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The contribution of Academician I. H. Aleksandrov to the construction of railways and bridges

Abstract. *One of the most important tasks of the modern history of science and technologies is the study of the activities of leading scientists and practitioners of the past, the influence of their ideas on the development of world science and the process of training specialists in the relevant sectors of the national economy. In the opinion of the authors of the article, one of such figures of the early twentieth century is Academician I. H. Aleksandrov. Historical and scientific analysis of life and activity of I. H. Aleksandrov as a scientist, engineer, organizer of science is of high topicality due to the scale and versatility of his scientific contribution. In the context of the development of hydro-engineering and hydropower, the development of transport communications, I. H. Aleksandrov had world-class achievements that glorified national science. Scientific creative work of I. H. Aleksandrov can be divided into five main directions of development of science and technologies: hydro-engineering, hydropower, geographic zoning, railway transport and irrigation. The construction of the Dnipro hydroelectric power station near Zaporizhzhia (1927-1932) (he prepared a project and directed the construction of the largest hydroelectric power station in Europe at that time), the development of the general plan for the electrification of the USSR (compiled projects of electrification of Central Asia and Eastern Siberia), participation in the construction plan Baikal-Amur railway line, development of the methodology of economic zoning of the Soviet Union and the theory of railway "super-*

mainlines" can be ascribed to the academician. The article concludes that the highly qualified teaching staff of the Moscow Higher Technical School and the Moscow Engineering School of the Office of the Ways of Communications contributed to the thorough theoretical training of a young engineer I. H. Aleksandrov. On the basis of a significant number of sources it was found that occupying different positions, I. H. Aleksandrov participated in solving complex technical issues of contemporary epoch, and scientific research was carried out by I. H. Aleksandrov in the context of the tasks of the engineering science of his time. I. H. Aleksandrov initiated scientific discussions on the construction of ports and canals, in his work he contributed in every way to the development of home industry and the introduction of progressive forms of transport, in particular railway. The authors assert that the modern view on the scientific heritage of I. H. Aleksandrov in the context of the development of hydro-engineering, hydropower and rail transport unambiguously acknowledges that in a concentrated-generalized form ideas, theories and concepts, put forward and scientifically grounded by academician I. H. Aleksandrov, today contribute to the development of scientific and technological process.

Keywords: *I. H. Aleksandrov; railway construction; railway bridges; railway transport; railways; railway machinery*

Introduction

Investigation of the life and activities of Academician I. H. Aleksandrov was mainly carried out by historians without the use of a "technical" toolkit, which objectively made it impossible to consider in full the work of I. H. Aleksandrov in the context of the history of home hydro-engineering and hydropower. There were no exceptions to the study of a few engineers who studied the scientific work of I. H. Aleksandrov. Therefore, the vast majority of publications about the scientist has a pronounced historical, ethnographic, literary-journalistic or popular science features. Besides, the main achievements of academician I.H. Aleksandrov are called only the development of the project and the construction of the Dniprohes and the creation of the theory of economic zoning of the USSR. We argue that the scientific contributions of Academician I. H. Aleksandrov are much bigger and more powerful.

Thus, 1901-1912 in the life and activities of I. H. Aleksandrov is characterized mainly by railway engineering projects (various man-made structures for the Orenburg-Tashkent railway, projects of engineering structures for the lines of Simbirsk-Ufa and the Central Amur Railway, the bridges across the Matyra, the Finnish bridge, Starytskyi bridge, etc.). In 1920-1925 I. H. Aleksandrov developed a draft of the Demuryno-Marhanets high-speed railway, proposing the use of electric traction. During 1921-1923 I. H. Aleksandrov was the head of the regionalization section and chairman of the Commission on new types of transport of the State Planning Committee of the USSR. In 1931 he proposed the idea to construct the Baikal-Amur high-speed railway. In 1932 he was a member of the Scientific and Technical Council of the People's Commissariat of Railways (NKPS) of the USSR. As Chairman of the Transport Commission of the Academy of Sciences of the USSR

I. H. Aleksandrov defended the development of the railway (the construction of locomotives, the introduction of electric traction and the development of rolling stock for various purposes), automobile, river, aviation transport, pipelines, and the construction of seaports.

In addition, the academician's papers include scientific articles, which indicate that in the area of his scientific and engineering interests there were urgent issues of rail transport development.

Research methods

The methodological basis of the work comprises the scientific principles of research, such as objectivity, historicism, systemic, complexity (Pylypchuk & Strelko, 2017; Pylypchuk & Strelko, 2018a; Pylypchuk & Strelko, 2018b). The principles of objectivity and that of historicism enable consideration of the studied historical events in their interrelation and development, giving the grounds to a comprehensive analysis and reliable assessment of historical facts. The application of the systemic method to the work allowed investigating comprehensively the achievements of I. H. Aleksandrov in the field of railway and bridge construction.

Results and discussions

At the turn of the XIX-th and XX-th centuries, a large railway network in the Russian empire, surpassing the network of any European country, as well as the largest in the world along the length of the railways, the availability of a number of technical advances showed a relatively high level of rail transport development in Russia (Kharlanovich, 1994, p. 132). In the 1890s there was an industrial upsurge in the country and at the same time the second rise in railroad construction. Between 1890 and 1900 more than 21 thousand miles of new railway lines were built. The length of the railway network, which amounted to 29,400 km in 1889, grew in 1900 to 50,700 km, i.e. in 60%. A number of railways were built in the Volga region, in black-soil provinces, in the north, in the Trans-Caucasian region. In the 1880s, the Trans-Caspian Railway was built in hard natural conditions, through a sandy desert. Since 1900, research had been carried out, and then the construction of the Orenburg-Tashkent railway with a length of 1852 km was initiated. In 1909, for goods transportation from the ports of the Caspian Sea, the Astrakhan-Red Corner line was put into operation deep into the country. At the same time, a railway line 236 km long from the Armavir station to Tuapse was built. In 1891 the construction of the Great Siberian Road from the Urals to the Pacific Ocean began (Soloveva, 1975).

In the 1890s fast-growing industry influenced the development of railroading in the Russian empire and provided the railways with the necessary equipment. In 1900, the number of locomotives increased to 12.6 thousand, freight wagons – up to 290 thousand and passenger cars – up to 16.4 thousand (Mokrshytskyi, 1941). Since the '80s of the XIX-th century, the role of the state in the development of rail transport was getting stronger. The policy of governmentalization of railways was carried out all around the country: firstly, new railways were built at the expense of the state, and

secondly, private railways were bought up by the government. From 1881 to 1900, 37 private railways were bought out, including the railways of the Main Society of Russian Railways. By 1912 about 70% of the network of main railways was "in the hands of the state treasury" (Vykup Yuho-Zapadnykh zheleznykh doroh, 1906, p. 81-83).

In 1885, the Statute of Russian Railways was approved, which regulated the activities and responsibilities of the railway administration (Khadonov, 1998).

Since the late 80's of the XIX-th century, railways management in Russia was carried out by three agencies: the Ministry of Railways (MSS), the Ministry of Finance and State Control. In the MSS there was concentrated all the administrative management of state railways, under its jurisdiction the technical, operational and economic aspects of the railway were. In 1892 in the MSS there was created the Engineering Council, which was involved in the development of technical specifications for the construction of railways, railway projects, estimates, feasibility studies, etc. (Salov, 1908).

The huge rise of railroad construction, the commissioning of new railway lines served as a powerful impetus for the further development of the metallurgical and machine-building industry, for economic and trade relations with other countries. Thus, at the end of the nineteenth and early twentieth century, the construction of railways in the Russian Empire had become large. And this had led to the need for the construction of many metal bridges. By that time home engineers had gained extensive experience in the design and construction of bridges and systematization of their technical solutions (Zenzinov & Ryzhak, 1978a). At that time, an independent branch of construction machinery was formed as well, in which a special role was given to building mechanics development: bridge designing and erecting.

However, before being actively involved to this process Ivan Havrylovych Aleksandrov had gone a long way. In the Moscow Technical College (today it is the Moscow State Technical University named after M. E. Bauman), in which the young I. H. Aleksandrov, lectures were delivered by Yevhen Oskarovych Paton, at that time, a young professor. He was a well-educated engineer, an outstanding connoisseur of bridge construction, theoretical and practical construction mechanic engineering (Zenzinov & Ryzhak, 1978b). Over time, I. H. Aleksandrov and Ye. O. Paton established friendly relations during their joint work on the design and construction of large bridges. That is, in 1896, in the third year of the technical school, I. H. Aleksandrov took a great interest in bridge construction and decided to devote all his life to this. In 1898, Ivan Aleksandrov moved to the Moscow Engineering School, which in a few years was renamed the Moscow Institute of Railway Engineers. The course in this school was designed for 5 years: three years of theoretical studies and then two years of practical training on a railway. The theoretical course of the mentioned engineering school I. H. Aleksandrov completed in 1901. The practice took place at the construction of the Orenburg-Tashkent railway, where he was engaged in drainage problems solving and designed road structures: bridges, viaducts, and later on he directed their construction.

In 1903, after ending his practical training, I. H. Aleksandrov returned to Moscow. He submitted a detailed report of his work practices and, after its defence, received a diploma certifying his approval as a civil engineer. Just-graduated engineer I. H. Aleksandrov went back to Central Asia, where during 1904 he worked in the Office of the section on the construction of the Orenburg-Tashkent railway (the office was located at the station Turkestan). In 1905 when his work contract on the railway construction finished, I. H. Aleksandrov returned to Moscow and restarted his work under the leadership of Ye. O. Paton on designing large bridges. Together they developed some issues of construction equipment; in particular, they were seriously engaged in calculating the dependence of additional stresses on the stiffness of riveted nodes of bridge farms (Zenzinov & Ryzhak, 1978c).

Works by I. H. Aleksandrov in the field of bridge construction (construction of poles and runways) have undoubted interest till now and reflect his work as a talented practical engineer. Although among other engineering works by I. H. Aleksandrov they are a small volume, their value is quite large. It is I.H. Aleksandrov who introduced into the practice the landing for collecting runways, wooden portal cranes, which were used in bridge construction as long as the middle of the XX-th century. He created many projects for light pedestrian bridges, various railway bridges of small, medium and large runs, a number of racks, caissons for erecting bridge supports, etc. In general, I. H. Aleksandrov, working on the construction of certain railroads, being at the very young age, carried out projects and participated in the erection of more than two dozen original structures, in the functioning of which the reliability, simplicity, and clarity of the schemes were closely linked, lower complexity of manufacturing and erection compared with the bridges of previous years and others designs.

To select the system of the runway structure to be built I. H. Aleksandrov in his projects necessarily took into account the production and economic characteristics of construction: the complexity of manufacturing and erection, weight, transportation, etc. Based on the works of well-known Russian bridge builders, I. H. Aleksandrov made a significant contribution to this field with his innovative work. Ivan Havrylovych not only designed but also supervised the work on the manufacture of metal structures of runways, various devices, and mechanisms for servicing all the operations for the creation of caissons for the erection of bridge supports. The construction of railway bridges and railway overpasses by I. H. Aleksandrov is worth particular mentioning. Thus, until 1906 there was the construction of the Orenburg-Tashkent railway, where, according to the projects by I. H. Aleksandrov, several bridges and many other structures were built (Sybyrskaia tsentralnaia zheleznaia doroha, 1889).

The discovered materials allow us to consider the participation of I. H. Aleksandrov in the development of bridge structures for artificial premises on the Orenburg-Tashkent railway, bridges across the Neva, the Moskva and the Volga rivers. On the specified railway line, based on local conditions (the width of water obstacles, the presence of an intersection with the roads, geological conditions) the

main practice was to design bridges of small runs in the form of cut-out beam systems. This determined I. H. Aleksandrov's choosing the appropriate constructive decisions on runway bridges. The operation of these runways is characterized by an analysis of the interaction of those real forces (in the form of the effect of a constant load on the weight of the railroad, and of temporary loads, on the re-variable load, as well as on a uniformly distributed load) that are created while the train movement and are taken into account in the calculation the "effort" scheme. These "forces" are perceived by the cross section of the metal main bridge trusses in the form of bending moments and transverse and longitudinal forces. I. H. Aleksandrov, considering the development of cut-out beam systems of bridges in the nineteenth century, noted that they were simplified for the purpose of "successful" manufacturing. That is, aesthetic considerations dictated the use of these systems to obtain "clearer and more common lines" of different forms of bridges.

Of course, I. H. Aleksandrov in his research relied on the scientific and engineering concepts and engineering practices of predecessors. So, developing the heritage of M. A. Beleliubskyi in the field of bridge construction, I. H. Aleksandrov at the beginning of the XX-th century unified the runway bridges. For small bridges from 7.2 to 19 m long there were unified cutting beam designs with a solid wall height of 0.92-2.3 m, with the "top" movement; with lattice farms with a height of 2.8 m at runways 19-21 m. In these runways, the bridges of two main unified beams (or trusses) of cross-sectional construction were "split" with lumbar vertical and longitudinal horizontal ties.

From 1905 to 1910, I. H. Aleksandrov, besides solving other problems, was actively involved in the design of railways and bridges. In particular, he took an active part in the development of the Orenburg-Tashkent railroad project, a number of bridges (the Finnish bridge over the Neva, the Borodino bridge in Moscow, the Starytskyi bridge over the Volga, etc.). Since 1912 scientific and engineering interests of I. H. Aleksandrov moved on to study irrigation problems, he developed projects for the construction of irrigation canals in Central Asia, which actively began to be used already in the soviet period.

The first large bridge with the participation of I. H. Aleksandrov was built in 1910-1912 in St. Petersburg (engineers M. A. Beleliubskyi, H. H. Kryvoshein, I. H. Aleksandrov, architect V. P. Apiskov, assistant engineer M. A. Chystiakov) and it was called – Finnish Railroad Bridge. The pedestrian movement on this bridge was forbidden. The design type is an arc with "bottom" traffic, a metal one, of seven runs, the main run up to 44.7 m, the total length of 1139 m. It is interesting that the bridge had two railway tracks (Bunin, 1986).

History shows that St. Petersburg at that time along the entire course of the Neva began to be systematically built up by large bridges. Among the large bridges across the Neva – Liteinyi, Troitskyi, Okhtynskyi – the Finnish bridge was built on the order of the announcement of the competition. The design of this bridge was absolutely in line with the high technical requirements of the time; its design was executed in a modern style. Cross-through arches with a tightening motion, "bottom" traffic and a

split run in the middle of the bridge are very favourably distinguished from other bridges. Thus, the bridge design reflected that time fashion: addiction of the combined systems and was executed in a clear engineering spirit. The Finnish bridge had seven arched runs. A significant increase above the river banks and the need to eliminate the level crossroads required the construction of a reinforced concrete rack – one of the first buildings of this kind. Externally, the bridge looked "heavy", but the approach used in its construction became a bold innovative solution. Today, after reconstruction, this bridge consists of 4 identical runs of 100 m each, in the form of arches with "bottom" traffic, two coastal runways and a split bridge in the middle. On the left bank, the entrance to the bridge passes by a railway multi-run overpass (built in 1911-1923 by a Danish company), on the right – a metal overpass. The engineering principles adopted in this bridge also influenced the system of the last of the city bridges constructed at the same time, and in this construction, the advantage was given to the beam-indistinguishable cross-section system with the lower curvilinear belt (Kochedamov, 1958).

In its constructive and compositional solution, the Finnish bridge is similar to Velykookhtynskyi. The construction of the Finnish bridge was repeated: the railway bridge across the Daugava in Ryha, it also resembles the famous one-run arched bridge in Sydney (Australia). For some time this bridge was called "New", and subsequently it became known as the "Finnish" because the bridge was built mainly on the funds of the Grand Duchy of Finland, which connected the Finnish railway with other railways of the Russian Empire.

We believe that the participation of I. H. Aleksandrov in the construction of such a significant bridge across the Neva River in St.Petersburg is a great achievement by a young engineer. This bridge made I. H. Aleksandrov's name well-known in the engineering world. Actually, this became another success I. H. Aleksandrov in the construction of large bridges. Thus, in the years 1911-1912 in Moscow, through the river of the same name the iron arches of the Borodino and Novospaskyi bridges began to be built (Nosarev & Skriabyna, 2004). The competition announced on the draft of anniversary Borodino Bridge, involved the best specialists of the time. Particularly interesting were several projects. Thus, one of the bridges in three runs, very successfully decorated in the memory of the Battle of Borodino, belonged to academician H.P. Prederii. Another project by engineers H. H. Kryvoshein and I. H. Aleksandrov, architects V. O. Pokrovskyi and Ye. I. Konstantinovych had four runs, emphasizing the national character of this monument, reviving the traditions of the famous builders of the Great Stone Bridge in the forms of the national stone architecture. Unfortunately, these and other, not less interesting projects were not implemented.

I. H. Aleksandrov took an active part in the construction of bridges in other cities and on ordinary roads. The widespread of metal bridges of various types are characteristic for the end of the XIX-th and the beginning of the XX-th century. At the beginning of this period, there were still trends in the construction of cast iron arches. But gradually the leading role was taken over by the iron beam farms that were

"transported" to the city from the railways, where they had long been used on a large scale. A number of city bridges of cantilever-beam type with a "bottom" traffic were being built. These include bridges in cities Pskov, Novgorod, Kyiv, Saratov, bridge projects for Nyzhnii Novgorod, Irkutsk and other cities.

From the beginning of the twentieth century, the massive construction of bridges from reinforced concrete was promoted by M. A. Beleliubskyi (Komech, et al., 2012). The beginning of this process was the construction of regional and local bridges in the territory of modern Ukraine. In the majority, these were bridges of a very simple beam construction without claims to the "high" architecture, but inexpensive and easily built. They represented the interpretation of wooden bridges in reinforced concrete, had original split icebreakers, but were primitive in shape. Subsequently, reinforced concrete was widespread to the railway structures. For instance, on the Kruglobaikalskaia railroad, all bridges, except for the big ones, were built of reinforced concrete. Some of them even now have a very picturesque look.

I. H. Aleksandrov also joined the process described. He is the author of the magnificent Starytskyi Bridge, built in the town of Starytsia, a small and obscure town on the Volga, 65 kilometres from Tver (Prokofev, 1965, p. 312-319). It is noteworthy that the construction was carried out at the same place, which in 1912 the military engineer, professor H. H. Kryvoshein and a young engineer I. H. Aleksandrov offered to the city authorities. But their proposed project was never fully implemented. However, in the old photographs, we see a bridge, somewhat similar to the modern one. The modern look of this bridge built in 1963 is impressive. There is definitely a lot for its design taken from the project by .H. Aleksandrov. The old bridge by I. H. Aleksandrov had served exactly 50 years.

For medium and large runs I. H. Aleksandrov developed unified run-off structures with a length of 36-85 m with grating main farms, with "bottom" traffic. Horizontal bonds took place on the upper and lower bridges belts, on the supporting slopes were assembled portal links – frames; the upper and lower belts of the main farms were executed as two-walled. Thus, the projects of such bridges by I. H. Aleksandrov became examples of a successful combination of the simplicity of the scheme of construction, improvement, and clarity of the lines of the bridge, the rationality of the intersections of all elements and nodes of the structures. The reflection of all the elements of the bridge design allowed to achieve a reduction in its labour capacity during the factory's production. This project was implemented during the construction of dozens of bridge crossings (Starytskyi most, 2016).

Bridge systems by I. H. Aleksandrov became traditional. By now, in the railway bridge construction, continuous beam-wall schemes of metal runways and triangular truss frames continue are to be used. The standardization of the cross sections of such grating farms in a welded version allowed the engineers to resolve the issue of the restoration of the country's railroads after the Second World War as soon as possible. As a permanent consultant in the trust of Stalmist and its divisions – Giprostalmist and the Main office of assembling works – I. H. Aleksandrov studied in detail the rationalization proposals put forward to his consideration. Contemporaries were

impressed with engineer I. H. Aleksandrov's skills to sort out the merits of the proposal and quickly compare the rationality of the proposed design change to the one that was usually used. A brilliant page of home bridge construction is the work during the industry recovery after the Civil War.

From the beginning of his engineering activity, I. H. Aleksandrov worked a lot and fruitfully at all stages of bridge construction. Restoring the destroyed railway bridges became an even more difficult task than building new ones. Each demolished runoff required the use of an individual approach and recovery methods due to the individual nature of the destruction. The acute shortage of metal made it necessary to make a correction for the large volumes of work on the replacement of crushed metal in place. The largest volumes of assembling works I. H. Aleksandrov had to perform in the recovery period after the first world and civil wars, as well as in subsequent years after these periods. At that time, most runs of railway bridges were restored. I. H. Aleksandrov introduced original and at the same time simple and highly effective methods to carry the works out in the conditions of lack of skilled workers and engineers and technicians, and lack of equipment, acute shortage of steel and metal rolling.

I. H. Aleksandrov united around himself gifted engineers, workers and led the specialists to build every bridge, created an organizational "core" of a team of soviet metal assemblers. During this period, the accumulation of experience in the reconstruction of bridges was accompanied by the training of personnel and the creation of a park of new assembly equipment. This was the most important and effective stage in the creation of a school of home metal assemblers.

Conclusions

Within an article, we do not have the opportunity to describe enormous I. H. Aleksandrov's contribution to the restoration of bridges. But each of the reconstructed bridges was unique in terms of the nature of the destruction, and it was necessary to find individual solutions and devices for its restoration. It should be noted that the reconstruction of railway bridges, which was carried out in Russia and in the soviet union during the Civil War and in the years after its completion, occurred during the years of devastation and acute shortage of metal, in the absence of the necessary mounting mechanisms. In a difficult environment, it was also necessary to solve food issues, baking bread, finding shelter for workers, and so on. It was a brilliant period in the activity of I. H. Aleksandrov. Here he manifested himself as a great organizer. A team educated by I. H. Aleksandrov accumulated great skills and got a high qualification. Subsequently, they began to solve the problems of manufacturing and assembling metal structures of industrial premises of the young soviet country, which also needed to be restored.

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Внесок академіка І. Г. Александрова у будівництво залізниць та мостів

Анотація. *Одним із актуальних завдань сучасної історії науки і техніки є вивчення діяльності провідних науковців та інженерів-практиків минулого, впливу їхніх ідей на розвиток світової науки та на процес підготовки спеціалістів відповідних галузей народного господарства. На погляд авторів статті, однією із таких постатей початку ХХ століття є академік І. Г. Александров. Історично-науковий аналіз життя та діяльності І. Г. Александрова як вченого, інженера, організатора науки є актуальним з огляду на масштабність та різноплановість його наукового внеску. У контексті розвитку гідротехніки і гідроенергетики, розвитку транспортних комунікацій, І. Г. Александров мав досягнення світового рівня, які прославили вітчизняну науку. Науково-творчий доробок І. Г. Александрова можна умовно розділити на п'ять основних напрямів розвитку науки і техніки: гідротехніка, гідроенергетика, географічне районування, залізничний транспорт та іригація. У доробку академіка – будівництво Дніпровської ГЕС біля Запоріжжя (1927–1932) (підготував проект і керував будівництвом найбільшої на той час ГЕС у Європі), розробка генерального плану електрифікації СРСР (склав проекти електрифікації Середньої Азії та Східного Сибіру), участь у створенні плану будівництва Байкало-Амурської залізничної магістралі, розробка методології економічного районування Радянського Союзу та теорії залізничних «надмагістралей». У статті зроблено висновок, що висококваліфікований професорсько-викладацький склад Московського вищого технічного училища та Московського інженерного училища Відомства шляхів сполучення сприяв ґрунтовній теоретичній підготовці молодого інженера І. Г. Александрова. На підставі значної кількості джерел встановлено, що обіймаючи різні посади, І. Г. Александров брав участь у вирішенні складних технічних питань сучасної йому епохи, а наукові дослідження І. Г. Александрова здійснювалися у контексті завдань інженерної науки його часу. І. Г. Александров вів наукові дискусії з питань будівництва портів і каналів, у своїй діяльності всіляко сприяв розвитку вітчизняної промисловості і впровадженню прогресивних форм транспорту, зокрема залізничного. З впевненістю можна стверджувати, що сучасне бачення наукової спадщини І. Г. Александрова в контексті розвитку гідротехніки, гідроенергетики та залізничного*

транспорту беззаперечно визнає, що в концентровано-узагальненій формі ідеї, теорії та концепції, висунуті та науково обґрунтовані академіком І. Г. Александровим, сьогодні сприяють розвитку науково-технічного процесу.

Ключові слова: *І. Г. Александров; будівництво залізниць; залізничні мости; залізничний транспорт; залізничні магістралі; залізнична техніка*

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Вклад академика И. Г. Александрова в строительство железных дорог и мостов

Аннотация. *Одним из актуальных задач современной истории науки и техники является изучение деятельности ведущих ученых и инженеров-практиков прошлого, влияния их идей на развитие мировой науки и на процесс подготовки специалистов соответствующих отраслей народного хозяйства. На взгляд авторов статьи, одной из таких фигур начала XX века является академик И. Г. Александров. Историко-научный анализ жизни и деятельности И. Г. Александрова как ученого, инженера, организатора науки является актуальным, учитывая масштабность и разноплановость его научного вклада. В контексте развития гидротехники и гидроэнергетики, развития транспортных коммуникаций И. Г. Александров имел достижения мирового уровня, которые прославили отечественную науку. Научно-творческое наследие И. Г. Александрова можно условно разделить на пять основных направлений развития науки и техники: гидротехника, гидроэнергетика, географическое районирование, железнодорожный транспорт и ирригация. В активе академика – строительство Днепровской ГЭС возле Запорожья (1927-1932) (подготовил проект и руководил строительством крупнейшей в то время ГЭС в Европе), разработка генерального плана электрификации СССР (составил проекты электрификации Средней Азии и Восточной Сибири), участие в создании плана строительства Байкало-Амурской железнодорожной магистрали, разработка методологии экономического районирования Советского Союза и теории железнодорожных «сверх-магистралей». В статье сделан вывод о том, что высококвалифицированный профессорско-преподавательский состав Московского высшего технического училища и Московского инженерного училища Ведомства путей сообщения способствовал основательной теоретической подготовке молодого инженера И. Г. Александрова. На основании значительного количества источников*

установлено, что занимая различные должности, И. Г. Александров участвовал в решении сложных технических вопросов современной ему эпохи, а научные исследования И. Г. Александрова осуществлялись в контексте задач инженерной науки его времени. И. Г. Александров вел научные дискуссии по вопросам строительства портов и каналов, в своей деятельности всячески способствовал развитию отечественной промышленности и внедрению прогрессивных форм транспорта, в частности железнодорожного. С уверенностью можно утверждать, что современное видение научного наследия И. Г. Александрова в контексте развития гидротехники, гидроэнергетики и железнодорожного транспорта беспрекословно признает, что в концентрированно-обобщенной форме идеи, теории и концепции, выдвинутые и научно обоснованные академиком И. Г. Александровым, сегодня способствуют развитию научно-технического процесса.

Ключевые слова: *И. Г. Александров, строительство железных дорог; железнодорожные мосты; железнодорожный транспорт; железнодорожные магистрали; железнодорожная техника*

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Work in the interests of rail transport: the second Minister of Railway Transport of the Russian Empire – Volodymyr O. Bobrynskyi (1869-1871)

Abstract. *The expanded and comprehensive study of the way of life of the personalities of prominent figures who have made a significant contribution to the formation and development of homeland and world science remains a topical task of historical science at the present stage of its development. The article is devoted to the coverage and periodization of stages of life and activities in the field of railroad construction of the Russian Empire, of its second Minister of Railway Transport Volodymyr O. Bobrynskyi. The preconditions of V. O. Bobrynskyi's career growth have been considered. The article shows how the study at St. Petersburg University influenced the formation of V. O. Bobrynskyi's personality. The stages of the military career of V. O. Bobrynskyi during the Crimean War of 1854-1856 have been investigated. Analysis of V. O. Bobrynskyi's activity in different public positions until he was appointed as the Minister of Railway Transport, allowed to assess his contribution to state building and the development of the Russian Empire in various fields. It has been established that Volodymyr Bobrynskyi, acting as the Minister of Railway Transport of the Russian Empire, became the initiator of the construction of 27 railway lines, and as the creator of the network of railways, including the Ukrainian segment. His activities during the administration of the ministry were aimed at strategic directions for the development of railways, in particular: to establish links between the railways that were still divided; to ensure continuation of lines that were not adjacent to the general railway network; to connect internal provinces with seaports (with Mykolaiv and Mariupol); to develop the railways in the*

interests of the coal and mining industry, as well as the Vologda and Vyatka-Dvina lines. In addition, on the initiative of the Minister, it was envisaged to include two strategic railway lines - from Prague to Warsaw and from Lukov to Ivanogorod. Analysis of reforms of V. O. Bobrynskyi in the management of the railways showed that he successfully pursued a policy of removing from the state administration all the lines already built, and those that were still being built on the expense of the public purse. At the end of the ministerial activity of V. O. Bobrynskyi in September 1871, the length of the railways in the Russian Empire grew almost twice and exceeded 13 thousand miles and almost all of them belonged to private railway companies. The article shows the role of V. O. Bobrynskyi in solving the problem of constru-ction of narrow-gauge railways. And although his occupying the post of Minister of Railway Transport was short-lived, some two years, V. O. Bobrynskyi should be referred to the constellation of those ministers who successfully built railway transport and its facilities.

