

# HISTORY OF TECHNOLOGY

DOI: 10.32703/2415-7422-2022-12-2-320-339

UDC 94:621.313:001(9):330.34 (477) «1920/1925»

Ihor Annienkov

National Scientific Agriculture Library of the National Academy of Agrarian Sciences of Ukraine

10, Heroiv Oborony Street, Kyiv, Ukraine, 03127

E-mail: [goalan93@gmail.com](mailto:goalan93@gmail.com)

<http://orcid.org/0000-0002-6642-8048>

## The practice of borrowing foreign projection and technological solutions in the design of electrical machines in Ukraine in the second half of the 1930s

***Abstract.** This article, based on the problem-chronological, comparative-historical, historiographical, and source-research methods, as well as the method of actualization, identifies the extent of borrowing foreign design and technological solutions in the Ukrainian Soviet Socialist Republic for projecting electrical machines in the second half of the 1930s, as well as the reasons for the absence of unambiguous information in historiography regarding the existence of this phenomenon in the republic at this chronological stage. The publication provides a general assessment of the quality of scientific support for the processes of creating electrical machines, establishes the ways of fulfilling the scientific-technical borrowings that were studied and the dynamics of their development, analyzes their role in the growth of the technical level of products of the Ukrainian electrical machine-building branch. It was found that the level of a scientific escort for electrical machine-building production in Ukraine during the considered period was insufficient for arranging a completely independent design of the entire range of sectoral industrial products, therefore, scientific and technical borrowings remained the only way to maintain the necessary rates of development in the design and production of new types of electrical machines across the entire latitude spectrum of their application. According to the archival documents, it was found that because of the rapid growth of the Soviet Union's needs at the turn of the 1930s–1940s for electric power equipment, on the one hand, and the improvement of the possibility of organizing its mass production in Ukraine, on the other, the scale of such borrowings grew like an avalanche. At the same time, because of the growth of the scientific-technical potential of the republican electrical machine-building, the nature of the procedure for their fulfillment at the end of the 1930s changed and allowed their mimicry as the exclusively independent achievements of domestic designers. This is how the achievements of Ukrainian electric machine*



*builders were presented to the entire Soviet society during the considered period, which subsequently allowed them to gain a foothold in the relevant historiography, however, the facts and arguments in this publication completely refute this established opinion.*

**Keywords:** *electrical machine-building; scientific-technical potential; scientific-technical cooperation; scientific support; industrialization; power electrical equipment*

### **Introduction.**

By the beginning of World War II, the Soviet electrical machine-building in all indexes was still lagging behind similar branches of the leading industrial states; however, it achieved significant success in mastering new types of products. During the 1930s, in the Ukrainian segment of this all-union branch of industry, a series of modernized, less material-intensive electric motors were introduced into production in the power range of previously produced machines, and the range of new electric machines was significantly expanded (Alexandrov et al., 1957). At the same time, Soviet historiography either directly states that the modernization of produced and design of new electric machines since 1932 by Ukrainian specialists was carried out without foreign scientific-technical assistance (Alexandrov et al., 1957, p. 311; Suzdaltsev et al., 1965, pp. 75–77), or the facts of such assistance are not mentioned at all, regardless of the period of development of the Soviet electrical machine-building development in general or Ukrainian in particular (Gusev, 1955; Martynuk, 1958). The post-Soviet historiography of the national electrical machine-building industry does not mention the involvement of foreign scientific and technical assistance in the development of electrical machines in the Ukrainian Soviet Socialist Republic (UkSSR, Ukrainian SSR) in the second half of the 1930s (Glebov, 1999; Tverytnykova, 2009), however, its absence is not approved too. A study by the American historian A.C. Sutton asserts that Ukrainian electrical machine builders used foreign scientific and technical assistance in the design of electrical machines during the 1930s, but the latest date for such direct cooperation is 1935 (Sutton, 1971, p. 154). Under direct cooperation, this researcher implies work for scientific and technical assistance agreements concluded between the Soviet government and foreign companies for the provision of such assistance to specific Soviet manufacturers of electrical machines. Generally, according to his data, the receipt of indirect foreign scientific-technical assistance, at least from *General Electric (GE)*, by Ukrainian electrical machine builders continued until the 1940s, although he does not specify the form of this assistance (Sutton, 1971, p. 165).

Thus, as historiographical analysis shows, current information about the practice of foreign scientific and technical borrowings made by Ukrainian electrical machine builders in the development of their electrical machines in the second half of the 1930s is incomplete and rather contradictory. This point makes it impossible to determine the real degree of independence of the scientific support of the Ukrainian electrical machine-building during the study period, which updates the presented publication. In

this regard, this article aims at establishing the scale of borrowings of foreign design and technological solutions in the Ukrainian SSR when designing electrical machines in the second half of the 1930s, as well as the reasons for the absence in historiography of unambiguous information regarding the existence of this phenomenon in the republic during the chronological period under consideration. To achieve this purpose, it is necessary to determine the overall quality of scientific support for the processes of creating electric machines in the UkSSR during this period in the context of the possibility of organizing their completely independent projecting. Also, it is required to establish the ways of making the scientific-technical borrowings, that have been researched, assess the dynamics of their development, and analyze their role in the growth of the technical level of products of the Ukrainian electrical machine-building.

### **Research methods.**

In preparing the publication, problem-chronological, comparative-historical, historiographical, and source-study methods were used, as well as the method of actualization. The combined use of these methods allowed: a) to determine the reasons for the gaps made by previous researchers in the coverage of the issue raised; b) to restore the general historical picture regarding the quality of the scientific support of the Ukrainian electrical machine-building industry that existed during the period under study; c) to establish the scale, role, and place of scientific and technical borrowings in the approach to the design of electrical machines practiced in the second half of the 1930s in Ukraine.

### **Results and discussion.**

First, it should be noted that because of the specifics of the pre-revolutionary path of development of national electrical engineering, it was deprived of its scientific support, and scientific-technical escort for the processes of creating electrical machines was carried out from abroad (Anniukov, 2014, p. 37). After the final establishment of Soviet power in Ukraine in 1921, the republican government did not pay due attention to the development of local electrical machine-building, since this industry fell within the competence of the government of Soviet Russia. As for Moscow, it was decided to give priority to strengthening the potential of electrical machine-building enterprises of the capital of the Russian Soviet Federative Socialist Republic (RSFSR) and Petrograd, while the restoration of the industrial capacities of the largest in the Union of Soviet Socialist Republics (USSR) Kharkivskii elektromekhanicheskii zavod [Kharkiv Electromechanical Plant] (*KhEMZ*) began only in 1924 (The State Archive of Kharkiv Region [SAKhR], 1924). Thus, until the mid-1920s, actions to organize their own scientific support for the processes of creating electrical machines in the UkSSR were carried out on a scale limited solely by the initiative of higher technical educational institutions located in the republic, without any significant support from the government and industry sectoral management. Meanwhile, the rapidly developing electrification of the national economy of the USSR, by this time, demanded the

quantity and range of electric machines never produced by the domestic industry. Considering the complete unpreparedness of the Ukrainian segment of the Soviet electrical machine-building for such a turn of events, the government of the USSR adopted and successfully carried out activities to introduce American constructions of electrical machines and American technologies of their production on German equipment, into the Ukrainian electric machine industry (Annienkov, 2020a). This became possible thanks to the agreement on scientific-technical cooperation concluded in 1925 between the State Electrotechnical Trust of the USSR (*GET*) and the German Allgemeine Elektrizitäts Gesellschaft (*AEG*), which come into effect in 1926 (Novikov, 2006, p. 16). The success was ensured because a few years earlier an identical event was brilliantly carried out by *AEG* itself, which had concluded a scientific and technical cooperation agreement with *GE* (Sutton, 1968, p. 189).

