PIONEERS OF TEACHING OF DESCRIPTIVE GEOMETRY IN THE UNIVERSITIES OF KRAKOW AND VILNIUS

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Abstract. The paper describes interrelations and significant works of G. Monge, M. Potier, G. Hreczyna, F. Sapalski, H. Rumbowicz et al. who are pioneers of descriptive geometry.

Keywords: History of Descriptive Geometry, industrial and construction drawings

1 Introduction

Plans and drawings were made up during expansion of industry and the improvements of construction of various objects, but their system was not united. Mathematician and engineer Gaspard Monge (10/05/1746 - 28/07/1818) realized that the development of technology requires strictly scientific, mathematically accurate system of graphic images that enables the representation of spatial structures in the plane and vice versa - restoring the real object represented in the plane by the architect-engineer.

2 Pioneer of Descriptive Geometry G. Monge and his first publication

This idea came to him in the military school at Mézières in 1765 and has been developed for a quarter of century. First time G. Monge has read the course of Descriptive Geometry in Normale higher educational school (*École Normale*) in Paris. Even then G. Monge was able to accurately and concisely teach the serious issues in his lectures. Lectures of a new subject appeared in separate thirteen parts. The first nine Jean Hachette (1760-1834) has collected into the book, which was published in 1798. More than 20 years of publications Descriptive Geometry was considered a state secret, uneasily that foreign used new thing can bring harm to France. Second edition has appeared in 1800 and the third - in 1811. G. Monge systematized, generalized and described graphic visualization methods in his work by using a orthogonal projection plane into two mutually perpendicular planes. After the publication of new subject, Descriptive Geometry of G. Monge became available and began to spread among a number of higher education schools of European countries: in Berlin Academy of Construction (1799), School of Artillery and Engineering in Warsaw (1812), Krzemieniec Lyceum ("the Volhynian Athens") (about 1818). Descriptive Geometry has been started to teach as a separate subject in Vilnius University since 1821. Interesting way of Descriptive Geometry was to St. Petersburg, and from there - to Vilnius and Kremenets.

3 First lecturers of Descriptive Geometry in Russia

Two emperors Napoleon and Alexander I have met each other in the neutral territory beside Tilsit on the raft in the Nemunas River on 25 June (7 July), 1807 for signing of a peace treaty between Russia and France. Treaties of Tilsit significant for Russia were signed in the covered pavilion after an hour of talk "tête-à-tête". Alexander I, knowing a high level of the engineering sciences and training of specialists in l'École Polytechnique of Paris, has received Napoleon's consent to draft to Russia four pupils of l'École Polytechnique to lead the

engineering works. P. Bazaine, M. Potier, Y. Destrem and A. Fabre came to St. Petersburg in 1810 with invitation of envoy in Paris A. B. Kurakin and by errand of Alexander I of Russia [1]. Institute of Engineering Corps of Roads in St. Petersburg began to work on 3 November, 1810, which was founded on 3 December, 1809 by Manifesto of Emperor Alexander I. M. Potier and A. Fabre were the first lecturers of Descriptive Geometry in Russia.

M. Potier was born on 20 September, 1786 in France, where has gained the military engineering education. M. Potier quickly rose through the steps of career: professor's position at Institute of Engineering Corps of Roads in St. Petersburg in 1864; raised to the rank of lieutenant colonel in 1815; raised to the rank of Major General on 28 June, 1823, degree of Lieutenant General granted for exemplary service on 6 December, 1834 and appointed as Director of the Institute and left as Professor of Descriptive Geometry. He has died on 4 March, 1855.

M. Potier has read lectures in French. Later the assistant engineer-lieutenant J. Sevastyanov began to read the course of Descriptive Geometry alongside the French language in Russian. Therefore, the students were able to listen to lectures in French and Russian.