Keywords: *the Russian Empire; reforms on rail transport; development of the railway network; private railway companies; Volodymyr O. Bobrynskyi's role in the reforms*

Introduction

By named Decree given to the Government Senate on June 16 (28), 1865, the commander in chief of the Russian Empire was awarded the title of Minister of Railway Transport, and his subordinate Office was called the Ministry of Railway Transport. The first minister of communications was P. P. Melnikov – the founder of the national transport science, the chief technical director of the design and construction of the railway line Petersburg-Moscow, the honorary academician of the St. Petersburg Academy of Sciences. Under his leadership, the Ministry (1865-1869) built about 4700 km of new railways.

After the resignation of P. P. Melnikov, Major General, Count Volodymyr O. Bobrynskyi was appointed as the Minister of Railway Transport. He became the 2nd Minister of Railway Transport of the Russian Empire. Although he was in this position for a short period of time – over 2 years, he managed to bring the construction of railways to 13 thousand miles. His achievement is also the fact that he proposed a railway network construction plan covering 27 railway lines with a length of 7362 versts (i.e. miles). V. O. Bobrynskyi planned and built important railways in the south and west of Ukraine. Today we successfully use his railways.

The purpose of this article is to highlight the main achievements of the 2nd Minister of Railway Transport of the Russian Empire, as well as to analyze his activities in the field of construction of new railways.

Research methods

During the preparation of the article, chronological, comparative methods of historical knowledge, classification, and systematization of historical sources and bibliographic material were used (Pylypchuk & Strelko, 2017; Pylypchuk & Strelko,

2018). The use of these methods and approaches to scientific research allowed to retrace the way of life and professional activity of V. O. Bobrynskyi systematically and critically evaluate the sources used, highlight the main points in the current state of studying the subject and the results of predecessors, specify the most promising directions of research, give a description of the previous works on this issue and clearly distinguish issues that have not yet been resolved.

Results and discussions

Volodymyr Bobrynskyi belonged to the constellation of those Ministers of Railway Transport in the Russian Empire of the second half of the nineteenth century, who laid and developed the foundations of the railroad business and thoroughly developed the transport system of the country. In the Encyclopaedia of History of Ukraine, V. Lazanskaya states that the Smila lineage (the Bobrynskyi-Smilianskyis) is a glorious Count family, its members were large landowners, industrialists, state and public figures, agronomists and generals (Lazanska, 2009). The patriarch of the Smila lineage of the Bobrynskyis was Oleksii Bobrynskyi. His sons - Oleksandr, Lev, and Volodymyr, buying up new lands to the acquired in the inheritance ones, at the beginning of the twentieth century had already 52 thousand acres. The Bobrynskyi-Smilianskyis founded 6 sugar factories, 1 refinery, 5 wineries, 4 brick factories, 1 sawmill, 2 flour-grinding factories, coal mines, and others. At the beginning of the XX century, their industrial enterprises produced annually products for 10 million rubles.

Figure 1. V. O. Bobrynskyi in Paris (in the ’40s of the 19th century)
(Count Vladimir Alexeevich Bobrinskyi, 1845)

They owned large estates in Tula, Kyiv, Kursk, Orel, Symbirsk and other provinces. The cost of estates, buildings and available capital amounted to 17.5 million rubles. They were the founders of powerful European sugar factories, owners and shareholders of enterprises in wine, flour mill, mining industry (Vivcharyk, 2005). With the assistance of the Bobrynskyi-Smilianskyis there started and for a long time were functioning Smilianski technical courses. It was the first in the Russian Empire educational institution, which trained specialists for sugar production.

Representatives of the Smila lineage of this glorious family were state and public figures, engaged in agronomy, genealogy, and archaeology. Oleksandr Oleksiiovych's first son was an attorney by education, from 1896 he was a member of the State Council of the Russian Empire, admired the genealogy, published a two-volume book titled "Noble generations Listed in the General Armorial of the All-Russian Empire" and "Student Songs of 1825-1855". His other son - Volodymyr Bobrynskyi (1824-1898) was a Tula landowner, but devoted himself to the railway business; in 1869-1871 he served as the Minister of Railway Transport of the Russian Empire (Moskalenko, 2009).

Volodymyr Bobrynskyi was born on 2 (14 October) in 1824 in St. Petersburg. After graduating from the University of St. Petersburg (in 1846), he served in the Petersburg provincial department, and then (from 1851) in the office of the Kyiv governor. He received his education at the Law Department of the University of St. Petersburg. He became a bachelor of law (Zenzinov, 1995a).

Figure 2. Volodymyr O. Bobrynskyi (1846)
(Count Vladimir Alexeevich Bobrinskyi, 1845)

With the beginning of the Crimean War of 1854-1856, he got into an active army. As a non-commissioned officer of the tsarist army, he participated in military operations on the Danube, in Crimea, under the siege of Silistra. In 1855 he became an officer, and since April 1856 he became an aide-decamp under Emperor Oleksandr II. He participated in the defence of Sevastopol. After the end of the Crimean War, he was in the retinue of the emperor and performed his personal mandate. Later, in 1863, he participated in the construction of the St. Petersburg-Warsaw Railway, where he headed the construction of the site from Vilnius to Warsaw. By the decree of Emperor Oleksandr II of April 17 (29), 1863 he was appointed as Acting Director of the Grodno Military Governor. On May 4 (16), 1863, received the rank of Major General and was appointed to the emperor's suite. By the decree of Oleksandr II from July 21 (August 2) in 1863, at his own discretion, he was dismissed with the preservation of the court rank.

On behalf of Emperor Oleksandr II in 1868, he carried out an audit of the Mykolaiv (St. Petersburg-Moscow) and Moscow-Kursk Railways, and from June 4, 1868, to April 20, 1869, he was a fellow (deputy) of the Minister of railway transport P. P. Melnikov. From April 1869 to September 1871 he was the Minister of Railway Transport of the Russian Empire.

Even before the appointment as the Minister, Count V. O. Bobrynskyi opposed the state construction of railways and criticized the views of P.P. Melnikov. In particular, this was manifested in the consideration of complaints from grain merchants from the districts of the Moscow-Riazan, Riazan-Kozlovsk and Orel-Vitebsk railways that on these lines the goods are delayed for several months and are not delivered in time to the destinations. And this damaged the interests of trade. Verification of these complaints was entrusted to V. O. Bobrynskyi as the Deputy of the Minister of Railway Transport P. P. Melnikov. V. O. Bobrynskyi travelled all of these lines and submitted to the Emperor Oleksandr II the report, bypassing his immediate supervisor. Recognizing the complaints of the grain merchants fair, Volodymyr Oleksiiovych proposed measures to increase the freight capacity of the railways: the construction of the second railway track in the Moscow-Viazma direction, the opening of additional junctions on single-line sections, the strengthening of water supply, the purchase of additional rolling stock, etc. He supported the railway policy of the Minister of Finance M. Kh. Reitern.

For the realization of these measures, V. O. Bobrynskyi recommended extracting from the state treasury loans to specified private railways in the amount of 9 million rubles. The issue was submitted to the Special Commission under the chairmanship of the chairman of the Committee of the Railways Count S. H. Stroganov. At that time, the Minister of Railway Transport P. P. Melnikov considered the complaints of grain merchants heavily exaggerated and guaranteed that before the start of navigation, all the goods would be transported and timely sent abroad, without the expense of the great means of the public purse. A special council members, as well as the Emperor Oleksandr II, did not support P. P. Melnikov.

After six months of work on the post of Minister of Railway Transport V. O. Bobrynskyi, at a council of prelacy of Russia under the chairmanship of Emperor Oleksandr II in late 1869, discussed the issue of railway construction in the country. V. O. Bobrynskyi noted that the Ministry of Railway Transport received a number of requests for permission for the construction of new railways and proposed to develop a new plan of the railway network to replace the one developed by P. P. Melnikov and approved two years earlier. And January 2, 1870, V. O. Bobrynskyi received from the emperor the command to draft a new network of railways, including into it five lines from the network of 1868. It was planned to build up to 4000 versts (i.e. miles) of new lines.

V. O. Bobrynskyi's proposals were repeatedly discussed at the meetings of the Railway Committee, and if the first part, which included five lines from the previous network with significant changes, did not raise any special objections, then the second, which consisted of 18 new lines, took place in three meetings and concerning some lines it came to disputes (Zenzinov, 1995b).

Figure 3. The second Minister of Railway Transport of the Russian Empire – Volodymyr O. Bobrynskyi (1869-1871)
(Bobrinskyi Vladimir Alekseyevich, 1824)

The second part, proposed by V. O. Bobrynskyi, had the following goals: to establish a connection between the railways that were still divided; to ensure continuation of lines that were not adjacent to the general railway network; connect the inner provinces with the seaports (to Mykolaiv and Mariupol); to develop the railways in the interests of the coal and mining industry, as well as the Vologda and Vyatka-Dvina lines. In addition, at the request of the military minister, it was envisaged to include in the plan two strategic railway lines - from Prague to Warsaw and from Lukov to Ivanugorod. Most members of the Railways Committee supported a new plan for building a railway network. After this, the emperor wrote: «Execute, and in relation to those questions which led to disputes, I approve the opinion of the majority» (Lapin, 2008).

As a result, the network of railways in 1870 covered 27 railway lines with a length of 7362 versts (i.e. miles). In addition, the Committee provided the Minister of Railway Transport, with the consent of the Minister of Finance, the right to enter into submissions on the construction of feeding (accessory) spurs in case of need. Unlike previous plans, in the new provision on the network, there was no division of lines into categories - it served as a general guide to the future activities of the Ministry of Railway Transport and the Ministry of Finance.

The first line, according to the new plan, became the Brest-Smolensk railway. Contrary to the rules, during the issuance of a permit for its construction, there was no competition between the searchers, although there were many people interested in the construction of this railway. March 4, 1870, this right, on the proposal of V. O. Bobrynskyi was given to the Moscow-Smolensk Railway Company. In the future, the system of competition between searchers in sealed envelopes was applied only once – when issuing a concession to the Brest-Berdychiv line. Officially V. O. Bobrynskyi explained this by the fact that search engines, captured by competition, could assign unevenly underestimated construction price, which would lead to underestimation of construction quality, violation of technical conditions, and later to the deterioration of the performance of the lines and the increase in the cost of their containment.

Characterizing the activity of V. O. Bobrynskyi on the management of the Ministry of Railway Transport, M. O. Kyslynskyi wrote in 1902: «He set himself the goal of completely removing the Government from direct involvement in the construction and operation of railways and to assign these responsibilities exclusively to private companies. In this case, Count Bobrynskyi had the active support of the Minister of Finance, who, as it is known, was himself an opponent of the state-owned railway industry. The period of 1869-1871 was a short period of time when the ministers of railway transport and finance made a full agreement on the main issues of rail policy» (Kislinskiy,1902).

Based on these guidelines, V. O. Bobrynskyi planned to remove from the state administration all the already built railway lines, and those that were still being built at the expense of the public purse on the Right Bank of Ukraine, dividing them into

three groups. The operation of the railways of each group was planned to be transferred to a separate joint-stock company. The lines were distributed as follows:

1st group - from Kyiv to Zhmerynka. The company also had to build a railroad from Berdychiv to Brest and a branch line from one of the points to the Austrian border.

2nd group - from Volochysk through Zhmerynka and Rozdilna to Odessa with Tiraspol-Chisinau line and with the Odessa-Balta-Yelisavetgrad railway. The company also planned to complete the Chisinau spur and extend it to the Prut River in the direction of Jass (Romania).

3d group - from Yelisavetgrad (now Kropyvnytskyi) to Kremenchuk, as well as to construct a line from one of the points of this railway to the city of Mykolaiv.

In total, in 1870 it was allowed to build new railways in length 1723 versts (i.e. miles), but it was built more, 2445 miles of new lines.

V. O. Bobrynskyi as the minister had unsuccessful attempts to construct narrow-gauge railways as feed lines to the railways with a simple track. All narrow-gauge railways (Livensk, Chudovo-Novgorod, and Yaroslavl-Vologda) were cheap, but their operation proved to be compatible with the high costs of transfer cargoes to wide-gauge wagons. And this greatly increased the cost of transportation. On the initiative of V. O. Bobrynskyi, during the sale of the Mykolaiv Railroad to the Main Society of Russian Railways, a contract with American Winans on the maintenance of the railroad had been terminated. The term of this contract expired in July 1874. For the termination of the contract, Winans received from the public purse a remuneration of 5 million rubles (Bogdanovich,1995).

At the end of the ministerial activity of V. O. Bobrynskyi in September 1871, the length of railways in the Russian Empire exceeded 13 thousand miles, and almost all of them belonged to private railway companies (with the exception of 67 km of Lyvny-Verkhivia branch line). There were 44 such companies. All of them were debtors of the government: by guarantees of shares and bonds issued by the companies; by deposit interest and repayment on bonds, on loans, and for transferring state-owned railways to private companies – to a total of 173.8 million rubles (Klimenko, 2006).

According to the well-known economist O. O. Chuprov, the construction of railways by private companies was expensive. In 1875 he noted: «For those who use our Orel-Vitebsk or Kozlovsk-Tambov lines, located on an equal footing, it is difficult to believe that they have cost our homeland as much as, for example, Germany's Bavarian and Baden state railways» (Chuprov, 1875). And he gives the cost by versts (i.e. miles) of construction at the rate of 1870: Orel-Vitebsk - 83 thousand rubles, Kozlovsk-Tambov - 82 thousand rubles, and such mountain railways as Bavarian - 82 thousand rubles, Baden - 78 thousand rubles.

Famous publicist and writer K. O. Skalkovsky described V. O. Bobryn-skyi: «In 1869 the Count. V. O. Bobrynskyi, whose father was famous for the founding of beet-and-sugar industry in the South of Ukraine, became the Minister. The Count, not familiar with the issue at all, had been the minister for a little more than a year and

lost his post for an unsuccessful project - to rent the Volga to the Epstein company» (Skalkovskiy, 1890). Another contemporary, academician of St. Petersburg Academy of Sciences O. V. Nikitenko wrote in this regard in his diary: «The Polish and Berlin capitalists nearly took possession of the Volga Shipping Company. The intervention of the Minister of Finance Reitern defeated the treaty already confirmed by Oleksandr II after the report of V. O. Bobrynskyi. Knowing from Reitern, Oleksandr II made a reprimanded V. O. Bobrynskyi and told him that he was very poorly surrounded by assistants. V. O. Bobrynskyi fell ill and was no longer in charge of the ministry. It is said that there were a lot of abuses in the Department of Railway Transport» (Pylypchuk & Strelko, 2017).

September 2 (14), 1871 V. O. Bobrynskyi was dismissed because of the disease without retaining membership in the State Council of the Russian Empire. After his resignation, he settled in the city of Smila and devoted himself entirely to agriculture, in particular, beet and sugar industry. Before the beginning of the Crimean War, he was elected a Cherkasy district chief of the nobility and led the Smila estate in the lifetime of his father. From the agricultural activity of the count, we should note the introduction into crop rotation of significant crops of spring, and then winter wheat, which eventually displaced the ravine and took the first place among the grain crops of the south-western region. But especially much work and energy he devoted to the concerns, support, and development of the homeland sugar industry. Thanks to his ability and ingenuity, the beet and sugar industry avoided the crisis, which could have caused the closure of many small beet and sugar factories. The result of this work V. O. Bobrynskyi was the publication by the government of the law of November 20, 1895, entitled «On Certain Measures for the Sugar Industry». In society, this law was called «government regulation».

His brilliant activity was marked by the state government with: The Order of St. Hanna, the 4th class "For Bravery" (1855); Silver medal in memory of the coronation of Oleksandr II (1856); The Order of St. Volodymyr, the 3d class (1868); the Order of St. Hanna, the 1st class (1886); Commander's Cross (1865).

V. O. Bobrynskyi died at the age of 74 in the city of Smila Cherkasy region of the Kyiv province.

Conclusions

The article covers the main achievements of the second Minister of Railway Transport of the Russian Empire V. O. Bobrynskyi.

Analysis of the activity of V. O. Bobrynskyi in various public positions and his military career until the appointment as the Minister of Railway Transport, allowed us to assess his contribution to state building and development of the Russian Empire in various fields.

It has been established that Volodymyr Bobrynskyi, acting as the Minister of Railway Transport of the Russian Empire, had a name for the initiator of the construction of 27 railway lines, and for the creator of the network of railways, including the Ukrainian segment. His activities during the administration of the

ministry were aimed at strategic directions for the development of railways, in particular: to establish links between the railways that were still divided; to ensure continuation of lines that were not adjacent to the general railway network; to connect internal provinces with seaports (with Mykolaiv and Mariupol); to develop the railways in the interests of the coal and mining industry, as well as the Vologda and Vyatka-Dvina lines.

Analysis of reforms of V. O. Bobrynskyi in the management of the railways has shown that he successfully pursued a policy of removing from the state administration all the lines already built, and those that were still being built on the expense of the public purse. At the end of the ministerial activity of V. O. Bobrynskyi in September 1871, the length of the railways in the Russian Empire grew almost twice and exceeded 13 thousand miles and almost all of them belonged to private railway companies. The article shows the role of V. O. Bobrynskyi in solving the problem of construction of narrow-gauge railways.

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Праця в інтересах залізничного транспорту: другий міністр шляхів сполучення Російської імперії – Бобринський Володимир Олексійович (1869-1871)

Анотація. *Розгорнуте та всебічне дослідження життєвого шляху персоналій видатних діячів, що зробили вагомий внесок у становлення та розвиток вітчизняної та світової науки, залишається актуальним завданням історичної науки на сучасному етапі її розвитку. Стаття присвячена висвітленню й періодизації етапів життя та діяльності на ниві розбудови залізничного транспорту Російської імперії, її другого міністра шляхів сполучення Володимира Олексійовича Бобринського. Розглянуто передумови кар'єрного зростання В. О. Бобринського. Показано важливу роль у формуванні В. О. Бобринського як особистості, такого етапу життя, як навчання у*

Петербурзькому університеті. Досліджено етапи військової кар'єри В. О. Бобринського під час Кримської війни 1854-1856 рр. Аналіз діяльності В. О. Бобринського на різних державних посадах до призначення міністром шляхів сполучення, дозволив оцінити його внесок у державотворення та розбудову Російської імперії у різних галузях. Встановлено, що на посаді міністра шляхів сполучення Російської імперії Володимир Олексійович Бобринський виступав як ініціатор будівництва 27 залізничних ліній, та як автор мережі залізниць, зокрема українського сегменту. Його діяльність під час керування міністерством, була спрямована на стратегічні напрямки розвитку залізниць, зокрема: встановити зв'язок між залізницями, які були ще розділені між собою; забезпечити продовження ліній, які не примикали до загальної мережі залізниць; з'єднати внутрішні губернії з морськими портами (з Миколаєвим та Маріуполем); здійснити розвиток залізниць в інтересах кам'яновугільної та гірничозаводської промисловості, а також Вологодської і В'ятсько-Двінської ліній. Крім того, за ініціативою міністра передбачалося включити до плану дві стратегічні залізничні лінії – від Праги до Варшави та від Лукова до Івангорода. Аналіз реформ В. О. Бобринського в управлінні залізничним господарством показав, що він успішно проводив політику вилучення з казенного управління усіх залізничних ліній як вже були побудовані, так і тих, що ще будувалися за рахунок казни. Наприкінці міністерської діяльності В. О. Бобринського у вересні 1871 р. протяжність залізниць в Російській імперії зросла у майже вдвічі та перевищила 13 тисяч верст і майже усі вони належали приватним залізничним товариствам. У статті показана роль В. О. Бобринського у вирішенні проблеми будівництва вузькоколійних залізниць. І хоча його перебування на посаді міністра шляхів сполучення було нетривалим, якихось два роки, В. О. Бобринського слід відносити до плеяди тих міністрів, які вдало розбудовували залізничний транспорт та його господарство.

Ключові слова: *Російська імперія; реформи на залізничному транспорті; розвиток мережі залізниць; приватні залізничні товариства; роль у реформах Володимира Олексійовича Бобринського*

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Работа в интересах железнодорожного транспорта: второй министр путей сообщения Российской империи - Бобринский Владимир Алексеевич (1869-1871)

Аннотация. *Развернутое и всестороннее исследование жизненного пути персоналий выдающихся деятелей, внесших весомый вклад в становление и развитие отечественной и мировой науки, остается актуальной задачей исторической науки на современном этапе ее развития. Статья посвящена освещению и периодизации этапов жизни и деятельности на ниве развития железнодорожного транспорта Российской империи, ее второго министра путей сообщения Владимира Алексеевича Бобринского. Рассмотрены предпосылки карьерного роста В. А. Бобринского. Показано важную роль в формировании В. А. Бобринского как личности, такого этапа жизни, как обучение в Петербургском университете. Исследованы этапы военной карьеры В. А. Бобринского во время Крымской войны 1854-1856 гг. Анализ деятельности В. А. Бобринского на различных государственных должностях до назначения министром путей сообщения, позволил оценить его вклад в строительство государства и развитие Российской империи в различных областях. Установлено, что в качестве министра путей сообщения Российской империи Владимир Алексеевич Бобринский выступал как инициатор строительства 27 железнодорожных линий, и как автор сети железных дорог, в частности украинского сегмента. Его деятельность во время управления министерством, была направлена на стратегические направления развития железных дорог, в частности: установить связь между железными дорогами, которые были еще разделены между собой; обеспечить продолжение линий, которые не примыкали к общей сети железных дорог; соединить внутренние губернии с морскими портами (с Николаевом и Мариуполем) осуществить развитие железных дорог в интересах каменноугольной и горнозаводской промышленности, а также Вологодской и Вятской-Двинской линий. Кроме того, по инициативе министра предполагалось включить в план две стратегические железнодорожные линии - от Праги до Варшавы и от Лукова к Ивангорода. Анализ реформ В. А. Бобринского в управлении железнодорожным хозяйством показал, что он успешно проводил политику изъятия из казенного управления всех железнодорожных линий, которые уже были построены, так и тех, что еще*

строились за счет казны. В конце министерской деятельности В. А. Бобринского в сентябре 1871 протяженность железных дорог в Российской империи выросла почти вдвое и превысила 13 000 верст и почти все они принадлежали частным железнодорожным обществам. В статье показана роль В. А. Бобринского в решении проблемы строительства узкоколейных железных дорог. И хотя его пребывание в должности министра путей сообщения было непродолжительным, каких-то два года, В. А. Бобринского следует относить к плеяде тех министров, которые успешно строили железнодорожный транспорт и его хозяйство.

Ключевые слова: *Российская империя; реформы на железнодорожном транспорте; развитие сети железных дорог; частные железнодорожные общества; роль в реформах Владимира Алексеевича Бобринского*

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A significant contribution of professor V .Ye. Timonov to the construction of seaports

Abstract. *Analysis of the creative heritage of Vsevolod Yevhenovych Timonov (1862-1936) - a prominent communications engineer, professor of the Institute of Engineers of Railway Transport of Emperor Olexandr I, a hydrotechnical expert, a specialist in the field of water transport, a port administrator, head of the Petersburg divission of railway transport (1899-1907), the founder and Director of the First Hydrotechnical Laboratory in the Russian Empire (1907-1920) and the Hydrotechnical Research Institute at the Leningrad Institute of Railway Engineers, a member of the Engineering Council of the Ministry of Railway Transport, Head of Statistics and Cartography of Ministry of Railway Transport (since 1907), head of the International section of the High Technology Council of the People's Commissariat of Railway Transport (since 1918), is especially important to understand the processes of development of homeland hydrotechnical science and water transport. His scientific works are devoted to the construction of ports, bridges, and lighthouses, to improvement of the conditions of navigation on the large rivers of the country, to regulation of their beds with rapids. He was the first who pointed to the advantage of mechanical excavation in improving navigable conditions on large rivers. Since 1886, V .Ye. Timonov worked at the Office of Railway Transport, while at the same time taking up construction and administrative and teaching positions. V .Ye. Timonov carried out the first works on the laying of quay-piers from rock body in the Baltic Sea (1887), organized and conducted the first dredging work (1887), explored the mouths of the Dnipro, Don and Volga rivers (1890) and defined the branches of each river for the improvement of navigation, made a draft of the rapids' parts of the Dnipro and conducted research works on one of the thresholds (1894), researched the coasts of the Pacific ocean to select the location of the Pacific port of Siberian Railway and chose a place for this port (Vladyvostok), investigated the rivers of the Amur region and proposed measures to improve them (1895), etc. V .Ye. Timonov is the founder of the original direction in the construction industry, one of the founders of the doctrine of ports, the founder of the theory of the framework of hydraulic structures, the developer of the theory of port infrastructure,*

the historian of science and technology. Vsevolod Yevhenovych occupies one of the honorary places in the world of hydraulic engineering, water, and partly rail transport. Common factors in problems, defined by him on the basis of his numerous and original works, as well as works of his students, made a significant contribution to the further development of hydraulic engineering not only in our country but also in the world. Scientific ideas of V .Ye. Timonov significantly expanded and deepened our understanding of the regularities of development of hydraulic engineering science. In the context of his original beliefs, he analyzed the previously accumulated scientific material and showed it in a new and correct interpretation. His works, his ideas, theories and views revealed unprecedented opportunities for hydraulic engineers.

Keywords: *the Russian Empire; reforms on water transport; development of a network of ports; the role of V .Ye. Timonov in the reforms of port construction*

Introduction

In the beginning of 1885, the attention of the scientific and engineering community of the Russian Empire was attracted by the article "Essay on the development of the Odesa port" of V. Ye. Timonov, a student of the 3rd year of the Institute of Railway Engineers, which was published in the journal "Engineer" (St. Petersburg) of the Ministry of Railway Transport (Timonov, 1886). As it is known at the same time, in Kyiv, there was edited the "Engineer" journal too, but of the Kyiv branch of the Russian Technical Society. The young author of the article gathered so much material during his student practice that this allowed him to draw up a brief history of the construction and development of the Odesa port. Vsevolod Timonov characterized the climatic, hydrological and geological features of the gulf, highlighted the issue of equipping important structures (reported information about the work on their construction), and demonstrated the need and ways to increase port capacity, in particular by expanding the area of the protected water and extending the harbor area.

Research methods

During the preparation of the article, chronological and comparative methods of historical knowledge, classification and systematization of historical sources and bibliographic material have been used (Pylypchuk & Strelko, 2017; Pylypchuk & Strelko, 2018a; Pylypchuk & Strelko, 2018b). The use of these methods and approaches to scientific research allowed to reconstruct the way of life and professional activity of V. Ye. Timonov in the field of construction and operation of seaports against the background of the modern era.

Results and discussions

After returning from the internship in Odesa to St. Petersburg, surprised at such a productive work of the student, the professor asked him: "For what purpose did you describe the Odesa port?" Vsevolod Timonov, without thinking, replied: "To add to

the bunch of human knowledge this small branch as well. I think, Professor, that we should make descriptions of all major transport facilities. Such systematization will ease the work of future designers. Because without a retrospective there is no prospect» (Timonov, 1978, p. 170-171). Despite the lack of sufficient experience, V. Ye. Timonov correctly described the technical history of the emergence and development of a large port on the Black Sea. He saw that the end of the nineteenth century was characterized by a rapid concentration of trade, commercial and industrial capital flows in the south of Ukraine and that this process was most evident in Odesa. Further development of sea trade and, first of all, grain trade, increase of urban population, growth of industrial enterprises - all this attracted not only homeland but also world public attention to Odesa in that time. Actually, that is why V. Ye. Timonov in his work notes that the competition between America, Australia, and India, since the second half of the nineteenth century, makes to pay even more attention to the equipment of the port of Odesa (Soloviova, 2018).

V. Ye. Timonov, from his younger days, witnessed the active development of maritime trade and the development of the port of Odesa. Apparently, this circumstance played a decisive role in the fact that in the technical activity of V .Ye. Timonov a question of development of homeland water transport and, first of all, the marine one, was almost the most important. Later, scientist-engineer V. Ye. Timonov (Fig. 1) became the author of many publications, which pricelessly contributed to solving various transport issues (Sokolsky, 2016).

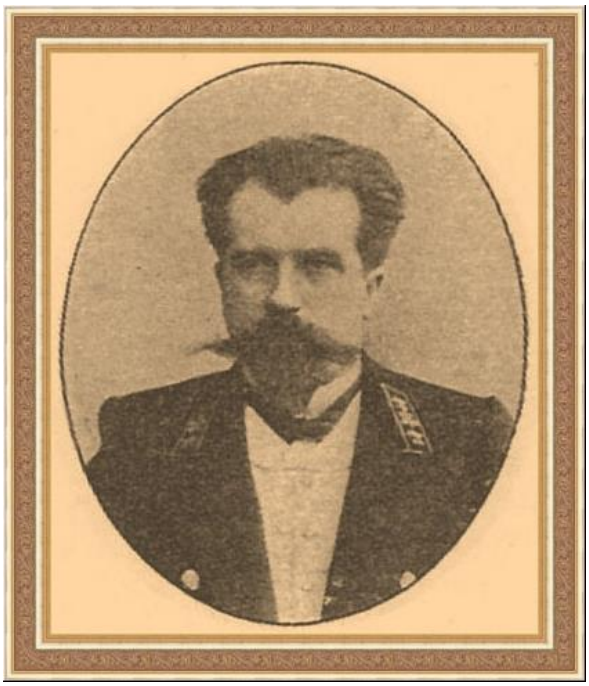

Figure 1. Portrait image of V. Ye. Timonov
(Timonov Vsevolod Yevhenovych, 2019)

Today it is clear to us that being a student V. Ye. Timonov could not make in his article a deep analysis of all the practice of construction and operation of the port, but the historical and technical research he prepared on the development of the port of Odesa was the first original work that began a series of similar works on other ports of the Russian Empire (Armiero & Tucker, 2017). All these works were published under the unique title «Description of Russian commercial ports and the history of their construction». Commission on the Arrangement of Commercial Ports of the Ministry of Railway Transport managed the process of preparation and publication of these works. It involved in the writing of «Description» a large author team of engineers-builders (Krasnoborodko, Alexeev, Tsvetkova & Zhukova, 1999). All subsequent publications of «Description» have become an excellent scientific material and have long been used in the design and construction of port facilities, and especially for the training of homeland specialists - port builders.

