AUGUSTIN MAIOR – A PIONEER IN THE MULTIPLE TELEPHONY

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Rezumat. *Această lucrare prezintă unele elemente importante din viaţa lui Augustin Maior, precum şi contribuţii ale acestuia în domeniul ingineriei. De-a lungul carierei sale, Augustin Maior a activat în domeniul telefoniei şi telegrafiei, efectuând experienţe şi publicând lucrări despre transmiterea simultană a mai multor convorbiri telefonice pe distanţe lungi, cu curenţi alternativi de înaltă frecvenţă. Augustin Maior, prin activitatea sa, a fost un fizician, pedagog şi inventator, un savant român care şi-a adus semnificante contribuţii la activitatea ştiinţifică internaţională.*

Abstract. *This paper presents some significant aspects from Augustin Maior's life and his contributions in the engineering field. Along his career, Augustin Maior activated in the field of telephony and telegraphy, effectuated experiments and published papers about simultaneous transmission of more than one telephonic conversation on long distances, using alternative currents of high frequency. Augustin Maior, by his activity, was a physician, pedagogue and inventor, a Romanian savant who brought significant contributions on international scientific activity.*

Keywords: multiple telephony and telegraphy, alternative current in high frequency, electrostatic induction, telephonic and telegraphic signals.

1. Introduction

The savant Augustin Maior had essential support in the history of universal engineering by having contributions in the *telephony and telegraphy fields*. He realized studies; he did experiments and published papers about simultaneous transmitting of several telephonic transmissions in the same time on a physical circuit.

In that era, and even before, it were contoured the fundamental ideas, it were elaborated the methods, and the result was the appearance of telephonically systems with many channels. Realization of first telephonically system with carrier currents was the result of researches and experiments of many savants and technicians, but Augustin Maior was on top of all.

In the history of sciences and techniques, there were many cases where merits of very important inventions were attributed to other scientist, such as to scientists well known or with important funds for research, or who had a lot of publicity.

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In Maior's case, comparative to the big number of papers he published, he is referenced only in few cases, which in fact, seems to be an unjust situation. But Romanian literature mentioned Maior's work and tried to put his contribution from the telephony field in the first rank.

2. Life and studies

Before analyzing Maior's work, it is necessary to consider as an introduction the context in which Augustin Maior lived.

Augustin Sabiniu Maior was born August 21st, 1882, on the town Reghin, from the Mureş District.

He was the second born child of Gheorghe Maior and first born son of Tereza Maior (maiden's name Cornea).

The father, Gheorghe Maior was natively from parish Huduc. Today's name of the parish is Maioreşti.

Augustin's parents, Tereza (a well educated woman) and Gheorghe (a school teacher and later on the Principal of the Romanian Primary School from Reghin) raised 5 children: Olivia, Augustin, Iuliu, Gheorghe and Ana.

Between the years 1882 and 1892, Augustin spend his childhood with his brothers in his parent's house. He attended the German kindergarten in Reghin and later on he enrolled in the German primary school in Reghin.

Between the years 1892 and 1896, he was registered in the German Evangelical High School in Reghin, where he did his gymnasium classes I - IV and graduated from the inferior courses of the high school in the summer of year 1896.

Between the years 1896 and 1898, Augustin Maior continued his medium studies (5th and 6th grade) in the town of Târgu-Mureş, at the "Piarist" High School. Augustin proved himself through his superior capacity of learning foreign languages and through his interest and tendency on the exact sciences.

In the year 1898, the humanist's orientation of most of the High Schools from his area did not satisfy the expectation of the pupil Maior, who was too capricious in getting a good preparation in physics and mathematics. He wanted to continue his studies in Germany, but the financial status of his family was too low to cover the money for school; and it was too much for them handle it at one time. But, with a huge effort, Gheorghe Maior, the father, managed to send his son Augustin to study in Budapest.

In the year 1989, Augustin Maior got registered in the 7th grade of the Catholic Gymnasium in Budapest, where he attended for two years as a foreign student. He

would commute daily, from Rákosliget and back to the suburbs of the Hungarian capital where his sister Olivia lived. Since then, Augustin Maior continued to live in his sister's house for almost 15 years.

In the year 1899 he stood out by his special interest in physics. Maior gained the sympathy of the professor August Schmidt, a very good instructor and educator. The professor succeeded in stimulating the scientific interest of the pupil Maior through presenting him with a vast biography of physics at a higher level then he would present to the rest of the class. In a very short period of time, Maior gained a very vast knowledge of physics and mathematics, and he actually reached a very high level comparing to the level to be taught in school.

On April 22nd of the year 1900, Maior presented his first paper in front of the Scientific College of the High School. The paper, called "*Electrostatic Induction Phenomena*", was a synthesis *of electrization proceedings by influence* and still a modern explication given to the phenomena of *electrostatic induction*.

This first paper published of Maior's reflected high level of knowledge and his capacity of synthesis. The reference of this paper contained scientific publications from the years 1896 and 1899, belonging to Hertz, Yäger, Holzmüller and Wülner. This paper was presented exclusively in German language. The paper has been awarded the prize of the Scientific College, the "golden medal", who was in reality a golden coin who worth 20 hungarian crown (national hungarian coins from that time). The paper was published in the Annual of the Catholic Gymnasium High School.

In June 1900, Maior passed the bachelor's exam and received the qualification of a "good" and "exceptional" student. Then he registered in the Mechanical Faculty of the Polytechnic Institute in Budapest. Just few years before, this faculty had enrolled for a short while other Romanian students, such as Traian Vuia and Aurel Vlaicu. Considered to be as one of the highest education, or of the greatest prestige, the Polytechnic Institute in Budapest had staff teachers like Réjtö Sándor, Rados Gusztáv, Kürschák József, Réthy Mór, known as the among best scientists, the members of Hungarian Academy.