Despite the high level of engagement, M. Potier has written a significant number of works. All works are written in French. They were translated by the student of Professor J. Sevastyanov. Different publishing offices have published M. Potier "Basics of the Descriptive Geometry" in French and Russian languages in St. Petersburg, 1816, intended for the use of pupils of Engineering Corps of Roads (Figures 1 and 2.). This was the first textbook of Descriptive Geometry in Russia. Later the course of this subject was included in other curricula of higher education schools of engineering profile in St. Petersburg, universities of St. Petersburg and Moscow.
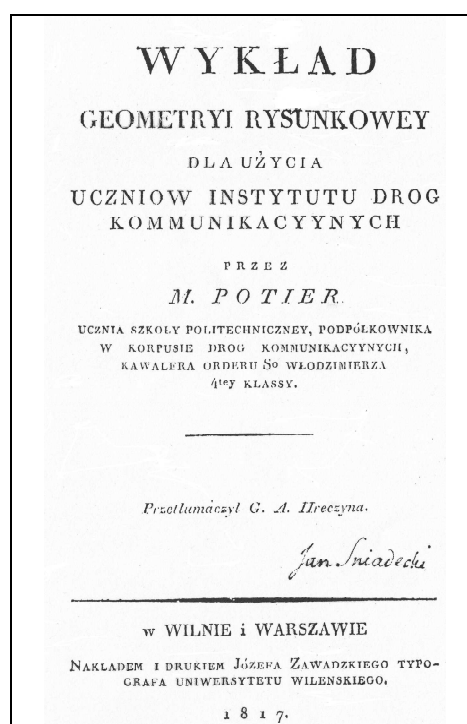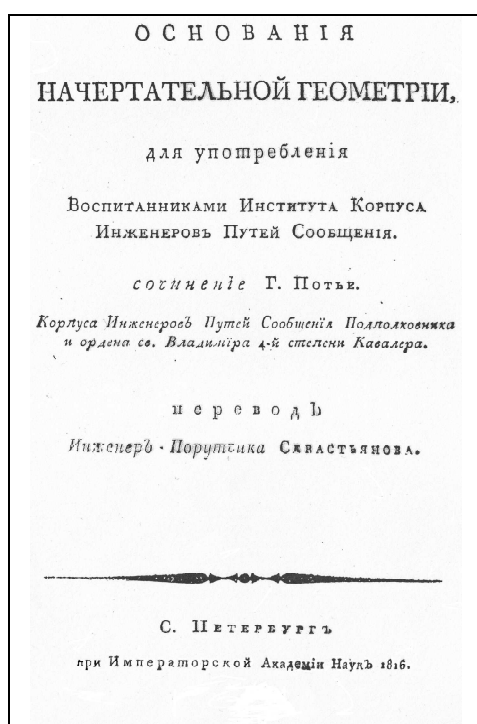

Figure 1: Translation of M. Potier textbook into Russian   Figure 2: Translation of M. Potier textbook into Polish

"Application de la géométrie descriptive á lárt du dessin" was published in 1817, and translation of J. Sevastyanov ("Приложения начертательной геометрии к рисовании") in

1818. M. Potier and J. Sevastyanov have pulished "Basics of stone cutting" in the same 1818 year. The book was printed in two columns, in Russian and French, as follows:

НАЧАЛЬНЫЕ ОСНОВАНИЯ РЕЗКИ КАМНЕЙ	TRAITE DE LA COUPE DES PIERRES [2, p. XI-XVII]

M. Potier "Basics of Descriptive Geometry" were assessed positively by contemporaries. The textbook was translated into Polish by university's graduate student G. Hreczyna. It was published in printing house of topographer J. Zawadski of Vilnius University (Figure 2). Future University rector from 1823 to 1824 Józef Twardowski (1786-1840) seemed pleased with not only the quality of the translation, but also the content. He wrote in 1818: "The book is small, but is written in a very understandable way" [3, p.362]. Its author M. Potier pointed that works of G. Monge, on which he referred to "are written clearly enough, but cannot be classified as elementary ones; the circumstance and demand of Descriptive Geometry course, despite the potential difficulties, has induced to undertake this work...[2, p. VII]. After the year of experimenting I was able to improve the layout of some parts. This course, of course, is not and cannot be perfect enough, which was aimed and what it will be later, but only destroying all life may newly shed the light on and assess the importance of created science" [2, p. IX-X].