Meanwhile, the undertaken activities did not change the essence of the scientific support of the processes of creating electric machines, which existed in the pre-revolutionary period on the territory of the UkSSR, aimed at producing duplicates of foreign constructions manufactured using foreign technologies. As an attempt to avoid consolidating the duplication of foreign machine designs and technologies for their manufacture as the basic concept of organizing scientific escort in the branch, in 1927, the UkSSR began to lay the foundations for a system of its own scientific support for national electrical machine-building. So, on October 1, 1927, on the initiative of the *KhEMZ* engineer and part-time teacher of the Kharkiv Technological Institute (*KhTI*) A. Ya. Berger, the Bureau of Research of Synchronous Machines (The Central State Archive of the Supreme Authority and Administration of Ukraine, 1932) was organized in the plant. The task of this Bureau was to learn from *AEG*'s design and technological experience in designing appropriate electrical machines. However, this company provided with either modernized pre-war (before World War I) own designs, or adapted copies of American machines, which significantly hampered the work of Ukrainian specialists to determine the modern fundamental principles of projecting electrical machines (Annienkov, 2020b, p. 142). The second factor hampering this work was the shortage of relevant specialists, since the purposeful training of designers of electrical machines in the UkSSR began only in 1930 (Annienkov, 2020b, p. 144).

In 1929, a direct agreement on scientific and technical cooperation between *GET* and *GE* was signed, which resulted in Ukrainian electrical machine builders receiving not German copies of American machine designs, but the original, although not the newest, project documentation (Sutton, 1968, p. 191). This significantly increased the level of competence of soviet developers of electrical machines, since it allowed them to deal directly with the modern achievements of electrical machine-building, and not with their interpretations. For a more detailed study of the American experience in the projecting of electrical machines at *KhEMZ*, which by that time had secured the status of the basic profile enterprise in the Ukrainian SSR, bureaus and laboratories were created, where factory specialists analyzed those technical solutions adopted at *GE* in the design of electric machines, the essence of which was not disclosed by American

manufacturers. However, these factory scientific-technical divisions, besides those mentioned earlier, were not permanent structures, part of the joint technical office of *KhEMZ*, and were created only for (and for a period) the solution of some specific technical and technological problems (Anniukov, 2016a, p. 48). This situation was caused by the fact that until 1934 *KhEMZ* was not an independently operating economic entity (although it had an internal trust structure of organization), but was a production unit in the *GET* system, and then in the *Vsesoyuznoie elektrotekhnicheskoe obiedineniie* [All-Union Electrotechnical Association] (*VEO*), which replaced the latter (*SAKhR*, 1934). Therefore, the creation of our own systemically organized scientific escort of production processes for a rather long period was outside the competence of the heads of *KhEMZ*, and *GET* and *VEO* considered the scientific-technical support provided to the plant by their subordinate research centers in Moscow and Leningrad to be sufficient.

Thus, until 1934, the own research divisions at *KhEMZ* were formed only on the principles of in-plant initiative, and their work was not coordinated systematically. To eliminate this shortcoming in organizing scientific escort and its factory structure of scientific support processes of creating electrical machines at *KhEMZ*, at the request of the People's Commissariat of Heavy Industry, to the position of chief-electrician was seconded a professor of the Leningrad Polytechnic Institute and chief-electrician of the Leningrad plant *Elektropribor* M. P. Kostenko (Kartsev, 1981). Under his leadership, a systematic scientific support of production was organized at *KhEMZ before 1937*, but not yet staffed with a qualified personnel resource, since the necessary influx of graduates of higher educational institutions trained in the relevant specialties began only in the second half of 1934, and before that, the opposite process of outflow of specialists from the plant was observed (*CSASAAU*, 1935). That is, until the end of the 1930s, there was no effective scientific support for the creation of electric machines at *KhEMZ*, or at least sufficient to completely abandon scientific-technical borrowings in their projecting. Taking this into account, as well as the fact that *KhEMZ* was the main and largest electrical machine-building enterprise in Ukraine during the period under review, we can assume the information available today in the relevant historical studies about the final transition of the Ukrainian segment of the core industry in the second half of the 1930s to independent projecting of electrical machines such that do not correspond to the actual historical events that took place.

Referring to archival documents confirms the above assumption since it follows that the termination of the scientific and technical cooperation between *KhEMZ* and *GE* in 1932 was due not to the Soviet Union's refusal of foreign scientific and technical assistance, but to the establishment of such cooperation with the British Metropolitan-Vickers (*MV*) according to the contract of April 14, 1931, on large-scale seven-year scientific-technical assistance concluded between *MV* and *VEO* (*SAKhR*, 1931). Moreover, after the reverse reorganization of *VEO* into *GET* with changes in the status of *KhEMZ* and similar to its large electrical machine-building enterprises of the USSR (Anniukov, 2015), this contract was renegotiated on November 14, 1935, and *KhEMZ*

was given the opportunity by direct [rather than through the branch management structures, as it had been before] access to the design and technological documentation of this subsidiary of the American *Westinghouse*, as well (according to the same form of the appropriate agreement) as of the Italian company *Ansaldo* (SAKhR, 1936b). Under contracts with *MV* and *Ansaldo*, the scientific and technical employees of *KhEMZ* were trained at the electrical plants of these companies to improve their qualifications. However, at the same time, highly qualified specialists were sent to these enterprises too, who were charged by the plant administration with the obligation at the place of the "internship" to in any way seize any information regarding by projecting of electrical machines that was not received by *KhEMZ* according to agreements on scientific-technical assistance (SAKhR, 1937e). To sum up, in the second half of the 1930s, Ukrainian electrical machine builders actively practiced borrowings of foreign design and a technological solution that were fulfilled without sanction of their authors. To maximize the effect of such activities in the USSR, special teams were formed comprising 8–10 research engineers, whose work profile was of the greatest current interest to the management of the enterprises they represented. For example, as of the summer of 1937, such profiles for *KhEMZ* were the works in the following areas: particularly large and particularly small DC machines, explosion-proof and acid-resistant electric machines, silent electric motors, an AC ship electric drive (SAKhR, 1937e). The relevant scientific and technical workers of this plant were included in the profile group of specialists seconded abroad, formed by the GET from representatives of all those interested in mastering the production of these types of products of the USSR enterprises.