Between years 1900 and 1904, student Maior followed the courses of the Mechanical Faculty; evidenced himself trough the originality of his scientific thinking, trough his creative spirit that was always revealed and trough the passion showed for scientific researches in faculty's laboratories.

Right from his first year of study, he obtained a prize for the paper in the Analytical Mechanical field, even if this course was supposed to be taught only in the second year of faculty.

Student in the second year, Maior distinguished himself trough a paper called "*Roulement et glissement*" ("*Rolling and sliding*"), which was a theoretical study of *rolling and sliding of the bodies*. In that paper, he operated with elements of Analytical Mechanical that were supposed to be learned about only in the third year of the faculty.

Next year Maior obtained another prize, for a theoretical – experimental paper about *elastically tensions* that appears in metals on elongation and compression. Maior explained the appearance of the tensions based on the *theory of propagation of elastical waves* emerged in metals of deformation and based on *wave's interference*.

Practically, Maior wanted to demonstrate the appearance of *interference layers*, and he made an experimental study in the Mechanical Technology laboratory of his faculty in this direction. Until that date this was only a theoretical concept. The laboratory was headed by Réjtö Sándor, a great scientist and university professor. Until the end of his life, Augustin Maior had the appreciation, trust and affection of this teacher, as a student, and after that as a researcher.

At the professor Réjtö's suggestion, Maior, after his graduation, decided to ask his father's financial support for the continuation of his studies in Germany. Fascinated by the reputation of the University in Vienna but mostly in Munich and Gottingen, the young engineer Maior started a study travel for one year.

After discovery of the *electron*, in the beginning of the century, the tries of different scientists to elaborate a unified theory about *electrical properties of material*, the number and the value of scientific publications of every type from that time determined the professional orientation of the engineer Maior to electrotechnical field in the beginning and later to theory of electricity and electromagnetism.

The year 1905 was crucial for the science. In this time the *general theory of relativity* of Albert Einstein was launched. This would become the second and maybe the biggest passion of the theoretician Augustin Maior. In that time Maior was at the University from Gottingen as a foreign student. He attended the courses of F. Klein, D. Hilbert, H. Minkowski, C. Rünge, E. Riecke, W. Voigt, L. Prandtl, H. Th. Simon, E. Wiechert and R. Schwarzschild.

The scientific life of Maior in Germany has a strong influence in the spiritual formation of the young absolvent Maior. Versed with German language, he adapted quickly in this medium and had contact with J. Stark, N. S. Bose and young M. Born and P. Debye, who later on would appreciate Maior's papers about the *theory of physics*.

At the end of his first semester in Göttingen University, Maior returned at Budapest to sustain his dissertation from the Mechanical Faculty.

In April 1905, Maior returned at Göttingen for a summer semester. Here he attributed the modern conception of Hilbert and Poincare to the existing connection between all domains of mathematical sciences and the science of physics.

This conception was the base of all Maior's scientific activity. Taking his time with the study of differential equations and equations with partial derivates, the young engineer understood this as a valuable suggestion to put in application, in technical field and as a basis to the solution of these problems. Of the correct interpretation depended the solution for many technical issues.

The success that Maior had later on as a engineer was first of all due to his profound knowledge of mathematics, and second of all, due to his capacity to interpret in a originally and bravely manner the theoretical results, always accurate, proofed by Maior.

In November 1905, the Technical Services of Post at Budapest had an opening for an engineer position. Maior competed for it, and he answered competently on all questions of the commission, showing spontaneities in thinking, and making himself very remarkable.

In December 1st, 1905, Augustin Maior was hired as an engineer who got a daily fee in the electricity laboratory of experimental Post Station of Budapest. Being in his first 25 years of existence, the experimental Post Station was organised at that time after the European model of research centres from west of Europe. It had a library with the newest publications from science and technique. It also had laboratories with the most modern equipment at that time and research personnel with more than 60 employers, majority of them with high degrees, such as in enginery, physician and chemistry.

The research activity with applications in telecommunications developed in 2 fields: electricity and chemistry, from where it appeared 2 sections, with different profiles, which functioned in the Hungarian institute.

In the laboratory of electricity, which was leaded on the beginning by Váter József and later on by Béla Gáti, is a serious activity of research, main oriented to the technique of *weak currents*. This research was made for the development of the existent equipment in the electro-communication and the measuring techniques, for the expansion and the improvement of the telegraphic communication systems and for construction, experimenting and commissioning of the new telephonically power plants from all Hungary.

The experimental Post Station from Budapest appeared for a short period of time but gain quickly an international success, after the great results of the staff and after the technical innovations of Béla Gáti and József Hollos.

In the year 1906, in the laboratory of electricity of experimental Station, Maior participated in the experiments initiated by Béla Gáti for the improvement of the quality of telephonic transmissions on long distances by applying the Pupin's method.

The great results determined Béla Gáti to start the *pupinisation* of telephonic networks from Budapest in the next year. This was an important event in the Hungary's history of post and telecommunications. Maior understood the practical inconvenient of applying this method and searched for solutions to eliminate these issues.

In this direction, Maior was using the *theory of alternative current* on the length of the wires. He demonstrated that by using alternative current in telephony, he could realize telephonic transmissions on long distances but, in the same time, it could be realized a *multiple telephony*.

The mathematical demonstration showed that using *alternative current in high frequency*, the negative effects of non-linearity are reduced when the frequency of carrier curent is growing. Maior was using the telephony in *alternative current* on simple circuits, using generators of type Poulsen, Goldschmidt and Alexanderson.