Two years after the publication of the monograph on the Odesa port, V. Ye. Timonov publishes his second major scientific work - the monograph "Libau Harbor" (1887) (Timonov, 1888). The author thoroughly described the past of the city of Libau and its port, characterizing the local physical and geographical conditions and the growth of cargo turnover. After a detailed analysis of the construction work in the port for about 150 years and a thorough description of the events carried out in recent years, V. Ye. Timonov stopped at characterizing a number of projects prepared by various authors for the proposed reconstruction of the Libau buildings.

In this paper, he also, as a young specialist, had not yet been able to make conclusions for the recommendations for the designers and builders of the Libau port. However, a clear elucidation in this work of the interaction of the sea and port facilities on the sandy coast made it possible for homeland port builders to assess correctly the impact of these factors on the construction of other port facilities.

The article «External structures of the Setsk port» by V. Ye. Timonov complemented the publications on the ports of Odesa and Libau (1887) (Timonov, 1887, p. 1-14). The author not only briefly described the history of the construction of fencing structures of the French port on the Mediterranean coast for 220 years but also established the great similarity of the hydrological and geological conditions of the Setsk and Libova ports. V. Ye. Timonov emphasizes in his article that in the Setsk port fencing facilities do not guarantee full protection of the harbor from sand, but still allow the use of this water area with relatively small operating costs. The experience of the builders of the Setsk port in relation to the struggle with the transfer of sand, described by V. Ye. Timonov, enriched the knowledge of homeland port builders and to some extent was taken into account in the design and construction of ports in similar conditions.

After the publication of his scientific works, especially those relating to the construction of quay-piers from artificial mass concrete, which V .Ye. Timonov himself first used on the coast of the Baltic Sea, as well as the organization of the first dredging work, he, as a young engineer, was invited for work at the Commission for

the Arrangement of Commercial Ports of the Ministry of Railway Transport. The Commission included such outstanding scientists as engineers of railway transport M. A. Beleliubskyi, M. M. Hersevanov, V. E. Liakhnitskyi, H. P. Perederii, O. R. Shuliachenko and others. Working in this commission V .Ye. Timonov participates in drawing up projects of port facilities, conducts an expert examination of a number of projects, develops a program of exploring places for the construction and development of ports, deeply studying foreign experience. Taking into account some suggestions of V. Ye. Timonov, the commission developed measures for the acceptance and testing of cement for port works.

During 4 years V. Ye. Timonov, while working in the Commission, did a variety of work: he considered projects, estimates and contracts for construction works in the ports of the Azov, Black, Baltic, White and Caspian Seas. He, as a rule, summed up all this work, participated in the drafting of port facilities. Undoubtedly, V .Ye. Timonov has greatly enriched himself in the field of homeland and foreign port construction with regard to the construction and arrangement of commercial ports, as well as the study of port affairs abroad. In his scientific works, V. Ye. Timonov cites numerous examples of irrational construction of a network of railways and waterways in western countries (Soloviova, 2018). He explains this process with stiff competition. V. Ye. Timonov constantly persuaded everyone that the construction of ports and their operation is a state-owned business. Moreover, speaking in the press, in his scientific articles, young Timonov resisted the predatory aspirations of certain groups of capitalists to take complete control of the port and other hydro-structures in some homeland coastal cities. Therefore, he published articles: «Who should build, equip and operate our ports» (1890) (Timonov, 1890), «On the role of government and private initiative in the field of equipment and operation of trading ports» (1892) (Timonov, 1892). V. Ye. Timonov advocated the transfer of the port economy, transport facilities of the country to the state, showed on the example of Western countries that the rigid competition of private farms leads to scattered railways, to the lack of monotony of buildings, to the parallelism in the functioning of the railways, etc.

On the initiative of hydrotechnical engineer M. M. Hersevanov on this issue in March 1891 a large discussion began in the state. Vsevolod Yevhenovych also took an active part in this discussion. In his reports, he strongly opposed the transfer of port and other hydraulic structures to private individuals. In these reports, V. Ye. Timonov made a number of conclusions, which subsequently had a great influence on the opinion of the engineering community and influenced the fate of homeland ports. It should be noted that, unlike railways, the construction of which had been developed the business of private companies and individuals, none of the ports of the Russian Empire had ever been in private hands.

Tymonov's publications, devoted to different technical issues of ports construction and organization of work of waterways, had a particular interest for port-engineers. This is evidenced by the article of V. Ye. Timonov «Characteristics of the marine construction industry and some of its tasks» (1891) (Timonov, 1891), which

describes the advanced methods on construction work at sea for its time. V. Ye. Timonov gives many interesting and instructive data on the specific features of the operation of seaport facilities.

V. Ye. Timonov paid special attention to the study of the materials used for the construction of ports (Fig. 2). In this context, V. Ye. Timonov did a lot in solving the problem of using cement. As we know, the development of industrial cement production in Western European countries had led to the widespread introduction of concrete into the practice of port-constructing works.

The use of concrete for marine structures actually initiated an era in the port construction industry. Blocks of concrete and of quarry stone masonry had become common in the homeland southern ports of the twentieth century. At the end of the nineteenth century, the construction of concrete structures in the Baltic ports began. However, in Odesa, Novorossiisk, Poti and other ports, signs of deterioration of the quality of the buildings were subsequently identified. This was explained very simply - seawater usually had a very harmful effect on concrete. V. Ye. Timonov did not ignore this important problem.

Figure 2. V .Ye. Timonov's scientific work «A brief overview of the historical development of the maritime construction business» (Timonov, 1894)

In 1889, V. Ye. Timonov made a speech at a meeting of the previously mentioned Commission, which described Portland cement procurement for port works. Vsevolod Yevhenovych proposed to change the rules that were in force at that

time on the use of cement. After all, these rules were in their time designed only for the construction of railway objects and provided for control of the quality of cement used by the contractor-builder at the site of work. In the construction of ports where the demand for cement was many times higher, these rules were not suitable. Vsevolod Yevhenovych proposed to establish control over the production of cement at the plant, to store cement in proper conditions and to check its quality before the port-building works.

In general, the Commission welcomed the proposals of V. Ye. Timonov, however, supplemented them with own recommendations regarding the use of cement and concrete in the construction works, in particular for the construction of bridges, hydraulic structures on the rivers, etc.

Construction of ports in the late XIX-early XX centuries led to the solution of many problems of port construction (Fig. 3). One of them was the study and discussion of the floating quay-piers of the system of engineer Sakhanskyi (Timonov, 1899). This engineer proposed to construct port fencing structures that would consist of empty iron boxes for the protection from sea disturbance. He suggested placing these boxes in one line, which according to the inventor, had to be in a semi-flooded state, without touching the seabed. Engineer Sakhanskyi proposed to attach these boxes to the bottom of the anchor chains, the tension of which had to be carried out by the force of buoyancy of boxes. Since the enormous cost of port constraining facilities has always been one of the most important obstacles in the development of marine port construction, the proposal of engineer Sakhanskyi was interesting not only for specialists but also for the public of the country. Therefore, the possibility of using the floating quay-piers of Sakhanskyi's system was discussed at the meetings of the Commission on the arrangement of homeland commercial ports. The reporter on this issue was V .Ye. Timonov. The young scientist made a detailed analysis of the proposal of Sakhanskyi, dismantled its shortcomings and noted that this proposal can not be applied to the practice of port construction due to imperfect design. «The Commission on the arrangement of domestic commercial ports», at the meeting of which there were M. M. Hersevanov, P. O. Fadieiev and other well-known hydropower engineers, agreed with the conclusions of the speaker V. Ye. Timonov. The speaker himself suggested that the inventor had to develop a method of attaching floating elements of the structure to the seabed, which would protect them from the effects of sea disturbance and their moving to the shore. Vsevolod Yevhenovych even published an article on «Investigation of the issue of the location of the external constructions of the port on the sandy coast in the application to the terms of Libau» (1890), which, among other things, gives a high rating to the proposals of Sakhanskyi and even gives valuable advice on the solution of this problem (Timonov, 1890, p. 61).

Figure 3. Scientific work of V .Ye. Timonov «Commercial ports of Norway, in connection with the question of the construction of ports on the Russian coasts of the Arctic Ocean» (Timonov, 1900)

V. Ye. Timonov played a significant role in solving complex problems of interaction between ports and rail transport. The end of the nineteenth century was characterized by the rapid growth of the homeland market. Different branches of the national economy of the Russian Empire were developing, railway construction was developing rapidly. The annual growth of the railway network from 1865 to 1875 reached 1.5 thousand kilometers, and from 1893 to 1897 – 2.5 thousand kilometers. From 1850 to 1880, 22 thousand km of railway lines were built in tsarist Russia, and most of the seaports were connected with the railway network.

In 1880, rail tracks reached to the Baltic Sea, in addition to St. Petersburg, to the Reval (Tallinn), Baltic, Ryha, Libau (Liepaja) ports. On the Black Sea, they reached to Odesa, Mykolaiv, Sevastopol, and Poti ports; on the Azov Sea - to Henychesk, Tahanroh, Rostov ports.

At the end of the nineteenth century rail tracks approached Vindava and Perno ports in the Baltic; Novorossiisk, Feodosia, Batumi ports - on the Black Sea; Kerch, Berdiansk and Mariupol ports - on the Azov Sea; Petrovsky (Makhachkala) and Baku ports- on the Caspian Sea. Railways also appeared on the Pacific coast.

The development of rail transport led to growth in freight turnover. Thus, in 1896 it exceeded 100 million tons and continued to increase. The work of transport on inland waterways grew. The volume of transportation for 15 years, from 1881 to 1896, grew from 14.4 million to 25.5 million tons. From 1856 to 1860, the capacity of ships reached 2783 thousand tons, and in 1886 - 1890, it was 13845 thousand tons, that is, it increased 3.66 times. During this period, the storage capacity of ships increased more than 2 times, compared with foreign fleets that visited homeland ports.

In such a situation, the engineer V. Ye. Timonov had a significant interest in complex transport problems. Yet in 1887, he published articles in which he raised the question of the construction of sea and river ports and the interaction of different modes of transport.

In a small work «A few words about the article by Meingardt titled « Mutual dependence of the Libau-Romny railway and the port of Libau» (1887) V .Ye. Timonov writes about the interaction of rail and sea transport and the need for better linking of their work (Timonov, 1887). By this time, the first place for the grain export was firmly occupied by Odesa. Grain was also exported from Taganrog, Feodosia, Novorossiisk and other ports. From the central provinces of European Russia, the black earth belt and the Volga region grain was transported by railways: Ryha-Orel (construction began in 1858), Libau-Romny (1871-1873) and Vindava-Rybinsk (1874). It crossed the country in a latitudinal direction and played a significant role in the development of the economy of the Russian Empire.

In his great work, «An essay on the development of the Libau port in connection with the question of its further improvement» (1888), devoted mainly to the history of the construction of this port and the analysis of hydrotechnical works, V. Ye. Timonov also writes about the interaction of sea and rail transport in this port (Timonov, 1888). In this paper, V. Ye. Timonov cites data that shows how, after laying in 1871 the railroad to the port its cargo turnover has sharply increased (from 1871 to 1875 – 4 times, and in 1876-1880 – 5 times). During this period, the port of Libau became one of the leading Russian ports for the export of grain, wool, flax and other agricultural products.

In the early '90s of the nineteenth century, the Russian government began construction of the world's largest railroad line, which was to connect the European part of Russia with the Pacific coast. According to the recommendation of the Ministry of Railway Transport, Vsevolod Yevhenovych became a member of the commission, under whose leadership railway lines in Siberia were built in a relatively short time. Therefore, the section of the railroad Cheliabinsk – Omsk – Novo-Nikolaevsk – Krasnoiarsk was built in 1896, Krasnoiarsk – Irkutsk – Vladyvostok – Khabarovsk – in 1897. Under the guidance of talented engineers, students of the St. Petersburg Institute of Railway Engineers, the construction of a large Siberian highway was carried out at an unprecedented pace. In this period, V .Ye. Timonov was able to resolve the issue of the location of the port on the shore of the Pacific Ocean eastern end of the Siberian Railway.

V. Ye. Timonov went to the Far East and there learned about the conditions of different parts of the Russian Pacific coast. He traveled all the coast of the continent from the mouth of the Amur to the Korean border and collected a huge material on the climatic, hydrological and geological features of various points. Taking into account the peculiarities of economic and strategic order, V. Ye. Timonov recommended building a new port in Vladyvostok.

His thoughts about the construction of the port in Vladyvostok, V. Ye. Timonov (by this time he received the title of professor) published in 1897 in the articles «On the choice of the place for the Pacific harbor of the Siberian railway» (Timonov, 1897) and «On the setting of the quay for commercial vessels in the city of Vladivostok» (Timonov, 1895). Despite the objections of a number of people, the recommendations of Professor V. Ye. Timonov were accepted. In Vladyvostok, a very important Russian economic center and strategic point in the Far East grew.

After returning from the Far East, Vsevolod Yevhenovych worked hard on drawing up prospects for the development of an entire group of Baltic and Black Sea ports, which demanded improvement of the interaction of rail and sea transport, and in some ports of river transport, in connection with the increase of cargo traffic flows by railways to these ports and back. This group of ports included: Ryha, Libau, Feodosia, Sevastopol, Novorossiisk, Batumi, Odesa ports.

Based on a detailed study of ports, he developed recommendations for improving their activities and sometimes justified the need to build new port facilities. So, getting acquainted with the work of the port of Odesa, the scientist faced with the fact of the destruction of the port quay-pier, which had been built intended for the processing of petroleum products. The destruction occurred as a result of the softening of fine sandy soils, which were under the external massive wall of the quay-pier. V. Ye. Timonov suggested closing these soils with a fascine mattress, and then closing it with a stone outcrop. In addition, on both sides of the massive wall at the bottom of the water area there were filled pile rows, which increased the strength of the base directly under the wall. The breakdown of the quay-pier was stopped.

V. Ye. Timonov in detail studies the practice of port operations and operational facilities in our and foreign ports. He attempts to establish standards for determining the capacity of the berth line, the territory and the water area of the ports and the required length of external restrictive structures. He raises the question of organizing special studies in this direction that is necessary in the design of new ports or the expansion of existing ones.

On this issue, he conducts an intensive discussion in the press with well-known figures in the field of construction, engineers Gnusin and Justus – and publishes several articles under the heading «On the question of determining the degree of need of existing commercial ports and their further development» (Timonov, 1897). During the discussion Professor V. Ye. Timonov puts forward a number of requirements that are crucial in assessing the effectiveness of existing port facilities: about the impact of the organization of the process of cargo operations in the port on

its capacity and methods for determining the investment required for the construction of a port with new cargo traffic flows.

On the example of Mykolaiv port V. Ye. Timonov proved to the opponents the timeliness of their demands for the removal of the berth line of the port. Position of V. Ye. Timonov correctly oriented specialists on the development of homeland ports to increase the intensity of operation of all port devices and mechanization, which was in place. V .Ye. Timonov at that time managed to establish that by improving the technology of processing ships it is possible to avoid large unpredictable costs for the construction of expensive port hydro-technical buildings (Soloviova, 2018).

In his articles, V. Ye. Timonov emphasizes the necessity of a comprehensive solution of the future cargo turnover of the planned ports, for example, Libau, Vindava and Ryha ports. The scientist-engineer considers them as points that are in a certain connecrion with each other. Therefore, in the opinion of Professor V. Ye. Timonov, before the construction of new buildings in one of the ports of this economic zone (it may be that the port has exhausted its capacity), it is necessary to evaluate the possibilities of processing a new cargo flow to the rest of the ports of this economic zones; in the presence of reserve capacities in another port, there is a new traffic flow, saving, thus, an investment.

The correctness of this point of view, which is currently considered as true as ABC, V. Ye. Timonov had to prove at that time not without difficulty. Subsequently, this principle of assessing the development prospects of ports of the same area was adopted in domestic port and construction practice.

Further, V. Ye. Timonov in this great article concludes the discussion that has taken place and specifies the number of concepts that make up the complex of values that characterize the economy of the port being built or expanding: the berthing port, the water area and the territory. In this article V. Ye. Timonov first introduced the term «aquatorium» to port practice, defining it with the concept of «water area of the port». This term has become a number of complex natural and technical disciplines. It establishes the main causes that affect the intensity of the mooring front, provides a method for calculating the port carrying capacity and depending on the type of cargo, the degree of mechanization, the methods of organizing cargo operations, the duration of the navigation period, etc.

Analyzing the data on the construction of the port in Vladyvostok, which had just begun to be built, and data on the already existing and intensively working port in Mykolaiv, V. Ye. Timonov had come to the conclusion about possibilities to significantly improve the turnover of the Mykolaiv port without the cost of building new berthing and coastal structures. To this end, he proposes to improve the work of mooring, coastal and floating cranes and port elevators. The scientist advises necessarily to associate all the planned activities, with the prospect of development of Odesa and Kherson ports.

Conclusions

The use of chronological and comparative methods of historical knowledge, allowed to perform the classification and systematization of historical sources and bibliographic material devoted to the life path and professional activity V. Ye. Timonov in the field of construction and operation of seaports.

It is shown that V. Ye. Timonov is the founder of the original direction in the port construction industry, one of the founders of the doctrine of ports, the founder of the theory of the framework of hydropower structures, the developer of the theory of port infrastructure, the historian of science and technology.

It is concluded that common factors in problems, defined by V. Ye. Timonov on the basis of his numerous and original works, as well as works of his students, made a significant contribution to the further development of hydraulic engineering not only in our country but also in the world.

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Вагомий внесок професора В.Є. Тімонова у будівництво морських портів

Анотація. *Аналіз творчої спадщини Всеволода Євгеновича Тімонова (1862-1936) – визначного інженера шляхів сполучення, професора Інституту*

інженерів шляхів сполучення імператора Олександра I, гідротехніка, фахівця в галузі водного транспорту, портового адміністратора, керівника Петербурзького округу шляхів сполучення (1899-1907), засновника і директора першої в Російській імперії Гідротехнічної лабораторії (1907-1920) і Гідротехнічного науково-дослідного інституту при Ленінградському інституті інженерів шляхів сполучення, члена Інженерної ради Міністерства шляхів сполучення, керівника відділу статистики і картографії Міністерства шляхів сполучення (з 1907 р.), голови Міжнародної секції Вищої технічної Ради Народного Комісаріату шляхів сполучення (з 1918 р.), має особливу вагу для розуміння процесів розвитку вітчизняної гідротехнічної науки та водного транспорту. Його наукові праці присвячені будівництву портів, мостів і маяків, покращенню умов судноплавства на великих ріках країни, регулюванню рік у їхній порожистій частині. Першим вказав на перевагу механічного землечерпання для покращення судноплавних умов на великих ріках. З 1886 р. В. Є. Тімонов був на службі у Відомстві шляхів сполучення, займаючи одночасно будівельно-адміністративні та педагогічні посади. В. Є. Тімонов здійснив перші на Балтійському морі роботи з облаштування молів з кам'яних масивів (1887), організував і провів перші землесосні роботи (1887), досліджував гирла річок Дніпра, Дону і Волги (1890) і визначав рукави кожної ріки для покращення судноплавства, склав проект порожистої частини Дніпра і провів дослідні роботи на одному з порогів (1894), досліджував береги Тихого океану для обрання місця кінцевого тихоокеанського порту Сибірської залізниці та вибрав місце для цього порту (Владивосток), досліджував ріки Приамурського краю і запропонував заходи для їх покращення (1895) і т.д. В. Є. Тімонов - засновник оригінального напрямку в портобудівництві, один із основоположників вчення про порти, фундатор вчення про будову гідроспоруд, розробник вчення про портову інфраструктуру, історик науки і техніки. Всеволод Євгенович займає одне з почесних місць у світовій гідротехнічній науці, водному та частково залізничному транспорті. Встановлені ним, на підставі своїх численних і оригінальних праць, а також праць його учнів закономірності в проблемах, розроблюваних ним, зробили вагомий внесок в подальший розвиток гідротехнічної справи не тільки у нашій країні, але й у світі. Наукові ідеї В. Є. Тімонова значно розширили і поглибили наші уявлення про закономірності розвитку гідротехнічної науки. У світлі своїх оригінальних переконань він піддав аналізові накопичений раніше науковий матеріал і показав його в новому і правильному висвітленні. Його праці, його ідеї, теорії і погляди розкрили перед гідротехніками небачені раніше широкі можливості.

Ключові слова: *Російська імперія; реформи на водному транспорті; розвиток мережі портів; роль В. Є. Тімонова у реформах портобудування*

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Весомый вклад профессора В. Е. Тимонова в строительство морских портов

Аннотация. *Анализ творческого наследия Всеволода Евгеньевича Тимонова (1862-1936) - выдающегося инженера путей сообщения, профессора Института инженеров путей сообщения императора Александра I, гидротехника, специалиста в области водного транспорта, портового администратора, руководителя Петербургского округа путей сообщения (1899-1907), основателя и директора первой в Российской империи гидротехнической лаборатории (1907-1920) и Гидротехнического научно-исследовательского института при Ленинградском институте инженеров путей сообщения, члена Инженерного совета Министерства путей сообщений, руководителя отдела статистики и картографии Министерства путей сообщения (с 1907 г.), председателя Международной секции Высшего технического Совета Народного Комиссариата путей сообщений (с 1918 г.) имеет особое значение для понимания процессов развития отечественной гидротехнической науки и водного транспорта. Его научные работы посвящены строительству портов, мостов и маяков, улучшению условий судоходства на больших реках страны, регулированию рек в их порожистой части. В. Е. Тимонов первым указал на преимущество механического землечерпания для улучшения судоходных условий на больших реках. С 1886 г. В. Е. Тимонов был на службе в Ведомстве путей сообщения, занимая одновременно строительно-административные и педагогические должности. В. Е. Тимонов совершил первые в Балтийском море работы по обустройству молов из каменных массивов (1887), организовал и провел первые землесосные работы (1887), исследовал устья Днепра, Дона и Волги (1890) и определял рукава каждой реки для улучшения судоходства, составил проект порожистой части Днепра и провел исследовательские работы на одном из порогов (1894), исследовал берега Тихого океана для выбора места конечного тихоокеанского порта Сибирской железной дороги и выбрал место для этого порта (Владивосток), исследовал реки Приамурского края и предложил меры для их улучшения (1895) и т.д. В. Е. Тимонов - основатель оригинального направления в портостроительсте, один из основоположников учения о портах, основатель учения о строении гидросооружений, разработчик учения о портовой инфраструктуре, историк науки и техники. Всеволод Евгеньевич занимает одно из почетных мест в мировой гидротехнической науке, водном и частично железнодорожном транспорте. Установленные им, на основании своих многочисленных и оригинальных работ, а также работ его учеников закономерности в проблемах, разрабатываемых им, сделали весомый вклад в*

дальнейшее развитие гидротехнического дела не только в нашей стране, но и в мире. Научные идеи В. Е. Тимонова значительно расширили и углубили наши представления о закономерностях развития гидротехнической науки. В свете своих оригинальных убеждений он подверг анализу, накопленный ранее научный материал и показал его в новом и правильном свете. Его труды, его идеи, теории и взгляды раскрыли перед гидротехникой невиданные ранее широкие возможности.

Ключевые слова: *Российская империя; реформы на водном транспорте; развитие сети портов; роль В. Е. Тимонова в реформах портостроительства*

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Professor M. V. Vynokurov: stages of freight wagons creation (1930-1950)

Abstract*. The urgent task of modern historical science is the comprehensive study of the personalities of prominent scientists and engineers who made a significant contribution to the formation of science and technology. The article is devoted to the analysis of the activity of professor M. V. Vynokurov in the field of the creation of freight wagons. In the history of science and technology. M. V. Vynokurov pointed out that it had been decided to produce new wagons using light-alloy steel, which greatly reduced the weight of the dead load. Such a solution was based on the technical experience of the US wagon industry. Particular attention was paid to the unification of the parts and assemblies subjected to the process of wear and damage to the most, were replaced with the current and periodic repairs of the wagon. This important measure has significantly reduced the cost of manufacturing and was important for the organization of repair because it simplified the ability to replace worn parts with spare ones. M. V. Vynokurov is known as a prominent specialist in the field of rolling stock, he devoted his life to the development of carriages and rolling stock. In preparing this article, chronological, typological, comparative methods of historical knowledge, classification and systematization of historical sources and bibliographic material were used that allowed to systematize and critically evaluate the sources used in relation to the question of the stages of the creation of freight wagons. The role of professor M. V. Vynokurov in this process is shown, covering the 1930-1950 years, the most productive years of a scientist and engineer. It was established that due to the personal contribution of M. V. Vynokurov in the unification of parts for different types of freight wagons, there was a reduction in operating costs of railways. This was achieved due to the massive production of various types of freight wagons. Study of the development of freight wagons through the biography of the scientist-engineer M. V. Vynokurov, which is an integral part of the complex of knowledge, implies the application of a systematic approach as a methodological means of scientific knowledge.*

Keywords: *railway transport; wagons; M. V. Vynokurov; science and technology; engineer*

Introduction

During the period of the railway transport existence, extensive experience in the field of rolling stock has been accumulated. Mykhailo Vasyliovych Vynokurov is a great example of this professional field (1890-1955) – doctor of technical sciences, professor, general director of draft of II rank, specialist in the field of construction of railway crews, dynamic interaction of rolling stock and track, teacher, organizer, founder and first head of the "Wagons" Department of the Dnipro National University of Rail Transport (DIIT).

Methods of the study

In the preparation of this article, chronological, typological, comparative methods of historical knowledge (Pylypchuk & Strelko, 2017; Pylypchuk & Strelko, 2018; Ustiak, 2018, p. 406), classification and systematization of historical sources and bibliographic material were used that allowed to systematize and critically evaluate the sources used in relation to the stages of the creation of freight wagons.

Results and discussion

In the postwar years, the government set the task for the leaders of the railway industry, to exceed the prewar level of transportation, which accordingly required an increase in the carriage rolling stock. It was supposed to accomplish this task, with the help of increased repair of defective wagons and the manufacture of new rolling stock.

M. V. Vynokurov noticed that the Soviet transport needed such wagons, which would be built on the level of the best models of modern technology and would fully meet the operational requirements of the railways. Therefore, he proposed his vision that the most efficient freight wagons should be those which: were the best used according to their carrying capacity and wagon capacity when transporting the widest range of goods; made it possible to carry out loading and unloading works quickly and conveniently; would have the lowest coefficient of packaging with sufficient strength of the wagon structure.

Analyzing the cargo rolling stock in accordance with his own proposals M. V. Vynokurov noticed that some of them did not quite meet the above requirements. In particular, due to the insufficient storage capacity of the covered 50-ton carriages which carrying load was used only by 77%, it turned out that each wagon loaded on average only 40 tons. Due to insufficient floor area and body carrying capacity, the lifting force of the four axle 50 and 60 ton platforms was used only by 55-65% (Vynokurov & Skyba, 1945. p. 27). So, summing up the above analysis, this led to the need to create new types of wagons, which took into account all these disadvantages and develop more advanced designs. Similar questions were also raised in his article by professor V. Povorozhenko and engineer L. Kohan in the journal "Railway Transport" №7.

In accordance with the requirements of the rolling stock department of the All-Union Research Institute of Railway Transport, it developed technical tasks for the

design of new freight wagons – box cars, gondolas and platforms. Also at the same time, the task was to determine the optimal values of the basic parameters of freight wagons, based on the most rational use of their carrying load and carrying capacity (Mokrshytskyi, 1946, p. 121).

For complete highlighting of this problem, it is advisable to give a description of each type of wagon separately.

The box wagon is the most versatile since it is intended for the transportation of goods requiring protection from outside air and other conditions. Such circumstances impose special requirements for choosing the main parameters of the box wagon. The strength of the upper structure of the track on most of the mainline and side lines of the national railways allowed loading on the rail not more than 18-19 tons. Such loading limited the carrying capacity of the wagon in 50 tons. Increasing the carrying capacity above 50 tons is also inappropriate and under the terms of using its lifting force. The increase in the lifting force of the car required a simultaneous significant increase in its carrying capacity for improvement in operation.

The experiments conducted by professor M. V. Vynokurov shown that due to insufficient carrying capacity in the existing 50-ton carriages on average 40 tons were transported. It was assumed a sufficient increase in capacity at dimensions 1-B, 0-B, but only if the length of the wagon exceeded 16 m, which meant reducing the carload to 3-3.5 t/m and elongation of the train. Consequently, the accepted carrying capacity of the wagon is 50 tons.

The total and specific capacity of the main types of covered wagons which operated on the railways of the USSR is given in table 1.

Table 1. *The total and specific capacity of the main types of covered wagons which operated on the railways of the USSR*

Wagon names	**Carrying load, t**	**Storage capacity, m^3**	**Specific capacity, m^3/t**
Riveted structure of 1929	50	89,4	1.79
Welded structure of 1936	50	89.8	1.80
Welded structure according to the unified drawing	50	89.0	1.78
Two-axle of the USSR factories production	20	45.4	2.27

According to the specific volumes in the table, the load capacity of the covered ones, especially the 50-ton carriages, can be used only when transporting loads of more than a bulk weigh, heavyweight. However, in practice, in box wagons, a sufficient quantity of low-volume cargo is transported, which, due to the insufficient body capacity of the wagons, can not fully utilize their lifting capacity. Analysis on the operation of covered wagons showed that their carrying capacity in the transport

of various goods was utilized on average only by 77%, that is, 50-ton wagons are practically used as wagons with a carrying capacity of 38-40 tons. The unsatisfactory use of the lifting force of wagons is the result of incomplete or insufficient load capacity of bodies.