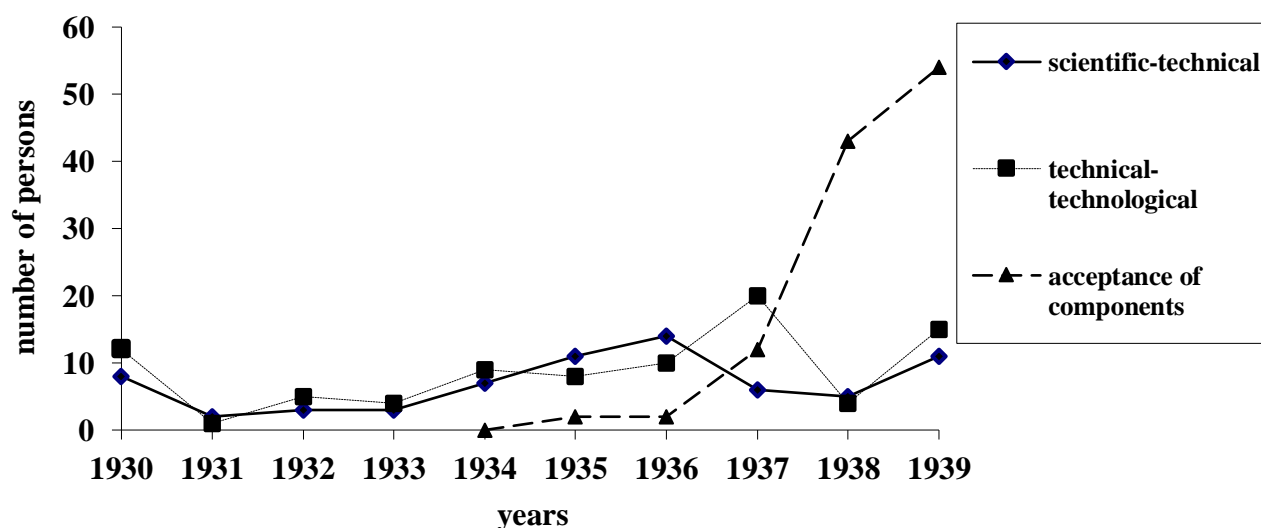
It should be noted that not only researchers were involved in the above activity but also technical specialists of the commercial departments of *KhEMZ*, seconded abroad by the plant to carry out the acceptance of those components purchased from foreign manufacturers for the electric machines *KhEMZ* produced. For example, in the summer of 1937, the USSR received a loan from Great Britain to purchase a wide range of electric drives for metal-cutting machine tools and their components from British manufacturers. To accept these products under the order of the Soviet government, *KhEMZ* sent specialists who were charged, among other things, "... by all available means to refresh all the drawing and informational material on the Soviet machine-tool electrical equipment ...", providing a detailed list of priority issues in projecting of electrical machines for metal-cutting equipment (SAKhR, 1937). The very fact of receiving components for machine-tool electric machines manufactured by *KhEMZ* from abroad indicates that the latter were designed on the basis of borrowed scientific-technical solutions. At the same time, the cited requirements for seconded employees confirm that several of these solutions were never reproduced by the factory specialists until the end of the 1930s.

The above and similar points mentioned in archival documents give us grounds to assert that, despite the creation of its system of scientific support by 1937, *KhEMZ* did not acquire significant independence in the development of electric machines by

that time, and in this matter, still needed foreign help. This is also evidenced by the presence in the plant's structure management office of the appropriate division – Bureau of Foreign Technical Assistance (SAKhR, 1937d). In addition, this fact was confirmed in 1938 in his voluminous [11 sheets] service note on the role of foreign scientific-technical assistance in the development of *KhEMZ* by deputy director and at the same time chief engineer of the plant M. N. Shevchenko, who analyzed in sufficient detail both the results obtained from such cooperation and its future prospects. Even though this document, in typical Soviet stylistics of the study period, presented the achievements of Ukrainian electrical engineering in terms of machine design in a hypertrophied form, the role of borrowings foreign scientific-technical solutions in this process is disclosed quite objectively. Thus, M.N. Shevchenko, whose competence cannot be questioned, absolutely directly claims that further (after 1938) independent projecting of electrical machines by the Ukrainian sector of the profiled industry, in principle, has already become possible, but only in the product range that is already mastered in production, and new machines sizes without the use of foreign ready-made scientific and technological solutions by domestic specialists cannot be created, which requires the continuation of the practice of concluding agreements on technical assistance with foreign, primarily American, electrical companies (SAKhR, 1938c).

The need for *KhEMZ* to conclude agreements on scientific-technical assistance with foreign electrical companies, as the basic one in the USSR (since 1934) enterprise for manufacturing electrical machines for the Navy and artillery (Annikov, 2019a), was discussed also in a top-secret note provided in 1939 by the USSR Artillery Research Marine Institute to the Armament and Supply Directorate of the Workers and Peasants Navy of the USSR. So, the 1st rank military engineer A.P. Konoplev pointed out in this document that the USSR completely lacked experience in designing ship and artillery AC electric machines, which, because of their extreme prevalence in modern weapons in an approaching war, requires the prompt organization of foreign scientific-technical assistance to *KhEMZ* in the development of this type of machine from American and French electrical companies (SAKhR, 1939). This problem of lack of experience was complicated by the fact that during the period under study there were no uniform standards for parameters of current for electrical-energy systems of ships and artillery units in the USSR, which led to many significantly differenced mechanical platforms in technical characteristics of even the same type of weapons (SAKhR, 1937a). Therefore, to avoid the need for massive alterations of mechanisms, both those already in service and those under construction, it was necessary to design an extremely wide range of AC electric drives, with each size of drives must be meeting the already existing tactical-technical characteristics of the mechanical units of the corresponding weapon systems. This point in preparation of the USSR for a big war required such a pace of design of these electric machines, which neither Ukrainian nor Soviet electric machine builders as a whole could provide even theoretically, which made foreign scientific-technical assistance in this matter extremely demanded.

Thus, in the projecting's context of the latest electric machines for the Ukrainian segment of the core industry, the need to conclude agreements on scientific-technical cooperation with leading manufacturers of electrical machines remained relevant throughout the second half of the 1930s. Meanwhile, the agreement on scientific-technical assistance with *MV* was concluded only until April 15, 1938 (SAKhR, 1937f), after which the practice of scientific-technical cooperation, carried out under such contracts, was not applied by *KhEMZ*. At least, no evidence of this was found in archival documents. However, this does not mean at all that Ukrainian electrical machine builders, after 1938, refused to borrow foreign scientific-technical solutions when designing electrical machines. As the war was approaching, foreign companies were reluctant to share not only that scientific-technical information that could improve the tactical-technical characteristics of the weapons produced by the USSR, but also that contributed to strengthening the scientific-technical potential of the Soviet industry as a whole (SAKhRF, 1938c). Thus, the conclusion of agreements on comprehensive technical assistance between the Soviet government and leading foreign electrical engineering companies began to lose its information attractiveness and economic feasibility. Therefore, since 1938, Ukrainian electrical machine-building have been developing the previously approved methods of unauthorized borrowing of scientific-technical information from its foreign owners, mostly carried out during the acceptance by *KhEMZ* employees of the components domestic electromachines, which were purchased from their manufacturers abroad. This fact, among other things, led to an abrupt increase in the number of *KhEMZ* employees sent abroad to accept products and components, which is revealed by the corresponding graph in Figure 1.



