



Augustin Maior

Physicist, inventor of frequency multiplexing transmission (1882-1963)



He was born at Reghin on 21 August 1882, was educated at the Piarist High School in Târgu Mureş (1896-1898) and the Catholic Gymnasium in Budapest (1899-1900), and attended and graduated from the Polytechnic Institute in Budapest (1900-1904). He specialised at the University of Göttingen (1905). In 1910, he participated in the international conference for engineers in the P. T. T. (Postal, Telegraph, and Telephone Services) domain from Paris, as the delegate of Austria-Hungary, and in 1912 he was elected as a member of the board of directors of the Postal, Telephone and Telegraph Services in Hungary.

In 1919, he was appointed Director General of the Postal, Telegraph and Telephone Services in Transylvania, and Director of the Institute of Theoretical and Applied Physics, from the Faculty of Sciences of the University in Cluj. In 1919, he established the first school of telegraphy and telephony, in Sibiu. At this school he taught the course of “Telegraph and Telephone Transmission Equipment.” From 1920 he was a Professor of Physics at the University of Cluj. In 1946 he was elected Dean of the Faculty of Sciences, the University of Cluj, and a full member of the Romanian Academy. Augustin Maior died in Cluj in 1963.

Augustin Maior began his pioneering work as regards the use of the same cable for several simultaneous calls in 1905, in the laboratory of the General P. T. T. Directorate in Budapest. The works were completed in 1907, when he succeeded in the transmission of five telephone messages through a single transmission line, 15 km away. The method used was and still is the same: carrier frequency multiplexing. To separate multiple calls on the same line, Augustin Maior used, also for the first time, the electric (electronic) resonator rather than the mechanical one that had been used in telegraphy prior to him. His practical results were presented at a high scientific level, laying the theoretical grounds for a new method in telecommunications.

He envisioned the use of electronic tubes, the triode, which had just been invented by the American Lee De Forest, in 1907. His theoretical works tackled signal distortion, long-distance transmission and efficient transmission (minimum loss of signal energy at resonance).

A. Maior demonstrated that distortions were reduced when the circuit approached resonance and when the carrier frequency increased. At the time, *carrier frequency multiplexing* was called the *multiplex carrier current transmission*. It is through this



method of carrier frequency multiplexing that all telecommunications are achieved today, irrespective of whether they are wireless (radio) or through copper wire or glass.

His works in this area included, among others:

- "Über Mehrfach Fernsprechen," published in *Elektrotechnische Zeitschrift*, Berlin, 1907,
- "Über Wechselstrom Telephone," in *Elektrotechnische Zeitschrift*, Berlin, November 1908,
- "The Use of High-Frequency Alternating Currents in Telegraphy, Telephony and for Power Transmission," in *The Electrician*, 6 February 1914, London,
- "Über das Einschalten langer Leitungen mit Wechselstrom," in *Elektrotechnische Zeitschrift*, Berlin, 1917.

In a note published in *The Electrician* from London on 21 April 1911, A. Maior said: "I showed... mathematically that multiplex telephony can be achieved with alternative high frequency currents so that each current may carry one call ... I mentioned that I was able to simultaneously transmit 5 calls. My experiments were presented at the first European Conference of Posts and Telegraphs (*our note*, 1908) and I communicated on a 15-km line."

Multiplex telegraphy had also been carried out before him, the signals being separated through mechanical resonators. In 1886, the Frenchman M. Leblanc presented in the review *La Lumière électrique* Elisha Gray's idea of using different frequencies for different telegraph messages, and E. Mercadier resumed the idea in 1893 in Chicago, again for "multiplex" telegraphy and also through the mechanical separation of frequencies.

After A. Maior, the German Ernst Ruhmer - the inventor of the phonograph - conducted an experiment in multiplex telephony in 1908, between his home and his nearby laboratory. In 1911, George Owen Squier officer (without scientific papers and pretences in this technical field) achieved, with his team of technicians, a multiple transmission on a very short-distance line, like Ernst Ruhmer.

In the second part of his scientific life, Augustin Maior delivered the courses on "Electricity and Magnetism" and "Acoustics and Optics" (1921) at the University of Cluj. His technical foresight and insight did not betray even when, as a dean in 1923, he approved Hermann Oberth's defence of his graduate dissertation entitled "By Rocket into Interplanetary Space," after Oberth's work had been rejected at the University of Heidelberg. He further investigated the gravitational field and quantum statistics, publishing works such as *On the Minimum Kinetic Energy of a Body in Motion* (1926), *On Radiation in a Gravitational Field* (1931), *Quantum Statistics* (1933) and *Gravity and The Slow Variation of Some Fundamental Constants* (1942).

O.C.