M. Potier training tool is written in axiomatic method. Only horizontal and vertical projection planes are used in the textbook for outlining of object. Profiled projection plane is not used. Complex drawing is formed by turning not the horizontal projection plane to the superposement with vertical projection plane, but on the contrary - the vertical is superposed with the horizontal one [4, p.2].

4   Pioneers of Descriptive Geometry of Polish origin

G. Hreczyna had to create Polish terminology of the subject himself while translating M. Potier teaching tool since previously there wasn't a printed textbook of Descriptive Geometry in Polish language. One can guess that to this end were used Polish manuscripts of Descriptive Geometry course of Frenchman Joachim Livet, the teacher of F. Sapalski, that were left for watching in the Society of Friends of Science in Warsaw, 1812 [5, p. 192]. This hypothesis requires further investigation.

Krzemieniec Lyceum ("the Volhynian Athens") (now - Ternopol region in Ukraine) in which arose a deep tradition of teaching mathematics should be mentioned when writing about G. Hreczyna. Four former of his students began teaching the Descriptive Geometry in Polish, Lithuanian and Ukrainian universities.

Grzegorz Hreczyna (1796-1840) has studied at Krzemieniec Lyceum owned by the Vilnius Educational District, later – at Vilnius University. He has gained a master's degree in philosophy in 1817. Since 1819 gifted pupil of professors Jan Śniadecki and Tomasz Życki taught geometry and algebra in the Lyceum. Lyceum was closed on 21 August, 1831, because the vast majority of lecturers and students took part in the revolt. G. Hreczyna has got adjunct position, taught pure and applied mathematics, because the establishment of the University of Kiev and the lack of qualified professionals in 1834. He was transferred to the University of Kharkov in which he was unanimously elected as extraordinary professor after defending a doctoral dissertation in 1838. The professor G. Hreczyna has died being only forty-fifth year old on 20 February, 1840, when the University Corporation members came to inform and congratulate him with the attestation of a PhD in mathematics. Professor has read pure and applied mathematics, statics, dynamics, hydrostatics and hydromechanics courses in

universities of Kiev and Kharkov according to his own written or translated works [6, p. 137 - 139].

Franciszek Miechowicz (1783-1852) after graduating Kremenets district school has been assigned in 1806 to the mechanic school of Krzemieniec Lyceum, where he taught arithmetic, geometry, physics and drawing. He has been drafted abroad in 1816 and visited France and England. Two years he studied in l'École Polytechnique of Paris. F. Miechowicz has returned to Kremenets, taught mechanics, architecture and Descriptive Geometry in Lyceum in 1821. Since 1834 he started to work in the Department of Descriptive Geometry of University of Kiev as an ordinary professor of architecture. F. Miechowicz according to his compendia has taught the Descriptive Geometry (2 hours per week), its applications - the shadow theory, the perspective (2 hours per week), architecture (2-3 hours per week) in Lyceum and the University of Kiev. A professor has issued works from mechanical theory in Kremenets and Warsaw, 1827 [6, p.530, 531].