Maior realized the first *duplex telephony schema* and experimented this in the laboratory. He demonstrated that practically we can send 2 *alternative currents*, in the same time, on the same line. On different frequencies, each current could be the bearer of a *microphonical current*. He continued the experiments on artificial cables and on a 15 km long cable with iron circuits, and succeed to transmit on a circuit 5 telephonic conversations, using as carriers *alternative currents on high frequency*.

In the year 1907, Maior published under the title "*Über Mehrfach-Fernsprechen*" ("*Over multiple telephony*"), in the German magazine "*Elektrotechnische Zeitschritft*" the results of his theoretical and experimental research. Here he demonstrated, mathematically, that we can have *multiple telephony* by using currents of high frequency, so every alternative current, which is characterized by a certain frequency, could be the carrier of a *microphonical current*. On the same line it could be transmitted much more carrier currents, so it could exist many telephonic ways of communication.

The frequency of the alternative current needs to be very high, to not have sounds in the receptor of the telephone. Improved results could be obtained by giving a path on a bearer frequency. In the article of the German magazine, it was

presented the schematic system of *multiple telephony* used by the inventor Maior in experiments, and noted the fact that by using the same system, it were transmitted 5 telephonic conversations simultaneously. The American magazine "*Electrical World*" published an abstract of the article, under the title "*Multiple Telephony*".

Maior discovered by transmitting on long distances of telephony conversations with the *alternative current* appears technical difficulties, bonded by the losses and distortions in propagation of the *high frequency* current along the telephonically cable. This why, he starts a theoretical and experimental study about these issues.

Between September 22 and 29, 1908, in Budapest it took place the "*First International Conference of PTT Engineers*", organized at the initiative of the engineer Kolossváry Endre, the chief of the Technical Service of Hungarian Post. This Conference collected the most known representatives of PTT administration from all Europe, known as celebrities from that field at that time.

The success was unexpected: there were 49 delegations, from 13 countries, eager to discuss speciality problems, mostly about assuring the good conditions of the international service of telegraphy and telephony, proposing solutions for improving the electro communications on long distances.

On this conference, Augustin Maior had a word and pointed the attention of specialists to a new system of telephony invented by him. On that time, he called his new system "*harmonica telephony*" or "*telephony in alternative current*". His presentation included a short theoretical demonstration of showing great advantages offered by the *alternative current* on high frequency on long distances and it was mentioned the possibility of using *alternative current* in *multiple telephony*.

The scientific presentation from "*First International Conference of PTT Engineers*" of Augustin Maior created a large base of discussion for specialists. In the year 1908 in Budapest it opened a new era in the history of telecommunication systems with *carrier currents*.

Later on, in the second and third decade of 20th century, this principle was put into practice by the greatest telephony companies from West Europe and U.S.

In November 1908, in the German magazine "*Elektrotechnische Zeitsehrift*" a new paper was published by Augustin Maior about *multiple telephony* in *alternative current*, called "*Über Wechselstrom Telephonie*" ("*Over telephony in alternative current*"). An abstract of this article was published then in "*Electrical World*", called "*Alternating Currents for Telephony*".

In December 1908, Augustin Maior was advanced in trainee engineer position. In February 1909, in the magazine "*Elektrotechnische Zeitschrift*" is published the paper of E. Weinberg (from Washington), where the affirmations and experiments of Maior are confirmed and a proposal for using Maior's method was made for transatlantic telephony. Maior continued to work on improving the multiple telephony systems, by elaborating and trying few other systems. In this direction, he proposed the use of the rectifiers on telephony circuits, in an era when electron tubes were the latest technical inventions.

In September 1909, in a new article "*Zur Mehrfachtelephone*" ("*About multiple telephony*") are presented the schematics of *multiple telephony* systems used in *alternative current rectifier principle*, schematics who put Maior on the history of modern telephony as a inventor of *telephonic systems*.

In February 1910, the well known professor from Berlin, K. W. Wagner, in a paper called "*Die Aussichten der Telphonie und Schnelltelegraphie durch Ozeankabel*" ("*Telephony and fast telegraphy perspectives thru suboceanic cables*"), raised an objection about utilizing Maior's systems on telephonic and telegraphic sub oceanic transmissions. It was demonstrated that these transmissions utilizing high frequency currents as an effect were huge distort voices and the telephony conversation was impossible.

In March 1910, under the same title, Maior published in the same magazine an article that theoretically demonstrated (based on the works of mathematician H. Poincare; using a new method for resolving the equations with partial derivative) the possibility to realize telephony and telegraphically sub ocean transmissions using the *alternative current of high frequency* and, more than that, the possibility of transmitting the telephonic signals with minimum distortions.

The invention about *multiple telephony* in *alternative current* incited the interest of the specialists and those were very detailed discussed in the science magazines of France, England, Germany and US. About this, it appeared on Berlin the first *Treaty of Theoretical Telephony and Telegraphy*, author Franz Breising. The paper, called "*Theoretische telegraphie*", presented the processes that appear on cables and telegraphic networks as applications of Maxwell electrodynamics. The author wrote about the researches effectuated in the direction of application of *alternative current of high frequency* in telephony and mentioned Maior's work.

Between September 5th and 10th, 1910, in Paris took place the "*Second International Conference of PTT Engineers*". At this conference arrived specialists from 21 countries. Here, Maior participate as an authority in the field, as one of the 9th members of Hungarians Post delegation. This delegation was scientifically ruled by Béla Gáti. At this conference, their work was introduced and known to K. W. Wagner, Devaux-Carbonell, and Breising, etc. The scientific

level of this conference was very high. Through the high level of knowledge presented on discussions, Maior became for good an authority in the front of the specialists, being considered a well known personality of the European area, a scientific authority in telecommunication area.