**Figure 1.** Dynamics of the number of *KhEMZ* employees seconded to foreign enterprises during the 1930s to get acquainted with scientific, technical, and technological achievements, as well as to accept components.

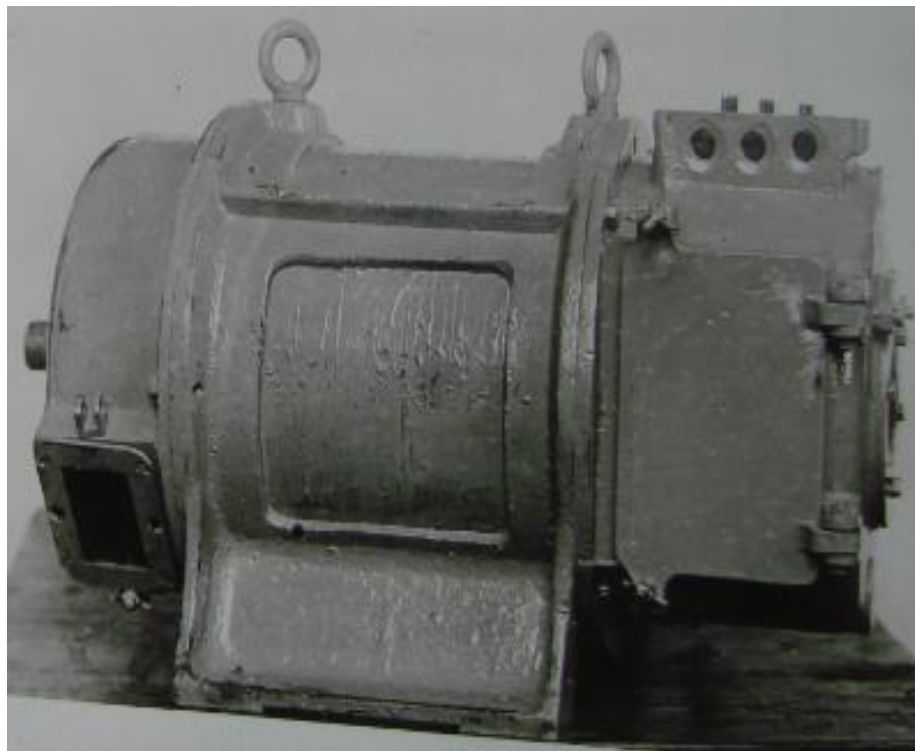


In general, the graphs presented in figure 1 were compiled based on the results of the analysis of cases with information about the *KhEMZ* employees seconded abroad, stored in the fund of the plant in the state archive of the Kharkiv region (SAKhR, 1936b). These graphs reveal that the number of scientific and technical employees of the plant sent to borrow design solutions for electric machines steadily increased from 1931 to 1936 (especially during 1933–1936). During the same period, the number of engineers sent to carry out borrowing of technologies for the production of electrical machines increased too, although in this case, unlike the previous one, the nature of familiarizing Ukrainian specialists with foreign technological achievements had a more frequent change of the periods of growth and reduction in the number of corresponding business trips. This is explained by the fact that the very process of introducing new types of electric machines into production during the study period in Ukraine proceeded stepwise, which, on the one hand, was determined by the method of economic management adopted in the USSR, and on the other, by the insufficient level of development of the scientific component of the branch scientific-technical potential.

So, the demand and supply for new types of electric machines, according to the Soviet method of organizing the work of the industry, were established by the government in a directive way, indicating specific dates of commencement: their production – to the designated manufacturer and use – to all (also designated) consumers. This procedure alone excluded the evolutionary transition from piece-by-piece to mass production of new types of serial electric machines as lean effective ways of using them and optimal technologies for their production were mastered. Accordingly, the evolutionary development of production technologies was excluded too, at least in manufacturing non-unified units and parts, the proportion of which in new types of machines is always especially large. However, the own forces of scientific support of electrical machine-building in the Ukrainian SSR during this period, albeit developed at an increasing pace, were still only mastering the general principles of projecting DC machines, therefore, they could not provide the required technologies for their mass and serial production overnight, much less could not provide such technologies for the production of AC machines. This moment, when receiving government directives regarding the mastering of new types of machines by Ukrainian manufacturers, caused the need to urgently borrow these technologies from foreign manufacturers of originals, which was duplicate by the Ukrainian electrical machine building industry, and, as a result, to an increase in the number of seconded domestic specialists for these purposes.

Along with the above, it is worth noting that the information assimilated by Ukrainian scientific-technical specialists on the principles of projecting DC electric machines allowed them to start independent development of individual models of equipment from 1934, mainly for military purposes (Annikov, 2016b; Annikov, 2017; Annikov, 2019a; Annikov, 2019b). Since these electric machines were designed according to foreign prototypes, they used mostly borrowed scientific-technical solutions, and, consequently, they copied parts and whole units of the original

designs. However, at the time of placing the corresponding military orders for already designed machines, not all of them had been mastered in production by national electrical machine builders. Therefore, since 1934, we can observe the emergence of such a phenomenon as seconding technical employees of *KhEMZ* abroad to accept components manufactured by foreign electrical companies by order of this plant for the electric machines it produces. By 1936, the volume of borrowed scientific-technical information on the principles of projecting DC machines, as well as the number of competent specialists, reached the level that allowed Ukrainian electrical machine builders to independently modernize foreign prototypes on a large scale and develop new models of electrical machines on their basis. This factor influenced the gradual reduction in the number of people seconded to get acquainted with foreign scientific-technical achievements in the projecting of DC electric machines presented in figure 2, which by 1938 led to a reduction in this kind of business trips as a whole. However, as for AC machines, the achievements of Ukrainian creators of electrical machines were much more modest, as a result, since 1939, the number of domestic specialists seconded to foreign electrical engineering companies began to grow again, this time – to borrow experience in projecting this type of electrical machines.



**Figure 2.** A DC motor of the MDP type, created at *KhEMZ* for automated drive systems for artillery mechanisms in 1938, based on design and technological principles borrowed from MV (SAKhR, 1937b).

Despite the above progress in scientific support for the production of DC electric machines in the Ukrainian segment of the Soviet electrical machine-building during the first half of the 1930s, the rate of creating an effective organization of design and

development works by 1937 lagged significantly behind the growth rate of the needs of the national economic complex of the country for such a technique. Therefore, the practice of producing duplicates of foreign designs in the Ukrainian electrical machine-building for DC electric machines was continued, which caused another increase in the number of business trips of *KhEMZ* engineering-technical personnel to borrow technologies for their mass and serial production. By 1938, the plant managed to organize outstripping projecting of DC electric machines in most of the range of their standard sizes and versions that existed at that time, and the need to borrow multiple technologies for their serial production disappeared, since the relevant knowledge accumulated by plant specialists was supplemented with the time sufficient for their implementation. Thus, in 1938, the number of *KhEMZ* engineering-technical personnel seconded abroad to borrow production technologies decreased to the level of 1933–1934, as well as scientific-technical personnel – to borrow design solutions.