Mykhailo Vasyliovych Vynokurov stated that along with the above values and the ever-increasing volume of freight traffic with different weight characteristics indicated the feasibility of replenishing the freight car fleet with high-capacity rail wagons.

Confirmation of this was the practice of American railways, which car fleet was replenished with box wagons of increased carrying capacity at a specified period (the load carrying capacity remained unchanged at 36.3 or 45 tons). Consequently, by 1931 the largest capacity of a covered American railway wagon of general purpose did not exceed 93 m^3. The Association of American Railroads (AAR) wagon by the standard of 1937 had a capacity of 105 m^3. In 1940 wagons of capacity up to 108-110 m^3 appeared, and in 1942 the AAR wagon with a storage capacity of 138 m^3 was accepted as a standard. The specific capacity of wagons increased from 2.05 to 3.04 m^3/t.

Also, M. V. Vynokurov noted that wagons with increased specific capacity are, under other equal conditions, more versatile than with a low specific capacity, since they allow better utilization of the carrying capacity of these wagons when transporting not only heavy-weight but light-weight cargoes (cargoes with a small volume weight). It is quite understandable that it is impossible to increase the specific capacity of new wagons to an arbitrary value, because when choosing the volume of wagons, it is necessary to take into account not only lightweight loads, as this will result in irrational use of the volume of wagons in the transport of goods of large weight and in inexpedient increase in the coefficient of tare carriages.

Investigation of the factors that determined the specific capacity of covered wagons (cargo turnover structure, loaded and empty mileage, range of transport, etc.) indicate the expediency of replenishing the freight car fleet with wagons with a specific capacity up to 2.4 m^3/t. With this specific capacity and carrying capacity of 50 tons, wagons should have a capacity of 110 m^3, which was adopted as a basis for the task designing of the wagon.

The choice of a rational relationship between the linear dimensions of the car (length, width and height) is determined, on the one hand, by the specified capacity of the body, and on the other, by the size of the rolling stock. The most economically feasible is the combination of the main dimensions of the wagon, which ensures the best use of the cross-section of the adopted dimension with the smallest possible length of the wagon. In this case, the length of the train, and accordingly the length of the station tracks, will be the smallest for it.

Wagon width, height, and length were determined by the following considerations. Based on the need to maintain the interchange of equipment for different human needs in transportation, the width of the car was 2750 mm. However, with the full use of the 1-B dimension, the width of the wagon could be increased by

100 mm, but this extension of the wagon led to an increase in its storage capacity by only 3-3.5%. Therefore, the width of the wagon was 2750 mm, and the height at the size 1-B it was 2750 mm and at the size 0-B it was 2400 mm. The internal length of the wagon was 1450 mm.

In addition to the lack of capacity, the operational disadvantage of existing four-wheel covered wagons was a relatively insufficient width of the door holes – 1830 mm. With such a width of the doorway, the use of mechanized vehicles during loading of the goods became more complicated.

The presence of only one relatively narrow doors on each side of the wagon made it difficult, and often made it impossible to load long-size carloads suitable for transportation in covered wagons, which affected the versatility of such cars.

M. V. Vynokurov believed that in order to determine the value for which it would be expedient to increase the width of the doorway in the covered four-wheel carriages, one should proceed from the possibility of the passage of the mechanical carriages into the wagon. For this purpose it was intended to increase the width of the doorway to 2400-2500 mm. In 1942 the standard of the covered wagon adopted by the AAR recommended increasing the width of the doorway of general purpose vehicles to 2134-2439 mm (7 or 8 feet) (Vynokurov, 1949).

An increase of the above-proposed width was inappropriate as it would have led to the reinforcement of the doors, and therefore it would have made it difficult to open and to close them. So, the width of the doorway of the freight wagon was 2450 mm.

Alongside with the choice of the most rational in the technical and economic ratio of the main parameters of the wagon, fully satisfying the operational requirements, there was a need to manufacture structures of new wagons at the level of the engineering machinery achievements of that time.

In the developed technical tasks on the new covered wagon, the frame of the wagon was of welded construction from the rolled section and cast steel; it consisted of the center sill, side, longitudinal and transverse beams, buffer, bolster and intermediate beams. Center sill was made of rolled z-section. The above body center plate of the center sill was reinforced with special cast steel and combined with the draft gear stop of the automatic coupling. The upper center plate was supposed to be eased and was on clinkers. The front draft gear stop of the automatic coupling was combined with cast steels of an automatic-coupler striker. To prevent the wearing of the walls of the center sill by the body frame of the friction gear, it was supposed to install variable lining on the walls of the center sill as wearing out were replaced by new ones. In this regard, the distance between the walls of the center sill increased to 350 mm. Also, the increased size was useful for the further modernization of auto-coupling equipment.

The wagon body was foreseen in two variants: a slanting-wall structure with a metal lattice and a wooden upholstery and a full metal structure with a wooden upholstery inside.

To strengthen the design of the body, the frontal walls are designed all-metal from pressed sheets. Such a wall greatly increased the strength and rigidity of wagons in the transverse direction and would prevent from destruction, as well as it would provide better storage of goods.

The weak element in the construction of an existing covered wagon was the roof. Poor attachment of the roof structure, and insufficient strength of the metal roofing on a meter (10000 weights/axle/km) the roof must be completely renewed on average 3-4.5 years. In fact, it was completely restored in shorter terms.

In newly built wagons, for the purpose of increasing the service life and reducing operating maintenance costs, a whole metal roof of pressed sheets was accepted. Mykhailo Vasyliovych noted that this introduction had almost twice strengthened the roof in comparison with the previous designs.

On the USSR railways there operated *gondola* of two types: 50-ton released in the US and 60-tons domestic gondolas. The latter were predominant in the gondola fleet of freight cars of the country.

The general purpose of the gondola was characterized mainly for the transportation of coal, ore and a number of other industrial goods. These cargoes were transported on the networks of the Ural-Kuzbass, Moscow-Donbass, and the upper structure of the track in these directions, as a rule, allowed loading from the wheelset on rails to 20.5 tons. Such loading allowed the weight of the gondola brutto to be up to 82 tons, and its carrying capacity up to 60 tons.

M. V. Vynokurov noted that ccording to the nature of the cargo transported in gondolas, their most advantageous feature was a large carrying capacity, especially in the universal type gondolas of the USSR. The gondolas produced in the USA had a carrying capacity of 63.5 tons, and domestic had 60 tons (Krason & Niezgoda, 2014).

The carrying capacity of the domestic gondola for the transportation of coal, ore and rolled steel products was also sufficient for the full utilization of its loading capacity, as it is indicated in table 2.

Table 2. *The carrying capacity of the domestic gondola for the transportation of coal, ore and rolled steel products was also sufficient for the full utilization of its loading capacity*

Name	**Use of load-carrying capacity, %**	**Use of storage capacity, %**
Ore	100	35
Coal	100	100
Coke	60	100
Rolled metal	100	60-70
Timber	45–56	100
Various equipment (machines, cars)	20–75	–

Such data indicate that the storage capacity of domestic gondolas was 66.8 m^3, sufficient for full utilization of its carrying capacity in the transportation of coal, ore and rolled steel products, which were transported in the gondolas in mass scale.

The lifting force was used the least satisfactory in the transportation of timber and various equipment. Consequently, for the full use of the load capacity during the transportation of such cargoes, the main factor was the length and floor area of the wagon.

Calculating the optimal value of the specific capacity of the gondola and taking into account taking into account the structure of cargo, empty running, the range of transportatios M.V. Vynokurov, proved that this optimal value for the gondola is 1.10 m^3/t, which corresponded to the value of the specific capacity of the existing gondola (1.11 m^3/t). With such indicators of specific capacity and adopted load capacity of 60 tons, the capacity of the gondola body had to be equal to $1.10 \cdot 60 = 60.6$ m^3, which was adopted for the technical task of gondola designing (Vinokurov, 1953).

The study also summarized that the size of the new gondola, load capacity, and storage capacity were close to the existing parameters of the domestic gondola and met the requirements envisaged in the technical specification only with some adjustments regarding the structural characteristics in length or overall characteristics for the existing gondolas. In existing types, the internal length was 12004 mm, in the new ones it was 12400 mm.

Extension of the gondola cab was carried out without changing the existing length of the frame by replacing the structures of the frontal walls by removing the lean-to trussed strut of the corner posts. In order to determine the length, the internal width of the gondola under the conditions of incorporation in the overall dimensions was 2825 mm. The cab height of the gondola was 1.88 m.

After the experiments Professor M. V. Vynokurov indicated the best running qualities and sufficient strength of the domestic type of gondola in accordance with the safety of operation. And he also pointed out the existing disadvantages, among which: the deflection of the truss top chord, breaking of the cemented joint of the truss node, breaking and convexity of cross stays, the deformation of the frontal doors.

Elimination of the above disadvantages of the gondola was assumed by strengthening the upper ratchet strap, replacing the side doors on a swing all-metal door with pressed walls, and replacing the wooden upholstery with a metal one.

In the gondola frame, the most frequent damage was its center sill in the places of installation of the friction gear of the automatic coupling, among them: abrasion and convexity of the upright post of the center sill around the angle stops, vertical cracks in the front or rear angle stop of the automatic coupling, the tearing of the ribs on the welding joints from the vertical wall of the center sill.

To eliminate these disadvantages it is assumed to use a center sill of special rolled products, as well as installing alternating overlays on the walls of the center sill, as in large-sized wagons.

Flat car is an open freight caron designed for the transportation of long-length, piece freight, containers and equipment that do not require protection from the weather. The main type of four-axle flat cars of the USSR railways were side flat cars with a lift capacity of 60 tons. In the fleet of domestic railways, there were also sided flat cars with carrying capacity of 50 tons and without platforms with a lifting force of 50 tons of the US production, as well as flat cars of domestic plants with a lifting force of 60 tons (Naeimi, Zakeri, Shadfar & Esmaeili, 2015).

Characteristics of domestic sided flat cars are given in table 3.

Table 3 *Characteristics of domestic sided flat cars are*

Name	Load capacity, t	Length in the middle, m	Floor area, m^2	Dead load, t	Tare weight ratio	Correlation
Welded structure of 1932	50	12.91	35.9	18.4	0.363	1.39
Rolled section structure of 1936	50	12.87	35.7	22.0	0.366	1.68

According to the data in the table, the use of the load capacity of the 60-ton flat car when loaded with various goods and their data with the characteristics are given in table 4.

An analysis on the lifting capacity of an existing type of 60-ton platform indicates that when transporting various loads accepted for platforms, their lifting force is fully used in the transportation of two or three types of cargo (ore, metals). Other cargoes give a very small load and, on average, the load capacity of four-axle 60-ton platforms does not exceed 35-50%.

Summarizing the analysis M. V. Vynokurov indicates that the most effective for operation is a flat car with a lifting force of 40 tons. However, despite this, it was decided not to limit the availability of flat cars with a lifting capacity of 40 tons for the domestic freight car fleet, since it was impossible to transport heavy piece goods on such flat cars.

Consequently, taking into account a number of advantages of flat cars of lifting capacity 40 tons, as well as the need to have along with this fleet of flat cars, allowed the transportation of heavy fix loads, the main parameters for design were developed on two types of load carrying capacity of 40 and 60 tons.

For the choice of the optimal length of flat car the possibility of adapting it to the conditions of bulk cargoes transportation was taken into account. The internal

length of the flat car, equal to 13500 mm, provided the laying of stacks of the most widespread wood species by length (6.5 m).

Table 4. *The use of the load capacity of the 60-ton flat car when loaded with various goods*

The name of the cargo	Possible loading on the flat car	Percentage of load-carrying capacity
Coal	26.9	53.8
Anthracite	28.3	56.6
Coke	18.8	36.6
Peat	10.7	21.4
Wood (round)	29.6	59.1
Sleeper	34.9	69.8
Fuel wood	27.2	54.3
Hardware items	37.4	74.9
Used machines	11.1	22.2
Straw	10.8	21.7
Sugar beet	18.0	36.0
Ferrous metal (scrap)	40.4	80.8
Fluxing material	42.7	85.4
Minerals (apatites)	48.5	87.0

The width of the platform was determined in terms of fitting the platform in size. The height of the sides compared to the existing ones was slightly higher. For longitudinal sides, the height was increased to 755 mm, and for transverse ones - to 605 mm. The increase in the storage capacity of the platform cab has made it possible to significantly increase the utilization rate of new types of platforms.

In order to develop the design of the platform's sides, it was necessary to take into account a number of structural defects of the existing designs of the edge fittings, resulting in massive loss and damage to the sides in operation. Such circumstances were worthy of attention, as the railways suffered from colossal losses to compensate for the premature wear of the sides.

To increase shelf life and reduce operating costs, new types of platforms were made all-metal.

Tank wagons The lifting capacity of tank wagons operating on domestic railways was quite different. The most efficient was a tank wagon with a cubic capacity of 50 m^3, in this connection, the capacity of the new tank wagon was 50 tons. Such a lifting force of a tank with a container of approximately 24 tons gives an axle load of 18.5 tons. In addition, the adopted capacity of the boiler provided the multiplicity with the main tanks of the existing types, determined particularly important for cargo operation (Dadyko & Draichyk, 1954, p. 410).

The design of the tank and especially the boiler was supposed to increase the strength compared with the existing four-axle tanks. The frame of the wagon consists of a center sill, side beams, cross beams (buffer, bolster and cross-bearer) and bearings for supporting the tank shell on the frame. The main requirements were that the thickness of the bottom and armor sheet should be at least 11 mm, and the upper cylindrical part is not less than 9 mm.

Drain devices for kerosene-oil tanks were located at the bottom of the boiler and had the occasion to open it through the hatch cover. For gasoline tanks, the drain device was installed according to the siphon principle.

On the cap of petrol tanks, a safety valve, an exhaust valve and test ports were provided for measuring the level of liquid in the tank. For transportation of heavy fuel oil it was necessary to develop a design of a tank shell with a device for heating, which would greatly facilitate the transportation and exhaust of black oil.

In order to develop the design of drainage devices, the latter must ensure that the products are quickly drained and poured into the tank and guaranteed to be free from the loss of devices along the way.

The number of bogies and axles in the old and new types of wagons was the same. As for the design of the bogie, it had to be improved. The bogie is the most difficult and responsible point in the design of the wagon. The running qualities of the wagon (smoothness, stability, etc.) depend on the device of a bogie and its spring suspension.

A new bogie for all four-wheel freight wagons was assumed with steel molded sides, which were cast along with cellar boxes and molten center bearer. Advantages were given to bogies without lower cross-linking. During the development of bogies designs, special attention was given to the correct choice of spring suspension for the more smooth running of the wagon. The spring suspension was required to provide a deflection at a maximum statistical load of 35-45 mm and the maximum possible deflection of 65-80 mm.

All freight wagons were required to have an automatic coupling and friction draft gear. The relatively rapid wear of individual elements of hexagonal devices led to the conclusion that it is necessary to increase the wear resistance of the draft gear of the automatic coupling (Tekhnycheskyi spravochnyk zheleznodorozhnyka, 1953, p. 304).

M. V. Vynokurov pointed out that it was decided to produce new wagons using low-alloy steel, greatly facilitated the tare weight.. Such a solution was based on the technical experience of the US wagon industry.

Particular attention was paid to the unification of parts and assemblies, that were subjected to the process of wear and damage to the most, were replaced with the current and periodic repairs of the wagon. This important measure has significantly reduced the cost of manufacturing and was important for the organization of repair because it simplified the ability to replace worn parts with spare ones.

Conclusions

The above mentioned basic characteristics of freight wagons, as well as the technical considerations and decisions of professor M. V. Vynokurov, obtained as a result of the analysis of existing designs of freight wagons and the experience of their operation, were the basis for designing and production of new types of freight wagons. His primary task was to provide the railway transport with new freight cars that corresponded to the level of the best samples of modern technology, Mykhailo Vasyliovych embodied in the best way.

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Професор М. В. Винокуров: етапи створення вантажних вагонів (1930-1950)

Анотація. *Актуальним завданням сучасної історичної науки є всебічне вивчення персоналій видатних вчених та інженерів, які зробили вагомий внесок в становлення науки і техніки. Стаття присвячена аналізу діяльності професора М. В. Винокурова у сфері створення вантажних вагонів. В історії науки і техніки М. В. Винокуров відомий як визначний спеціаліст в галузі рухомого складу, він присвятив своє життя розробці вагонів і вагонного господарства. М. В. Винокуров зауважив, що було прийнято випускати нові вагони з використанням низьколегованої сталі, що значно полегшувало вагу тари. Таке рішення базувалося на врахуванні технічного досвіду вагонобудівної промисловості США. Особлива увага приділялася уніфікації деталей і комплектуючих вузлів, які піддавалися в процесі експлуатації зносу і найчастішим пошкодженням, в наслідок чого вони замінювалися при поточному та періодичних ремонтах вагона. Цей важливій захід давав значне зниження собівартості виготовлення і мав велике значення для організації ремонту, тому що спрощував можливість заміни зношених деталей запасними. При підготовці даної статті було застосовано хронологічний,*

типологічний, порівняльний методи історичного пізнання, класифікації та систематизації історичних джерел і бібліографічного матеріалу, які дозволили систематизувати та критично оцінити використані джерела стосовно питання етапів створення вантажних вагонів. Показана роль професора М. В. Винокурова в цьому процесі, охоплюючи 1930–1950 рр., найбільш продуктивні роки вченого та інженера. Встановлено, що завдяки особистому внеску М. В. Винокурова в уніфікацію деталей для різних типів вантажних вагонів, відбулося здешевлення експлуатаційних витрат залізниць. Це досягалося завдяки масовому виготовленню різних типів вантажних вагонів. Вивчення розвитку вантажних вагонів через біографію вченого-інженера М. В. Винокурова, що є складовою частиною комплексу знань, передбачає застосування системного підходу як методологічного засобу наукового пізнання.

Ключові слова: *залізничний транспорт; вагони; М. В. Винокуров; наука й техніка; інженер*

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Профессор М. В. Винокуров: этапы создания грузовых вагонов (1930-1950)

Аннотация. *Актуальной задачей современной исторической науки является всестороннее изучение персоналий выдающихся ученых и инженеров, которые сделали весомый вклад в становление науки и техники. Статья посвящена анализу деятельности профессора М. В. Винокурова в сфере создания грузовых вагонов. В истории науки и техники М. В. Винокуров известен как выдающийся специалист в области подвижного состава, он посвятил свою жизнь разработке вагонов и вагонного хозяйства. М. В. Винокуров отметил, что было принято выпускать новые вагоны с использованием низколегированной стали, что значительно облегчало вес тары. Такое решение базировалось на учете технического опыта вагоностроительной промышленности США. Особое внимание уделялось унификации деталей и комплектующих узлов, которые подвергались в процессе эксплуатации износу и частым повреждениям, в следствии чего они заменялись при текущем и периодических ремонтах вагона. Это важное мероприятие давало значительное снижение себестоимости изготовления и имело большое значение для организации ремонта, так как упрощало возможность замены изношенных деталей запасными. При подготовке данной статьи были использованы хронологический, типологический, сравнительный методы исторического познания, классификации и систематизации исторических источников и библиографического материала, которые*

позволили систематизировать и критически оценить использованные источники по вопросу этапов создания грузовых вагонов. Показана роль профессора М. В. Винокурова в этом процессе, включая 1930-1950 гг., наиболее продуктивные годы ученого и инженера. Установлено, что благодаря личному вкладу М. В. Винокурова в унификацию деталей для различных типов грузовых вагонов, произошло удешевление эксплуатационных расходов железных дорог. Это достигалось благодаря массовому изготовлению различных типов грузовых вагонов. Изучение развития грузовых вагонов через биографию ученого-инженера М. В. Винокурова, что является составной частью комплекса знаний, предполагает применение системного подхода как методологического средства научного познания.

Ключевые слова: *железнодорожный транспорт; вагоны; М. В. Винокуров; наука и техника; инженер*

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The textbook "Parts of Machines" by V. O. Dobrovolsky and its importance for the development of higher technical education in Ukraine

Abstract. *The article describes the activities of the famous Ukrainian researcher, Doctor of Technical Sciences, Professor of the Odessa Polytechnic Institute Victor Opanasovich Dobrovolsky on the preparation of seven editions of the textbook «Parts of Machines». At the present stage of development of the history of science and technology, a comprehensive analysis of the scientific activities of V. O. Dobrovolsky, in the field of general engineering is extremely limited, and coverage of its role in the organization and development of higher technical education in Ukraine is practically absent. The scientist was one of the first who responded to the lack of a full-fledged manual on the discipline «Parts of Machines» for higher education and devoted most of his work at the Odessa Polytechnic Institute to solving this issue. The evolution of the textbook, from the publication of scientists in 1926 the first edition «Lecture notes» to the last, the seventh, personal edition of the «Parts of Machines» 1954 has been analyzed. The main directions and priorities that were identifying by the researcher in each of the publications for the preparation of students and technician have been defined. The place of personal scientific achievements, developments, inventions of V. O. Dobrovolsky and his colleagues and students in the preparation of materials of the textbook, conformity of the given information to the courses' programs and all sorts of recommendations from the Ministry of Education and a wide stake of scientists with whom Viktor Opanasovich collaborated have been considered. The correspondence of textbooks to modern achievements of science and technology and the scientist's constant attention to new home and foreign developments and inventions have been described. The common features and differences in the structure of textbook, causes of reductions, additions, and the emergence of new sections, in accordance with the tasks, which were faced V. O. Dobrovolsky in different periods of its activities have been established. The great popularity and widespread use of the textbook by the majority of higher*

technical institutions throughout the USSR which was a consequence of the general availability and in-depth processing of the stated theoretical and practical material, its relevance and compliance with the challenges of time have been noted.

Keywords: *V. O. Dobrovolsky; professor; ONPU; general engineering; transmission*

Introduction

The rapid development of world machine-building, increasing its technology and miniaturization led to the emergence of a number of specialized scientific disciplines necessary for the training of engineers and designers. Under the influence of these processes in the second half of the nineteenth century, the division of the science of mechanical engineering took place in a number of fundamental directions: technical mechanics, applied mechanics, resistance to materials and parts of machines. Before the discipline of the machine parts, the task of studying modern methods of calculation and the basics of the design of individual details, which was the basis of the creation of any complex mechanism, and transformed it into the theoretical basis of machine building and engineering design, arose. The first textbook entitled "Parts of Machines" on the territory of the Russian Empire in 1881 became the work of the outstanding scientist, founder of higher technical education in Ukraine V. L. Kirpichova, whose ideas and undertakings, found further development in the writings of other scholars: P. K. Khudyakova, A. I. Sidorova, V. E. Thira, A. N. Rogovsky, I. I. Bobarikova and others (Ivanov & Finogenov, 2008, p. 5).

Among scientists, whose scientific work was of fundamental importance for the development and establishment of domestic and world machine-building in the first half and mid-twentieth century. An important place is occupied by the figure of Victor Opanasovich Dobrovolsky (1884-1963). The research activity of the prominent Ukrainian scientist, doctor of technical sciences, professor of the Odessa Polytechnic Institute, whose authorship covers more than 160 scientific works on the design of machines and transmissions, materials science, which greatly contributed to the revival of scientific and technological progress of the country, impresses with its versatility and diversity. However, the most significant part of his scientific heritage is the multiple editions of the textbook "Parts of Machines", which became a solid ground for the training of engineers around the world. The coverage of the role and place of a scientist for the development of domestic engineering by modern Ukrainian historiography is extremely limited and consists of works of a general biographical nature issued by a number of OPI figures, among which it is particularly worth noting the works of V. S. Gusarev (Gusarev, 2015), K. I. Zablonsky (Zablonskij, 1998) and a bibliographic index published by the staff of the Scientific and Technical Library of ONPU (Gnatjuk, Islamgulova & Jakovleva, 2008). The lack of scientific works that would provide a comprehensive assessment of the scientific heritage of Victor Opanasovich, based on a general analysis of his works, only increases the relevance of the research topic. The purpose of this work is to highlight

and analyze the author's textbook of the scientist "Parts of Machines" and its importance for the development of a high technical school in Ukraine.

Research methods

The basis of this work is the general scientific principles of research, such as objectivity, scientific, historicism, systemic, complexity. Widespread use of analysis and comparative-historical methods made it possible to identify and trace the relationship between different editions of the textbook of the scientist. With the help of the systemic method, each separate manual appeared as a complex system of interconnected elements and allowed to reveal a number of regularities that were the basic elements for the discipline "Parts of machines" from the point of V. O. Dobrovolsky. Also, when writing the work, it was applied: historical, problem-chronological, historiographical and biographical methods.

Results and discussion

Determining role in the formation of V. O. Dobrovolsky as an engineer, mechanician, and later a scientist of general engineering determined the studies in 1902-1908 at the Faculty of Mechanics and Technology of the Kharkov Institute of Technology (Archive ONPU, p. 3). In Kharkov, he met Professor of the Institute Vadim Erastovich Tyr, the author of the textbook "Parts of Machines" in 1907 (Electrotechnical Herald, 1926), whose professionalism, awareness and scientific interests were of great importance for the preparation of Viktor Opanasovich. Significantly contributed to the expansion of the scientific outlook of the scientist during his studies in KhTI and in subsequent years acquaintance with the works of A. I. Sidorov and P. K. Khudyakov the problems of designing and designing machines that were one of the most advanced in the Russian Empire (Dobrovol'skij, 1954, p. 11).

The activity of teaching the discipline "Parts of Machines" a scientist began in 1918 in the newly founded Odessa Polytechnic Institute and at the Evening Workers' College (Gnatjuk, Islamgulova & Jakovleva, 2008, p. 6). Immediately with the beginning of the course, V. O. Dobrovolsky faced a number of serious problems: the low level of students' training, which was considerably worse in connection with the First World War and the Civil War in the territory of the Russian Empire, the weak link of the curriculum with a practical component machine building, the lack of a clear and comprehensive manual for the training of engineers and designers, which fully meets the modern challenges facing science. To fill the need for higher education in a new and compact comprehensive textbook that covered new achievements in science, took into account changes in the normalization and standardization of parts, and met a number of prominent scholars with the task and program of the course. In 1925 and 1926 A. I. Sidorov published in two parts a manual entitled "Course of Machine Parts," in 1926, P. K. Khudyakov published a textbook "Details of Machines," I. I. Bobarikov prepared in 1926 work "Parts of Machines" (Dobrovol'skij, 1954, p. 12).

V. O. Dobrovolsky tried to solve the problem with the lack of academic literature on discipline. The great practical experience in the field of production, scientific work in various fields of engineering and teaching during the 1918-1926 years. The disciplines "Parts of Machines" provided Viktor Afanasovich with the necessary foundation for the publication of the "Abstract for the course "Parts of Machines" in 1926 (Gnatjuk, Islamgulova & Jakovleva, 2008, p. 23). The main provisions laid down by the scientist in the pages of his own lecture notes relate to the availability, systematization and general simplicity of the material outlined. The structure of the manual consisted of sections devoted to the parts of machines servicing the rotary movement, gears, special parts. The author considered the problems of studying the physical principles of parts implemented in the construction, outlined the theoretical foundations of design and their mathematical description, considered the causes of damage and failures in the work of machines. The abstract contained a large amount of background information, which greatly increased its value in the absence of reference literature, but needed to deepen and clearer structuring of the material outlined, updating and supplementing information on new developments in the fields of mechanical engineering: gear and pass transmissions, reducers, continued shafts actively develop and develop science in the 20-es of the twentieth century.

The tumultuous work during the next two years after the publication of the abstract of lectures, testing work with students, correcting deficiencies, and supplementing it, made it possible for V. O. Dobrovolsky in 1928 to turn the abstract in a glass copy into a full textbook for high school, published in Ukrainian (Dobrovol'skij, 1928a). Taking into account that in the technical universities in the 1920-es the courses of the theory of mechanisms, the resistance of materials and parts of machines were highlighted in separate disciplines, the author greatly limited the presentation of theoretical questions, focusing on practical problems of mechanical engineering. The textbook consisted of four sections: parts for connecting machine parts, parts for serving circular motion, transmission and special details (Dobrovol'skij, 1928a, p. 515). This structure of the submission of material confirmed the approach of V. O. Dobrovolsky to the construction of the program studying the course "Parts of Machines", because despite the introduction of corrections in subsequent editions, retained the main model for almost the entire second half of the twentieth century. The introductory part of the manual related to the author's explanation of the term "machine" for its meaning, types, and general requirements (Dobrovol'skij, 1928a, p. 5). Revealing these concepts, the researcher analyzed the views of many foreign authors, but did not mark the achievement of K. Marx, whose "question about the car is considered the most accurate" (Dobrovol'skij, 1932, p. 5), which was considered a disadvantage for contemporary Soviet historiography and was reasonably taken into account in subsequent editions.