During September 14th and October 15th of the year 1910, Maior with other participants from the conference visited Basel's exposition and then research labs of technical services of Posts from Vienna, Graz, Nürnberg and München. Returned at Budapest, Maior continued his studies about propagation of alternative current on the length of the cables and on how to improve the transmission methods of transmitting on distance the *telephony signals* using *electrical resonance*.

The Redaction of Hungarian Engineers and Constructors Magazine requested Maior to publish 2 articles about his scientific information and speciality. After this, Maior became a permanent collaborator of this magazine and published short informative notes from scientific actuality of that time, news from telegraphy and telephony field. In his published papers, Augustin Maior signed under the pseudonym of "*Mjr*". Few papers published: "*Fast telegraphy*" (1910), "*New types of microphones*" (1910), "*Newest microphones*" (1911), "*Telephonically relays*" (1911) "*Telephony in big cities*" (1912) "*Electrostatic loading of telegraph cables because of locomotive steam*" (1912) etc.

In the year 1911 C. O. Squier, from the U.S., patented a system of multiple telephony in the same year when he realised a *simultaneous transmission* of 2 *telephonically conversations*. New York State rewards him with a prize of 50,000 dollars and made a lot of publicity in his name.

On March 17th of the year 1911 the British magazine "*The Electrician*" published an article of B. S. Cohen where Squier was called the inventor of *multiple telephony*.

On March 24th of the year 1911, because Maior was in contact with all news from his field, observed that an error was made. He sent a letter to the redactor of this magazine. In this letter he alleged the fact that the *multiple telephony* in Europe was not a new thing, but being known by the European specialists for about 4 years due to the papers published by him.

On April 21st of the year 1911, "*The Electrician*" magazine published Maior's letter and recognised his priority in this area.

In the year 1912, Augustin Maior advanced as a full engineer. Being recognized as a scientific personality, Maior became a part of the Administration Council of Posts in Budapest.

The Society of Telephony from Argentina proposed him a Technical Advisor position, with the possibility to patent all of his inventions. Maior refused to take action on the business in the big industry, because his goal was not to obtain financial advantages from his researches. Maior didn't patent any of his inventions; he wanted only the scientific recognition of his work.

In April 1912, in a new article, Maior reverted with a few completions on his works from before. More than that, he analysed the *telephonic system* of Squier, and he demonstrated that this was a simplified variant of Maior's system proposed in 1907, because this system could be used only for *simultaneous transmission* of 2 conversations.

The Hungarian Union of Engineers and Constructors suggested Maior have a lecture about the *multiple telephony* in *alternative current*. In front of a competent auditorium, composed by the most known representative of technical group from Hungary, Maior presented applications from his point of view about the *high frequency current* in transmitting of *telegraphic and telephonic signals* on distance, using *the electrical resonance* and he presented, in the final, the *multiple telephony*.

In the year 1913 Maior's presentation was published under the title "*Using of alternative currents in high frequency in weak and strong currents technique*". After this, Maior was concerned about the new aspects of *electric wave propagation along cables* and thought of the possibility of using them as guidelines for electromagnetic waves.

Maior realised experiments with the scope to demonstrate the role of *electrical resonance* in transmitting on distance of *telephonically and telegraphically signals,* successful experiments who confirmed his theoretical reasons.

On February 6th of the year 1914, a Maior's paper, called "*Using of high frequency currents in telephony, telegraphy and transmission of the energy*", published on magazine "*The Electrician*" from London, UK, created a new detailed discussion in the speciality magazines. For the first time, it appeared the idea of using the *electrical* resonance in *telephonic transmissions*, for the scope of attenuation of the *telephonic signal* on telecommunication cable. This idea was assumed later on by Maior, in his publications from after War.

Between the months June and July of the year 1914, after the outrage from Sarajevo, in Hungary starts the preparations for War. PTT service is overstressed. Maior is mobilized on Post where he was working day and night.

In the year 1915, the concern of all peoples was given to problems of War. For 4 years, the creative work was missing, all the energy was canalised for destroying the materials and spiritual goods of humanity. World-wide scientific activity was

almost zero, the exchange of information did not exist and the collaborations between scientists were obeyed by political factors.

On March 4th of the year 1916 Augustin Maior married with Alexandrina Precup.

The wife of Augustin Maior was born on April 24th, 1888 in the parish Solovăstru (from the town Reghin), and she grew up in the house of her uncle Gheorghe Țăranu, functionary on the Post of Budapest, known as one of the most active members of the literary society "Petru Maior". Gheorghe Țăranu was an unconditioned fighter for Romanian intellectuality and for promoting the Romanian national ideals, for liberty and national unity. Alexandrina Maior was a woman with great morals and intellectual qualities and she would contribute for 4 decades on creating a good climate in the development of professional activity of her husband, by having an impeccable family's life.

On August 27th of the year 1916, World War I was in full development. Romania entered in War for Entente Cordiale group. At that time, Augustin Maior was provisory released from Post service job.

On February 1917, Augustin Maior was mobilised in the gun's factory of Gyor, as a lieutenant and his job was to calculate the ballistic data of the new types of guns that needed to be designed. Except his research job effectuated here, Maior redacted the most of his completed paper, a synthesis of all problems presented in the previous publications. This synthesis was called "*Über das Einschalten langer Leitungen mit Wechslstrom*" ("*Over connecting of long cables with alternative current*") and the paper was published in "*Elektrotechnische Zeitschrift*" magazine. In this paper it was presented the general solution of much discussed problem of transitory phenomena that appears on the length of electrical circuits. This solution was very much commented and analysed by de specialists. Later it was very often put in the References of specialised papers and everybody accepted Maior's opinion.