Franciszek Sapalski (1791-1838) was born in Warsaw, Poland. He has studied at the Warsaw gymnasium and Krzemieniec Lyceum, served in the army. He has joined the Warsaw artillery and engineering school after passing the competitive exams in 1810, where Descriptive Geometry was taught by Jan Joachim Livet (1783-1812) graduate student of l'École Polytechnique of Paris. At this time he J. Livet already has prepared the first manuscript of Descriptive Geometry publication in Polish, which was left to watch in Society of Friends of Science in Warsaw, 1812.
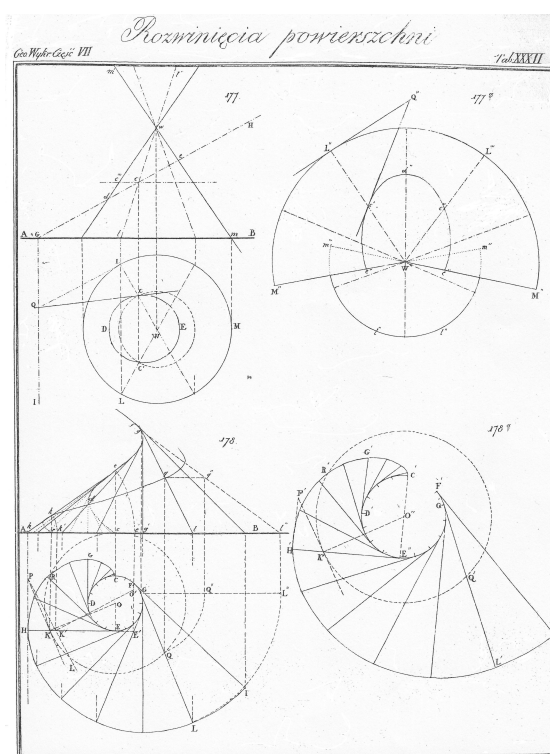

Figure 3: Cover of Sapalski textbook   Figure 4: Drawing of Sapalski textbook

F. Sapalski was interested in Descriptive Geometry while studying engineering sciences in Warsaw and even took private lessons at J. Livet. He has graduated School of Engineering with lieutenant degree, served at the French army side, retired with Major degree, studied in Paris. On his return to Poland in 1816 he was nominated as Assistant Professor and taught lectures of Descriptive Geometry at the University of Krakow. F. Sapalski has become

a Dean of the Faculty of Mathematics in 1823 and member of Society of Friends of Science in Warsaw in 1824. He has published the first textbook of Descriptive Geometry in Poland (Figure 3, 4). F. Sapalski's textbook could be found in Vilnius and Kaunas schools.

One copy of the first volume of the book previously has been owned by Kaunas gymnasium, the other – to the Library of Vilnius Cadet Corps. This is evidenced by library stamps of the old gymnasium and military school. This way textbook is saved in Lithuania, because its property has been thrown along the higher education schools of Russian Empire after the closing of the university. A. Koch and T. Wieja have written about F. Sapalski and his textbook in 2011 [7, p. 67 -74].

5   Descriptive Geometry at the Vilnius University

Karol Podczaszyński (1790-1860) was born in Žirmūnai (now Varėna district, Grodno region, Belarus). He has joined the Krzemieniec Lyceum in 1808 or 1809. Manager of this school T. Czacki (1765-1813) was an extraordinary personality. He has concentrated professionals of various scientific and cultural industries in Kremenets. So spiritual environment of Lyceum, lecturers' example have encouraged the youth to seek knowledge, nurtured their morality. He probably took over the first knowledge of geometry, Descriptive Geometry, technology, drawing from his Lyceum lecturer T. Miechowicz. K. Podczaszyński distinguished from other students with talents and diligence. He used to be awarded for a good learning each year. He has passed the exams and received the diploma of sworn surveyor on 13 June, 1813 [8]. The same year on 12 September he entered the Faculty of Physics and Mathematics of Vilnius University. Within a very short period of time within a year he graduated from university in 1814 and on 5 April he obtained a master's degree in philosophy. The University Council has advised K. Podczaszyński to continue to study the architecture in St. Petersburg Academy of Arts by university funds with a purpose to take position in the Department of Architecture. According to signed instruction of Rector J. Śniadecki, studies are recommended to begin with independent analysis of French authors' works of architecture and Descriptive Geometry. K. Podczaszyński, realizing the importance of Descriptive Geometry began to study G. Monge works, even wrote its summary and sent to the dean of physics and mathematics faculty together with the report. "However, Podczaszyński was not satisfied with the level of training of the architects in St. Petersburg Academy of Arts. He had to train individually while mastering the specialty according to Vilnius University Guide". K. Podczaszyński perfectly passed the exam and was awarded a silver medal in Academy on 30 April, 1816 [9, p. 12-17]. He began to teach the architecture at the Vilnius University in 1816. He studied in Paris from 1817 to 1818. He has returned to Lithuania and worked at the Department of Architecture of University in 1819. From "The introduction to the architecture course with added table" framed by K. Podczaszyński from 1818 to 1819 it is visible big attention to graphic things, focusing on "the presentation of drawings according to Descriptive Geometry rules, accurately representing the structure projections or picture which it will have according the presentation" [10, p. 179 -188]. Hence, the Descriptive Geometry was then integrated into the architecture course. K. Podczaszyński has been elected and approved as the adjunct Associate of University on 2 October, 1820 [11, p. 106, 107].

