement of noise in the streets of Prague (1935-1937) organized by National Institute of Public Health. It was measured at twenty traffic-frequented places, and on November 19, 1937, the city council declared a day of silence, resulting in decrease of noise of 5-8 phones [3].

From the point of view of the physical approach to acoustics, we cannot fail to mention Professor Josef Bartolomej Slavík (1900-1964). He was born to Czech parents in Bulgaria and moved to the Czechoslovakia only after graduating from high school in the 1920s. In 1927, he obtained the degree of engineer at the Faculty of Mechanical and Electrical Engineering at the Czech Technical University in Prague. In 1928, he became an assistant professor at the Institute of Electrical

Engineering. He later studied physics at the Faculty of Natural Sciences of the Charles University in Prague and in 1936 received the title of Doctor of Natural Sciences. At that time, he was already fully devoted to acoustics, where he focused mainly on room acoustics and the sound system of cinemas and stadiums. After the end of the Second World War, he was involved in the renewal of Czech higher education and founded the Department of Physics of the Faculty of Electrical Engineering of the Czech Technical University in Prague, which he headed until his sudden death during a lecture in May 1964. J. B. Slavík influenced a whole generation of acousticians, including Jiří Tichý (1927-2019), Oldřich Taraba (1922-2007) and Felix Kolmer (1922-2022). The Department of Physics is a leading workplace in the field of acoustics in the Czech Republic to this day. Research in the field of room acoustics, physical acoustics and noise and vibration control was carried out here; the ultrasound group led by prof. Taraba was also significant.

In the field of electroacoustics, we cannot forget Josef Merhaut (1917-2004), who started his studies before the Second World War, but could only finish his studies after it. After his studies, he joined the newly established company Tesla, where he was responsible for the development of electroacoustic transducers. In 1964, he was appointed professor and moved to CTU, where he founded the department of electroacoustics. At the end of the 1960s, he designed and constructed an electrostatic pressure loudspeaker, the solution of which attracted worldwide attention. His assistant and successor was Professor Zdeněk Škvor (1935-2015), who was also an excellent expert in electroacoustic transducers and was the inventor of a number of patents. He contributed significantly to the development of the doctoral study program Acoustics at CTU.

After 1945, state research institutes were also established, some focused on pure science united in the Czechoslovak Academy of Sciences and others focused on applied research. Among them, we cannot fail to mention Research Institute of Sound, Picture and Reproduction (VÚZORT), which was founded in 1945 and represented an important center for the study of acoustics and recording technology throughout the communist period. For many years, the director of the institute was prof. F. Kolmer. Another similar institute was VÚRT (Radio and Television Research Institute) founded at the end of the forties, where they focused not only on electroacoustics, but also on the construction of recording and television studios or the synthesis of musical instruments. After the democratic changes, most

of these institutions were privatized and subsequently transferred to another type of company or disappeared.

3. INDUSTRY

The development of electroacoustics in the former Czechoslovakia was connected (similarly to the development of low-current electrical engineering) with the wider introduction of the telephone and radio broadcasting between the world wars. We can find here, for example, brands such as the Knotka brothers' Microphona (founded 1926) which mainly manufactured telephones, telephone switchboards and later also radio receivers. Especially in the Bohemia, it was possible to find branches of then-starting concerns such as Blaupunkt (originally called Ideal) or Siemens. Everything was interrupted by the Second World War, when part of the manufacturers were absorbed by German companies and transferred to war production. For example, the company Microphona produced aircraft instruments. One of the largest companies was called Elektra Praha and was founded on 18 January 1921 with exclusively Czech capital and sold to the Philips concern in 1932. This company had a wide range of production - light bulbs, tubes and radio equipment, including transmitters and receivers.

After the war, as part of industrial consolidation, all large industrial enterprises were nationalized. In the case of the electrical industry, they were included under the TESLA heading.

The national enterprise TESLA Strašnice was founded on August 10, 1946, through the nationalization and merger of originally separate companies - they were either Czechoslovak companies or, more often, branches of foreign concerns. The naming of the company after the brilliant Slavic engineer Nikola Tesla documents the effort for rapprochement and cooperation between all Slavic peoples. Officially, TESLA was the successor of Elektra Praha, however, it was ceremoniously founded in the headquarters of Microphona.