On October 6th of the year 1917, Maria, the first child of Maior's, was born.

In the year 1918, the political atmosphere from Hungary became much tensed. It started the proletarian Hungarian revolution lead by de Béla Kun and over in the year 1919 by proclaiming the Republic of Soviet Hungarian.

On December 1st of the year 1918, Great National Meeting from Alba Iulia proclaimed the union of Transylvania with Romania. The End of the War fulfils the expectation of centuries of Romanian people. On January 27th of the year 1919, Romanian Govern made a request to intellectuals to return in Romania. In 3 days, Maior got back in Sibiu (Romania) and established his domicile there.

During February and March of the year 1919, became the reorganise activity of PTT service from Transylvania, as a Central Director, with a temporary title.

Maior organised the PTT service and worked day and night. Due to his idea, the stamps were reprinted to be used on sending letters. Maior kept a lot old personnel information and he introduced the Romanian Language in the administrative service of Post as an official language.

On April 1st, to compensate the qualified personnel from administrative post, at Maior's proposal, in Sibiu, it started the first School of Telegraph and Telephone from Transylvania. Maior was the principal of this school and one of the 3 professors from the initially collective of teaching. Maior was teaching here "*Apparatus of telegraphically and telephonically transmission*". After 3 months of functioning, this school gave first 44 specialists in exploitation of telegraph and telephone, functionary and technicians who were distributed immediately in post offices of telegraphy and telephony who functioned later on in all Transylvania.

On April 14th, Augustin Maior became the Central Director of Post, Telegraph and Telephones from all Transylvania and Banat.

Between May and June of the year 1919, Maior coordinated the action to rebuild the urban network of Transylvania. His suggestions and original ideas permitted to establish the connections with Romanian installations in a short time. His activity situated him on the top of the Romanian representative in technical field and in the patriots of his time.

Maior's activity in organising the Post and the war interrupted his scientific activity. That's why, when a proposal come to him to become aggregate professor of technological physics on Science University from Cluj, he sent a request to Cult Resort to be admitted on that new Faculty, that was opened in the autumn of the same year.

In July 1919, a board constituted by academicians Petru Poni, Ludovic Mrazec and Gheorghe Ţiţeica, after analysing the scientific activity of Maior from the published papers, decided to invest him with title of titular professor on Theoretical and technological Physics at the new Institute from the Science Faculty from Cluj.

Between August and September, parallel with the activity of Central Director from Post, Maior organised the local for the future Institute who will be leaded by him. For this activity, in the news paper "*Gazeta Transilvaniei*" ("*Transylvanian Gazette*") appeared an article which presented his glorious activity. Based on the same idea, in September, the news paper "*Unirea*" from Blaj was an article which presented Maior in a very good light in the front of the future students. After the war, on October 1st, the University was reopened with a huge enthusiasm. Augustin Maior was the Director of Technological and Theoretical Institute from the Science Faculty.

On October 27th of the year 1919 Gheorghe-Augustin, the second child of Maior's, was born. On that time, Maior's family lived on Cluj.

On October and December, the first semester, the activities of all Faculties of Cluj were going slowly because of the inadequate equipment of the laboratories. That's why, it was almost impossible for Maior to teach technological physics. Maior's trials to renew the equipment and to transform the university's ateliers in technology labs were a complete failure because of the persons leading the University.

On January 1st of the year 1920, without any official authorisation, Maior changed the name of the Institute lead by him in "*Applied and theoretical physics*" and, even if it was a lot of contestations, in the Institute it would be taught only theoretical physics, on the level and from the model of Physics Courses from German universities.

On January 29th, Maior started a campaign for funds to create a modern lab of physics, for student's preparation. This lab had the specific of electricity and electro-radio technical. Maior sent a request to the University's Rectorship and asked for lab and library funds. He also asked for hiring qualified personnel: assistants, preparatory, lectors, technicians and laboratory assistants. After that, at the University in Cluj it was created the nucleus of first Romanian school of theoretical physics, which would function for 3 decades with Maior as a principal, and later on ruled, by Maior's disciples.

In February 1920, Maior was released from the position of Central Director of PTT and he continued his didactical work, but kept a close relation with post labs, as an Honorary Member of Administration Council of PTT Direction. Maior hold this position until the date of his retirement.

In the year 1921, Maior was already recognized and appreciated as a specialist, as an authority in telecommunication field. Maior received from Ministry of Communications from Bucharest as a member in the Technical Committee from General PTT Direction, committee headed by Vasilescu-Carpen. Maior's role in this committee was with study of the improvement of telephony installations "*with and without wire*".

For almost 20 years, on general meetings from Ministry and on work meetings of technical committee, Maior had its contribution on solution of technical problems from telecommunications field from Romania. The Telephony Society who contracted the installation works, used principles of *multiple telephony*, but in a state more advanced with what Maior presented in his papers, but well known by him.

On Cluj, it was created "*Society of Science*". In the first number of the Bulletin of this Society, Maior published the paper called "*Over the problem of transmitting of energy*", taking again the theoretical study from previous years.

In the same year, Maior was trying for the last time to create a labs installation for continuing his experiments in telecommunication field. The equipment from the lab is rudimentary; it was no possibility for replace and some results, unconvincing, weren't published. Maior's theoretical hypothesis about the possibility of *resonant transfer* in *telephony transmissions* on distances were verified experimentally few years ago, and the applied method is still new and needs more experiments until this will be improved.

Maior give up on experimental physics, but with all his scientific orientation from later on, he will return many times about these technical problems by demonstrate from theoretical point of view the validity.

During the *Institute of applied and theoretical physics*, the professor Maior taught the courses called "*Electricity and magnetism*" and "*Acoustic and Optics*", planned the material for every course on a length of 4 semesters.