Students liked professor very much, because he took care of them, so the number of listeners of his lectures increased and one talented architect has grown from it. H. Rumbowicz has been directed to teach mathematics in Vilnius Teacher Seminary, motivated to go deep into Descriptive Geometry. F. Rimgaila has defended a doctoral dissertation on 12 October, 1828 and after receipt of recommendation from K. Podczaszyński, written to Professor J. N. L. Durand went to study to Paris. He wanted to publish a full-scale textbook of

Descriptive Geometry after returning to Lithuania. In the letter to F. Rimgaila, K. Podczaszyński commended his idea: "Your work, Mister, about Descriptive Geometry in native language is meritorious, very useful and public-spirited contribution, supplementing our literature with serious work… Our citizens will immediately understand the global scientific benefit of this work..."[12, p. 129].

In 1822 K. Podczaszyński has formed "Project of establishment of Special School of Architecture at the Imperial Vilnius University" [13, p. 1-15]. Subjects have been divided into main and subsidiary ones. Subsidiary list included the Applied Descriptive Geometry. "First year's students had theory of shadows and perspective, second year's – wood compounds and stone tooling." Therefore, second year's students had to learn basics of stereotomy. Descriptive Geometry had to be taught by Professor or Associate Professor. It was the first effort to establish higher education school in Lithuania in which will be qualified the architects only. Nice intentions have stuck in Tsar Chancellery for a long time. Tsar Nicholas I of Russia with decree of 1 May, 1832 has signed University closing act after suppression of revolt in 1831. K. Podczaszyński has lost his position of school visitor and professor of architecture of Vilnius Province. All hopes to establish a School of Architecture have collapsed. He corresponded with his former student architect F. Rimgaila despite deteriorating health and comforted him because of the difficulties while implementing the constructions in Samogitia [12, p. 133-136].

Hipolit Rumbowicz (1798-1838) - mathematician, architect, professor of Vilnius University was born in Lithuania in a family of minor nobleman Benedykt Rumbowicz, who had a Nałęcz coat-of-arms. Its genesis can be attributed to Rumbowicz family, which ruled Rumbonys mansion (now Alytus district in Lithuania). H. Rumbowicz, after graduating from the Vilnius gymnasium, has entered Vilnius University on 15 September, 1814, and has been raised to the candidates of philosophy on 26 June, 1815. H. Rumbowicz has been granted the Master's degree in philosophy on 23 June, 1817. H. Rumbowicz after receipt of recommendation from Professor K. Podczaszyński, began to teach mathematics and drawing in Teachers' Seminary on 1 October, 1819, which operated at the Vilnius University and provided the sustenance and other advantages. In parallel, he went deep into Descriptive Geometry and architecture. He began to teach descriptive geometry in Vilnius University, 1822. H. Rumbowicz has read lectures of this course according J. Hachette, like his colleague F. Sapalski. He successfully has passed the exams, defended a PhD thesis in philosophy and has been elected as an Assistant Professor on 1 September, 1823. In the same year, he has been confirmed the Head of newly established Department of Drawing Geometry. Already in 1817 his colleague from the course G. Hreczyna gave H. Rumbowicz a translation of M. Potier textbook into Polish. Heading up the Department created more favorable conditions for meeting the author of popular textbook, to take interest in M. Potier teaching methods and training tools not only at Institute of Engineering Corps of Roads in St. Petersburg, but also to visit other higher education schools of the Russian Empire. For that reason he asked for working on probation to the higher education schools, in which Descriptive Geometry was taught. Management gave the consent and Vilnius University has drafted H. Rumbowicz for half of the year to St. Petersburg and Moscow "to gain perfection in Descriptive Geometry" in 1828. [14, p. 19-20].