Meanwhile, an increase in the number of self-designed DC electric machines in Ukraine caused a rise in the volume and range of purchases of their components abroad, since, because of the circumstances given in this article, units and parts by foreign manufacturers were still widely used in the designs of domestic machines. The organization of our own production of such components was not always expedient or even possible at all. Before 1939, the plant technological services were engaged in accelerated production of as many duplicates of DC electric machines as possible due to the soon expiry of the term of scientific and technical assistance contracts, and they were not able to carry out technological preparation of production of those components which were not included in the design of duplicated machines. Therefore, to avoid disruption of the schedule for the development of analogs of foreign DC electric machines in production in general, it became more expedient to purchase components of machines developed in the Ukrainian SSR from their foreign manufacturers, which were not mastered by the domestic electrotechnical industry. Wherein, a fairly large part of the separate specific units of electric machines could not have been projected at all by Ukrainian developers, since they had just mastered the corresponding methods. These circumstances influenced the fact that starting from 1936 we can observe a rapid growth of *KhEMZ* employees seconded to foreign electrical engineering enterprises in order to carry out the acceptance of the components purchased by the plant from them.

By 1939, besides the above reasons, the growing number of employees seconded abroad by *KhEMZ* abroad was influenced by organizing the production of a wide range of AC machines at the plant. However, at that moment, the conclusion of agreements on scientific-technical cooperation between the Soviet electrical machine-building industry and foreign companies in the previous form of providing comprehensive scientific-technical assistance was no longer practiced. As a result, the geographic scope and nature of the activities of Ukrainian electrical machine builders seconded abroad have changed. So, while in 1935–1938, British electrical engineering enterprises accounted for an average of 84% of all *KhEMZ* employees seconded abroad, then since 1939, only 21%, for the USA this figure remained unchanged at

2.5%, and for Germany, it changed from 8% up to 54%, respectively. In addition to the Italian electrical machine-building industry, as an alternative to the above-mentioned main donor countries of relevant scientific-technical knowledge, since 1938, electrical engineering enterprises of France, Switzerland, and Sweden became involved in cooperation with the Ukrainian core branch. As a result, the analyzed indicator for countries other than Great Britain, Germany, and the United States has changed from an average of 5.5% in 1935–1937 up to 22.5% in 1938–1940. At the same time, it should be recognized that in the overwhelming majority of cases during 1939–1940, foreign scientific-technical assistance to Ukrainian electrical machine builders was limited to the supply of components, which also led to an increase in the number of *KhEMZ* employees seconded to accept them, as can be seen in the graph in Figure 1 (SAKhR, 1937f; SAKhR, 1938a; SAKhR, 1938b; SAKhR, 1941a).

Meanwhile, the expansion of the geography of suppliers of components indicates an increase in the number of design solutions borrowed by *KhEMZ* abroad when projecting its models of electric machines. However, since 1939, these borrowings were carried out by the scientific-technical personnel of *KhEMZ*, mainly not at enterprises-manufacturing, but at their research base. To do so, initially, scientific-technical employees of *KhEMZ*, as well as other industry research centers and factories, were seconded abroad to study there the range of produced electric machines in the line of operational parameters of interest to the USSR. After they had chosen the optimal models of machines, the Soviet government, depending on the situational circumstances, purchased the latter both in single copies and in batches, and to accept this equipment on the previously mentioned principle, special groups of seconded employees of the *KhEMZ* were formed. Once at the manufacturing plant, these groups tried to glean any information of a scientific-technical and planning-economic nature regarding not only the purchased equipment but generally for the entire range of products manufactured by such an enterprise, thus increasing own arsenal of corresponding knowledge. Upon delivery of the purchased electric machines, their individual copies were dismantled and additionally studied in the research laboratories of *KhEMZ* to adapt their designs as a whole or only their components of interest to the enterprise to the existing production technologies at the plant, as well as to clarify the modernization potential of the purchased models of machines. Much attention when conducting this kind of research in the USSR at the turn of the 1930s–1940s was paid to identifying the possibilities of replacing scarce non-ferrous metals, the production of which in the required volumes in the country by the beginning of World War II had not been established (SAKhR, 1941c).

The given methodology of scientific and technical borrowings directly follows both from the assignments for business trips posted in those archival materials, on the basis of which the graphs in Figure 1 were built, and from the instructions to employees seconded abroad, as well as to the administrative staff of the industry forming the relevant groups, previously given in this article. In addition, individual elements of this methodology are displayed in archived tasks for the purchase of specific foreign

samples of electric machines for their subsequent copying, as well as archived plans for the study of such samples (SAKhR, 1936a). While in a secret report to the chief engineer of *KhEMZ* A. I. Bertinov, the head of the Special Design and Technological Department of this plant for the projecting of military electrical engineering H. G. Vaisman listed the companies [*GE, Westinghouse, Clark Cooper, Hammer*], at which electric machines were purchased on purpose for for the subsequent full-scale copying of the units and mechanisms used in them when creating a range of electrical machines of repeated short-term conditions of operation for the Workers-Peasants Red Fleet of the USSR, and also briefly described the methodology used for this and the results of its application (SAKhR, 1940). In their totality, all the available relevant archival materials allow us to assert that after 1938, copying of scientific and technical solutions used by them in the design of electrical machines, unauthorized by foreign manufacturers, became the main way of corresponding borrowings carried out by Ukrainian electrical machine builders.

At the same time, it should be recognized that, in contrast to the previous period of wide and more open scientific and technical cooperation with foreign electrical firms, since 1938, the practice of borrowing technologies for the production of electrical machines by direct or modified copying from the original manufacturers has almost ceased to be applied in the UkSSR. This was replaced by the practice of borrowing technologies for performing individual material-processing operations from those foreign enterprises where they were performed in the most optimal version for Ukrainian electrical machine builders, which, of course, did not include only electrical machine-building plants. Therefore, by 1939, the number of foreign enterprises of interest to the Soviet electrical machine-building, in terms of the material-processing technologies used there, had increased, and since it was rather difficult and time consuming to obtain them in the required volumes solely by unauthorized means, they were mostly borrowed on a purposeful short-term contractual basis. As a result of these circumstances, the number of *KhEMZ* technologists seconded abroad to get acquainted with production technologies by 1939 again began to outstrip the number of seconded designers. However, the predominant transition of Ukrainian specialists at the turn of the 1930s 1940s from borrowing the general principles of projecting electric machines to borrowing specific design and technological solutions in their development, as well as the transition to mostly independent copying of foreign originals, with their simultaneous modification and modernization, testified to the significantly increased quality of the scientific component of the branch scientific-technical potential compared to the first half of the 1930s.