On the date of January 13th of the year 1922 is born Ileana, the third and last child of Maior's.

After the end of War, the funds for education weren't enough for a good organisation and function of High level Institutes from University of Cluj. It wasn't the possibility of lithographical courses for students and no library to replace these. First books and magazines are donated to Physics Institute by the teacher Maior from personal library. Later will start to redact the physics courses and Maior personally will search for funds on the companies from Cluj, also for book's orders and foreign magazines. Like this, the library of Physics Faculty from Cluj will have a lot of papers and still is one of the most important libraries from Romania.

In the year 1923, still with passion to the field of electro-radio technical, with his small collective, Maior build a radio apparatus with earphones. This it was the first radio apparatus who functioned on Cluj. Under a schematic program, this radio could be listened by all categories of public who was interested to find out the newest applications of modern techniques, from that time. Later, on this apparatus it was attached a loud-speaker and works until the year 1945.

In May 1923, the young absolvent Hermann Oberth wanted to hold his dissertation on the Sciences Faculty from Cluj. Maior approved this because of the original scientific contains, on the date of May 28th. The dissertation paper of Hermann Oberth later on became very famous. As the president of the board on Oberth's exam, Maior gave to him the diploma in physics. Hermann Oberth, in

years it was called "*the parent of cosmonautics*". With Maior's help, Hermann Oberth became a member of the Scientific Society from Cluj. Hermann Oberth always appreciates Augustin Maior for his intellectual capacity and for what Maior did for him.

With the didactic collective formatted by Maior, he continued to organise the electricity lab. On this lab is attached a mechanical atelier with electrical machines. The students are doing activities also in the atelier. Maior is planning the activities, of what is doing in the lab and for guidance of didactic and technical personnel. Maior put the bases of his lab, used for university tests and also for original student's research and for improving the future physics teachers. Unfortunately, Maior's initiative wasn't appreciated at all and received a lot of contestations.

All the discussions related by the *theory of relativity* of Albert Einstein capture all attention of the professor Maior. In fact, these are from the year 1918, when Maior sent *A Note* to the magazine "*Physikalische Zeitschrift*", on one year after Einstein's publication, where Maior indicates a relation between *quantum theory of radiation* and *relativist theory of gravitation*. Because of the political events from Hungary, probably this note never arrived on destination.

In the year 1919, Maior wrote about this and mentioned he doesn't know if the note was published or not.

In the year 1924, in the Society Bulletin of Science from Cluj, was published in 2 versions, English and French, Maior's paper, called "*Temperature and gravitation*". In this paper, Maior tries for the first time in the speciality literature, to establish a relation between the *mass* of a body and his *temperatures*, based of *quantum theory of radiation* and also based on *equivalent mass-energy* (Einstein's principle).

In October, a group of university professors (Maior it was a part of the group), creates on Cluj "*Universitary Extension*", a society built to present the science, culture, economic and social sciences, society who has activity thru public conferences in all localities from Transylvania.

For 10 years, the teacher Maior has lectures in more than 30 urban and rural centres. Few names of Maior's conferences: "*Telephony and international telegraphy*", "*Radiophony*", "*About relativity*", "*Travel on a sunbeam*", "*Soles from Universe*", "*Beginning of the worlds*", "*Life of the Sun*", "*Quantum and micro organisms*", "*Modern cosmogony*" etc. Technician by training and theoretician by vocation, Augustin Maior had the 2 important qualities who defined the contemporaneous scientist. With these papers, Maior is considered one the first engineers-physicians from Romania.

In the year 1925, on the Sciences Faculty from Cluj appeared first lithographed courses of "*Electricity and magnetism*" and "*Acoustic and optics*". Completed and improved later on with his youngest collaborators, assistants and preparatory, Maior's courses were published in many editions and until the year 1947 were the only courses of physics from Cluj.

In the year 1926, Maior published the paper that was called "*Over the minimum of kinetic energy of a moving body*". Maior became a member of the redaction committee of the first big Romanian encyclopaedia. Maior takes care of Physics and Technical Sciences. He redacts a "supplement", a completion of the course about electricity and magnetism.

In the year 1927, Maior became a member of the Administration Council of Electric Central Station from Cluj, where he will have activity for 2 decades, an activity of technical consultant in problems related of transmission and distribution of electrical energy.

In July he goes to a travel to Vienna and Graz, in Austria, as a part of a delegation who visited electrical central station for acquisition some modern equipment.

In the year 1928 in his article "*Warmetonnung im Gravitationsfelde*", published in the magazine "*Physikalische Zeitsehrift*", Maior returned with some completions about the previous papers, about the relation between gravitation and temperature. He also published many articles in Society Bulletin of Science from Cluj.

In the year 1929 Maior became a member of Technical Council of Society "*Sonametan*" with the centre in Bucharest and a branch in Mediaş. Augustin Maior is advanced dean of the Sciences Faculty from Cluj. In the same year appeared the Encyclopaedia "*Minerva*". Notions of science and technical have a peak thru clarity of presentation and big volume of presentation of the contents. Here, Maior it was the scientific redactor and he had a lot of support.

In the year 1930, Maior is decorated with the medal "*Work reward for education*" (first class), for his didactic activity developed in the 10 years from his hiring in higher education and received distinguee for his activity in the scientific filed, education and mass culture, for the help thru technical advisors to different industrial plants. From this moment, Maior's main scientific concern is in the relativity thermodynamics.

During the year 1931 is published the paper "*Over the radiation in gravitationally field*". Maior is concern of scientific promote of young collaborators. He gets grants for and students and sent the best elements on studies in foreign countries.

