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DESIGN OF AGRICULTURAL MACHINERY IN UKRAINE, ITS CONFORMITY TO THE INTERNATIONAL REQUIREMENTS OF QUALITY, STANDARDIZATIONS AND CERTIFICATION

Summary: The modern condition of design, construction and manufacture of agricultural machinery the technological level of which would be in accordance with the international quality standards, standardizations and certification is considered.

Key words: agricultural machinery, international quality, certification

Farm machines belong to difficult mobile machines the development of which is carried out in the direction of the further intensification of technological processes, constant increasing of high-speed operations mode and increasing of engine power. Besides they should have rather high resource of reliability, durability and stability to execute technological process, despite of constant changes of external conditions in which their operation is carried out (changeable loading on the side of external condition and their working parts contact with inhomogeneous properties of materials).

Creation of agricultural machinery on a modern technological level is a difficult process involving a consequent execution of design, construction and manufactures and demanding purposeful, interdependent, comprehensively proved operations at each stage. Thus the first stage–designs are researches and search of scientifically proved, technically realized and economically expedient engineering decisions in this or that technological process of farm mechanization. Actually the result of a design is a common, scientifically proved project object. Agricultural machinery design is a development and creation of a system as a logical basis of operations enabling to solve a final task under corresponding conditions and limitations involving this or that farm machine or working part [1]. Thus at the first stage there is a necessity of fundamental scientific research on a technological process, careful scientific processing and possibly exact installation of a physical nature of this process in due time, specifications on its realization, quality of the consequent execution of the process operations, corresponding conditions and limitations involves of an agricul-

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tural area), etc. Therefore the first stage of creation of agricultural machinery of a modern technological level can be successfully fulfilled only by highly skilled scientists and researchers having deep corresponding theoretical knowledge, acquainted with modern methods of experimental researches and of their results processing enable to the critical analysis of the obtained results.

Agricultural machinery construction is a creation of a concrete object which will fulfill the conditions of its design. A creation of a necessary construction is a concrete structure of machine elements involving mutual placing of working parts, a halter, details of this or that machine, instrument, device.

Agricultural machinery constructing at the result end must detail scientific and engineering decisions which have been obtained at the design and make careful calculations of constructions durability, stability and reliability, and also solve all questions of machines manufacturing technology and their working parts, their further maintenance conditions. Thus higher requirements are expressed to constructing technology as scientific decisions, researches and projections of designed new technological process to introduce a concrete structure (to introduce in 'metal') process – it is not always easy and sometimes it is impossible. Besides, keeping at construction the multifold exact calculations of durability, stability and reliability of working parts and elements of farm machines demand a great responsibility of the designers as the operation results will to a great extent define power consumption and metal consumption of the machine, and, consequently, its cost. Actually this stage of creation of agricultural machinery is completed by an occurrence of a 'successful' or 'unsuccessful' construction.

Design execution and construction of agricultural machinery is carried out according to standardized stages and also methods designed and used by long-term branch practice.

Holdings further of multifold objective trials of farm machines, samples specification of the designer documentation and their preparation for a serial production, also demand purposeful responsible operation of a highly skilled part of scientists, researchers, technologists.

Let's analyze the level of agricultural machinery projection, its correspondence to the international quality requirements, standardization and certification in Ukraine. In most cases the quality of farm machines and instruments being produced now in Ukraine is considered low. Both in the recent times and now reliability and durability of modern farm machines considerably yield to the world standards. Also, the power consumption in the processes is too high while using home-made farm machines. The reason of poor quality is presumably the absence of necessary high-quality materials used for their building and an impossibility to use good quality, reliable completing articles (bearings, cardings shafts, cog-wheels, reducers, etc.), as well as lack of various profiles of roll stock, electronic controllers and monitoring, etc.

Now technology manufacturers have no limitations in buying metal and completing articles, any devices and systems for the creation of their own farm machines, however, in general, to receive samples does not mean reaching the world, unfortunately. There were examples when domestic production engine was installed on the completed and reliable tractor of the world famous VOLVO corporation, but 'the result wasn't a tractor'.

Leading firms of the world have developed the production of agricultural machinery and by most powerful own achievements or cooperation have created machinery complexes which can satisfy any manufacturer of agricultural production.