At the end of each section, a list of sources was provided, mainly by foreign scholars, for which the author was criticized for the excessive exaltation of "bourgeois science." Despite the large volume of the manual that exceeded five

hundred pages, there were still no sections devoted to gear and worm gears, variators, factors affecting the strength of parts, standards in mechanical engineering, characteristic of future editions. The manual "Parts of Machines" immediately won the adherence and recognition in scientific circles as one of the best in the country. Contributing to this was the publication in 1928 by Victor Opanasovich of a collection of numerical examples with the solutions, tables and formulas "Calculations of machine parts" (Dobrovol'skij, 1928b), which generally includes seven editions oriented to students and designers without university education, for developing calculating and design skills, which, as the researcher considered, was the basic element in the preparation of a design engineer.

The work of V. O. Dobrovolsky with his original textbook was threatened with termination in 1929, when he, as chief engineer, was arrested on fabricated allegations, but due to the family's request, the leadership of the university, and the fact that during his absence reading the course "Parts of Machines" in the OPI was suspended, the charge was lifted, and the scientist justified (Gusarev, 2015, p. 20).

The second edition of the textbook "Machine Details" was held in 1932 and was partially redesigned, especially with regard to the introductory part and the supplementary version of 1928. While fully preserving the previous structure, the author adjusted the material in accordance with the program of studying students at the university and reduced the number of examples where Norms and calculations were given that depart from the original mathematical model during the design process. The sections on gearboxes, gear transmissions, information on passive transmissions and the disadvantages of their theory, due to the current discussions in the USSR on the rational efficiency of passes, have increased with new information. Of particular value in the textbook were the parts of the gear, worm, passive transmissions, variators, which were considered by the researcher in their own scientific researches, on the eve of the publication of the textbook, the same goes for the section on welding, the new methods of which were also in the sphere of interests of Viktor Opanasovich. In the chapters of the textbook there appeared a large number of new general standards and norms, the issue of the test of metal rupture, as the main one, was critically examined, since, according to V. O. Dobrovolsky, it did not determine the fragility, wear, elasticity of the material, and pointed to the need to determine the permissible voltage, as the boundaries of elasticity (Dobrovol'skij, 1928a, p. 9). In the sections devoted to wedges, screws and other "simple machines", the scientist noted that such a definition in the literature is false and that all such mechanisms, which consist of one component, should be considered as parts of machines (Dobrovol'skij, 1928a, p. 7).

The new page for the discipline "Parts of Machines" was discovered by Viktor Opanasovich in the edition of the next edition of his own textbook in 1938, it was the first publication of the manual in Russian, which in the future will have five reissues (Dobrovol’skij, 1938). The new textbook was mapped according to all the recommendations of the program to the course "Parts of Machines" approved by the Committee on Higher School Affairs and taking into account the resolutions on

books on the topic "Parts of Machines" published in the newspaper "Technique". Compared to previous releases, in which the author singled out only a few pages of general calculation and design fundamentals in the introduction, the new version of the textbook, the existing three parts: sealing and connection, machine parts, servicing rotary motion and transmission, added another called – general data to calculate and design Principles (Dobrovol'skij, 1938, p. 5). The emergence of a new section was of special significance from the scientific standpoint, based on his own pedagogical experience, he highlighted the critical mistake of most students who perceived the design process in the form of entering numerical data into mathematical formulas, while the textbook translated this process into an applied field and technological, emphasizing the variability, requirements, and conventionality in the design. From the third edition, V. O. Dobrovolsky adheres to the principle of filling material: initially the theoretical basis, then, on its basis, the construction and methods of their calculations, combined with examples and illustrations, in contrast to the first two parts, where the theoretical part was submitted limited. This approach allowed students to understand the general principles of design and to solve the exercises and tasks that followed the course.

In the first section, for the first time, information was presented separately on the voltage in the machine parts (Dobrovol'skij, 1938, p. 24), factors influencing the part (temperature, friction, operational heating) (Dobrovol'skij, 1938, p. 45), shape of parts and their division (Dobrovol'skij, 1938, p. 49), normal. In the section devoted to fastening and welding, the information has considerably expanded, a part devoted to riveting has appeared (Dobrovol'skij, 1938, p. 74), welding (Dobrovol'skij, 1938, p. 111), bolted connection (Dobrovol'skij, 1938, p. 144). V. O. Dobrovolsky introduced a part devoted to such detail as a wedge key (Dobrovol'skij, 1938, p. 199), for example, he showed how mathematical research can draw conclusions and data for design. In the section "Axes and shafts", a great deal of new information was provided on the classification of shafts, material science issues, calculations of strength, based on personal research by Victor Opanasovich and his student, who studied the shafts, L. B. Ehrlich. There was a separate item devoted to bearings (Dobrovol'skij, 1938, p. 371) in the section "Details Serving the rotary motion" is largely based on the original research of the scientist and the department "Parts of Machines" OPI, especially as it relates to the part dedicated to special bearings, where the bearing "Nomy" was considered, in relation to which the researcher published an article in the Journal of Mechanical Engineering (Dobrovol'skij, 1929), and the paragraph "Needle bearings", the development of which was one of the first on the threshing floor of the USSR department under the leadership of Viktor Opanasovich, and marked the publication of a number of articles during the 30-es of the XX-th century and the monograph "The Eagle Bearing" in 1935 (Dobrovol'skij, Podderegin & Podderegin, 1935). The point about the transfer did not pass the addition and reformatting, which also constituted the sphere of scientific interests of the scientist. The section is devoted to passports, received a solid foundation in the form of a

separate monograph "Pass transmission" in 1934 (Dobrovol'skij, 1936a), and a globose worm gear in the article 1936 (Dobrovol'skij, 1936b).

Regarding the general trends of the textbook, the author reduced the number of deductions, examples and tasks so as not to overload the textbook, since the presentation of the course was conducted in parallel with the use of special collections of tasks and machine parts designs, which were also developed and continuously refined and published by scientists in 1933, 1934, 1935, 1936.

The next edition of the 1939 textbook (Dobrovol'skij, 1939) was an almost complete copy of the previous one with only a few minor additions and corrections. The two pre-war editions of the 1938 and 1939 book were a reflection of the researcher's new vision of the subject "Parts of Machines", taking into account the latest scientific advances and recommendations in various fields of engineering multiplied by twenty years of teaching the course and almost thirty as a designer and engineer, contributed to the emergence of the most complete a textbook on discipline on the thorns of the entire USSR.

The end of the Second World War marked the return of Viktor Opanasovich to his teaching activities as a main activity and continued his work on improving his own textbook. In 1945 the third Russian edition of the manual "Parts of Machines" was published (Dobrovol'skij, 1945). The basis of the work, as before, consisted of personal studies and research work of the scientist, as well as materials provided by his students who had already completed or continued postgraduate studies, including: L. B. Ehrlich, S. L. Mak., K. I. Zablonsky and the staff of the department "Parts of Machines". The structure of the textbook has not changed much compared to the previous editors, but received a number of new additions aimed at improving the study of material, has been significantly expanded and reached a record eight hundred and fifteen pages. Such an increase in the amount of material submitted was due to the presentation in the manual of a large number of calculations for design, which required an updated program for the course "Parts of Machines", which were previously placed by the author in a separate edition of "Calculations to machine parts," but fully contain all the necessary material, even in this volume it was not possible, therefore in future editions the calculation material will be reduced.

Again, the first section was corrected, in which a small retreat appeared on the requirements for the parts of machines (Dobrovol'skij, 1945, p. 6), in order to comply with the latest technical requirements and designation. In order to improve students' learning of the variability that arises during the design process, due to different properties of materials, V. O. Dobrovolsky reformatted a number of sub-points that provided important theoretical information. Part of the "voltage in the machine parts," was supplemented with information about the load and turned into a "Classification of Voltages and Load" (Dobrovol'skij, 1945, p. 9), the section on the factors affecting the resistance of the parts has increased considerably, with the advent of information on decrement, surface condition, absolute dimensions that were absent in the past edition. There were new sub-items devoted to the characterization of mechanical properties of materials (Dobrovol'skij, 1945, p. 12), theory and definition of durable

stocks (Dobrovol'skij, 1945, p. 33). With the introduction of these changes, the section "General information, some data for calculations and the basis of design" turned into a solid theoretical basis for students when familiar with the design features and their differences compared with mathematical calculations.

The second section also changed, where the researcher provided information on new types of welds and a section devoted to the details of welded products (ribs, flanges, levers) (Dobrovol'skij, 1945, p. 172), which supplemented previously verified information. In the part devoted to "Parts servicing the rotary motion", the points of "rolling resistance friction" with "special bearings" were merged and a new section on "safety couplings" was added (Dobrovol'skij, 1945, p. 501).

The largest modification and additions were to the section on the transfer, which has increased from two hundred to three hundred pages. The review of tooth gears has considerably expanded, due to the great attention to this issue, the Department of Machine Parts, OPI on the eve of the war, and especially with the studies of the post-graduate student V. O. Dobrovolsky – K. I. Zablonsky. In the context of the development of research in the field of worm gears, the researcher greatly supplemented the material devoted to them, a section on the details of these programs appeared, aimed at improving the understanding of their design and work. Also, for the first time separately presented friction-gear variators of planetary type (Dobrovol'skij, 1945, p. 806) and pulsed variators (Dobrovol'skij, 1945, p. 808), which only began to be actively explored and used in the second half of the twentieth century.

The textbook of 1945 edition became the largest and most complete summary of information on the discipline "Parts of Machines" in the USSR (Zablonskij, 1998, p. 170). The material presented in it was tested on a multitude of classes with students, at the same time, differed in its own novelty. The textbook took a prominent place in the development of the discipline, but later, V. O. Dobrovolsky returned to an earlier method of material presentation and reduced the excessively voluminous parts with calculations and tasks.

The progressive evolution of science caused the scientist to update the manual. In 1951, the publication of the sixth edition of the "Parts of Machines" (Dobrovol'skij, 1951), which was an updated and updated version of 1945. Following the course "Parts of Machines" for universities, within the scope of the material, compared with the previous publications, the structure of the textbook has changed, to the more modern, which has become the basis for all further manuals of the author and his students, and also is the basic and for most modern manuals on the course "Parts of Machines". Changing priorities in the preparation of designers, led to increased priorities of transmissions, the importance of studying their designs, in the process of training designers and engineers has increased significantly, and in the textbook they took the third chapter (Dobrovol'skij, 1951, p. 300), and the parts serving the rotational motion, respectively, became the fourth (Dobrovol'skij, 1951, p. 555). In addition to the new structure of the sixth edition, the main innovations concerned a slight reduction in the calculation material (formulas, tasks, figures,

schemes) and the overall update of the information presented in accordance with new standards and norms implemented in the country and achievements in various fields of engineering.

The last personal edition of V. O. Dobrovolsky's textbook "Parts of Machines" was held in 1954 (Dobrovol'skij, 1954). Understanding the inability to contain, even in the old record volume of the basis of the theory and methods of calculating the parts of machines at the same time with materials for calculation and design, including the formula formulas, standards and norms, Victor Opanasovich radically reduced the volume of the textbook. The sections devoted to the rivets and bolted joints, which was associated with the gradual replacement of the latest welding, significantly decreased. The section on transmissions updated and supplemented with information, especially concerning teeth gear transmissions, the research of which actively developed during this period, including the employees of the department "Parts of Machines" OPI. In a separate division there was a "Cutting of gear wheels with a straight teeth" (Dobrovol'skij, 1954, p. 246), there were data on new types of couplings and methods for their calculation (Dobrovol'skij, 1954, p. 553), the material on the shafts expanded, which made it possible to significantly update the third section, "Details Serving the rotary movement", respectively, on the new achievements of science and technology.

The seventh edition laid the foundations for further development and development of the textbook as the basis for the preparation of students, unlike the previous parts, which were simultaneously being prepared as reference books for designers. It is this approach that will be implemented in the next seven editions, the collective of the authors of the department "Parts of Machines" OPI together with V. O. Dobrovolsky, which will be published during 1956-1972 (Gnatjuk, Islamgulova & Jakovleva, 2008, p. 12).

Conclusions

Personal experiences of Viktor Opanasovich in preparing his own textbook are amazing in their scope. For almost 25 years, the author independently worked out, prepared, systematized and tested the information he collected, constantly reflexing and trying to supplement and improve it. The work of the scientist in various directions of mechanical engineering and the perspective and original research conducted at the department under his leadership, combined with enormous pedagogical and practical experience, gave him the opportunity to develop an accessible and understandable textbook that responded to the challenges of time and could be used as students during training, as designers during work. Thanks to the constant work of the scientist, in the conditions of almost complete lack of educational literature in the late 20-es of the twentieth century the country received the first fullest collection of materials on discipline, which gave the opportunity to prepare thousands of engineering and design personnel. Further editions of the textbook only increased its value for higher technical education, and its use has become an all-Union nature. Much of the recommendations for the calculations and

design of gears and parts of machines, presented in books by Victor Opanasovich, are still used.

Emphasizing the value of the manual for the development of science, it is important to note that the works of V. O. Dobrovolsky were crucial for the establishment of the discipline "Parts of Machines" in the first half of the twentieth century, and together with the collection "Calculations of machine parts" actually formed the basis of its teaching in higher technical educational institutions of Ukraine and the USSR during this period.

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Підручник «Деталі машин» В. О. Добровольського та його значення для розвитку вищої технічної освіти в Україні

Анотація. *В статті розглянуто діяльність видатного українського науковця, доктора технічних наук, професора Одеського політехнічного інституту Віктора Опанасовича Добровольського з підготовки семи редакцій підручника «Деталі машин». На сучасному етапі розвитку історії науки і техніки, комплексний аналіз наукової діяльності В. О. Добровольського, в галузі загального машинобудування, в цілому представлений вкрай обмежено, а висвітлення його ролі в організації та розвитку вищої технічної освіти в Україні, майже відсутнє. Вчений, одним із перших розпочав роботу над проблемою відсутності повноцінного посібника з дисципліни «Деталі машин» для вищої школи, розробкою і удосконаленням якого, він продовжував займатися на протязі усієї власної діяльності в Одеському політехнічному*

інституті. Проаналізовано еволюцію підручника, починаючи з публікації В. О. Добровольським у 1926 р. першого видання «Конспекту до курсу «Деталі машин»» до останнього, сьомого, особистого видання «Деталі машин» 1954 р. Встановлено основні напрямки та пріоритети, що виділялись вченим, у кожному із семи видань для підготовки студентів і конструкторів та розглянуто доцільність їх визначення в контексті розвитку машинобудування з точки зору історичної ретроспективи. Коротко охарактеризовано роль особистих досліджень, винаходів, розробок науковця та його колег і учнів, в підготовці матеріалів підручника, відповідність наведеної інформації програмам курсів, та змінам, що вносились вченим до видань різних років, задля відповідності завданням програм та різного роду рекомендаціям, що надходили від Міністерства освіти та великого кола науковців, з якими співпрацював Віктор Опанасович. Особливу увагу приділено відповідності підручників сучасним для них досягненням науки і техніки, та постійну увагу вченого до нових вітчизняних та зарубіжних розробок та винаходів. Порівняно структуру посібників та встановлено причини скорочень, доповнень і появи нових розділів, у відповідності до завдань, що стояли перед В. О. Добровольським у різні періоди його діяльності. Наголошено на великій популярності та широкому використанні підручника більшістю вищих технічних закладів на просторах усього СРСР, що було наслідком загальної доступності та глибокого опрацювання викладеного теоретичного і практичного матеріалу, його актуальності і відповідності викликам часу.

Ключові слова: *В. О. Добровольський; професор; ОПІ; загальне машинобудування; передача*

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Учебник «Детали машин» В. А. Добровольского и его значение для развития высшего технического образования в Украине

Аннотация. *В статье рассмотрена деятельность известного украинского исследователя, доктора технических наук, профессора Одесского политехнического института Виктора Афанасьевича Добровольского по подготовке семи редакций учебника «Детали машин». На современном этапе развития истории науки и техники, комплексный анализ научной деятельности В. А. Добровольского, в сфере общего машиностроения, представлен крайне ограничено, а освещение его роли в организации и развитии высшего технического образования в Украине, практически отсутствует. Ученый, одним из первых отреагировал на отсутствие полноценного пособия по дисциплине «Детали машин» для высшей школы и посвятил решению данного вопроса большую часть своей работы в Одесском политехническом*

институте. Проанализирована эволюция учебника, начиная с публикации ученым в 1926 г. первого издания «Конспекта к курсу «Детали машин»» до последнего, седьмого, личного издания «Деталей машин» 1954 г. Установлены основные направления и приоритеты, которые выделялись исследователем в каждом из изданий для подготовки студентов и конструкторов и рассмотрено целесообразность их определения с точки зрения исторической ретроспективы. Кратко характеризировано место личных научных достижений, наработок, изобретений В. А. Добровольского и его коллег и учеников, в подготовке материалов учебника, соответствие приведенной информации программам курсов и изменениям, вносимым ученым в издания различных годов, для соответствия задачам программ и разного рода рекомендациям, поступавших от Министерства образования и широкого кола ученых, с которыми сотрудничал Виктор Афанасьевич. Особое внимание уделено соответствию учебников современным для них достижениям науки и техники, и постоянное внимание ученого к новым отечественным и зарубежным разработкам и изобретениям. Установлены общие черты и различия в структуре пособий, причины сокращений, дополнений и появления новых разделов, в соответствии с задачами, которые стояли перед В. А. Добровольским в разные периоды его деятельности. Отмечена большая популярность и широкое использование учебника большинством высших технических заведений на территории всего СССР, что являлось следствием общей доступности и глубокой проработки изложенного теоретического и практического материала, его актуальность и соответствии вызовам времени.

Ключевые слова: *В. А. Добровольский; профессор; ОПИ; общее машиностроение; передача*

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Development of meteor astronomy at the Odessa University during the period of Ukraine's independence

Abstract. *The article using the methods of bibliographic and source study analysis and systems approach highlights the state and main trends in the development of meteor astronomy in Odessa during the time of independent Ukraine. At the beginning of the 21st century, continuous meteor patrol was restored at the Odessa Astronomical Observatory, which was intensively conducted at the Observatory during Soviet times. It was based on the use of the television and telescopic method, which was used in the CIS for the first time. The advantages of using the television telescopic method in comparison with the photographic and radar methods for solving the fundamental problems of meteor astronomy are noted. The text gives valuable information on the features of continuous meteor patrols at the observation station Kryzhanovka and the work of the expeditionary automatic meteor patrol on Snake Island (Odessa region, Ukraine). The methods of conducting telescopic television observations and processing observational material developed by Odessa researchers are considered. The main directions of meteoric studies conducted in the Odessa Astronomical Observatory using television meteor patrol materials were determined. Studying the physics of meteoric phenomena, obtaining exact coordinates of individual meteor radiant, spectral observations of meteors, studying double and multiple meteors, studying the structure and density of meteoric dust particles, solving interaction problems meteor showers with the Earth's atmosphere, statistics of meteor phenomena in the Earth's atmosphere are the main directions of meteoric studies of Odessa Astronomical Observatory. The scientific potential of Yu. M. Gorbanev in the field of meteor astronomy of, the leader of the meteoric group, O. V. Holubaieva, the head of the meteor's television patrol at the Kryzhanovka observation station in 2003-2011, as well as participation in the meteor research S. H. Kimakovskyi, I. I. Kimakovskyi, S. V. Podlesniak, I. A. Stognieieva, L. A. Saresta, A. F. Prinzykov, V. A. Shestopalov, etc are noted. Conclusions are drawn about the importance of conducting meteoric research for the development of fundamental and applied science.*

Keywords: *Odessa Astronomical Observatory; meteor patrol; television telescopic method; Kryzhanovka, Snake Island*

Introduction

Today the research of meteors is a current task, which is important not only for fundamental science. As a result of numerous theoretical and experimental work carried out by scientists all over the world, the great practical importance of meteor research, the possibility of using meteor phenomena to solve a number of practical problems, in particular, forecasting meteoric danger for spacecraft, developing near-Earth dust cloud models, became apparent (Ovezhel'diev, Kashcheev & Nechitajlenko, 1986). The study of the physics of meteors gives an idea of the nature of the interaction of particles of macroscopic size with velocities unattainable in laboratory conditions (~ 11-73 km/s) with the atmospheres of the planets. The results of this kind of research may be used and are used to solve the problem of overheating of the skin of spacecraft when they enter the dense atmosphere of the Earth and other planets or their satellites (Kozak, 2006, p. 1). Studies of the drift of meteor trails contributed to the formation of modern concepts of atmospheric circulation at an altitude of 80-110 km, tides and internal atmospheric gravitational waves, and the effect of circulation processes in the upper atmosphere on weather and climate (Ovezhel'diev et al, 1986, p. 84). The study of the distribution and evolution of meteoric orbits in the solar system contributes to cosmogony, in particular, makes it possible to establish a genetic connection with the bodies that generate them (Kozak, 2006, p. 1).

The meteoric research at the Odessa Astronomical Observatory (OAO) started in the nineteenth century, but it received the greatest scope in the middle of the twentieth century. Scientific interest in the study of meteoric phenomena was caused primarily by the study of near-Earth space and the development of astronautics. The participation of the Odessa Astronomical Observatory in the research program of the International Geophysical Year was of great importance for the development of meteor astronomy at Odessa University. The performance of the functions of the Head Office for the “Meteor Astronomy” problem contributed to the strengthening of the international authority of OAO (Hrushytska, 2017). In the following years and until today, OAO is one of the leading scientific institutions of Ukraine in the field of meteoric astronomy. However, in the history of domestic science and technology, this issue has not been studied sufficiently.

Several works by Ukrainian researchers are devoted to the history of Odessa meteor astronomy of the Soviet period (Kramer, 1996; Kramer, 1997; Hrushytska, 2017). As for the history of the development of Odessa meteor astronomy in independent Ukraine, it has not been studied and is represented mainly by short use information in a number of scientific publications (Koval, (Eds.), 2015; Smyntyna et al., 2008).

The purpose of this study is to determine the state and main trends in the development of meteor astronomy in Odessa during the time of the independence of Ukraine using the methods of bibliographic and source study analysis.

Research methods

The methodological basis of the study consists of the basic principles of modern historical science – the principles of historicism and objectivity. The principle of objectivity implies consideration of the studied historical events in their interrelation and development, the principle of objectivity is focused on a comprehensive analysis and reliable assessment of historical facts. The use of methods of bibliographic and source study analysis contributed to the search and systematization of primary information, and the use of the system method allowed to investigate comprehensively the state and development prospects of Odessa meteoric astronomy in the period of independence of Ukraine.

Results and discussion

A systematic study of meteor phenomena in Odessa was carried out from 1953 till 1993, and in the regime of continuous patrol since 1956. The meteor patrol is that the panoramic equipment is constantly ready to receive a signal from a certain area of the celestial sphere to fix the meteor. At the same time, the main features of meteors are their short duration (observed for about seconds and less) and the unpredictability of the place of flight in the sky (Holubaiev, 2017, p. 26). During this time, more than 600 images of basic meteors were obtained, that is, meteor phenomena recorded simultaneously on two or more optical instruments (cameras) spaced at a sufficient distance. Such observations in meteor astronomy are called basic and they allow determining the basic kinematic parameters of meteoric phenomena – the altitude, speed, and coordinates of an individual meteor radiant (Smyntyna et al., 2008, p. 138). In addition, several thousand non-basic meteors were obtained, which could not be used for a full-scale investigation (Kramer, 1997).

But over time, the meteor patrol technique grew old and needed significant modernization, which required significant material investments. This coincided with the economic crisis in the country after the collapse of the USSR and gaining independence, as well as the crisis of panoramic radiation receivers. That is, the photo faded into the background, and large new receivers did not exist (Gorbanev, 2013). It took almost a decade to search for new methods and since 2003 (although attempts to use new television methods by Odessa researchers began since 2000), meteor studies in Odessa have been restored. They are based on the use of the television telescopic method, which allows solving the fundamental problems of meteor astronomy and was used in the CIS for the first time (Koval, 2015, p. 926). By this time, the modernization of the observation equipment was completed and a meteor TV patrol was created. A monochrome camera «WATEC LCL 902» was used as a panoramic radiation receiver. The camera allows you to record meteor phenomena with a temporal resolution of 0.02 seconds (Gorbanev et al., 2006). A

wide range of observational equipment was used: from the Schmidt system telescope (F = 540 mm, F/D = 2.25, the field of view FOV = 0.68º × 0.51º, the limiting magnitude SLM = 13.5 mag, the astrometric accuracy - 1-2 ") to Fisheye lenses (F = 8 mm, F/D = 3.5, FOV = 36º × 49º, SLM = 7 mag) (Holubaiev, 2015).

This method of research compared to traditional methods being used in the twentieth century - photographic and radar, allows us to observe rather weak meteors up to + 10^m. But the existing photographic observation technique (from high-aperture short-focus cameras to super-Schmidt) does not allow meteor phenomena to be observed, weaker than + 4^m (Smyntyna et al., 2008, p. 138). Although the radar method allows observing a large number of meteors from + 7^m to + 15^m around the clock and regardless of weather conditions, however in this case, the ionized trace is fixed, rather than the optical image of the meteor (Holubaiev, 2017, p. 31). Combining the optical capabilities of the telescope (long-focus aperture lenses) and the technical characteristics of a CMOS sensor (CCTV cameras) made it possible to shift the threshold for recording meteors in the optical range to + $5^m \div + 10^m$. Such a range of meteoric bodies was previously the least studied, as well as there were no high-precision catalogues with their orbital elements, kinematic and physical characteristics. Over time, the technique of telescopic television observations and processing of observational material was developed and a catalogue with meteors kinematic parameters up to + 10^m was created (Holubaiev, 2017, p. 35; Gorbanev, 2017).

Since June 2003 to this day, meteor patrols are regularly conducted at the observation station Kryzhanovka of OAO (Holubaiev, 2017, p. 37).

In addition to stationary installations, which conduct regular patrol observations at the observation station Kryzhanovka, there is an expeditionary automatic meteor patrol. It is used during astronomical expeditions to Snake Island (Odessa region, Ukraine), as a rule, during the action of the Perseid meteor shower in August, the maximum of which falls on August 11-12 (Koval, 2015, p. 926). In 2003, the first expedition was conducted to study and select the location of the meteor patrol, in 2004 the first photographic meteor observations were conducted (Smyntyna et al., 2008, p.139). In 2005, the meteor patrol was tested on the island, consisting of one station and a non-manned unit. In 2006, in order to conduct basic meteor patrols, two observation stations were deployed on the island were deployed. The base stations of meteor patrol showed high tactical and technical capabilities of the observation complex. In 2007, similar observations were made on Snake Island using an upgraded installation to study July meteor showers (Holubaiev, 2017, p. 38).

A database has been created for each instrument, being continuously updated during the initial processing of new observations. The database contains information on meteors that were recorded from 2003 to 2017 with continuous meteor patrols (Holubaiev, 2017, p. 38; Gorbanev, 2017).

The database structure includes observational material (video films) and video processing data (single images and combined images of the meteoric phenomenon, summed images of star fields, background values files, etc.). For the formation of

statistics of television observations of telescopic meteors, a technique was developed and software was created that allows for the rapid analysis of the entire volume of observational material. After a night of meteor patrols, observational material is promptly entered into the database and is automatically processed by the developed software. Since the situation with meteoric activity is constantly changing, this approach allows for a comparative analysis of incoming observations with data from previous years. This is very important for planning future observations and increasing the productivity of patrols (Gorbanev, 2008, p. 245).

A technique has been developed and a processing software package has been created that allows carrying out positional and photometric measurements of observational material. The technique was tested on observational material 2003-2007. The program complex included the following main components (Kimakovskyi, Gorbanev, Knyazkova, Shestopalov & Holubaiev, 2008, p. 247):

1. AVICutter – a program for working with television films of observations and pre-processing of star and meteor images.
2. Combo – a program for creating with N frames a combined image consisting of fragments with images of a meteor in a single coordinate system.
3. PSF - a program for quick search and identification of observed parts of the starry sky.
4. PicScan – a program for measuring television images of meteors.
5. Meteor Pole – a program for calculating the poles of large circles of meteor trajectories.
6. FROSA – a program for obtaining the coordinates of a meteor radiant by the Stanukovych method using non-basic observations.

The processing procedure includes working with television films of observations and pre-processing of star and meteor images. At the next stage, an on-line search and identification of the observed parts of the starry sky, and then measurements of star and meteor images are carried out. The final stage of processing is to obtain high-precision coordinates of points of meteor trajectories, the poles of their large circles, coordinates of radiant, light curves of meteor phenomena, etc. (Gorbanev, 2008, p. 245).

The main directions of meteor studies at the Odessa Astronomical Observatory on television meteor patrols include the following questions (Gorbanev, 2008, p. 246):

1. Statistics of meteor phenomena in the earth’s atmosphere;
2. The study of radiation areas of meteor showers;
3. The obtaining exact coordinates of individual meteoric radiant;
4. The study of the physics of meteor phenomena;
5. The outbreak nature of the birth of meteoric phenomena;
6. Meteoric “tails” (wake);
7. The nature of meteor’s persistence;
8. The study of the structure and density of meteoric dust parts.

Meteor studies are conducted under the guidance of a graduate of the Odessa University in 1985, Yurii Mykhailovych Gorbanev, who graduated from the graduate school at the department of astronomy under the guidance of a well-known specialist in the field of meteoric astronomy in the USSR, doctor of physical and mathematical sciences, Professor Yuhym Naumovych Kramer. In 1997, Yurii Gorbanev defended his thesis for the degree of candidate of Physics and Mathematics on the topic: "Drift, accretion and transformation of the orbits of interplanetary dust particles." In 2000, he got a position of senior researcher. Currently working in the department of small bodies of the Solar system of the Scientific Research Institute "Astronomical Observatory" of ONU named after I. I. Mechnikov. Kimakovskyi Serhii Reymundovych, Kimakovska Iryna Iliivna, Podlesniak Serhii Vasyliovych, Stohnieieva Iryna Aleksandrivna, Sarest Leonid Aleksandrovich, Kniazkova Olena Fedorivna, Shestopalov Vasylii Oleksandrovych, Holubaiev Oleksander Vladymyrovych and others took part in the meteor studies (group members).

