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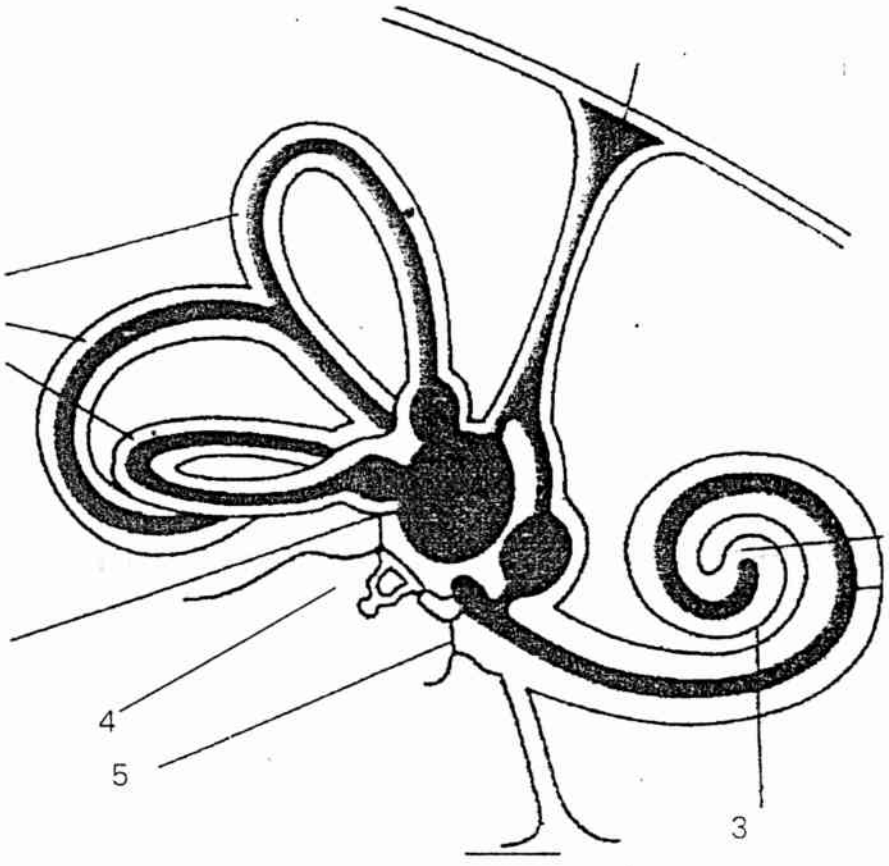

ON CENTENARY OF THE BIRTH OF THE NOBEL PRIZE WINNER
PHYSICIST, GYÖRGY BÉKÉSY

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THE FIRST MEASUREMENTS FOR HUMAN SPEECH-HEARING SHARPNESS

Éva T. Veress, Zsuzsa Sárközi, Alpár Vörös

Babeş-Bolyai University, Faculty of Biology and Geology,
Str. Clinicilor nr. 5-7, 3400 Cluj Napoca, Romania
valpar@atom.ubbcluj.ro

1. Introduction

The purpose of our article is to present and evaluate Endre Hőgyes's original audiometrical instruments first published in 1879 in the "Orvos Természettudományi Értesítő"[1], a work that has not been done till now because the original source is hardly accessible. The lexical reference of the theme is also incomplete. Our article also presents the results of the measurement-series and points out the importance of Hőgyes work for the development of medical sciences in general and for György Békésy subsequent work in particular. Thus the first instrument for measuring hearing sharpness with a valve was used by Békésy in 1923 at the János Hospital from Budapest.

Our intention is to make Hőgyes work better-known and to pay our tribute to his memory on the 120th anniversary of the measurement-series performed by him.

2. The antecedents of the hearing sharpness measuring instrument

Endre Hőgyes (1847-1906) the physician, educator and the outstanding public figure can be considered the forerunner of György Békésy in the field of audiology. The importance of his scientific activity is due to the fact that he introduced Pasteur's antirabic vaccine in Hungary and improved it in the form that is still in use. Nevertheless there are few who know about his audiological

studies. Between 1875 and 1883, as professor at the General Disease and Pharmacology Department of the Hungarian Royal University of Cluj (Transilvania), he constructed an epoch-making instrument for measuring hearing sharpness.

The possibility of constructing this instrument was due to the invention of the magnetic loudspeaker (Reis 1861) and of the headphone (Bell 1876)[2]. The news of these inventions reached Cluj on the 12th of January 1878, when Antal Abt, a professor at the University was delivering a lecture that presented the telephone[3]. Two months later, in March, Endre Hőgyes presented the results of his phone system based measurements with a telephone structured magnetoinductor for stimulating nerves and muscles[4]. In April he presented his instrument for measuring hearing sharpness that was based on the principle of telephone[5] and it's detailed description and practical application was published in the following year's *"Orvos Természettudományi Értesítő"*.