He has listened to lectures of M. Potier at Institute of Engineering Corps of Roads in St. Petersburg, interacted with the famous mathematician, engineers from St. Petersburg, Moscow, took interesting in the level of technical development in Russian industrial companies. On the way back from St. Petersburg, H. Rumbowicz visited Dorpat University (now University of Tartu, Estonia), in which Karel August Senf (28/02/1770-02/01/1830) has

worked. He has published a textbook of Descriptive Geometry "Geometrische Zeichenlehre ein Schulbuch für die Schulen der Ostseeprowinzien" in Dorpat, 1828 [15, p. 170-176]. During the same traineeship H. Rumbowicz has visited Warsaw, too. The professor was inquisitive and diligent, excellent painter, engraver and draftsman. Students liked him and abundant group of listeners have attended his lectures.

Although H. Rumbowicz devoted a lot of time to the Department, training base, teaching of new subject, but also have left the printed works and manuscripts. He has been writing about architectonic issues in the daily newspaper "Dziennik Wileński" in 1822. In the same year struck off "Description of the methods of construction from ramming clay". He has published the first part of drawing textbook for the parish schools in Vilnius, 1827: "Początki linearnego rysunki ułożone dla szół parafialnych przez Hipolita Rumbowicza, Adjunkta Universytetu. Wilno. 1827" This is the first textbook of such subject for the schools of lower tier of teaching, corresponding attitudes of the Lithuanian Educational Commission. The book opens with "Teacher's Guide". This is methodical instructions for organizer of the lesson, discussions about drawings rules, cabinet installation and so on. The author emphasized that each student's work, made in the stone tables must be tested and discussed errors. After that it can be drawn on paper and the teacher evaluates the work.
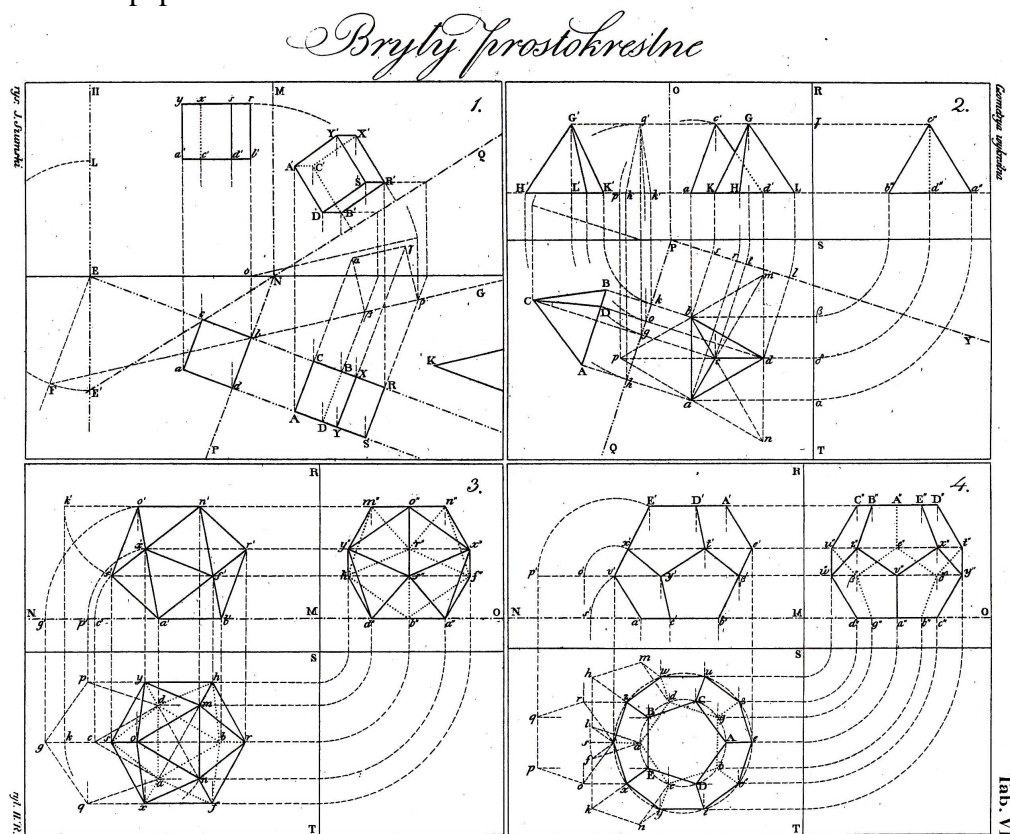