In 2017, O. V. Holubaiev defended his thesis for the degree of candidate of Physics and Mathematics on the specialty 07/05/12 – Remote aerospace research on the topic: "Kinematic and physical characteristics of meteoroids with radiants near the Sun according to ground-based television observations" under the direction of Yu. M. Gorbanev. During 2003-2011 O. V. Holubaiev was the head of the television meteor patrol at the Kryzhanovka observation station. The defence took place on June 27, 2017 in the specialized academic council K 26.062.13 at the National Aviation University. In the thesis of O. V. Holubaieva solved a set of scientific problems of meteoric astronomy related to the improvement of observational methods, processing observational material and analyzing the results obtained to study the kinematic and physical properties of meteoroids, which, when collided with the Earth, have radiants near the Sun on the celestial sphere. This study is of practical importance for assessing the degree of threat on such collisions, because such objects are the most dangerous due to the lack of modern capabilities of ground or space technology to fix them in advance even on approaching the Earth from heliocentric distances of less than one astronomical unit from the Sun (Holubaiev, 2017).

One of the important tasks of meteor astronomy is to determine the global influx of interplanetary dust matter into the Earth’s atmosphere. To solve this problem, various observational methods (visual, photographic, television, radar) and theoretical methods are involved. To solve the problem of interaction of the meteor shower with the Earth’s atmosphere, determine the height of occurrence, disappearance and maximum brightness of a single meteor, Odessa researchers created a computer model of a meteor phenomenon. It allows, by setting the basic parameters of a meteor phenomenon and using the basic equations of meteor physics, as well as the empirical model of the Earth’s standard atmosphere CIRA-86, to simulate a meteor phenomenon and obtain a standard light curve of meteor brightness by given speed, meteor inlet angle, particle mass and density. (Gorbanev & Ivanova, 2004, p. 135). In addition, using the statistical test method, this model allows generating elements of N orbits by given distributions for the meteoroid swarm, and then, based on the model

of the Earth's motion and the meteoroid, select model particles of the meteor shower. A model was tested using observational material from the World Geminid Meteoric Data Centre. According to the results of the calculations, the following results were obtained: after the meeting with the Earth and the formation of the meteor shower, the initially independent elements of the meteoroid swarm became dependent on only the geometric factor of selection. This primarily concerns such elements as the semi-major axis of the orbit, eccentricity and longitude of the ascending node. The inclination of the orbit of a meteoric particle of the Geminid meteor shower is the least vulnerable orbital parameter for geometric selection (Gorbanev & Kimakovskij, 2004, p. 141)

New technical observational capabilities of the television method allowed to record and study in detail the double and multiple meteors, which are 0,62% of all recorded meteors at Kryzhanovka station. Their study is relevant because of the difficulty of observing these objects. Processing was carried out using the software Odessa Meteor, which was supplemented by programs designed and created to work with double and multiple meteors. Computer processing of television images of double meteors showed the reliability of such a meteoric phenomenon. The classification of images of double and multiple meteors was carried out and the cases of crushing of meteoric particles were described. The detected increase in the angular distance between the components during the flight of a double meteor serves as evidence of their atmospheric origin (Kimakovska, Gorbanev & Kimakovskyi, 2017). Also at the observation station Kryzhanovka A085 in Odessa, spectral television observations of meteors were conducted (Gorbanev, Mozgovaya & Kimakovskaya, 2015).

At present, the monitoring of near-Earth space by the telescopes of the observatory in search of small bodies and comets is being continued in Odessa, (Konovalova, Gorbanev & Davruqov, 2018). Observation results are promptly sent to international electronic circulars (Koval, (Eds.), 2015, p. 926). The effect of major meteor showers on total ozone in the Earth's atmosphere is being investigated (Gorbanev et al., 2017).

Conclusions

So, the high international status of OAO in the field of meteor astronomy, which it received in Soviet times, was not lost in the years of independence. The meteor team work under the leadership of Yu. M. Gorbanev ensured the continuity of generations, the restoration of basic meteor observations and continuous meteor patrols by telescopic television, the creation of new equipment, the development of new methods for processing observations and corresponding software. This allowed conducting researches, which have important theoretical and practical significance for both fundamental science and applied science. In view of this the study of the modern history on the astronomy development at Odessa University seems to be a promising research area.

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Розвиток метеорної астрономії в Одеському університеті у період незалежності України

Анотація. *У статті з використанням методів бібліографічного й джерелознавчого аналізу та системного підходу висвітлено стан і основні тенденції розвитку метеорної астрономії в Одесі у часи незалежної України. Показано, що на початку XXI століття в Одеській астрономічній обсерваторії було відновлено безперервне метеорне патрулювання, яке інтенсивно проводилося в обсерваторії у радянські часи. Базувалося воно на застосуванні телевізійно-телескопічного методу, що був використаний на території СНД вперше. Відзначено переваги застосування телевізійного телескопічного методу у порівнянні з фотографічним та радіолокаційним методами для вирішення фундаментальних задач метеорної астрономії. Подано інформацію про особливості проведення безперервного метеорного патрулювання на спостережній станції Крижанівка та про роботу*

експедиційного автоматичного метеорного патруля на острові Зміїний (Одеська обл., Україна). Розглянуто розроблену одеськими дослідниками методику проведення телескопічних телевізійних спостережень і обробки спостережного матеріалу. Визначено основні напрями метеорних досліджень, що проводяться в Одеській астрономічній обсерваторії за матеріалами телевізійного метеорного патрулювання: вивчення фізики метеорних явищ, отримання точних координат індивідуальних радіантів метеорів, спектральні спостереження метеорів, вивчення подвійних і кратних метеорів, вивчення структури і щільності метеорних пилових частинок, розв'язання завдань взаємодії метеорних потоків з атмосферою Землі, статистика метеорних явищ у земній атмосфері. Відзначено науковий доробок у галузі метеорної астрономії Ю. М. Горбаньова – керівника метеорної групи, О. В. Голубаєва – завідувача телевізійного метеорного патруля на спостережній станції «Крижанівка» у 2003-2011 роках, а також участь у проведенні метеорних досліджень С. Р. Кімаковського, І. І. Кімаковської, С. В. Подлесняк, І.О. Стогнєєвої, Л. О. Сареста, О.Ф. Князькової, В. О. Шестопалова та ін. Зроблено висновок про важливість проведення метеорних досліджень для розвитку фундаментальної та прикладної науки.

Ключові слова: *Одесская астрономическая обсерватория; метеорне патрулювання; телевізійний телескопічний метод; Крижанівка; о. Зміїний*

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Развитие метеорной астрономии в Одесском университете в период независимости Украины

Аннотация. *В статье с использованием методов библиографического и источнико-ведческого анализа и системного подхода освещено состояние и основные тенденции развития метеорной астрономии в Одессе во времена независимой Украины. Показано, что в начале XXI века в Одесской астрономической обсерватории было восстановлено непрерывное метеорное патрулирование, которое интенсивно проводилось в обсерватории в советские времена. Базировалось оно на применении телевизионно-телескопического метода, который был использован на территории СНГ впервые. Отметим лишь преимущества применения телевизионного телескопеческого метода по сравнению с фотографическим и радиолокационным методами для решения фундаментов ментальных задач метеорной астрономии. Представлена информация об особенностях непрерывного метеорного патрулирования на наблюдательной станции Крыжановка и о работе экспедиционного автоматического метеорного патруля на острове Змеиный (Одесская обл., Украина). Рассмотрена разработанная одесскими исследователями методика*

проведения телескопических телевизионных наблюдений и обработки наблюдательного материала. Определены основные направления метеорных исследований, проводимых в Одесской астрономичний обсерватории по материалам телевизионного метеорного патрулирования: изучение физики метеорных явлений, получение точных координат индивидуальных радиантов метеоров, спектральные наблюдения метеоров, изучение двойных и кратных метеоров, изучение структуры и плотности метеорных пылевых частиц, решение задач взаимодействия метеорных потоков с атмосферой Земли, статистика метеорных явлений в земной атмосфере. Отмечено научный потенциал в области метеорной астрономии Ю.М. Горбанева - руководителя метеорной группы, А.В. Голубаева – заведующего телевизионного метеорного патруля на наблюдательной станции «Крыжановка» в 2003-2011 годах, а также участие в проведении метеорных исследований С.Р. Кимаковского, И. И. Кимаковской, С. В. Подлесняка, И. А. Стогнеевой, Л. А. Сареста, А. Ф. Князькова, В. А. Шестопалова и др. Сделан вывод о важности проведения метеорных исследований для развития фундаментальной и прикладной науки.

Ключевые слова: *Одесская астрономическая обсерватория, метеорное патрулирование; телевизионный телескопический метод; Крыжановка; о. Змеиный*

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Natural museums of Ukrainian universities (XIX - early XX centuries)

Abstract. *One of the most important tasks of the modern history of Biology is the study of natural museums work at universities, their influence on the development of world science and their importance in the process of training the relevant specialists. One of the tasks is to study the role of the personalities of prominent scholars who have made a significant contribution to the formation and development of natural science. The article is devoted to the analysis of the formation, development, and work of the university natural museums of Ukraine, the creation of collections, systematization of the collected material, equipment of specialized premises and buildings. On the basis of the analyzed sources, the work of university natural museums, the state of collections, their quantity, filling, and cost are highlighted. The names of scholars of museums, patrons who donated collections and people who sold their own collections to natural museums are given. The article reveals a rather long history of universities in Ukraine. The oldest of them, Lviv University, was created in 1661 on the basis of the Jesuit College. A number of universities appear in the nineteenth century. In 1805 Kharkiv University was opened, and then in 1834 Kyiv University. Later, in 1865, the Novorosiysk University was founded in Odesa on the basis of the Rishelie Lyceum; in 1875 the Chernivtsi University was opened on the basis of the seminary. Together with universities, natural museums are created, which were becoming centers of knowledge and research. Universities opened geological, mineralogical, zoological, botanical, paleontological museums with appropriate collections. During the writing of the article, the materials from reports on the state and work of Kharkiv, Novorosiysk, Kyiv and Lviv universities were used. The functions of museums at universities are considered. This is, first of all, the identification and selection of materials for collections, the study, systematization, organization of the registration and storage of museum collections and as a result the exhibition. The role of the use of museum collections for the training and education of future specialists is also considered. Not the last role is assigned to university museums as popularizers of a positive image of an educational institution, and hence prospective recruitment of a new generation of students. It can be said with certainty that the natural museums of Ukrainian universities of the 19th and early 20th*

centuries were advanced and in no way inferior to the university museums of Europe concerning the organization, collection, systematization and conducting of scientific research.

Keywords: *mineralogy; geology; zoology; botany; paleontology; museum collections*

Introduction

Approval of industrial production has given a powerful impetus to the development of science, in particular, technical and natural sciences. The need for raw materials and energy sources led to the study of the earth's subsoil, consequently, the demand for raw materials for processing capacity, resulted in the emergence of new varieties of plants and animals. Under these conditions, universities became centers that aimed at studying on a level with the history, culture, and nature of the region. Along with the teaching and research work, they concentrate the collecting activities, which are due to the appearance of the museum of natural history that usually begin to occur almost simultaneously with the establishment of universities.

The purpose of this article is to highlight the main stages of the formation and development of natural museums at Kharkiv, Novorosiysk, Kyiv and Lviv universities.

Research methods

During the preparation of this article, a historical method was used in the context of considering the stages of formation and evaluation of the results of the activity of natural museums of Ukrainian universities of the 19th and early 20th centuries. The historiographical analysis allowed to systematize and critically evaluate the used sources, to highlight the main thing in the study of the topic, to determine the directions of research of scientists and museum staff. Also, the problem-chronological method was used to dismember the topic of the article into several rather narrow problems, each of which is considered in chronological sequence. In addition, a biographical method is used, according to which the scientist-researcher is endowed with living feelings, emotions and considered as a distinguished person in science. There are several such researchers for consideration.

Results and Discussion

In 1807, shortly after the opening of the Kharkiv University, two large collections were purchased at the mediation of the first trustee S. Potockyi from Kharkiv Academic District of Count, which formed the basis of the oldest mineralogical museum in Ukraine. The first of them – the collection of Professor Andre, which he had been collecting for forty years – cost 8000 francs and accounted for more than 5000 mineralogy from various deposits in Western Europe, in particular, quartz minerals, zeolites, and a large number of fossils. The second one - the Chetti collection – consisted of 520 minerals, including pyroxenes, feldspars, and others, and was acquired for 1800 francs (Logvinenko, 1955, pp. 35-36). In the same

year, the Chetti Collection, which includes 100 coral, 36 sea urchins, 18 sea stars, 2623 turtles, 235 butterflies, 540 beetles and 127 scarlet birds, is purchased for the foundation of a zoological museum (Osipov & Bagaley (Eds.), 1908, pp. 329).

As for the museums of the Novorosiysk University, some of them were based on the museums of the Rishelie Lyceum, or their individual collections. Thus, on the basis of the natural science cabinet of the lyceum in 1865 a zoological museum was created, one of the organizers of which was Professor I. A. Marcusen. The museum obtained, in particular, a collection of Professor of Lyceum O. Nordman, a famous naturalist, a researcher of the fauna of the Black Sea and the Black Sea area. In the lyceum, professors Hassagen, Baikov, and Markusen gathered a collection of minerals, rocks and ores, which at the time of the transfer to the university totaled 2195 samples (Yurzhenko (Eds.), 1968, p. 206). The mineralogical museum received 6764 mineral names with the cost of 3084 rubles 19 kopecks from the Lyceum (Markevich, 1890, p. 635). A large number of exhibits came from the Lyceum and the Botanical Museum.

In the middle of the nineteenth century, the museums of Lviv University are founded. Thus, in the 1852-1853 academic year, a mineralogical museum was created where mineralogical and geological materials were stored. Its founder and the first manager was a professor of natural science, a botanist doctor G. Lobazhevskyi, who simultaneously taught Mineralogy and Petrography. In accordance with the specialty of its founder, the museum in its early years was mineralogical and botanical. A little later, in 1884, a zoological museum was created, the founder of which was the famous ichthyologist, ornithologist, and geographer B. Dybowskyi. Initially, the museum contained about a thousand specimens of exhibits, among which there were no collections of nests and eggs of birds, skeletons and horns of animals, other groups of animals were not represented at all.

In the 1875–1876 academic year, the first after the opening of the Chernivtsi University, a geological-geographical museum was created in it, and a little later, in 1877, a zoological museum was opened.

Professors of universities have played a significant role in the life of museums. Often they were the founders and initiators of the creation of museums, in some cases museums were equipped by their cost. Thus, the Museum of Zoology of Novorosiysk University was equipped at the expense of the prominent biologist, the future Nobel Prize laureate (1908) I. I. Mechnikov, who for some time was its manager. Professors made a significant contribution to both the equipment of museums and the enrichment of their collections. Thus, the mineralogical museum of Kharkiv University for 26 years was headed by the well-known hydrogeologist Professor N. D. Borisyak, at which the admission to the museum significantly expanded. For 36 years the museum was headed by crystallographist and petrographist Professor O. S. Brio. As a result of their work, the number of samples of minerals in the collection doubled, and in 1905 they numbered more than 15 thousand (Logvinenko, 1955, p. 37). Both scientists paid attention to the availability of equipment: N. D. Borisyak bought, among other things, a microscope and a spectroscope,

O. S. Brio purchased a device for the determination of minerals, electromagnetic apparatus, etc. The Professor of the University, a well-known geologist O. V. Gurov enlarged the collection of the geological museum by bringing a gift as a collection consisting of 4586 numbers of rocks and fossils, taken in the south of Russia (Osipov & Bagaley (Eds.), 1908, p. 318). One of the managers of the zoological museum of Kharkiv University was Professor O. M. Nikolskyi. It was he who set up the museum collection of the vertebrates of the Russian Empire and also presented the collection collected by the museum to the stuffed birds.

Already in the first years of the existence of the zoological museum of the Novorosiysk University, its work was led by professors I. I. Mechnikov, O. O. Kovalevskyi, V. V. Zelenskyi. Mechnikov and Kovalevskyi handed over to the museum collection material of marine invertebrates for the replenishment of the collections, which they brought from abroad. Kovalevsky personally produced a number of comparative-embryological preparations. As for Zelenskyi, it was under his leadership that the museum, in the exposition of which represented almost all the existing systematic groups of the world's fauna, became one of the best zoological museums of the former Russian Empire. Exhibits collected by O. O. Kovalevskyi, enriched the collection of another zoological museum of Kyiv University. In particular, he handed over to it a large collection of invertebrates of the Black Sea, numbering more than 2500 specimens.

The mineralogical museum of the University of Kyiv is associated with the name of Professor K. M. Feofylactov. Studying the geology of Ukraine, he significantly replenished the mineralogical and paleontological collections of the museum with samples, which he collected annually, mainly in the vicinity of Kyiv. He also formed a significant collection of post-tetra deposits of Ukraine from numerous drill boreholes. A lot of efforts were given to make geological collections of this museum by P. A. Tutkovskyi, whom V. I. Vernadskyi considered as the best connoisseur of the inorganic nature of Ukraine. During scientific expeditions to Ukraine, he collected a collection of rocks and fossils, the most interesting of which was the labradorite breed from the village Kamyanyi Brid, crystalline limestone from village Kozievka and some sandstones (Onoprienko, 1987, p. 24). K. F. Kessler played a significant role in forming the collections of the zoological museum of Kyiv University. Kessler is the author of the first major work devoted to the fauna of Ukraine. For several years he has researched fauna of the Kyiv province and other regions of Ukraine. All materials collected by him came to the museum, which made him the owner of one of the most significant collections of local fauna.

The exposition of the zoological museum of Lviv University was greatly enriched by its founder B. Dybowskyi. For participating in the Polish uprising in 1863, he was sent to Siberia, where he began the study of the fauna of Lake Baikal and Baikal area. After the exile, he organizes an expedition to the Far East, during which he studies the fauna of Kamchatka, the Amur basin and the coast of the Sea of Japan. Gathered collections subsequently entered the museum's exposition. Among them are mollusks of Lake Baikal, Kamchatka, birds of Eastern Siberia, insects,

vertebrates, crustaceans of Lake Baikal and its surroundings. To the mineralogical museum, an outstanding mineralogist and petrographist, the founder of modern petrography, F. Tsirkel transmitted the collection of local sedimentary rocks, the complex of rocks of the Carpathians, and the well-known specialist in the geology of oil R. Zuber gave his collection of corals.

University staff also made efforts to enrich museum collections, in particular, the mineralogical museum of Kharkiv University was replenished with collections compiled by the staff of the Department of Mineralogy. Ornithologist, entomologist, and taxidermist I. M. Vidgelm, an employee of the Zoological Museum of the Novorossiysk University from the day its foundation, for decades, he made his own stuffed birds for it and entomologic preparations. The mineralogical museum of the Novorossiysk University in 1903 was presented a collection of Ural minerals in the amount of 20 pieces by a laboratory assistant Novitskyi, it included gold, beryl, tourmaline, rutile (Imperial Novorossiysk University, 1904, p. 38). Employees of the Department of Paleontology V. D. Laskarov and M. I. Andrusov also handed over to the museum the collections gathered by them.

The contribution to the development of university museums were also made by scientific societies. Thus, the Society of Naturalists at the Kharkiv University released funds for geological excursions, during which collections were gathered, which was completely received by the geological museum.

A significant source of replenishment of museum collections was the acquisition of collections from firms and individuals. Thus, preparations for the zoological museum of Novorosiysk University were mainly purchased abroad: in Paris, Hamburg, Amsterdam, and other cities. Only in 1876-1878 valuable collections of exotic birds, among which 120 species from the island of Java and fish were purchased (Yurzhenko (Eds.), 1968, p. 157). The Mineralogical Museum of Kharkiv University annually bought samples of minerals, and only in 1880, it came from Kranz collection of minerals, which accounted for 1002 shrubs (Logvinenko, 1955, p. 37). In 1853, the same museum bought a platinum nugget, a crystal of gold and gold-bearing quartz from a pharmacist Davydenko, and in 1858 from a mining engineer Lysenko with a collection of minerals from 789 shrubs (Osipov & Bagaley (Eds.), 1908, p. 299). In 1864, when the mineralogical museum of Lviv University received funds for its development, a collection of minerals from 2800 samples was purchased (Lazarenko & Korobtsova, 1953, p. 328). The museum also replenished its collections through orders from firms of Schuhard, Egerte and others.

Much of the museum's exposure belongs to the most diverse donations from individuals. Thus, in the mineralogical museum of the Kharkiv University in 1826 a collection of barons Marshal-Bybershteyn came into existence consisting of 100 mines of the Caucasus (Osipov & Bagaley (Eds.),1908, p. 298). Mineralogical Museum of Novorossiysk University was presented a beautiful collection of cinnamon samples by Mining Engineer P. S. Sergeyev.

Having accumulated exhibits, museums expanded their expositions and shared a number of separate museums. From mineralogical museums, there were museums of

geology. At the Kharkiv University this happened in 1866, in Novorosiysk – in 1872, in Lviv – in 1905. At the same time, newly-created museums were allocated significant collections. So, the Kharkiv Geological Museum received petrographical and paleontological collections, which included: a collection of coal rocks and Jurassic fossils in the number of 102 rooms, a collection of Donbas rocks with 158 units, a collection of rocks and fossils of the mostly tertiary system of southern Russia with 208 units (Osipov & Bagaley (Eds.), 1908, p. 310). Lviv Geological Museum also received from mineralogical the geological and paleontological collections.

As the museums developed, the rooms they occupied became tight, or simply were not adapted for museum needs, and universities were trying to solve this problem. The first premises received by the Geological Museum of Kharkiv University were an old one-storey building, dark, semi-destroyed, with two rooms, the largest of which was the museum's collections. Over time, due to the lack of space, the museum actually turned into a warehouse. To ensure the normal conditions for its existence, in 1899, a separate two-story house was built for it (Buzeskul, 1900, p. 38-39). Already next year the museum was located in it, occupying the first floor, and the second placed the audience and the laboratory.

In 1892 the mineralogical museum of Lviv University, which since its foundation was located in the building on Mykolayi Street, was transferred to a newly constructed building at the following address of Dlugosha street, 6, where it occupied seven rooms on the ground floor. In 1906, after the allocation of a geological museum, it was given room in the house on the Mykolayi Street, where geological and paleontological collections were transferred. Later, in 1913, the museum moved to the new building of the university at the address Dlugosha Street, 8.

The collaborative work of colleagues, university students and amateurs has led museums to accumulate valuable collections of value. Only at the University of Novorosiysk Mineralogical Museum until 1902 a collection of minerals from 1866 units for the cost of 9776 rubles 46 kopecks was gathered, and in the geological museum at the beginning of the next year, 1903, there were collections of rocks and fossils on 9269 rubles 5 kopecks (Imperial Novorossiysk University, 1904, p.28). It did not concede to the Kharkiv University. Already in the beginning of 1907, in its zoological museum, 7826 exhibit items were stored in 55126 copies for a total of 41634 rubles 92 kopecks, mineralogical – 18947 items in 18756 copies to 32291 rubles 57 kopecks, in geological – 9570 items for 25915 rubles 8 kopecks (Imperial Kharkov University, 1908, p. 75-76).

Conclusions

Natural museums of Ukraine of the 19th and early 20th centuries had numerous, rare collections in their repositories. All of these museum collections were not deadly. First of all, they served the students' training. But their role was beyond the purely educational and auxiliary, they also served the specialists who could obtain the necessary data from them. In particular, the Museum of Geology at Kharkiv

University attracted the attention of mining figures, who could get information about it in relation to local geological conditions of minerals. University museums have also been opened to a wide range of visitors. This was done when the collections were of interest to the general public, and when the conditions for storing the exhibits allowed to open the exposition for review. So, when the Zoological Museum of the Novorosiysk University was transferred from an awkward room in the main building on Dvorianska Street in more adapted premises on Preobrazhenska Street, it became accessible to visitors. Although the size of the collections of university museums, as well as the scientific value of their exhibits, were different, all the museums, in their strength, served to improve the training of specialists. They became centers of attraction for both prominent scholars and young researchers and turned into original scientific centers that contributed to raising the scientific and cultural level of both students and the general public, to the knowledge of nature as their region, and around the world.

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Природничі музеї університетів України (XIX – початок XX ст.)

Анотація. *Одним із актуальних завдань сучасної історії біології є вивчення діяльності природничих музеїв при університетах, їх вплив на розвиток світової науки та їх значення в процесі підготовки відповідних спеціалістів. Також одним із завдань є вивчення ролі персоналій видатних вчених, що зробили вагомий внесок в становлення та розвиток природничої науки. Стаття присвячена аналізу становлення, розвитку та діяльності університетських природничих музеїв України, створення колекцій, систематизації зібраного матеріалу, обладнання спеціалізованих приміщень та будівель. На основі проаналізованих джерел висвітлено роботу університетських природничих музеїв, стан колекцій, їх кількість, наповнюваність та вартість. Надаються імена наукових співробітників музеїв, меценатів, які дарували колекції та людей, які продавали свої власні колекції природничим музеям. В статті розкрито досить довгу історію університетів на території України. Найстаріший з них, Львівський, створено у 1661 році на базі єзуїтської колегії. Цілий ряд університетів з'являється у XIX столітті. У 1805 році відкрито Харківський, а в 1834 році – Київський університети. Пізніше, у 1865 році в Одесі на базі Рішельєвського ліцею створено Новоросійський університет, у 1875 році на базі духовної семінарії відкривається Чернівецький університет. Разом з університетами створюються природничі музеї, які стають осередками знань та наукових досліджень. При університетах відкриваються геологічні, мінералогічні,*

зоологічні, ботанічні, палеонтологічні музеї з відповідними колекціями. Під час написання статті були використані матеріали звітів про стан та діяльність Харківського, Новоросійського, Київського та Львівського університетів. Розглянуто функції музеїв при університетах. Це, насамперед, виявлення і відбір матеріалів для колекцій, вивчення, систематизація, організація обліку та зберігання музейних колекцій і як підсумок – експонування. А також розглянута роль використання музейних колекцій для підготовки і виховання майбутніх фахівців. Не остання роль відводиться університетським музеям, як популяризаторам позитивного іміджу навчального закладу, а значить і перспективного набору нового покоління студентів. З впевненістю можна сказати, що природничі музеї університетів України XIX – початку XX століть були передовими і не поступалися університетським музеям Європи стосовно організації, збирання колекцій, їх систематизації та проведення наукових досліджень.

Ключові слова: *мінералогія; геологія; зоологія; ботаніка; палеонтологія; музейні колекції*

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Музеи естественных наук университетов Украины (XIX - начало XX вв.)

Аннотация. *Одной из актуальных задач современной истории биологии является изучение деятельности музеев естественных наук при университетах, их влияние на развитие мировой науки и их значение в процессе подготовки соответствующих специалистов. Также одной из задач является изучение роли персоналий выдающихся ученых, внесших весомый вклад в становление и развитие естественных наук. Статья посвящена анализу становления, развития и деятельности музеев естественных наук университетов Украины, созданию коллекций, систематизации собранного материала, оборудования специализированных помещений и зданий. На основе проанализированных источников освещается работа университетских музеев естественных наук, состояние коллекций, их количество, наполняемость и стоимость. Предоставляются имена научных сотрудников музеев, меценатов, которые дарили коллекции и людей, которые продавали свои собственные коллекции музеям естественных наук. В статье раскрыто достаточно длинную историю университетов на территории Украины. Самый старый из них, Львовский, основан в 1661 году на базе иезуитской коллегии. Целый ряд университетов появляется в XIX веке. В 1805 году открывается Харьковский, а в 1834 году – Киевский университеты. Позже, в 1865 году в Одессе, на базе*

Ришельевского лицея создан Новороссийский университет, в 1875 году на базе духовной семинарии открывается Черновицкий университет. Вместе с университетами создаются музеи естественных наук, которые становятся центрами знаний и научных исследований. При университетах открываются геологические, минералогические, зоологические, ботанические, палеонтологические музеи с соответствующими коллекциями. При написании статьи были использованы материалы отчетов о состоянии и деятельности Харьковского, Новороссийского, Киевского и Львовского университетов. Рассмотрены функции музеев при университетах. Это, прежде всего, выявление и отбор материалов для коллекций, изучение, систематизация, организация учета и хранения музейных коллекций и как итог – экспонирование. А также рассмотрена роль использования музейных коллекций для подготовки и воспитания будущих специалистов. Не последняя роль отводится университетским музеям, как популяризаторам положительного имиджа учебного заведения, а значит и перспективного набора нового поколения студентов. С уверенностью можно сказать, что музеи естественных наук университетов Украины XIX-начала XX веков были передовыми и не уступали университетским музеям Европы по организации, сбору коллекций, их систематизации и проведения научных исследований.