3. Description of the instrument

The first version of the instrument of the instrument for measuring hearing sharpness and for selecting people who suffer from impaired hearing had the following main parts: primary circuit made up of 1. speaking phone (*A*), 2. hearing phone (*B*) and a secondary circuit containing a Siemens-bridge (*C*) for the variation of the volume of sound at will in the hearing phone. The sound source was a metronome (figure 1.).

The fact that he realised that the decrease of volume might create sensory illusions proves how thoroughly he analysed the problems that might appear during the measurements. He avoided this by inserting a Pohl gyrotop between the resistance bridge and the hearing phone, which could interrupt the circuit of the hearing phone. If the person did not signal the interruption of the sound he knew that it was sensory illusion and repeated the measurements.

instrument by two rooms or, at field work, the person and the instrument were placed on different levels (ground-floor, cellar).

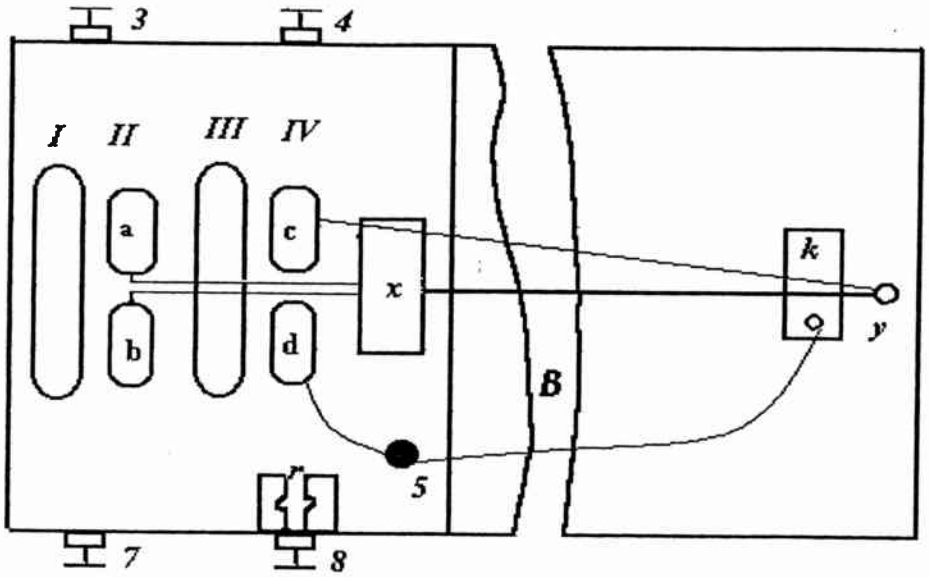


Fig.2. *The second instrument rheostat's line diagram.*

The general aim of the experiment was to determine the average hearing sharpness and to select those with reduced hearing and with impaired hearing. In the case of the first instrument this was expressed in Siemens units[i], while in the case of the second one it was given by the length of the platinum or silver wire. The results were reproducible. To have results that could be statistically analysed they worked with a great number of persons (257) who were mainly students. The measurements were made in Cluj and Şardu (Romania). The average duration of a measurement was about 15-30 minutes.

4. Results and evaluation

The measurement's were carried out by Endre Hőgyes's students, Lajos Kovács and János Kertész[6]. The results showed that out of the 257 examined people 194 was normal hearing persons. The average values taken from these

[i] Siemens unit: the resistanse of a mercury column at 0°C with 1mm^2 cross-section and 1m length.

measurements gave the average hearing limit of a normal ear. The lower limit of reduced hearing was also determined: it corresponded to 40 cm platinum wire length. For picking out those who suffer from impaired hearing the platinum wire was replaced by silver wire.

The instrument was used only for qualitative measuring, because at that time the notions related to hearing were not cleared up yet.

The advantages of Endre Hőgyes's instrument compared to the instrument developed by Kronecker and Hartmann in the same year were the following: Hőgyes used a metronome and then an electromagnetic bell as a sound source, while Daniel Hartmann used a tuning fork which was kept vibrating by a Daniel-battery. Further, Hőgyes excluded the possibility of sensory illusion while Hartmann overlooked this thing.

Hartmann's instrument was hardly usable, that is why the research was not continued by them, while Hőgyes's instrument was suitable for field work.

Although the instrument invented by him had its limits, too, it can be considered as the first audiometer and the measurements made with it, the first series of measurements on a world scale. This is why Endre Hőgyes can be considered the father of audiometry.

REFERENCES

[1]E. Hőgyes, Módszer a halló erőnek telephonnal való meghatározására, *Orv. Term. Értesítő*, ed. by Erdélyi Múzeum Egyesület, **4(1)**, 1879, 90.