Despite some difficult problems on a nation-wide level there is the question: 'How to design and produce agricultural machinery which will meet the international requirements of quality and what is the main hidden problem?' In our opinion it is 'traditions' and 'high culture of manufacture' of agricultural machinery and they are very capacious and complex concepts which envelope many important, interdependent questions. Beginning with careful scientific working up constructions of this or that farm machine, that or this combine or tractor, and finishing with modern machine tools and equipment of the machine-building enterprises where skilled workers will do. It is obvious that highly-reliable agricultural machine building and technology will take place only on a foundation of modern computer methods of its construction, careful, enveloping research, exact calculations, the most modern testing high-quality manufacture with the guaranteed forecast of all machine reliability. Besides it is necessary to support in every possible way the so-called 'maintenance reliability' of farm machines on the basis of new methods development of engineering service and repair. This manufacture culture and traditions will not appear in the near future. But it is necessary in most cases to start to do something from the first steps or we will stay a backward state otherwise.

Major directions and operations, the key questions of scientists and designers which work in the field of agricultural machine industry, are obvious. Use of modern methods and the complex dynamic systems of building will result in farm machines enabling optimum decisions at the choice of parameters and conditions of their operation regime. Let us observe more carefully and what is the condition of this question today?

The practice of widely copying and producing of foreign farm machines makes can even 'eliminate' the need for an operation of the majority of designing room field scientists and high school science. However it is already well-known that 'blind' copying in most cases finally results in economic losses, even if it is not apparent at the first sight. It is impossible to trade with profit with home production in conditions of high ruthless competition on the markets. So it is done all over civilized world are being. There is a need to constantly put in one's own engineering decisions, beginning from the funding of fundamental theoretical and experimental researches. And we are alive witnesses when the world famous corporations of Germany make the order to their own universities to carry on such researches and spend considerable sums to create or purchase very expensive means and sandbar researching and production testing of home products at the highest technological level. From the reports of domestic scientists who visited the world famous American corporation of the manufacturer of agricultural machinery 'John Deere' it follows the firm management spends about 1,5–2,0 million dollars (every day!) on holding thorough scientific (theoretical and experimental) researches, designer and design processing, multifold searches, and thus 'invest in the future'. In the corporation structure there is their 'own university' with staff of 400 scientists and the design rooms for the development of different types of farm machines include more than 200 highly skilled designers and stylists. The corporation keeps their own scientific operations and prospective processing in a strict secret.

At a gain of the world market, 'the present war' on scientific and designing front begins. It is obvious, that for an obtainment of an annual profit at the rate of 10,0–13,0 billion dollars (behind data's 2002 years) the management of a firm can permit to spend more than 400 million dollars per year for fundamental research and development and designing operations. Almost all the representatives of the corporation who can understand the reality, very carefully market their own modern developments, collecting the information on refusals, imperfection, requirement of the future buyers, searching pro-

spective ways of development etc. The same position exists in the civilized world and in other branches-aviation, food, building, etc.

Certainly it has not eliminated similar 'copying' (scientific and technical 'espionage' exists till now), as in the conditions of the world market economy however it is done in such a way, with such careful processing, that 'duplicates' have already got their own 'face', which is much better than in the previous case. In the domestic system of agricultural machine industry, unfortunately, 'duplicates' are lower on the order than 'originals'.

Domestic samples of complicated agricultural machinery are developed and created without corresponding scientific processing. They are very popular on exhibitions and fairs, though painted gray, as they are technical means with the period of maintenance which is often very short, consisting of 'finishing', 'processing' and 're-equipment'.

Currently, as a rule, nobody is interested in the quality of operation, high operation parameters and power consumption during the process. It is proved, that the farm machines designed without corresponding scientific processing (that is without fundamental theoretical and experimental researches aiming at multifold dynamic calculations depending on a high-speed condition and mass distribution in mechanisms) have on the order worse power consumption and reliability.

Then slogans begin to be produced: 'to buy agricultural machinery of western manufacture is cheaper than to produce one's own'. To the officials the realization of this thesis is very favorable and the home agricultural machine industry tires out in no time because of even more difficulties with sales.