Ключевые слова: *минералогия; геология; зоология; ботаника; палеонтология; музейные коллекции*

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Establishment of scientific research in communication studies in the 1920s - 1930s

Abstract. *The article discusses and analyzes the role assessment and communication significance in state control systems in works and prominent representatives' statements of political thought from antiquity to the beginning of the twentieth century in accordance with the understanding of this phenomenon essence in the considered historical epochs. It is shown that from the history of political thought, although some well-founded concepts of the relationship between the authorities and the population of the thinkers of ancient China, India, and antiquity are known, they require more detailed and systematic understanding. The influence of the managerial and communicative ideas of Confucius, Plato and Aristotle on the subsequent works of Caesar, Cicero, the thinkers of the Middle Ages, the Renaissance and the Enlightenment are consistently discussed. A comparative analysis of individual views on the relationship between the state of public administration and communication of theologians and scientists of the XIII-XVIII centuries was conducted: F. Aquinas, F. Petrarch, L. Bruni, N. Machiavelli, M. Luther, T. More, T. Campanella, J. Boden, G. Grotius, J. Locke, T. Hobbes. Particular attention is paid to the ideas of S. Montesquieu, I. Kant, and G.-V.-F. Hegel as the founders of the scientific discourse around the problems of war and peace, the effectiveness of government and relations with the subjects of this management, with the people. In particular, the developments of the Chicago school in the United States and the Institute for Social Research in Germany, which laid the theoretical foundation for the beginning of the formation of information and communication theories that created the basis of the modern stage of communication development in the late twentieth century - early twenty-first century. Research and analysis in the work of the first historical ideas and theoretical concepts of the role, communication place and importance in public administration systems, advanced for 2500 years by a galaxy of eminent thinkers of the past, allows to rethink the sources of conceptual ideas of communicology put forward in the 20th century and approach the objective assessment of the perspective the role of the communication component of the humanity civilizational development in the twenty-first century.*

Keywords: *history of science; history of communication studies; communication studies; communication; communicativeness; communication theory*

Introduction

Modern scientific discourse on the definitions of the essence and nature of communication and communication studies, their genesis in the political, state and economic domains is exacerbating and becoming increasingly principle-guided. Such a situation requires a diverse and versatile coverage of the real picture of preconditions and development of theoretical works on communication studies in terms of their historical evolution. The understanding of these development processes should be based on contemporary views of the essence and cause-and-effect development sequence of theoretical thought in this branch of knowledge in the 20th century.

Theoretical issues of the development of social communications are discussed in research works of such Ukrainian scholars as V. Bebik, O. Zernetskaya, V. Ivanov, A. Konovets, G. Pocheptsov, V. Rizun, E. Romanenko, and A. Kholod. Concepts for communication studies and communicology were developed by such prominent scholars and thinkers as J. Baudrillard, N. Wiener, P. Lazarsfeld, H. Lasswell, N. Luhmann, B. Westley, C. Shannon, W. Schramm, R. Jacobson, and others. The history of communication studies in the first half of the 20th century is reviewed in the works of E. Wartella, O. Hnatiuk, J. Delia, E. Dennis, E. Rogers, M. Sproule, and C. Czitrom. However, national science has paid insufficient attention to this subject.

Research methods

The main purpose of this publication is to present the historical picture of the first period of theoretical works developing the comprehension of communication as a political and social phenomenon of the 1920s and 1930s.

The use of methods of bibliographic and source study analysis contributed to the search and systematization of primary information, and the use of the system method allowed to investigate comprehensively the state and development prospects establishment of scientific research in communication studies in the 1920s-1930s.

Results and discussion

After the radical changes in technical means of transport (river, sea, land transport, transportation routes) in the late 18th century, especially in England, understanding, and knowledge of communication processes was gradually becoming a necessity for the organization of collective work. It spurred scientific thought to explain the phenomenon of communication that occurs in public life and governance in other European countries. Favorable preconditions emerged for analysis and theoretical explanation of communication processes, and those preconditions are reflected in the ideas and statements of a number of researchers of that time up to the end of the nineteenth century, including A. Comte, A. Saint-Simon, H. Spencer, C. Darwin, K. Schapp, and others. With the advent and spread of technical means of

communication – telegraph, telephone, radio – in the 19th and early 20th centuries, the communication and information transmission practice required theoretical comprehension of these processes from political and socioeconomic angles. The dominant doctrines of that time, including the popular Marxism, failed to provide intelligible scientific explanations of the new phenomena of practical communication. The consequences of social cataclysms and the First World War accelerated and intensified the research efforts in this field.

Scientific discourse is currently continuing on the dating and chronology of the communication studies history. The establishment of communication studies is sometimes dated back to the 1950's (Shalina, 2016). However, that starting point actually corresponds to the third, rather than the first historical period, when communication studies shaped up as a separate branch of research. Some authors associate the study of issues of political and managerial communication with research works in the field of propaganda during the First World War, revolutionary events and civil wars of 1914-1922. But in those years, there appeared only isolated works on methodologies of military propaganda, which can only be regarded as a preamble for future systematic studies of social communications. The century-old development path of the science that studies communication can by convention be divided into several periods, each of which is characterized by new significant achievements and transformations. There are arguably six evolutionary stages in the genesis of communication studies. In fact, the first period of research in the field of communication should be attributed to the time from the turn of the 1920s through the turn of the 1940s. Those research attempts were based on the knowledge and understanding of the communication between authorities and people, and among individuals, from the time of emergence and establishment of statehood in Ancient China and Ancient Greece as reflected in works of many outstanding thinkers of the past, from Confucius, Plato and Aristotle and up to authors of the early 20th century. These problems attracted the attention of leading sociologists and politicians of that time.

It was at the turn of the 1920s that basic concepts of communication science started to form up, including in its applied branches. Since then, mankind has gone a long way from the first ideas and concepts concerning social communication, its significance and role in the social, managerial and technological aspects to a set of sciences studying the application specifics of various communication channels, including the Internet and the problem of influence of media (network) communications on the global development of our civilization. However, many of the basic ideas of communication studies that have been put forward earlier sparkle today a broad and heated scientific debate. For this reason, it is important to turn to the outset of systematic efforts and publication of the first theoretical works in this field of knowledge.

The terminology of communication studies is yet to be established. Contemporary sources define communication studies as a science that studies the humanitarian aspects of communication, development of information systems and

tools, and the nature, forms, and results of their impact on society. In scientific practice, there are some related terms: communication studies, communication theory and media-logy (Fedorov, 2010). This definition of communication studies can be taken as the basis for the correlation and fixation of all periods of formation and development of information and communication research in the 20th – 21th centuries.

The kickstart to the study of the role of communications in social and political processes came from works of prominent sociologist M. Weber. In 1919, his book "Politics as a Vocation and Profession" was released, in which he discusses three types of legitimate public authority in power (rational, charismatic and legal), which has the monopoly on violence (Veber, 1990). Studies by this author in the field of rational public relations, which he defended in debates with classical Marxism from 1905, had a significant impact on researchers – philosophers and sociologists – supporters of the "critical theory." Theoretical search for alternative concepts began. The centers of research in the influence of communication on the behavior of the masses in crucial situations and situations of conflict became Chicago (USA), Frankfurt am Main (Germany) and Petrograd (Russia).

The ideas of M. Weber also had a definite influence on Russian-American sociologist P. Sorokin. In his fundamental works of that time, he most clearly showed the understanding of the role of communication in the development of revolutionary hostilities and in state governance practice, where the communication component linked the causes and subsequent actions of the revolutionary masses. The two-volume "System of Sociology" book was released in 1920 in Petrograd, the reason he was expelled from the post-revolutionary Russia in 1922. "Sociology of the Revolution" published in 1925 and "Social Mobility" in 1927 were released in the United States during his first emigration years (Sorokin, 1992). P. Sorokin had analyzed 1622 social crises and revolutions from 600 BC until 1925 and in the 1930s began to study the changes in the reaction of people in situations of social cataclysms, the polarization of their way of thinking and social behavior, interpersonal and intergroup communications.

The first decades of the 20th century in Western communication studies were marked by the activity of the Chicago school associated with the bloom of the empirical stage of research in American sociology. The founder of the school, R. Park, his colleagues N. Anderson, E. Burgess, R. McKenzie and other scholars focused on problems related to the role of communication in social ecology and in the processes that deepen and exacerbate social inequality and form a special urban "spiritual atmosphere" of communication. The influence of this school in the scientific world persisted until the Second World War. The theoretical aspect progressed at an especially fast pace, trying to find and identify some special mass media properties that make an actual influence on the thinking, behavior, and intentions of people. This period of time also coincided with the works of the US researchers in communication studies, W. Lippmann and H. Lasswell, who fulfilled a social order at the University of Chicago, studying the effectiveness of propaganda and the influence of mass communication systems (media) on the mindsets, habits

and relationships of people among themselves and with the authorities. In 1927, H. Lasswell's book titled "Propaganda Technique in the World War" was published. The book discussed methods of propaganda work as a necessary tool for the government to form the needed public opinion. In the 1930s, he introduced the notion of "mass communications" into research practice. H. Lasswell compared the impact of the mass media and communications with the effect of a "subcutaneous needle" or "magic bullet," independent of the characteristics of a particular individual. This prompted certain power circles to use mass communications to manipulate people's behavior without limits. This mistake had been finally overcome many years later (in the 1970s), but up to now, it sometimes begins to dominate in certain circles of media tycoons and oligarchs who own television channels.

The propaganda experience of the First World War period was also in focus of study in the Weimar Republic in the 1920s and the early 1930s, where there was a group of scholars engaged in propaganda studies in 1922. On the basis of this group, the Institute for Social Research affiliated with the Johann Wolfgang Goethe University in Frankfurt am Main was founded in 1923. The organizational and research leaders of the Institute were philosopher M. Horkheimer, sociologist and cultural scientist T. Adorno and economist F. Pollock. From 1930, M. Horkheimer was gradually acquiring the management functions in the Institute and finally became its head in 1931. In the same year, the activities of this Institute were expanded to the Netherlands, where the archival department was established, and to Switzerland, where its branch was opened in Geneva.

Those who cooperated with the Institute of Social Research and its branch included many, known in Germany and the rest of Europe, philosophers, sociologists and economists of Marxist orientation, who, however, were very critical of certain concepts of this doctrine and sought to update it and re-think it theoretically in terms of social relations, the role of the state and its communications with the masses, influence on culture, etc. Their attempts to compensate for what Marxism missed – the understanding of the role of information and communication in the socio-economic life, led to the ultimate formation of the basic concepts of communication studies, enriched by some ideas of M. Weber, G. Hegel, I. Kant, S. Freud and other authors, as well as empirical propaganda data collected by the Institute for Social Research.

Having sensed the threat of Nazism at an early stage, the staff of the Institute began to relocate their activities out of Germany in the early 1930s. Before Hitler came to power, M. Horkheimer emigrated to the United States for ideological and national reasons, followed by the majority of the research staff by 1933. At the turn of the 1940s, a colony of immigrants from Europe, mostly German researchers, emerged in a small town on the west coast of the USA, between Los Angeles, the ocean and Hollywood. They united around the Institute for Social Research, whose director remained to be M. Horkheimer even in immigration, and continued to develop a research school at the University of Columbia, which is referred to in the

history of research as the Frankfurt School in the United States, although its members did not use this name for themselves (Kuznetsov, 2011; Elizabeth C. Hanson, 2017).

On the whole, the activities of communication researchers of the Chicago and Frankfurt schools, as well as works of P. Sorokin and P. Lazarsfeld, and some other sociologists laid the theoretical foundation for the forthcoming formation of information and communication theories that created the basis for the present development phase of communication studies and communicology. The past lagging behind of Marxist theories in realizing the role and place of communication in public relations and the significance of the interaction between the authorities in power and the masses was overcome.

In the period between the two world wars, numerous private research efforts of various researchers in different fields of knowledge (mathematics, linguistics, semiotics, psychology) contributed to the future development of communication studies. More and more researchers from different countries became involved in work on communication problems. In the middle of the 1930s, the research heritage of the Chicago school was revisited. Based on a profound analysis of the propaganda role, methods and techniques, ways of social development and governance, H. Lasswell laid the foundation for a new research direction in communication studies between 1936 and 1940 known as structural and functional, which provided the theoretical basis for one of the modern concepts of communication. But competing research schools began to put forward alternative concepts. At the turn of the 1940s, various approaches appeared, introducing different understandings of the communication phenomenon in human societies and technical systems for decades to come. Researchers in various fields of knowledge still fundamentally differently interpret the notion of communication (Kislov, 2012). This controversy remains open as yet. But in response to that challenge, all the competing research groups worked out the most correct research methods for studying the activities of the media and mass communications (Lasswell, 1942). This methodological experience still remains valuable and in demand.

From 1937, the Rockefeller Foundation generously funded a large research project on the radio as a mass medium. Many scholars who had immigrated from Germany and Austria to the USA participated in that project. Among the most notable were P. Lazarsfeld, who headed the Bureau of Applied Social Research at Columbia University in 1933-1940 and T. Adorno, who also worked there. They studied the impact of the media and mass communications on the population, in particular, during election campaigns. P. Lazarsfeld came to the realization that communication media only partially affected voters' choice, and began to develop his own communication model.

At the beginning of the 1940s, in the face of military confrontations, a new level of mobilization propaganda was required and the efforts to study mass communication processes especially intensified. It was necessary to find practical methods for analyzing communication processes. At that time, the direction of scientific modeling of mass communications developed and established, and one of

the most proponent representatives of that direction was again H. Lasswell. He was one of the speakers at the permanently held seminars on mass communications in 1939-1940, where he outlined approaches to the model vision of mass communication process (Gnatyuk, 2004). H. Lasswell was the founder of the so-called "quantitative method of content analysis," within the framework of which he proposed a classical linear model of communication-based on the first model proposed by Aristotle offering the speech formula made up of three constituent elements: "the speaker," "the subject of the speech" and "the person to whom he addresses" (Aristotel, 2000): According to H. Lasswell, the content should be concretized using the formula: "Who? What is spoken about? What channel is used? To whom is the speech addressed? What is the effect of information transmission? This formula has become especially valuable for the development of appropriate research methods in the further analysis of communication processes. The theoretical and methodological significance of H. Lasswell's concept manifested itself in the fact that in this formula he identified five key elements of the exchange communication process: the communicator, message, transmission channel, recipient (audience) and effect (effectiveness, success of the process). The latter component itself raised questions the answers to which came later in the subsequent periods of the development history of communication studies from new breakthrough ideas and theories generated under the pressure of the Second World War.

Conclusions

The study and analysis of the first ideas and theoretical concepts of the role, place and importance of communication in socioeconomic systems, put forth in the period between the turn of the 1920s and the turn of the 1940s, allows us to rethink the sources of the basic conceptual premises of communication studies and come close to the objective assessment of the prospective role of the communication component in the development of human civilization in the 21st century.

The scientific understanding of the significance of communication for the development of our civilization came only after the advent and sufficient spread of mass communication technologies and media from the second quarter of the 20th century. The outset of the comprehension of the communication phenomenon is rooted in a huge but scattered experience and numerous promising research ideas and products. The causes of the intensive research efforts were specific practical tasks, such as, for example, the need to have a more effective media impact on the public.

A major factor that fueled the research effort in this field was the significant financial support the researchers received at that time from special public and private funds in the United States. This fostered the concentration of best brains and holders of advanced scientific views of the time in this field. At the same time, favorable conditions were created for free self-development and competition of innovative ideas and research products, formation of unique informal research schools. Thus, additional conditions were created for successful work in the new areas of research,

including communication studies where a solid foundation was laid for potential theoretical and technological achievements in the decades ahead.

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Становлення наукових досліджень в контексті комунікології 1920-1930 рр.

Анотація. *У статті розглядається і аналізується оцінка ролі і значення комунікації в державних системах управління в працях і висловлюваннях*

видатних представників політичної думки від античності до початку XX століття, відповідно до розуміння суті даного явища в розглянуті історичні епохи. Показано, що з історії політичної думки хоч і відомі деякі досить обґрунтовані концепції взаємин влади і населення мислителів стародавнього Китаю, Індії і античності, але вони вимагають більш детального та систематизованого осмислення. Послідовно розглянуто вплив управлінсько-комунікативних ідей Конфуція, Платона і Аристотеля на наступні праці Цезаря, Цицерона, мислителів Середніх віків, епох Відродження і Просвітництва. Проведено порівняльний аналіз окремих поглядів на взаємозв'язок стану державного управління і комунікації теологів і вчених XIII-XVIII століть: Ф. Аквінського, Ф. Петрарки, Л. Бруні, Н. Макіавеллі, М. Лютера, Т. Мора, Т. Кампанелли, Ж. Бодена, Г. Гроція, Дж. Локка, Т. Гоббса. Особливу увагу приділено ідеям Ш. Монтеск'є, І. Канта і Г.-В.-Ф. Гегеля як основоположників наукового дискурсу навколо проблем війни і миру, ефективності державного управління та взаємовідносин з суб'єктами цього управління, з народом. Зокрема, розглянуто і напрацювання Чиказької школи в США та Інституту соціальних досліджень у Німеччині якими було закладено теоретичний фундамент в початок формування теорій інформації та комунікації, які створили основу сучасного етапу розвитку комунікативістики в кінці XX століття - на початку XXI століття. Дослідження і аналіз в роботі перших історичних ідей і теоретичних концепцій ролі, місця та значення комунікації в системах державного управління, висунутих протягом 2500 років плеядою видатних мислителів минулого дозволяє переосмислити джерела концептуальних положень комунікативістики, висунуті в XX столітті, і підійти до об'єктивної оцінки перспективної ролі комунікаційної складової цивілізаційного розвитку людства в XXI столітті.

Ключові слова: *історія науки; історія вивчення комунікації; комунікаційні дослідження; комунікація; комунікабельність; теорія комунікації*

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Становление научных исследований в контексте коммуникологии 1920-1930 гг.

Аннотация. *В статье рассматривается и анализируется оценка роли и значения коммуникации в государственных системах управления в трудах и высказываниях выдающихся представителей политической мысли от античности до начала XX века в соответствии с пониманием сути данного явления в рассматриваемые исторические эпохи. Показано, что из истории*

политической мысли хоть и известны некоторые достаточно обоснованные концепции взаимоотношений власти и населения мыслителей древнего Китая, Индии и античности, но они требуют более детального и систематизированного осмысления. Последовательно рассмотрено влияние управленческо-коммуникативных идей Конфуция, Платона и Аристотеля на последующие труды Цезаря, Цицерона, мыслителей Средних веков, эпох Возрождения и Просвещения. Проведен сравнительный анализ отдельных взглядов на взаимосвязь состояния государственного управления и коммуникации теологов и ученых XIII–XVIII веков: Ф. Аквинского, Ф. Петрарки, Л. Бруни, Н. Макиавелли, М. Лютера, Т. Мора, Т. Кампанеллы, Ж. Бодена, Г. Гроция, Дж. Локка, Т. Гоббса. Особое внимание уделено идеям Ш. Монтескье, И. Канта и Г.-В.-Ф. Гегеля как основоположников научного дискурса вокруг проблем войны и мира, эффективности государственного управления и взаимоотношений с субъектами этого управления, с народом. В частности, рассмотрено и наработки Чикагской школы в США и Института социальных исследований в Германии которыми было заложено теоретический фундамент в начало формирования теорий информации и коммуникации, создавших основу современного этапа развития коммуникативистики в конце XX века – начале XXI века. Исследование и анализ в работе первых исторических идей и теоретических концепций роли, места и значения коммуникации в системах государственного управления, выдвинутых на протяжении 2500 лет плеядой выдающихся мыслителей прошлого позволяет переосмыслить источники концептуальных положений коммуникативистики, выдвинутые в XX веке, и подойти к объективной оценке перспективной роли коммуникационной составляющей цивилизационного развития человечества в XXI веке.

Ключевые слова: *история науки; история изучения коммуникации; коммуникационные исследования; коммуникация; коммуникабельность; теория коммуникации*

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UDC 94(477):929 Лігін (Lihin)

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Essay on the life and activities of V. Lihin (1846-1900)

Abstract. *The article deals with the facts of the life and work of the prominent Odessa scientist, doctor of mechanics, professor of the Novorossiisk University Valerian Lihin (1846-1900). At the present stage of development of the history of science and technology, a comprehensive analysis of the scientific work of V. Lihin, presented in the field of mechanics and mathematics, while work in other directions remained beyond the curiosity of historians. The role of Lihin in the organization of the scientific school of theoretical and applied kinematics is shown. As a teacher, Valerian Mykolayovych formed a new approach to teaching applied mechanics, constantly emphasizing the important influence of this science on the development of technical progress and the industrial complex of the economy. And his activities in the number of scientific, technical and charitable societies are almost unknown. Thus, Valerian Lihin was a member and held management positions in the three most famous scientific and technical societies of Odessa. Their influence on the socio-economic development of the city and region is analyzed. The basic directions of activity of Lihin in the structure of the Association are established and their expediency from the point of view of historical retrospective is considered. Particular attention is paid to the Odessa branch of the Russian Technical Society, which Lihin has been managing for 15 years. This time has become a period of intensive and extensive development, and its activity has actively contributed to the development of the city and the economic prosperity of the region. Equally important, in our opinion, is the research and organizational work of Valerian Lihin in the Society of Naturalists, which contributed to the dissemination of the results of his research work in broad circles. Also the work of a scientist within the Society of Horticulture is noted, where he demonstrated his talent as an organizer of the educational process. The gardening school, created on the initiative of Lihin, contributed to the transformation of Odessa into a flowered garden among the steppe. The article highlights his role in the organization and development of special technical education in the South of Ukraine. It was this talent that contributed to his rapid career growth.*

Keywords: *Novorossiisk University; mechanics; kinematics; Odessa branch of the Russian Technical Society; Society of Naturalists; Gardening Society*

Introduction

Valerian Mykolayovych Lihin − one of the forgotten names of national history. A scientist, a public figure, a person of progressive thinking, whose activity is difficult to overestimate for the development of science and education in Odessa, the region as a whole. And, if for historians of science and technology he was known as a mechanic scientist, who first developed the questions of kinematics in domestic science, then other aspects of his life and activities remained unknown for a long time. The purpose of the article is to highlight its teaching, scientific, organizational and public activities within the Novorossiysk University and in Odessa.

Research methods

The basis of this work is the general scientific principles of research, such as objectivity, scientific, historicism, systemic, complexity. When writing the work was applied: historical, problem-chronological, historiographical and biographical methods. Widespread use of analysis and comparative-historical methods allowed identifying and tracking the main milestones of Valerian Lihin's life and work.

Results and discussion

Valerian Mykolayovych Lihin was born on July 26, 1846 in St. Petersburg. Subsequently, in 1854 his family moved to Odesa. In 1864 Valery Mykolayovych Lihin entered the Reshylevskyi Lyceum, and then, in connection with the opening of the Novorossiysk University in 1865, he was enrolled as a student of the Faculty of Physics and Mathematics of the same university. In 1869, V. Lihin graduated it with the Candidate of Mathematical Sciences degree and received a gold medal for the work "On the gravity of ellipsoids". Valerian Lihin spent the whole year at the Zurich Polytechnic School for the study of practical mechanics. In 1872 V. Lihin passed an examination for a master's degree in applied mathematics and soon he was elected assistant professor at the Department of Mathematics at the Novorossiysk University. V. Lihin in 1874 defended a thesis at the Kharkiv University for a doctor's degree and was elected an extraordinary professor. (Oven, Rishavi & Zanchevskiy, 1900, p. 44-49).

V. Lihin was an outstanding scientist and talented teacher. He lectured on all sections of theoretical mechanics, taught the theory of transfer mechanisms, the theory of regulators, the mechanical theory of heat and the theory of thermal machines, hydrostatics and hydrodynamics, descriptive geometry. His “Lectures on Applied Kinematics”, “Theory of gear wheels" were published in 1884. For the first time in the program of the university in the 1874-1875 academic year, they introduced a descriptive geometry and machine drawing.

Under the leadership of Lihin formed a new direction in the research and teaching of mechanics at the university. The questions of applied mechanics began to occupy an important place in the university curriculum and the scientific activities of its students. The number of training hours for teaching mechanics courses was increased. Valerian Mykolayovych insistently introduced practical and seminars on

mechanics, on which the tasks were solved and difficult theoretical questions were considered (Bogolyubov & Shtoklo, (Eds.), 1987, p. 217).

Teaching and research activities V. Lihin at the university were extended to mathematics. In particular, he paid attention to the problems of the mechanical solution of algebraic equations (1877). From the beginning of the 70's he began to read at the university the descriptive geometry and provided a high level of teaching. (Bukatevich et al., 1968, p. 271).

Valerian Mykolayovych conducted a rather thorough methodical work during the preparation of the disciplines he read. I was preparing methodical manuals for students, translated the most relevant textbooks. The translations made by V. Lihin of Descriptive Geometry and Sonne's textbook "Basic Principles of Applied Mechanics" are known. He also prepared bibliographic manuals on various issues of mechanics and mathematics. (Lihin, 1883, p. 1-15).

Professor of Novorossiysk University V. Lihin created in Odessa a scientific school on theoretical and applied kinematics, the most striking representatives of which were Kh. Hokhman, I. Zanchevskyi, D. Zeiliher, M. Vasyliev. It should be noted that the works of V. Lihin and his students on the theory of gear and hinge mechanisms, the theory of interconnections, the theory of structure and synthesis of mechanisms, the theory of screw computing were of a priority nature.

Most of scientific work of V. Lihin had a single direction - the study of theoretical and applied kinematics. To develop the geometric theory of the motion of a point and the unchanging system, the scientist proposed in 1872, in the paper "Geometric theory of the motion of a point and the unchanging system," a new approach to the description of kinematics, dividing it into geometrical and mechanical parts. In the geometric part, the laws of finite and infinite displacements of points were investigated without the concept of time, and in the mechanical - the laws of changing the velocities and accelerations of the points that were deduced as a consequence of the geometric part. In addition, the scientist has greatly summarized the ideas of M. Shale. In his work "Generalization of some geometric properties of the motion of systems" (1873), he proved the new general properties of the acceleration of the "n" – order of points of the immutable system in its motion, and studied the flat motion of the collinear-variable system.

V.M. Lihin first showed the general properties of accelerations of any order of points of the unchanging system while moving in parallel with a fixed plane, with its most general spatial motion, as well as moving around a fixed point, determined the geometric points of points with unit, normal and full acceleration "n" is the order of the specified types of motion of the unchanging system, which summarized the previous results of A. Rezal and O. M. Somov.

In the work "The Classification of Toothed Wheels" (1874), the scientist, based on the most general geometric theories of the theory of engagement, developed the theory of gear transmissions and created the first classification of both existing and non-existent, but theoretically possible gear wheels based on their characteristic

parameters. Unfortunately, this scientific fact remained almost unseen in the scientific literature on applied mechanics.

In 1878, the scientist published a paper "An Essay on the New Views of Relo on the mechanism", which represented the first critical review of the theory of Relo in Ukraine. V. Lihin clarified this Relo definition of the machine, proposed his own method of kinematic and geometric synthesis of hinged mechanisms on the basic introduction of the concepts of pair with double and three-way mobility.

V. M. Lihin was the first in Ukraine interested in the theory of plane hinge mechanisms, created (1883) a generalized bibliography of works on this theory. In the writings "On Hinge Rod Systems" (1885) and On the Hinge Systems of Poselie, Hart, Kempe, he developed the theory of hinged guiding mechanisms, and deduced the relation between the kinematic characteristics of this and the transformed movements in each of the mechanisms of Poselie-Lipkin, Hart, and Kempe.

He was a profound connoisseur of the latest ideas of the European machine science, and he constantly acquainted the domestic scientific community with the works of its founders, and stimulated the development of applied mechanics in Ukraine.

After 25 years of dedicated work at the University, in 1895 Valerian Mykolayovych left teaching work. He was elected to the position of mayor, instead of and after the recommendation of Hryhorii Hryhorovych Marazli, who resigned for health reasons (Reshetov & Izik, 2012, p.141-147).

In the second half of the nineteenth century in the South of the Russian Empire began rapid industrial and economic development. In particular, the pace of growth was amazing Odessa. During this period, the seaport and railways are rapidly developing, various workshops and factories are being built in the city, a unique water supply and sewage system, active electrification, a large number of public and residential buildings are being built. All these transformations would be hard to imagine without the participation of the Odessa branch of the Imperial Russian Technical Society.

The creation and development of the OB IRTS was due to the enthusiasm of a number of prominent engineers, scientists, technicians, and culture. The Society operated in Odessa from 1871 to 1920, but the flourishing of its activities was associated with Valerian Mykolayovych Lihin, who was the chairman of the Branch from 1882.

By joining the Society in 1874, Valerian found him not in the best condition: in the four departments of the Society there were 73 members, the meetings were held not regularly. Lihin joined the IV-mechanical department and proved to be very active and effective. A year later he was elected as the head of the IV department. But his effective nature required even more. Through his hard work, he quickly gained recognition among the members of the society, his progressive thinking and attempts to popularize science and technology, his sincere love for his native land contributed to his election in 1882 to the post of the leader of the OB IRTS.

It is from this time that active intense and extensive development of the company begins. For 15 years, that Lihin was the chairman of the OB IRTS, the company expanded to 350 members. The range of issues that the Odessa Branch was doing so broad that there was a need for the creation of divisions. Some departments - building, architectural and mechanical - existed since the opening of the Odessa Branch of IRTS. Subsequently, chemical, marine, mining, military, photographic, Standing Committee on Technical Education, factory, sanitary-technical, and electrical engineering departments were formed. In addition, the directions of activity have become very diverse:

– since 1882 OB IRTS began to participate in various industrial and scientific exhibitions, and subsequently to hold its own (photo exhibition 1890, exhibition of professional education dedicated to the 100th anniversary of Odessa in 1894, 1895 military exhibition and exhibition is devoted to questions of a house-building);

– since 1883, the society, together with the Kiev branch of the Russian Technical Society, began to conduct excursions to various industrial objects;

– since 1885, the society begins its own publishing activity, the "Notes of the Department" are published;

– in 1891 a school of tenants of the building industry was founded;

– In 1892, the opening of its own OB IRTS house;

– 1892 arrangement of 2 laboratories in the premises of the house: chemical and photographic;

– In 1893 handicraft courses were opened;

– In 1895 the courses of photography were opened.