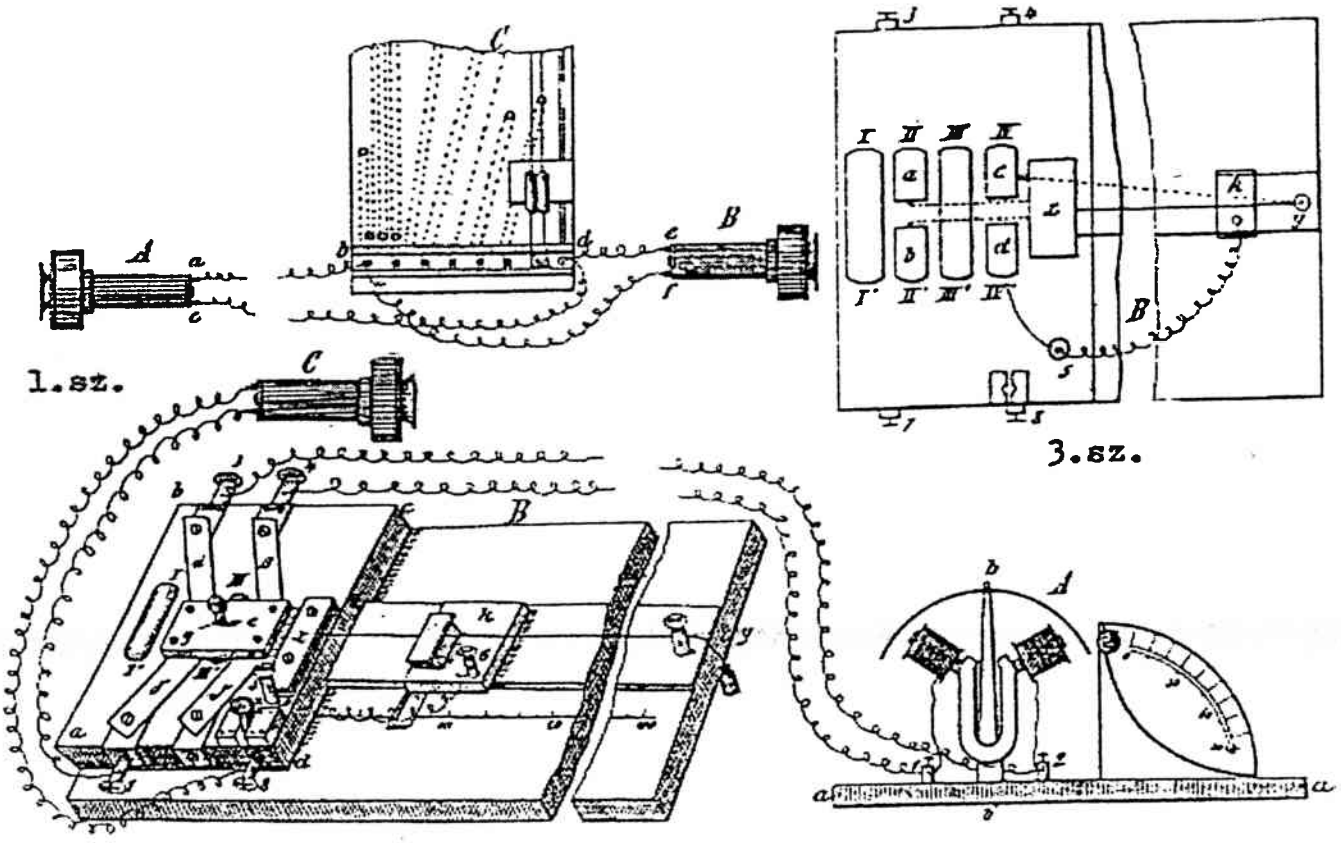
[2]Á. Götze, A hallóképesség vizsgálatának kialakulása. *A gyógypedagógiai tanárképző főiskola évkönyve*, Budapest, 1971, 215-229.

[3]A. Abt, A telephonról, *Értesítő*, ed. by Erdélyi Múzeum Egyesület, **3**, 1878, 1-4.

[4]E. Hőgyes, Telephonszerkezetü Magnetoinductor ideg-izom izgatásokra, *Értesítő*, **3**, 1878, 5-7.

[5]E. Hőgyes, Módszer a halló erőnek telephon által való meghatározására, *Értesítő*, **3**, 1878, 12.

[6]L. Kovács, J. Kertész, A hangerő felfogás alsó határai telephonikus meghatározások alapján, *Orv. Term. Ért.*, **5(2)**, 1880, 125-188.



1.sz.

3.sz.

2.sz.

ábra. Högyes Endre hallásmérő berendezése

1.sz. első változat

2.sz. második változat

3.sz. a második változat áramköre