In the year 1933 appeared "*Encyclopaedia of technical inventions*" author N. P. Constantinescu, who was the first Romanian paper where Maior's name are putted together with great inventors from universal technical field. Augustin Maior

didn't know the author, Maior's data, which were presented in 4 pages, had a source of information the articles of Maior between the years 1907 and 1932 and also the comments from the literature of that time. In the same year, Maior published a paper called "*Quantum statistics*".

In the year 1934, from the initiative of the Academician D. Hurmuzescu is created "*Romanian Association for the Advancement of Science*", where Maior is an honorary member. On the Congress organized on Bucharest, Maior promote a lecture called "*A new formula in the theory of radiation*".

Maior revert ideas about transmitting on distance of *telephonically signals* with *high frequency current* with an *electrical resonance*. He published a new article about this issue.

In the year 1935, concerned by the effect of universe expansion against substance and energy – one of the most interested issues of contemporarily astral-physics – Maior elaborate a paper with the title "*Energy and radiation in the expansion universe*"

In the year 1937, Augustin Maior is elected with unanimity of votes a full member of the Academy of Sciences from Romania.

In the year 1938, international scientific collaborations are interrupted by the start of the World War II.

Maior published the article "*Over the thermodynamic symbolism*", where he tries to apply the thermodynamically symbolism on the study of relation of gravity, heat and radiation.

In the year 1939, "*Institute of applied and theoretical physics*" will become "*Cathedra of theoretical physics*" of the Faculty of Sciences from Cluj and by this change of the title it was officially signed the 'born certificate' of the first Romanian school of theoretical physics, who was headed by Augustin Maior.

In the year 1940, on the Congress of *RAAS* from Iaşi, Maior lectured the communication "*Over the non-Euclidean space from interior of the nucleus*". In this communication, Maior considered the nucleus as a hyperbolic space. In this paper, some phenomena are tried to be explained, phenomena who are happened in the atom, based on non-Euclidean mechanics. This paper will be sustained during a meeting of the Romanian Academy and published, later, in "Comptes rendus de l'Academie Roumaine".

In September 1940, after the Vienna Dictate, all members from University of Cluj are refuges to Sibiu and Timişoara. Maior choose to move out to Timişoara will all his family.

On Timişoara, Maior participate on actions to choose optimal conditions for the opening of the new university year.

In September 1942, Maior published the paper "*Gravitation and lent variation of some <fundamental constants>"*. By exploiting the analogy between macroscopic Universe models against microscopic model of the atom is created a connection between electromagnetically phenomena from the interior of the atom and macroscopic phenomena of gravitation. Like this, is established an original connection between gravitational constant and the energy of a body on the temperature of absolute 0.

This Maior's paper it was sustained by the academician professor Dimitrie Pompei, on the meeting from April 17th, 1942 of the Academy of Science from Romania. Choosing of academician Pompei for sustaining of some papers of Maior it wasn't aleatory.

Augustin Maior was very much appreciated by many Romanian mathematicians worldwide recognised, like Dimitrie Pompei, Gheorghe Țiteica, Simion Stoilow, Gheorghe Vrânceanu, Grigore Moisil, Caius Iacob, Gheorghe Călugăreanu, Theodor Angheluță, etc. As a proof of these appreciations, Maior it was invested in 1946 as an honorary member of Institute of Mathematical Sciences from Romania.

In October 6th of the year 1944, on a meeting of the Romanian Academy, Maior presents the paper "*Over the energy of point 0*". The author confirmed and demonstrates mathematically by the movement of the electrical charged particles in a gravitational field, is appearing a convention current with a magnetic field. This affirmation, which is based on the idea of producing of cosmic magnetism by the movement of electrical charge in gravitational field, is completely original and new in astrophysics.

Between July and August of the year 1945, the University is returning to Cluj. Maior is 63 years old and is leading the actions of rebuilding the library, laboratories and workshops.

In the year 1946, Augustin Maior is invested as Dean of the Faculty of Sciences.

Maior is publishing a more detailed paper about the relation between temperature and gravitation. Maior lectured based on the theory of quantum could be made a thermodynamically study, very detailed, of the gravitation. Maior's believes are the know laws of gravitation are valid only on normal temperatures; on high temperatures these laws needs to be corrected according with thermodynamically laws.

In the year 1947, when Maior is 65 years old, became consultant professor on Faculty of Physics and Mathematics from Cluj.

On May 17th, in the British magazine "*Nature*" is published a paper of well known savant P. S. M. Blackett, where is presented an empiric relation of magnetically moment of a moving body who is rotated in a gravitational field.

In the year 1949, Maior observed an analogy between the relation advanced by Blackett and the one established by him in the articles published in the years 1942 and 1944.

Maior generalised his formula and obtained an identical result and the conclusions were presented in a paper under the title "*Over magnetic field of a rigid body in movement*", in the Bulletin of the Society of Sciences from Cluj.

In the year 1950, on a meeting of the French Academy of Sciences, the well known savant Louis de Broglie, the founder of the quantum mechanics and laureate of the Nobel Prize in the year 1929, lectured Maior's paper with the title "*Champ gravifique et magnetisme*" ("*Gravity field and magnetism*")

In the year 1951, Maior published the paper with the title "*Energy of degenerated gazes*". There are introduced the notions of "*pseudotemperature*", "*pseudoentropy*", "*radiant entropy*", thru analogy with classical thermodynamic, for realising the transformation of a gaze from corpuscular to light phase.

This phenomena it was, in Maior's believes, in the interior of the stars, on huge pressures who are there and with a negligible consumption of energy.

In the year 1953, in the Scientific Bulletin of the Romanian Popular Republic was published the last paper of Augustin Maior.