Thus, for the creation of well-developed home agricultural machine industry it is necessary to further and stronger unite scientists and manufacturers. And there was such a union as the state and enterprises gave enough money to make the decision of current scientific questions of agricultural machinery design and significant means were secreted and very powerful scientific forces were invited including almost all institutes of the URSR Academy of Sciences.

And success was achieved in this field, too. So, in 1938 the tractor of domestic production HTZ-NATI-ITA received Grand Prix on the international exhibition of agricultural machinery in Paris. In 1958 the tractor of manufacture of Kharkov tractor plant μ T-20 on the World's fair in Brussels has received the Gold Medal and the Diploma of the 1st degree. This tractor was exported to more than 30 countries of the world. In 1957 and 1961 on the World's Fair of Agricultural Machinery in Brussels beet combines KC-3 and CKEM-3 produced by manufactures of Dnipropetrovs'k combine factory received the highest awards. Combine harvester CK-3 has recently had the international recognition and numerical international awards.

Where are the awards on the word level in the recognition of the tireless operation of domestic scientists, designers, and manufacturers?

There was only a necessity for the transition to a uniform system of architecture and a realization of scientific researches earlier for many research and development establishments of an agricultural direction departments, machine-testing stations, a design room, faculties of a farm mechanization of agrarian high school. Now scientific researches are carried out in innumerous establishments which have still remained and hardly exist. The best conditions are created now at agrarian universities (basically through outflow to them of an overwhelming majority of Dr. Sc. Tech.), however their scientific developments are still in demand of an 'introduction', impossible to realize quickly. Making first-class scientific operations higher school scientists have no opportunity 'to sell' and the projects remain dead, paper ones. What careful scientific working up of new samples of agricultural machinery can we speak about?

The work of designers at constructing farm machines and their working parts is considered as a very important component of the designing process and effort is being put in very high requirements, too. Nice farm machines outside as a rule have also quite good technical-operation parameters and are often bought.

What conclusions can we do on these important questions for our country? How to design and construct agricultural machinery in Ukraine? Do we need field plant, or academic and high school science in the field of an agricultural machinery industry in general? The answer is obvious. It is necessary to concentrate effort on introducing scientists, designers, testers in the field into the development of main complex projects, such as: 'Grain', 'Sugar Beet', 'Potato', 'Flax', etc. It is necessary to match the competition of researches and developments which are carried out in the country, their careful critical analysis and comparisons with the world level. And it will cause the necessity to have development coordinators of these complex projects (on the majority of farm machines which are developed, it can be NNC IMESG UAAS) who would have an opportunity to attract in this operation the leading experts from universities and other scientific establishments.

Thus only a strong union of scientists, designers and manufacturers developing complex projects of farm machines can overcome backlog which is felt now if to compare the world samples with domestic developments. There is no other way from a crisis condition in the field of agricultural machine industry. A well-known scientist in the field of agricultural machine industry, professor V.J.Anilovich spoke in 1996: 'Unfortunately, the position of agro-engineering science is not good. However, with time, everything must be placed in its proper perspective, so that the state keeps strong on its legs and people can live in it adequately. Consequently, the science and education in it would be the one to hold the most serious position...!" [2].

There is a hope that design, construction and manufacturing of agricultural machinery in Ukraine will get to the level which will meet the international requirements of quality, standardization and certification in future.

REFERENCES

1. Сисолин П.В., Сало В.М., Кропивний В.М., 2001: Сільськогосподарські машини: теоретичні основи, конструювання, проектування. Книга 1. Машини для рільництва. – К.: Урожай, 282 с.

Sisolin P.V., Salo V.M., Kropivniy V.M., 2001: Silskogospodarski mashyny: teoretychni osnovy, konstruyuvania, proyektovania. Kniga 1. Mashyny dla rilnictva. Urodjay, s. 282

 Анилович В.Я., 1996: Мой путь в отраслевую инженерную науку (Воспоминания и размышления). Харьков, 118 с.
Anilovich V.Ya., 1996: Moy puti v otraslevuy idjenieryu nauku (vospomnienya i razmyshlenya), Kharkov, s.118

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