### **Conclusions.**

Contrary to the opinion established in the historiography of the Soviet and Ukrainian electrical machine-building, neither in 1933 nor in 1935, as it is presented in the relevant historical studies, the transition in the industry under study to a fully independent product projecting did not and could not happen at all. The main obstacle

to abandoning the leading role of foreign scientific-technical solutions in the projecting of domestic electrical machines in the second half of the 1930s was the lack of effective own scientific escort for the processes of making such technique. Thus, the material-technical, organizational, and personnel components of the scientific support system for the creation of electric machines were finally formed only by 1938 at their main manufacturer in the republic – *KhEMZ*. At the same time, the experience in projecting DC machines, in the entire range of their then use, has not yet been fully gained by the plant until the beginning of the 1940s, and in the part of AC machines, it absented almost completely. Thus, scientific-technical borrowings remained the only way that allowed the Ukrainian electrical machine-building to maintain the necessary rates of mastering new types of electric machines in the projecting and production across the entire spectrum of their application, dictated by the chosen rates of industrialization of the USSR. As World War II unfolded, the pace of industrialization of the USSR further accelerated, which directly influenced the formation of spasmodic growth dynamics in the scale of borrowing from abroad the relevant design and technological solutions in the Ukrainian segment of the Soviet electrical machine-building. At the same time, with increase the quality of scientific support for the processes of creating electrical machines in the UkSSR, domestic projectors at the turn of the 1930s–1940s made a transition from duplicating foreign projects of machines as a whole to compilation projecting. In addition, during this period, the number of unauthorized borrowings of constructive solutions that were carried out by Ukrainian electrical machine builders from foreign manufacturers increased significantly. Also, as preparations for the war progressed, the degree of confidentiality of information about foreign business trips of Ukrainian specialists in electrical machine-building grew, which, combined with the two previous factors [secrecy in the carried out of borrowings and compilability on their subsequent implementation] allowed the Soviet government, for political reasons, to successfully simulate the transition of the national industry to a completely independent projecting of electrical machines before the public. The ideological necessity of presenting the socialist way of conducting the national economy as the most effective, which persisted throughout the entire period of the USSR's existence, influenced the fact that Soviet historians did not need to reconstruct the real picture of the scientific support of the domestic electrical machine building in the late 1930s. Thus, the myth spread by the Soviet government at that time about the complete refusal of the industry to borrow foreign design and technological solutions in the projecting of electrical machines was finally entrenched in the relevant historical works.

**Funding.**

This research received no external funding.

**Conflicts of interest.**

The author declare no conflict of interest.

## References

- Alexandrov, A. G. et al. (1957). *Istoriya energeticheskoy tekhniki SSSR. [History of power engineering of the USSR]*. In 4 volumes. Belkind, L. D. et al. (Eds). Vol. 2: *Elektrotekhnika. [Electrical engineering]*. Moscow, Leningrad: The State energy publishing house [in Russian].
- Annikov, I. O. (2014). Opredelenie urovnia nauchnogo obespecheniia proizvodstva na zavode Russkogo Obshchestva “Vseobshchaia kompaniia elektrichestva” v 1915–1918 gg. posredstvom nomenklaturnogo analiza vypuskaemoi produktsii. [Determining the level of scientific support for production at the plant of the Russian Society “Vseobshchaia company elektrychestva” in 1915–1918 through nomenclature analysis of maded products]. *Vestnik Tomskogo universiteta. Istoriya – Tomsk State University. History*, 5(31), 3–38 [in Russian].
- Annikov, I. O. (2015). Orhanizatsiini struktury elektromashynobudivnoi haluzi v Ukrainskii RSR u 1922–1941 rr. [The organizational structure of Electric Machine Industry in the Ukrainian in 1922–1941 years]. *History of Science and Technology*, 5(7), 3–20. Retrieved from <https://www.hst-journal.com/index.php/hst/article/view/175> [in Ukrainian].
- Annikov, I. O. (2016a). Kontseptsiiia naukovu-tekhnichnoi polityky v elektromashynobuduvanni Ukrainskoi SRR u period NEPu (1921–1931 rr.). [The concept of scientific-technical policy in the electrical machine building of the Ukrainian SSR during the NEP period (1921–1931)]. *Evropský filozofický a historický diskurz*, 2(2), 44–50 [in Ukrainian].
- Annikov, I. O. (2016b). Zapochatkuvannia na Kharkivskomu elektromekhanichnomu zavodi seriinoho vyrobnytstva sylovykh chastyn avtomatyzovanykh system upravlinnia artyleriiskym vohnem (1935–1941 rr.). [Foundation for the serial production of power units of artillery fire control systems at the Kharkiv Electromechanical Plant (1935–1941)]. *Visnyk Dnipropetrovskoho universytetu. Serii: Istoriia i filosofiiia nauky i tekhniki – Dnepropetrovsk University Journal: History and Philosophy of Science and Technology*, (24), 134–144 [in Ukrainian].
- Annikov, I. O. (2017). Uchast Kharkivskoho elektromekhanichnoho zavodu v stvorenni radianskoï zaliznychnoi artylerii (1931–1941 rr.). [Participation of the Kharkiv Electromechanical Plant in the creation of the Soviet railway artillery (1931–1941)]. *Viiskovo-naukovyi visnyk – Military Scientific Journal*, (27), 247–256 [in Ukrainian].
- Annikov, I. O. (2019a). The Kharkov Electromechanical Plant contribution to the soviet military submarine fleet formation in the 1920–1941. *Colloquium*, 11(3), 147–164. <http://dx.doi.org/10.34813/08coll2019>.
- Annikov, I. O. (2019b). Uchast Kharkivskoho elektromekhanichnoho zavodu v oboronnykh prohramakh Radianskoho Soiuzu v 1920-kh – 1930-kh rokakh. [Participation of the Kharkiv Electromechanical Plant in the defense programs of