This paper ends the cycle of publications over the thermodynamically problem of the gravitation. In his published papers, Maior proofs the influence of the temperature over the gravitation and this process is happening on very high temperatures like the ones from massive celestial bodies.

On ordinary temperatures, the phenomena that could evidence cannot be observed or measured by any method, for the moment.

Augustin Maior always believes in his work and the future will answer to the questions raised by him. In the year 1954 he sent to Romanian Academy a manuscript of the paper with the title "*Gravitation and creating of the heat*", with the scope for this manuscript to be kept in Academy Annals, as a proof of his contribution on development of contemporaneous astrophysics.

In the year 1956, Maior left and never returned on the Cabinet of the Faculty of Physics, in his place remained his assistant, Professor Victor Marian.

In the year 1957, Constantin G. Bedreag redacts "*Biography of the Romanian physics. Biographies*". Here, Maior's name appeared with Dragomir Hurmuzescu,

Eugen Bădărău and Ştefan Procopiu, prestigious Romanian savants, founders of physics school in Romania. This it was the first official recognition of Maior's contribution on development of high level education from Romania.

In the year 1958, appear few pages with the autobiography of savant Maior, but not very detailed.

In the year 1959, Maior redact a manuscript, in a very concise way, with his conceptions about some problems of thermodynamically and relativist electro dynamically nature.

This manuscript, like all papers published by Maior, is reflecting a large scientific horizon in theoretical physics field. One of Maior's questions, like "*energy of a universe in expansion*", "*gravitation and lent variation in time of the <fundamental constants>", "electrodynamics of the moving bodies*" are even today actual problems and still unsolved.

On April 3rd of the year 1961 Augustin Maior's wife died, which was a terrible smash for him. After that, his health became more and more weak.

On 3rd October of the year 1963, Augustin Maior dies after a short sufferance, in his house, on 81 years old.

The funerals are on the Cemetery from Cluj, on October 5th of the year 1963.

3. Maior's contribution in Romanian education

The Romanian scientist Augustin Maior it was one of the founders of physics education in Romania. Maior is a part in the history of science and Romanian technique.

Augustin Maior demonstrates the scientist's duty is to fight until the end for his believes. Like this, by promoting the personality and by creating something, contribute on the formation of scientific tradition of his people.

Between the years 1968 and 1969, in the most important Publishing Houses from Romania, like "Editura Didactică şi Pedagogică" and "Editura Enciclopedică" and other magazines of culture and speciality appeared papers who mentioned contribution of Augustin Maior of development of the science, techniques and education in Romania.

In the year 1973 is opened on Bucharest the *Museum of Romanian railways*, where a special stand is created for Augustin Maior, as a helper of posts development and to communications from Romania.

Until these days, appeared in Romanian press short lectures about Maior's contributes of development of international telephony.

Conclusions

The contributions brought by the scientist and engineer Augustin Maior in the field of telegraphically and telephonically transmissions on a cable put him in the top of the inventors with creator efforts who fundamental the *theory of telephonically systems* with carrier currents and accelerate the progress of this area.

Even if Maior activated in a field where the contributions of the authors were very had to be distinguished, because of his publications, Maior's work was revealed and we can know his proposals and his experiments.

On the end of the year 1906 the inventor Augustin Maior was the first person who realized on Budapest experimentally simultaneous conversations, on a number of 5, for a long distance for that time, 15 km.

Maior didn't brevet his inventions because it was interested only about his work, not to win money, as he wrote: "*I published and I still publish all these with the mention I never had any material advantage*".

Abbreviations

PTT Post Telephone Telegraph
RAAS Romanian Association for the Advancement of Science

R E F E R E N C E S

[1] Mihai Drăgănescu, Gheorghe Cartianu, Victor Mercea, Adelaida Mateescu, Dan Dascălu, Liliana Bocu, Nicolae Teodosie, Vol. *Contribuţiile lui Augustin Maior la telefonia multiplă*, Editura Academiei R. S. România, Bucureşti, 1980.

[2] Liliana Bocu, *Augustin Maior (1882 – 1963)*, Vol. *Contribuţiile lui Augustin Maior la telefonia multiplă*, Editura Academiei R. S. România, Bucureşti, 1980.

[3] Adelaida Mateescu, *Contribuţiile lui Augustin Maior în domeniul telefoniei şi telegrafiei*, Vol. *Contribuţiile lui Augustin Maior la telefonia multiplă*, Editura Academiei R. S. România, 1980.

[4] M. Drăgănescu, *Din istoria telecomunicaţiilor în România*, Vol. *Contribuţiile lui Augustin Maior la telefonia multiplă*, Editura Academiei R. S. România, 1980.

[5] I. M. Ştefan, *Din istoria tehnicii româneşti*, Editura Didactică şi Pedagogică, Bucureşti, România, 1965.

[6] V. Marian, *Figuri de fizicieni români*, Editura Enciclopedică, Bucureşti, România, 1969.

[7] V. L. Ghinsburg, *Astrofizica contemporană*, Editura Enciclopedică, Bucureşti, România, 1972.

[8] *** *Dicţionar de fizic*ă, Editura Enciclopedică, Bucureşti, România 1972.

[9] *** *Anuarele Universităţii din Cluj,* 1921-1956.

[10] I. M. Ştefan, V. Moroianu, *Focul viu. Pagini din istoria invenţiilor şi descoperirilor româneşti*, Bucureşti, România, 1963.

[11] I. Ilea, *Augustin Maior pioner al telefoniei multiple prin curenţi purtători*, Telecomunicaţii 12, 7, 1968.

[12] N. Perciun, *Augustin Maior – 90 ani de la naştere*, Căile ferate române, 16, 10, 1972.