During the period of socialism and the planned economy, Tesla included all the development and production of low-current electrical engineering. Production plants were located all over Czechoslovakia. It also included some research institutes focused mainly on consumer electronics and telecommunications. For example, Tesla Valašské Meziříčí, founded in 1954, was focused on the development and production of loudspeakers, speaker systems and headphones. From the point of view of electroacoustics, Tesla Litovel

should also be mentioned, where gramophones and later CD players were produced. In Slovakia, let's mention, for example, Tesla Vráble, where amplifiers and sound chains for cinemas and theaters were produced.

After social changes in 1989, individual parts of the company became independent and privatized. Most of these enterprises disappeared over time, because their condition after a long period of communist management made them unable to compete in the new market environment. As an example, let's mention once again Tesla Valašské Meziříčí, which was privatized in 1993 and renamed TVM. In a competitive environment, it survived until 2010, when it disappeared without a replacement.

To mention at least something positive, in 1994 the Italian loudspeaker systems and power amplifier designer Roberto Barletta immigrated to the Czech Republic and two years later he founded the company Xavian Electronic. The company has since grown to become one of the major player in the Hi-Fi world.

4. PROFESSIONAL GROUPS AND SOCIETIES

We do not know much about the association of experts in the field of acoustics in the period between the wars. We only know that there were associations focused on recorded music, i.e. gramophone records. Also in the 1930s, the first Czechoslovak Acoustical Society was founded, but we know nothing about its focus and members (apart from Prof. Slavík) [2]. After the Second World War, there was a rapid development of electronics, which followed on from wartime production. This led to the establishment of various associations. However, after the communist coup, any association that was not controlled by the communist state was suspect. This also applied to acoustics and related fields.

In 1951, the ICA (International Commission for Acoustics) was established, where Czechoslovakia was presented. Following the example of this international organization, in 1959 the Acoustical Commission was established at the Czechoslovak Academy of Sciences to represent Czechoslovakia at the ICA. Logically, Prof. Slavík became the first president and after his death in 1964 he was replaced by Prof. Kolmer. This Acoustical Commission also represents our country in FASE (as a founding member), the predecessor of EAA.

A year later in 1960, the (state-controlled) Czechoslovak Scientific and Technical Society was founded, which consisted of a number of professional associations and

commissions. One of them was the Commission for Environmental Technology, which also included a professional group called Noise and Environmental Acoustics. Among the founders we find names like J. B. Slavík or Jiří Tichý, later the group expanded to include medical doctors focused on hygiene aspects (Prof. J. Havránek) and hearing (Prof. K. Sedláček) as well as electroacoustics (Prof. J. Merhaut). This group included not only educators from universities, but also researchers from industrial research centers. Members of this group, with the support of the Acoustics Commission, organized the first international acoustics conference in 1961, of which a total of 30 were subsequently held. The main undertaking of this group was the organization of acoustic seminars, which have been held twice a year since 1964 (except when large international congresses were held in the Czech Republic and covid pandemy) [4]. The tradition of these was taken over by the Czechoslovak Acoustic Society and, after the division of the republic, the Czech Acoustic Society, and 103 of them have been organized to this day.

The formation of the standard acoustical society was related to the liberalization of the political situation in the country at the end of the eighties. Preparations for the establishment of the Czechoslovak Acoustical Society were already underway in autumn 1989, however, the first meeting was held on April 3, 1990, attended by 119 acousticians from Bohemia, Moravia and Slovakia. The society officially started its activities after the first general assembly, which took place on December 11, 1990 at the Czech Technical University in Prague. Those present elected Dr. Pavel Urban (1930-2021) as the first president, who led the society until the division of the republic. The society, like the republic, was divided into the Czech and Slovak parts on January 1, 1993, and the first president of the Czech Acoustic Society was prof. Zdenek Skvor.

Finally, let us remind you that there are other societies in the Czech Republic that include acoustics. For example, the Czech Society for Nondestructive Testing, which brings together experts in the field of ultrasound and acoustic emissions, is very active. Since the nineties, we have also had the Czech section of the Audio Engineering Society. Understandably, there is considerable overlap between members of individual companies.

5. CONCLUSION

This article is an attempt to summarize the development of acoustics in the Czech lands. It tries to present developments both in the local political context and on a global scale. The author is not a historian and therefore it

was not easy for him to find all the necessary information. It is therefore likely that some important events or persons have been omitted, for which he apologizes.

6. ACKNOWLEDGMENTS

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