Figure 5: Work samples of Descriptive Geometry made with the English calligraphy

H. Rumbowicz in printing house of J. Zawadzki began to publish textbook of Descriptive Geometry for university students ("Geometrya wykreślna." Wykład rzutowych i obrazowych wykreśleń. Dla użytku uczniów uniwersyteckich. Wilno, 1929) in Vilnius, 1829. But only the introduction and the first chapter were printed. The introduction describes the subject, objectives and significance of Descriptive Geometry. The first chapter is devoted to visualization of points, lines, planes and polyhedrons in the orthogonal projection planes.

There are six tables with 30 drawings in the inserts of textbook. They are scored in the lithographic workshop of University, established in 1821, where H. Rumbowicz has studied the art of engraving. Lithography machines and stones were brought from Warsaw, and lithographic paper - from St. Petersburg [16, p. 39, 105]. The drawings characterize with high culture of performance. Types of drawing lines are used perfectly. English calligraphy is selected for the main notes, which was taught in the gymnasium at the time during classes of calligraphy (Fig. 5). Other chapters of Descriptive Geometry remained in the manuscript after the closure of Vilnius University. The second chapter was devoted to the developments of surfaces and cuts of the general situation, the third – for the worksheet of rotational surfaces. The fourth and fifth chapters should examine the shadow theory tasks related to the cuts. The end of textbook is used for spatial perspective.

M. Połyński on 7 September, 1832 - The Interim Chairman of Committee of Vilnius Schools has received an order of Military Governor Board of Vilnius to find an architect who can "finally restore the imperial palace in Białystok." Former professor of Vilnius University K. Podczaszyński has recommended H. Rumbowicz to hold office of architect in Białystok. He has left to execute a responsible order on 1 November, 1832 while executing the Emperor's will. Later, he transformed the emperor's summer residence for the needs of established Institute of Noble Girls [14, p. 1-7]. Author of the first textbooks of Drawing and Descriptive Geometry died in Białystok, 1838.

6   Conclusions

1. Works of the French geometers, traineeships of University researchers in l'École Polytechnique of Paris and other educational institutions have influenced teaching of Descriptive Geometry and graphical subjects in Krakow and Vilnius universities.

2. An important meaning had textbook of Descriptive Geometry of M. Potier printed in St. Petersburg in French, 1816. Translators have formed scientific terms of the new subject in taught languages during a short time and translated the textbook into Russian and Polish.

3. Most significant germs of Descriptive Geometry and its teaching period in Vilnius University is year from 1814 to 1832. There favorable conditions have created for the first Descriptive Geometry's Professor H. Rumbowicz to write and publish textbooks of technical graphics for schools and university.

4. Descriptive Geometry curriculum has been determined by works of French authors accumulated in educational institutions and original textbooks of H. Rumbowicz and F. Sapalski.

5. Plans of K. Podczaszyński have failed, and H. Rumbowicz textbook of Descriptive Geometry was not completed for publishing after the closure of Vilnius University.

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PREKURSORZY NAUCZANIA GEOMETRII WYKREŚLNEJ NA UNIWERSYTETACH W KRAKOWIE I W WILNIE

W artykule przedstawiono wzajemne relacje i znaczące prace geometrów G. Monge, M. Potier oraz pionierów geometrii wykreślnej na uniwersytetach w Krakowie i Wilnie: G. Hreczyny, F. Sapalskiego, H. Rumbowicza i innych.