- the Soviet Union in the 1920s – 1930s]. *History of education, science and technique in Ukraine: Materials of the XIV All-Ukrainian Scientific Conference of Young Scientists and Specialists* (pp. 285–288). Kyiv: National Academy Agrarian Science [in Ukrainian].
- Annikov, I. O. (2020a). Cooperation with AEG in 1925–1928 as the first form of scientific-technical borrowings in the electric machine-building industry of the Ukrainian SSR. *History of Science and Technology*, 10(1(16)), 34–49. [https://doi.org/10.32703/2415-7422-2020-10-1\(16\)-34-49](https://doi.org/10.32703/2415-7422-2020-10-1(16)-34-49).
- Annikov, I. O. (2020b). Formuvannia pershoi v Ukraini shkoly konstruktoriv elektrychnykh mashyn (1920-i roky) [Formation of the First School of Electric Machine Engineers in the Ukrainian SSR (the 1920s)]. *Eminak: naukovyi shchokvartalnyk – Eminak: Scientific Quarterly Journal*, (2(30)), 135–145. [https://doi.org/10.33782/emina2020.2\(30\).414](https://doi.org/10.33782/emina2020.2(30).414) [in Ukrainian].
- Glebov, I. A. (Ed). (1999). *Istoriia elektrotehniki. [History of electrical engineering]*. Moscow: Moscow Power Engineering Institute [in Russian].
- Gusev, S. A. (1955). *Ocherki po istorii razvitiia elektricheskikh mashin [Essays on the history of the development of electrical machines]*. Moscow, Leningrad: The State energy publishing house [in Russian].
- Kartsev, V. P. (1981). *Mikhail Polievktovich Kostenko*. Moscow: Nauka [in Russian].
- Martynuk, F. M. (1958). *Mashynobuduvannia Ukrainskoi RSR v period sotsialistychnoi industrializatsii [Mechanical engineering of the Ukrainian SSR during the period of socialist industrialization]*. Kyiv: Kyiv State University Publishing House [in Ukrainian].
- Novikov, M. V. (2006). *Inostrannyi kapital v sovetskoii elektrotekhnicheskoi promyshlennosti silnykh tokov formy privlecheniia i rezultaty ispolzovaniia 1920–1932 gg. [Foreign capital in the Soviet electrical industry of heavy currents: forms of attracting and results of use (1920-1932)]*. Ph. D. thesis Abstract. Volgograd: Volgograd State University [in Russian].
- Sutton, A. C. (1968). *Western Technology and Soviet Economic Development (1917–1965)*. In 3 volumes. Vol. 1: 1917–1930. Stanford: Stanford University.
- Sutton, A. C. (1971). *Western Technology and Soviet Economic Development (1917–1965)*. In 3 volumes. Vol. 2: 1930–1945. Stanford: Stanford University.
- Suzdaltsev, V. V. et al. (1965). *Ocherk istorii Kharkovskogo elektromekhanicheskogo zavoda [Essay on the history of the Kharkov Electromechanical Plant]*. In 2 parts. Voznesenskiy, A.A. (Ed). P. 2: 1918–1964. Kharkov: Prapor [in Russian].
- The Central State Archive of the Supreme Authority and Administration of Ukraine. (1932). F. r-797, D. 1, C. 194, Ss. 1–4 f.v., dt. 1932. *Doklad inzhenera A.Ya Bergera na I Vseukrainskom energeticheskom sieezde “Ob issledovatel'skikh biuro v elektropromyshlennosti” [Account “On research bureaus in the electrical industry” by engineer A. Ya. Berger at the 1st All-Ukrainian Energy Congress]* [in Russian].



- The Central State Archive of the Supreme Authority and Administration of Ukraine. (1935). F. r-1252, D. 1, C. 77, Ss. 248–255, dt. 01. January 1935. *Svedeniia o nalichii i potrebnosti v inzhenerno-tekhnicheskikh kadrakh KhEMZ. [Information on the availability and need for engineering and technical personnel of KhEMZ]* [in Russian].
- The State Archive of Kharkiv Region. (1924). File [F]. p-15, Description [D]. 1, Case [C]. 26, Ss [Sheets]. 40–41 f.v. [overleaf], dt. 16 March 1924. *Otchet o rabote iacheiki zavoda Elektrosila №1 za period s dekabria 1923 g po mart 1924 g. [Report on the work of the cell of the plant Electrosila No.1 for the period from December 1923 to March 1924]* [in Russian].
- The State Archive of Kharkiv Region. (1931). F. r-4217, D. 4, C. 47, Ss. 83–89, dt. 15 April 1931). *Dogovor Gosudarstvennogo Vsesoyuznogo elektrotekhnicheskogo obiedineniia “VEO” s Elektricheskim Aktsionernym obshchestvom “Metropoliten-Vickers” v Londone. [Contract of the All-Union Electrotechnical Association “VEO” with the Electric Joint Stock Company “Metropolitan-Vickers” in London]* [in Russian].
- The State Archive of Kharkiv Region. (1934). F. r-4217, D. 4, C. 27, Ss. 62–62 f.v., dt. 25 October 1934. *Spravka Glavnogo upravleniia energeticheskoi promyshlennosti Narodnogo komissariata tiazheloi promyshlennosti SSSR Kharkovskomu elektromekhanicheskomu zavodu o iego perevode na samostoyatelnyi ustav. [Certificate from the Main Directorate of the Energy Industry of the People's Commissariat of Heavy Industry of the USSR to the Kharkiv Electromechanical Plant on its transfer to an independent charter]* [in Russian].
- The State Archive of Kharkiv Region. (1936b). F. r-4217, D. 4, C. 47, Ss. 133–133 f.v., dt. 25 November 1936. *Pismo No. 1977 Glavnogo upravleniia energeticheskogo mashynostroeniia Narodnogo komissariata tiazheloi promyshlennosti SSSR direktoru KhEMZ. [Letter No. 1977 of the Main Directorate of the Power Machine Building Industry of the People's Commissariat of Heavy Industry of the USSR to the director of KhEMZ]* [in Russian].
- The State Archive of Kharkiv Region. (1936a). F. r-4217, D. 4, C. 47, Ss. 94–96, dt. 31 July 1936. *Sluzhebnaia zpiska № 418 n/o tekhnicheskogo direktora i nachalnika biuro mashynostroeniia KhEMZ v Glavnoyie upravleniie energeticheskogo mashynostroeniia Narodnogo komissariata tiazheloi promyshlennosti SSSR. [Service note No. 418 n/o of the technical director and head of the technical bureau for mechanical engineering of the KhEMZ to the Main Directorate of the Power Machine Building Industry of the People's Commissariat of Heavy Industry of the USSR]* [in Russian].
- The State Archive of Kharkiv Region. (1937). (F. r-4217, D. 4, C. 44, Ss. 167–168, dt. 16 June 1937). *Rasporyazheniie zamestitelia nachalnika Glavnogo upravleniya energeticheskogo mashinostroyeniia Narkomata tyazheloi promyshlennosti*

- nachalniku Upravleniya elektropromyshlennosti i direktoru KhEMZ. [Order of the Deputy Head of the Main Directorate of the Power Machine Building Industry of the People's Commissariat of Heavy Industry to the Head of the Electrical Industry Directorate and the Director of KhEMZ] [in Russian].*
- The State Archive of Kharkiv Region. (1937a). F. r-4217, D. 2, C. 26, Ss. 4–6, dt. 13 February 1937. *Rezolyutsiia po standartizatsii i elektrifikatsii 2-y konferentsii po morskomu elektrooborudovaniuu. [Resolution on Standardization and Unification of the 2nd Conference on Marine Electrical Equipment] [in Russian].*
- The State Archive of Kharkiv Region. (1937b). F. r-4217, D. 2, C. 170. Ss. 90–152, dt. 16. April 1938. *Otchet laboratorii spetsialnogo privoda Spetsialnogo byuro Proyektno-tekhnicheskogo otdela KhEMZ ob ispytanii oborudovaniia k silovoi sinkhronnoi peredache zavoda № 205. [Report of the laboratory of a special drive of the Special Bureau of the Design and Technical Department of KhEMZ on testing equipment for a power synchronous transmission of plant No. 205] [in Russian].*
- The State Archive of Kharkiv Region. (1937c). F. r-4217, D. 4, C. 44, 177 s, dt. 13 January–9 November 1937. *Materialy ob oformlenii zarubezhnykh komandirovok. [Materials on registration of foreign business trips] [in Russian].*
- The State Archive of Kharkiv Region. (1937d). F. r-4217, D. 4, C. 44, Ss. 152–154, dt. 20 September 1937. *Pismo zamestitelia nachalnika Glavnogo upravleniia energeticheskogo mashinostroyeniia Narkomata tyazheloi promyshlennosti SSSR direktoru KhEMZ. [Letter from the Deputy Head of the Main Directorate of the Power Machine Building Industry of the People's Commissariat of Heavy Industry of the USSR to the Director of KhEMZ] [in Russian].*
- The State Archive of Kharkiv Region. (1937e). F. r-4217, D. 4, C. 44, S. 163, dt. 11 July 1937. *Rasporyazheniie glavnogo inzhenera KhEMZ nachalniku byuro inostrannoi tekhnicheskoi pomoshchi zavoda. [Order of the chief engineer of KhEMZ to the head of the bureau of foreign technical assistance of the plant] [in Russian].*
- The State Archive of Kharkiv Region. (1937f). F. r-4217, D. 4, C. 44, Ss. 165–166, dt. 27 July 1937. *Vypiska iz plana inostrannoi tekhnicheskoi pomoshchi na 1937 g. [Extract from the plan for foreign technical assistance for 1937] [in Russian].*
- The State Archive of Kharkiv Region. (1938a). F. r-4217, D. 4, C. 47, 179 s., dt. 3 January–27 December 1938. *Perepiska s Glavnym upravleniim energeticheskogo mashinostroyeniya o komandirovках za granitsu. [Correspondence with the Main Directorate of the Power Machine Building Industry about business trips abroad] [in Russian].*
- The State Archive of Kharkiv Region. (1938b). F. r-4217, D. 5, C. 237, 82 s., 5 January–23 November 1938. *Materialy o zarubezhnykh komandirovках. [Materials about foreign business trips] [in Russian].*
- The State Archive of Kharkiv Region. (1938c). F. r-4217, D. 5, C. 237, Ss. 58–68, dt. 21 March 1938. *Pismo № 539 s zamestitelia direktora KhEMZ v Glavnoe*