On May 6, 1892, the ceremony of the ceremonial laying of the building of the Odesa branch of the Imperial Russian Technical Society took place. And already on November 29, 1892 the house was opened. (Zapysky Odesskoho Otdelenyia Imperatorskoho Russkoho Tekhnycheskoho obshchestva, 1893, p.17-18) This was the first case of possession of immovable property in the history of the Russian Technical Society.

He brought many benefits to the Permanent Commission on Technical Education (Otchet o deiatelnosty Odesskoho Otdelenyia Imperatorskoho Russkoho Tekhnycheskoho obshchestva za 1891, 1892, p. 1-4), headed by Lihin from 1891 to 1896. This commission carried out enormous work: in 1894 the First Exhibition of Technical and Vocational Education was held, the materials of the exhibition "Technical and Professional Schools of Odessa" were published, the School of Construction Tenants was created (Otchet o deiatelnosty Odesskoho otdelenyia Imperatorskoho russkoho tekhnycheskoho obshchestva za 1896 hod, 1897, p. 2-53).

Immediately after the opening in 1856, the Novorossiyskyi University became a center for the development and dissemination of progressive scientific ideas. Therefore, it is logical that a number of scientific societies were founded on the basis of the University: the Society for History and Antiquities, the Society of Naturalists there were also charitable societies: Society for the Relief of Graduates of the University.

V. Lihin was a member of the Society of Naturalists from November 27, 1876.

Since November 20, 1876, the Society has a Mathematical Branch, chaired by one of the vice presidents, who have traditionally been chosen from mathematicians. Thus, the first chairman was Professor M. Umov from 1876 to 1880, Professor V. Lihin occupied this post in 1880-1889 (Markevich, 1890, p. 724).

His activities within the framework of the Mathematical Department were very active and diverse: he delivered reports and abstracts (Zapysky Novorossyiskoho obshchestva estestvoyspytatelei, 1877; Zapysky Matematycheskoho otdeleniia Novorossyiskoho obshchestva estestvoyspytatelei, 1881; Zapysky Matematycheskoho otdelenyia Novoros-syiskoho obshchestva estestvo-yspytatelei.1883; Zapysky Matematycheskoho otdelenyia Novorossyiskoho obshchestva estestvoyspytatelei, 1885; Lihin, 1885) , conducted correspondence with leading mathematicians and mechanics on actual scientific problems – the results were immediately reported to members of the society. In 1880, Valerian Mykolayovych was elected Vice-President of the Society and chairman of the Mathematical Department. On behalf of the department, he established cooperation with the world's famous mathematical organizations.

In 1887, the Novorossiysk Society of Naturalists consisted of 133 members, among them 17 honorary, 108 active and 8 employee members. President of the Society V. V. Zalenskyi, vice-presidents – V. M. Lihin, A. O. Kovalevskyi, N. A. But the administrative work of Lihin made itself felt, the activity in the Mathematical Department is significantly reduced in comparison with the first decade of the department's existence. In 1886 the Mathematical Branch of the Society held only 1 meeting, where 3 reports were heard.

1889 Valerian Mykolayovych Lihin left the post of vice-president of the Society of Naturalists and the manager of the Mathematical Department, having left the work at the Novorossiysk University, due to the heavy burden of public activity.

Valerian Lihin's life forces were devoted to one more Society. In 1884, the department of the Imperial Russian Gardening Society was founded in Odessa. The Society was headed by Hryhorii Hryhorovych Marazli. Valerian Mykolayovych Lihin was a deputy chairman of the Odessa Department of the Imperial Russian Gardening Society and held this post until 1897, when he was forced to leave the city in connection with the increase.

Over the first two years of its existence, more than 300 members joined it. The Society's activities took place on a unique schedule – in the winter the Gardening Society held a meeting, where discussions were held on various branches of the gardening industry. In the spring, summer and fall, members of the Society conducted excursions to explore the gardens and get acquainted with the various techniques of care for fruit trees and other plants.

Almost immediately, among the members of the community, there was the idea of creating a school for the training of qualified gardeners. The initiator of the school, according to the memoirs of the members of the society, was V. M. Lihin.

On October 10, 1886, a school was opened. The school course consisted of a two-year preparatory class and a three-year specialized course. In the preparatory class there was a course of elementary folk college, low-literate or non-writing young men aged 13-14 years were taken to it.

We know about the history of the origin and existence of the school thanks to the work of P. S. Shesterikov. The publication of the 25th anniversary of the Odessa gardening and gardening school is dedicated to the bright memory of the initiator of the school - V. M. Lihin (Shesterikov, 1912, p. 1-3).

In 1889 Valerian Lihin left the teaching staff – he was elected to the post of Comrade of City Mayor. Under his guidance and with the direct participation, a number of educational institutions were opened. The number of popular schools increased almost twice, the female gymnasium turned into a professional. The city's 6-year school was organized, which in 1897 gave the name of V. M. Lihin (Stoletye Odessy, 1894, p. 65-67).

Valerian Mykolayovych also took care of the creation of the Polytechnic Institute in Odessa. It was he who raised this question back in 1895 at the meetings of the Odessa branch of the Imperial Technical Society. In his address, V. Lihin analyzed the needs of the South of the Russian Empire in qualified personnel and the possibility of their training by local educators. Such ideas of Lihin were actively supported by his patron and friend, even from the student's years – Serhii Yuliyovych Vitte (Vitte, 1924, p. 57-60).

On the initiative of S. Yu. Vitte, the Ministry of Finance contributed to the promotion of higher technical and commercial education in Russia. Thus, in the opinion of Vitte, one could solve a number of problems in the national economy of the country. According to the estimates, the Ministry of Finance annually released significant amounts of money for the maintenance of polytechnic institutes. With the direct participation of the Ministry of Finance, Kyiv and Warsaw (both in 1898) and St. Petersburh (in the fall of 1902) polytechnic institutes were established. (Ilyin, 2006, p. 128-130).

In 1895, Valerian Mykolayovych became a mayor, replacing the previous one who left this post because of a poor health condition. Position of city mayor V. M. Lihin occupied until 1897.

1897 became a turning point in the career of Valerian Mykolayovych. He was recommended as one of the candidates for the post of Minister of Education. But he did not get this post. He was appointed ad the Trustee of the Warsaw School District, where he actively contributed to the opening of the Warsaw branch of the Imperial Russian Technical Society (1897) and the Warsaw Polytechnic Institute (1898).

Valerian Mykolayovych died in the beginning of 1900. He was buried in Odessa on January 25 with all possible honors as one of the greatest citizen.

Conclusions

Occupying an active public position, V. Lihin took care of the general state of education and literacy of the inhabitants of Odessa and the country. He was a member

of a variety of scientific, non-governmental organizations and charitable foundations. Its contribution to the development of the city and region cannot be overestimated.

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Нарис життя та діяльності В. М. Лігіна (1846-1900)

Анотація. *В статті розглянуто факти життя та діяльності видатного одеського науковця, доктора механіки, професора Новоросійського університету Валеріана Лігіна. На сучасному етапі розвитку історії науки і техніки, комплексний аналіз наукової діяльності В. Лігіна, представлений в галузі механіки та математики, в той час, як робота в інших напрямках залишилась поза межами цікавості істориків. Показано роль Лігіна в організації наукової школи теоретичної та прикладної кінематики. Як педагог, Валеріан Миколайович сформував новий підхід до викладання прикладної механіки, постійно наголошуючи на важливий вплив цієї науки на розвиток технічного прогресу та промислового комплексу економіки. А його діяльність в складі чисельних науково-технічних та благодійних товариств є майже не відомою. Так, Валеріан Лігін був членом та займав керівні посади в 3 найвідоміших науково-технічних товариствах Одеси. Проаналізовано їх вплив на соціально-економічний розвиток міста та регіону. Встановлено основні напрямки діяльності Лігіна в складі Товариств та розглянуто їх доцільність з точки зору історичної ретроспективи. Особливу увагу приділено Одеському відділенню Російського технічного товариства, яким Лігін керував впродовж 15 років. Цей час став періодом інтенсивного та екстенсивного розвитку, а*

його діяльність активно сприяла розбудові міста та економічному процвітанню регіону. Не менш важливими, на нашу думку, є науково-дослідна та організаційна роботи Валеріана Лігіна в складі Товариства Природознавців, що сприяла поширенню результатів його дослідницької роботи в широких колах. Також розглянута робота науковця в складі Товариства Садівництва, де проявив себе його талант, як організатора освітнього процесу. Школа садівництва, створена за ініціативи Лігіна сприяла перетворенню Одеси на квітучий сад серед степу. В статті висвітлено його ролі в організації та розвитку спеціальної технічної освіти на Півдні України. Саме цей талант сприяв його стрімкому кар'єрному зростанню.

Ключові слова: *Новоросійський університет; механіка; кінематика; Одеське відділення Російського технічного товариства; Товариство природодослідників; Товариство садівництва*

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Очерк жизни и деятельности В.М. Лигина (1846-1900)

Аннотация*. В статье рассмотрены факты жизни и деятельности выдающегося одесского ученого, доктора механики, профессора Новороссийского университета Валериана Лигина. На современном этапе развития истории науки и техники, комплексный анализ научной деятельности В. Лигина, представленный в области механики и математики, в то время, как работа в других направлениях осталась за пределами интереса историков. Показана роль Лигина в организации научной школы теоретической и прикладной кинематики. Как педагог, Валериан Николаевич сформировал новый подход к преподаванию прикладной механики, постоянно подчеркивая важное влияние этой науки на развитие технического прогресса и промышленного комплекса экономики. А его деятельность в составе многочисленных научно-технических и благотворительных обществ почти неизвестной. Так, Валериан Лигин был членом и занимал руководящие должности в 3 самым известных научно-технических обществах Одессы. Проанализировано их влияние на социально-экономическое развитие города и региона. Установлены основные направления деятельности Лигина в составе обществ и рассмотрены их целесообразность с точки зрения исторической ретроспективы. Особое внимание уделено Одесскому отделению Русского технического общества, которым Лигин руководил в течение 15 лет. Это время стало периодом интенсивного и экстенсивного развития, а его деятельность активно способствовала развитию города и экономическому процветанию региона. Не менее важными, по нашему мнению, является научно-исследовательская и организационная работы Валериана Лигина в*

составе Общества естествоиспытателей, которая способствовала распространению результатов его исследовательской работы в широких кругах. Также рассмотрена работа ученого в составе Общества Садоводства, где проявил себя его талант, как организатора образовательного процесса. Школа садоводства, созданная по инициативе Лигина способствовала превращению Одессы в цветущий сад в степи. В статье освещена его роль в организации и развитии специального технического образования на Юге Украины. Именно этот талант способствовал его стремительному карьерному росту.

Ключевые слова: *Новороссийский университет; механика; кинематика; Одесское отделение Русского технического общества; Общество естествоиспытателей; Общество садоводства*

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The rights of juveniles in civil procedure (the 2nd half of the XIX century)

Abstract. *The article highlights the contribution of scientists of the Kyiv Law Society to solving the problems of juveniles, their legal personality, as well as the ability to act as an orator or respondent in the civil process. In the essay we made an attempt to determine The legal significance of the concept of legal personality, which consists of such components as: legal capacity, legal competence and delictual capacity under the current Ukrainian legislation. The analysis on legal sources operating on Ukrainian territories in the second half of the nineteenth century was carried out. It showed that all people aged from 14 to 21 were considered to be juveniles, and in turn were divided into two categories by age. In addition, it has been shown that the rights of representatives of different social classes were different, and various additional rules on custody and guardianship which enriched one and limited the rights of others. were constantly issued. This led to the fact that in the early '70s of the XIX century there were about fifteen types of guardianships. It has been noted that the given situation has led to the corresponding difficulties in the regulation of legal relationships, in particular, due to the lack of systematic rules on custodianship and guardianship. It has been shown how the members of the Kyiv Law society raised this issue and tried to initiate its solution at the legislative level. In particular, it has been shown that there wasn't a general opinion on the matter in the second half of the XIX century. First of all, due to the inconsistency of legal norms in various legal acts. The speeches of the Society members, in which they told about the peculiarities of the current practice on the given issue at that time have been highlighted. From these it has been concluded that the most common was the thought that gave a juvenile a certain independence in the right to sue and answer in court with the permission of the trustee. It has been noted how the inflexibility of the social and legal system hampered the development of civil law, primarily because of the conservative views of the aristocracy regarding the granting of rights and freedoms to other classes of citizens in the country. It has been traced how the development of certain issues of civil law in the activities of Ukrainian scientists led*

to an increase in the limits of the juvenile legal personality and the current full civil capacity of juveniles in the civil process.

Keywords: *the history of law; legal personality; rights of juveniles; legal capacity; active capacity; Kyiv Law Society*

Introduction

The Kyiv Law Society, which operated at the Kyiv St. Volodymyr University in the second half of the XIX century, worked in an interesting time for our country, namely at the time when many legal concepts were formed, which nowadays are firmly established in the Ukrainian legislation. Among such concepts, we want to highlight the term "legal personality", the formation of which took place in scientific circles just in the late XIX century.

In 1879, in the Kyiv Law Society there broke a lively debate regarding the legal personality of juveniles, in particular, their ability to independently be an orator or respondent in the civil process.

Research methods

In this research, a historical method of research, based on the study of the origin, formation and development of objects in the chronological sequence, through which an in-depth understanding of the essence of the problem is achieved has been used. In addition, a chronological method involving the presentation of historical material in a chronological order on all stages of the development of the historical phenomenon has been used. And also the principles of historical authenticity, objectivity, consistency and comprehensiveness have been used. General scientific methods: analysis, synthesis; as well as source-study and archival analysis (Pylypchuk, 2018; Pylypchuk & Strelko, 2017; Pylypchuk & Strelko, 2018).

Results and discussion

But first, we will consider the concept itself, its components and their significance in procedural legal relationships. First, *legal personality* is the ability of a person to act as a participant in a legal relationship, that is, to administer equitable right and legal responsibilities (Kelman & Murashyn, 2006, p. 274). It is divided into three components:

– *legal capacity* is a person's ability to have civil rights and responsibilities. It appears from the moment of birth and terminates with the deeming of a citizen to be deceased. This includes, for example, non-proprietary human rights (right to life, to a name, to housing, to a healthy environment and others). No citizen in his life can be deprived of civil legal capacity, but he may be limited in it. Law determines the content of civil legal capacity. In some areas, legal capacity emanates from a certain age or with a corresponding profession (for instance, the right to run for president of Ukraine is only at the age of 35).

– *legal competence* is the ability of a person to independently exercise his rights and responsibilities. A legal person carries out actions that entail legal consequences.

Full legal capacity comes with the attaining of majority that is from 18. In cases of marriage before attaining majority, full capacity is reached from the moment of marriage. With attaining majority, a citizen becomes sufficiently mentally mature, has certain life experience and can do any lawful actions.

Diminished capacity is reached by citizens aged from 14 to 18 years and has the following content: a) the right to dispose of his salary, scholarship or other income; b) independently exercise rights to the results of creative, intellectual activities protected by law; d) to be a participant (founder) of legal entities, if this is not prohibited by law or constituent documents of a legal entity; e) the right to contribute to and dispose of credit institutions.

A juvenile performs other acts with the consent of the parents (adopters) or trustees. Consent to commit a legal act by a minor must be obtained from any parent. In case of objection from the parent with whom the minor lives, the consent of the guardianship and trusteeship body is necessary.

Diminished capacity is provided to minors under the age of 14 years: a) the right to commit small household deals on their own; b) to exercise personal non-proprietary rights to the results of intellectual, a creative activity protected by law. A minor is not responsible for the damage he has caused. Responsibility is taken by parents or guardians.

Limited capacity can be determined by the court for citizens suffering from mental disorder, which significantly affects their ability to realize and (or) manage their actions; as well as those who abuse alcohol, narcotic drugs, toxic substances, etc., and thus places themselves or their families in a difficult financial situation. A limited-capable citizen can enter into agreements on the disposal of property only with the consent of parents or trustees. He can make only small household deals.

Recognition of a citizen as legally incapable can be made only by a court decision, if a citizen, as a result of a chronic, persistent mental disorder, is not able to realize the significance of his actions and (or) manage them. Recognition of a citizen as legally incapable entails certain legal consequences: a guardianship is established over him, he can't make any transactions. The guardian makes them instead of him and in his interests.

– *passive dispositive capacity* is the ability of a person to take legal responsibility for his wrongful acts, that is, offenses. Prerequisite for passive dispositive capacity is *mental capacity*, which is the ability to realize his actions and manage them at the time of committing a socially dangerous act (Tsyvilnyi kodeks Ukrainy, 2019, pp. 17–22).

All these components make it possible to consider the concept of "legal personality" as a subjective legal right - "right to a right", which exists within the framework of general legal relations in accordance with the norms of constitutional law. Of course, this includes the right of the person to be a plaintiff or defendant in court, including a minor.

In the second half of the XIX century, these concepts were not as clearly defined as now. Majority was reached at the age of 21. Children under the age of 14 were

considered to be juveniles and incapacitated and therefore had no right to exercise their rights. Minor children (14-21) were divided into two categories: the first (14-17) – juveniles, who had diminished capacity and had the right to dispose of their movable property; the second (17-21) – minors who were entitled to manage immovable property without the right to dispose of it (to sell, mortgage), which occurred only at the age of 21. For the juveniles and the first category of juveniles, there was an institution of guardianship, for the second category of juveniles there was an institution of custody (Derbakova, 2014; Cunningham, 2005).

In addition, during the XIX century, various additional rules custody and guardianship were constantly issued for different social classes, which resulted in the formation of about 15 types of guardianship in the late 1960s. Thus, in the second half of the XIX century, a difficult situation in the regulation of legal relationships was created, in particular, due to the lack of systematic rules on custody and guardianship (Kvas, 2014).

For comparison, we note that in today's Ukraine the institution of guardianship works for juveniles and persons recognized as incapacitated, and the institution of custody for minors and persons with limited capacity (Tsyvilnyi kodeks Ukrainy, 2019, pp. 27-32).

Domestic legislation was in a state of reform (the period of the reign of Emperor Alexander II), therefore, there were frequent differences between established norms and judicial practice. One of them was the issue of civil procedural rights of juveniles. In a word, it was about their legal personality in the civil process.

In Article 19 of the «Statute of Civil Proceedings» of 1864, the norm was fixed: «For everyone who is under guardianship … for their minority, their parents or guardians sue and are sued». At first sight, it is evident that this norm concerned only the first category of minors (14-17 years old), but in reality, it gave rise to a lot of incomprehensible court decisions and precedents. Practice showed that this norm was used for different categories of juveniles, in various aspects and situations, therefore, it urgently required the elaboration and explanation (Ortynska, 2017).

Therefore, at the meeting of the Kiev Law Society on September 15, 1878, the head of the Society, professor V. H. Demchenko raised this question and made a lecture in order to understand, in the end, whether the minors have the right to "to sue and to be sued" in court. In particular, he noted that both academics and judges did not hold one opinion, but in general, in legal literature and judicial practice, there were three different views on this issue:

– the first: all people under the age of 21 did not have legal personality in the civil process;

– the second: people of the secondary category of juveniles, aged from 17 to 21, had the right to act as plaintiffs or defendants in court only with the permission of parents or guardians;

– the third: people who reached the age of 17 received full legal personality judicial process.

As we can see, the logical category in this list was not included at all.

In fact, the formation of Art. 19 was based on the thought of the State Council about the abolition of various terms of infancy and juveniles, consolidated by the Imperial Court on April 27, 1864, according to which all persons under the age of 21 were recognized as minors, and till then they were given a guardianship.

Thus, V. H. Demchenko noted, that instead of the scheduled several articles, one in the above-mentioned editorial, which did not distinguish between the age of a minor, neither custody nor a guardianship, appeared in the Statute. At the same time, as in 1785, custody and a guardianship in domestic legislation began to be considered as independent institutions. And in general, he denied the procedural capacity of juveniles, regardless of age.

V. H. Demchenko's report caused some objections among the members of the Kyiv Law Society. So, the lawyer H. M. Barats noted that the State Cassation Department adhered to the idea based on Part 2 of Article 179 of Vol. X of The Digest of Laws of the Russian Empire, which pointed to the representation of the institution of guardianship and custody only in relation to mentally ill persons. All the juveniles aged from 14 to 21 had civil legal personality only with the permission of parents or trustees.

I. Ya. Davydenko noted that the practice of old courts always required the participation of trustees in the process. Especially in oral debates, because the court had to deal only with adults, not children.

M.P. Orlov emphasized that doubts and controversies around Article 19 could not be resolved at that time, as the reissue of Art. 19 provided for another organization of the guardianship that remained in the blueprint stage. And according to the old law, neither the trustee nor the underage person could act independently. Both of them had to participate. And according to the new Regulations of Civil Proceedings, such a procedure was not foreseen in general, and therefore could not be implemented. This explains the constant fluctuations of practice, which, of course, had to be stopped.

O. A. Kvachevskyi also drew attention to the fact that the protection of the rights of juveniles at court should occur with the participation of trustees, because the legal capacity of the plaintiff and the defendant was determined by substantive laws, and not procedural ones. laws, and not procedural ones.

To this V. H. Demchenko replied that, since the old laws of the court defined the functions of the trustees in relation to judicial protection differently (the trustees acted independently) than they were determined in relation to substantive civil law (the trustees acted in conjunction with juveniles), it was impossible to apply the rules of substantive civil right to their procedural activity.

P. K. Skordelli noted that juveniles have the right to sue and to be sued in court directly on their behalf in the perception of the trustee, who could not conduct a process without a minor, as the main interested person. He based his views on other norms of domestic legislation. In particular, he noted that both the old and the new Senate recognized that a person who had reached the age of 17 had to sue and to be sued in court on his own behalf, and not through a trustee. The jurisdiction of the case

was determined by the person of the juveniles, not the trustee, because the main person in the process is the minor himself, who owns the legal relationship, and in whose interests the case is conducted, and a trustee is an auxiliary person. After all, jurisdiction should have a solid foundation, which is the person of the juveniles (Prtokol zasedaniya #7, 1879).

V. P. Panasiuk expressed a strange idea that in this situation it is necessary to take into account not only the age of juveniles but also his status: whether he manages his real estate himself or not, after reaching the age of 17. According to him, if a juvenile manages it himself, he may have the relevant legal personality in court, and if his immovable property is managed by a trustee, then the latter should be responsible.

P. K. Skordelli replied to this that the difference between actual management and non-management of immovable property by a minor was not confirmed by the law, and therefore had nothing to do with this issue. By law, a person who has reached the age of 17 and received a trustee was considered to be in control of his property. It is inappropriate to attribute the capacity to sue and to be sued in the court to the fact of management. The right to sue and to be sued was the main part of a person's legal capacity. Therefore, with the achievement of the corresponding age, this capacity increases without any relation to the management or possession of immovable property. The same was about of the property of a minor in the form of bank capital, which the latter had the right to claim in the bank, after reaching the age of 17, with the consent of the trustee (Prtokol zasedaniya #8, 1879).

In general, the above-mentioned Article 19 of the "Regulations of Civil Proceedings" did not reflect any of the three above-mentioned views. But, as we can see from literature and jurisprudence, the second approach to its interpretation was the one that gave the juvenile a certain degree of independence in the right to sue and to be sued" in court with the permission of the trustee.

Unfortunately, such an incomprehensible situation on this issue remained until 1917. First of all, it was due to the inflexibility of the socio-legal system. The aristocracy, as a class, was so conservative, so afraid of losing its power that any reforms were perceived rather negatively than positively, especially in the legislative sphere.

Today, Article 47 of the "Civil Procedure Code" defines all the conditions of civil legal personality for both adults and juveniles:

«Individuals who have reached the age of majority, as well as legal persons, have the capacity to personally exercise civil procedural rights and perform their duties in court (civil procedural capacity).

Juveniles aged between fourteen and eighteen, as well as persons whose civil capacity is limited, may personally exercise civil procedural rights and perform their duties in court in matters arising from the relations in which they personally participate unless otherwise established by law. The court may engage in such cases a legal representative of a juvenile or of a person whose civil capacity is limited.

In the case of a marriage registration of an individual who has not reached the age of majority, he acquires civil procedural capacity from the moment of marriage registration. A juvenile, who is given full civilian capacity, also acquires civil procedural capacity» (Tsyvilnyi kodeks Ukrainy, 2019, p. 18).

Conclusions

As we can observe, in the late XIX century, there was a tendency to increase the limits of the legal personality of juveniles; as a result, nowadays we see the full civilian capability of this category of citizens in the civil process (Goncharova, 2017). Of course, the scope of the rights of a person and a citizen in the European community increased over time; so at the moment in Ukraine it is considered that a juvenile, aged from 14 to 18, is already capable to take responsibility for their actions in a civil proceeding, as well as to file claims against those who, in her opinion, exert illegal actions.

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Права неповнолітніх в цивільному процесі (друга половина XIX століття)

Анотація. *У статті висвітлено внесок вчених Київського юридичного товариства у вирішення проблем неповнолітніх, їх правосуб'єктності, а також можливості виступати у якості позивача чи відповідача у цивільному процесі. Визначено юридичне значення поняття правосуб'єктність, яке складається з таких складових, як: правоздатність, дієздатність і деліктоздатність за чинним українським законодавством. Проведено аналіз діючих у другій половині XIX ст. на українських землях джерел права, який показав, що усі особи віком від 14 до 21 року вважались неповнолітніми, і в свою чергу поділялись на дві категорії за віком. Крім того, показано, що права представників різних суспільних станів були різними, постійно видавались різні додаткові правила про опіку і піклування, що збагачувало одних і обмежувало в правах інших. Це призвело до того, що на початку 70-х рр. XIX ст. нараховувалось близько п'ятнадцять видів опік. Зазначено, що вказана ситуація призвела до відповідних складнощів у врегулюванні даних правовідносин, зокрема, через відсутність систематизованих правил про опіку і піклування. Відображено, як члени Київського юридичного товариства підняли це питання і намагались ініціювати його вирішення на законодавчому*

рівні. Зокрема, показано, що однієї загальної думки з даного питання в другій половині XIX ст. не існувало. В першу чергу через неузгодженість правових норм в різних нормативно-правових актах. Висвітлено виступи членів Товариства, у яких вони розказали про особливості діючої практики з даного питання на той час. Саме з них було зроблено висновок, що найпоширенішою була думка, яка давала неповнолітній особі певну самостійність в праві позиватись і відповідати у суді із дозволу піклувальника. Зазначено, як негнучкість соціально-правової системи гальмувала розвиток цивільного законодавства, в першу чергу, через консервативність поглядів аристократії стосовно надання прав і свобод іншим станам громадян в країні. Простежено, як розвиток певних питань цивільного права в діяльності українських вчених призвів до збільшення меж правосуб'єктності неповнолітніх у цивільному процесі і існуючої на сьогоднішній день повної цивільної дієздатності неповнолітніх громадян у цивільному процесі.

Ключові слова: *історія права; правосуб'єктність; права неповнолітніх; правоздатність; дієздатність; Київське юридичне товариство*

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Права несовершеннолетних в гражданском процессе (вторая половина XIX века)

Аннотация. *В статье освещен вклад ученых Киевского юридического общества в решение проблем несовершеннолетних, их правосубъектность, а также возможность выступать в качестве истца или ответчика в гражданском процессе. Определено юридическое значение понятия правосубъектность, состоящее из таких составляющих, как: правоспособность, дееспособность и деликтоспособность по действующему украинскому законодательству. Проведен анализ действующих во второй половине XIX в. на украинских землях источников права, который показал, что все лица в возрасте от 14 до 21 лет считались несовершеннолетними, и в свою очередь делились на две категории по возрасту. Кроме того, показано, что права представителей различных сословий были различными, постоянно издавались различные дополнительные правила об опеке и попечительстве, что обогащало одних и ограничивало в правах других. Это привело к тому, что в начале 70-х гг. XIX в. насчитывалось около пятнадцати видов опек. Отмечено, что указанная ситуация привела к соответствующим сложностям в урегулировании данных правоотношений, в частности, из-за отсутствия систематизированных правил об опеке и попечительстве. Отображено, как члены Киевского юридического общества подняли этот вопрос и пытались инициировать его решения на законодательном уровне. В частности,*

показано, что одной общей мысли по данному вопросу во второй половине XIX в. не существовало. В первую очередь из-за несогласованности правовых норм в различных нормативно-правовых актах. Освещены выступления членов Общества, в которых они рассказали об особенностях действующей практики по данному вопросу того времени. Именно из них был сделан вывод, что самой распространенной была мысль, которая давала несовершеннолетнему лицу определенную самостоятельность в праве судиться и отвечать в суде с разрешения попечителя. Указано, как негибкость социально-правовой системы тормозила развитие гражданского законодательства, в первую очередь, из-за консервативности взглядов аристократии по предоставлению прав и свобод другим сословиям граждан в стране. Прослежено, как развитие определенных вопросов гражданского права в деятельности украинских ученых привело к увеличению границ правосубъектности несовершеннолетних в гражданском процессе и существующей на сегодняшний день полной гражданской дееспособности несовершеннолетних граждан в гражданском процессе.

Ключевые слова: *история права; правосубъектность; права несовершеннолетних; правоспособность; дееспособность; Киевское юридическое общество*

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