- upravlenie energeticheskogo mashynostroieniia Narodnogo komissariata mashynostroieniia SSSR. [Letter No. 539 s of the Deputy Director of KhEMZ to the Main Directorate of the Power Machine Building Industry of the People's Commissariat of Machine Building of the USSR] [in Russian].*
- The State Archive of Kharkiv Region. (1939). F. r-4217, D. 4, C. 2, Ss. 3–7, dt. 11 January 1939. *Zaklyucheniie № 86 s na pismo № KO 8603 gruppy konstruktorov zavoda KhETZ na imia Predsedatelia Sovieta Narodnykh Komissarov. [Conclusion No. 86 s on the letter No. KO 8603 of the group of designers of the KhETZ plant addressed to the Chairman of the Soviet of People's Commissars] [in Russian].*
- The State Archive of Kharkiv Region. (1940). F. r-4217, D. 6, C. 3, Ss. 1–12, dt. May 1940. *Dokladnaia zapiska o prodelannoii rabote SpetsPTO KhEMZ za period s 1 yanvaria po 1 maia 1940 g. [Report on the work done by SpecPTO KhEMZ for the period from January 1 to May 1, 1940] [in Russian].*
- The State Archive of Kharkiv Region. (1941a). F. r-4217, D. 6, C. 11, 20 s., dt. 30 January–28 June 1941. *Perepiska s Glavnym upravleniyem elektromashinostroitelnoi promyshlennosti ob oformlenii komandirovok za granitsu. [Correspondence with the Main Directorate of the Electrical Machine-Building Industry on the registration of business trips abroad] [in Russian].*
- The State Archive of Kharkiv Region. (1941b). F. r-4217, D. 6, C. 13, Ss. 16–19, dt. 7 April 1940. *Plan oboronnykh opytно-issledovatel'skikh rabot na zavode KHEMZ na 1941 god. [The plan of defense experimental and research works at the KhEMZ plant for 1941] [in Russian].*
- The State Archive of Kharkiv Region. (1941c). F. r-4217, D. 6, C. 68, Ss. 15–16, dt. 3 April 1941. *Instruktsiia po peresmotru assortimenta produktsii, izgotovleniie kotoroi predusmotreno iz defitsitnykh materialov, s tseliu perevoda yeie na zameniteli [Instructions for revising the range of products, the manufacture of which is provided from scarce materials, in order to transfer them to substitutes] [in Russian].*
- Tverytnyukova, O. Ye. (2009). *Vnesok uchenykh kharkivskykh Tekhnolohichnoho ta Elektrotekhnichnoho instytutiv u rozvytok elektrotekhnichnoi haluzi Ukrainy (1885–1950 rr.) [Contribution of scientists of Kharkiv Technological and Electrotechnical Institutes to the development of the electrotechnical branch of Ukraine (1885–1950)]: Ph.D Thesis. Kharkiv: National Technical University “KhPI” [in Ukrainian].*

### **Ігор Анненков**

Національна наукова сільськогосподарська бібліотека Національної академії аграрних наук України, Україна

## **Практика запозичень зарубіжних конструкторсько-технологічних рішень при проектуванні електричних машин в Українській РСР у другій половині 1930-х років**

**Анотація.** У статті, на ґрунті проблемно-хронологічного, порівняльно-історичного, історіографічних та джерелознавчих дослідницьких методів, а також методу актуалізації, визначені масштаби проваджених в Українській Радянській Соціалістичній республіці запозичень зарубіжних конструкторсько-технологічних рішень при проектуванні електричних машин у другій половині 1930-х років, а також причини відсутності в історіографії однозначної інформації стосовно існування даного явища в республіці на цьому хронологічному відтинку. В публікації надана загальна оцінка якості наукового забезпечення процесів створення електричних машин, встановлені шляхи здійснення досліджуваних науково-технічних запозичень і динаміка їхнього розвитку, проаналізована роль цих транзакцій у зростанні технічного рівня продукції українського електромашинобудування. Встановлено, що рівень наукового супроводу електромашинобудівного виробництва в Україні впродовж розглянутого періоду був недостатнім для організації повністю самостійного проектування всієї номенклатури галузевої продукції, тому науково-технічні запозичення залишалися єдиним шляхом, що дозволяв підтримувати необхідні темпи освоєння в проектуванні та виробництві нових типів електричних машин по всій широті спектру їх застосування. На базі архівних документів з'ясовано, що у зв'язку зі стрімким зростанням потреб Радянського Союзу на рубежі 1920-х – 1930-х років в електросиловому устаткуванні з однієї сторони і покращенням спроможності організації його масового випуску в Україні – з іншої, масштаби таких запозичень збільшувалися лавиноподібно. Разом з тим, завдяки зміцненню науково-технічного потенціалу республіканського електромашинобудування, характер процедури їх здійснення наприкінці 1930-х років змінився і дозволив їх мімікрію під виключно незалежні розробки вітчизняних проектувальників. У такому вигляді протягом досліджуваного періоду досягнення українських електромашинобудівників представлялися всьому радянському суспільству, що дозволило цьому наративу закріпитися у відповідній історіографії, утім розміщені в даній публікації факти та аргументи повністю спростовують цю усталену думку.

**Ключові слова:** електромашинобудування; науково-технічний потенціал; науково-технічне співробітництво; наукове забезпечення; індустріалізація; силове електроустаткування

Received 15.09.2022

Received in revised form 19.11.2022

Accepted 24.11.2022