

Olena Bashta¹
Olena Dzhuryk²
Victor Romanenko³
Natalia Dzhuryk⁴

LIFE AND SCIENTIFIC ACHIEVEMENTS OF TRYPHON MAKSYMOVYCH BASHTA

National Aviation University
Kosmonavta Komarova prospect, 03680, Kyiv, Ukraine
E-Mails: ^{1,2}kafpgkg@ukr.net, ³romane@ukr.net, ⁴djudi@inbox.ru

Abstract: *The article considers life and scientific achievements of T. M. Bashta (1904 -1987), a product manager of aircraft industry and the founder of home scientific school of industrial hydraulics. Two strategic branches – machine tool-building and aeronautic – are indebted exactly to him for its advance.*

Keywords : aircrafts; Bashta T. M.; hydraulic drives; machine-tool industry.

Tryphon Maksymovych Bashta was born in the Poltava region in a large family of a blacksmith. He studied at the faculty of Mechanical Engineering of the “Kyiv Polytechnic Institute”, later – at post graduate study in KPI. Before long he was directed to Moscow to the Institute of ‘Red Professors’, which prepared administrative and technical country’s elite. A great number of famous political leaders finished this educational institution. He was to choose – politics or engineering, and he, without any doubts, chose the second one.

At the same time he graduated from Moscow State University, Faculty of Mechanics and Mathematics.

Between 1931 and 1938 T. Bashta had been working at the Experimentale Research Institute of metal cutting machines. There he organized and headed the unique bureau in the USSR, where the samples of hydraulic units were formed. In 1935 T. M. Bashta was chosen as the academic secretary of the Technical Branch of Academy of Sciences of the USSR. At that very moment the Head of the Technical branch of academy was S.O. Chaplyhin, «the second father of Russian aircraft industry after F.E. Zhukovsky» – as Tryphon Maksymovych suggested. They became acquainted when Tryphon Maksymovych had been studying at The Institute of ‘Red Professors’. Curiosity, determination, exceptional industriousness and incredible technical knowledge of young Tryphon Maksymovych captivated renowned academician. He kept a close eye on Bashta’s activity, supporting young scientist in different ways. 1936 was particularly profitable when the «Gidroprivod» plant in Kharkov was initiated and spearheaded by T.M.Bashta’s monograph «Hydraulic drives and mechanism of

metal cutting machines», which became the basic aid for a whole generation of machine tool builder.

At the same time on the basis of all his works he was honored by doctor's degree by the committee of the Academy of Sciences of the USSR without defense of a thesis. In 1939, during Stalinist purges, T.M. Bashta was arrested and due to preposterous charges sentenced to 10 years of imprisonment. But situation in those days cried out of aircraft renovation. In such a way, Tryphon Maksymovych found himself in aircraft design engineering bureau, which was organized by people's commissariat of home affairs from convicted scientists. This bureau was directed by renowned aircraft designers A.M Tupolev and V.M Petliakov, who were prisoners at that moment.

The Spanish Civil War, which soviet aviators took part in, showed, that soviet aircrafts gave up their place to German ones and The Khalkhin-Gol Battle demonstrated the high level of the Japan’s Aviation. Possibility of future massive conflicts demanded air force renovation, but nearly all soviet aircraft designers were imprisoned. All that conditions made L.Beria, people's commissar of the USSR of home affairs, create special prisons – design engineering bureaus, where purged scientists and aircraft designers worked on the creation of new technical devices.

While A.M. Tupolev was making out a list of specialists to work in such an uncommon bureau, he remembered about a young enthusiast- hydraulic technician T.M. Bashta and included him in this list, although he wasn’t bound up with aircraft.

Among the prisoners were such famous people as A.M. Tupolev, S.P. Korolev, V.M. Miasyshchev, V.M. Petliakov, A.V. Nadashkevych and others –

academic and engineering elite of aviation branch. Doctor of Engineering Science, aircraft designer with a God-given talent, T.M. Bashta started working with drawing-board. Later he was made a leading designer and deputy of A.M. Tupolev and V.M. Petliakov concerning creation of hydraulic systems and units. He was put in to manage the work with hydraulic systems and units for two speed dive bombers – Tu-2 and Pe-2. How did these aircrafts look like? They were speed dive and high-rise aircrafts, which had a bomber armament mobility and speed of fighter-bomber. Increase of air speed, compared with earlier created, stipulated a requirement to use capacity boosters amplifiers. The proposition of Tryphon Maksymovych to apply a hydraulics for this purpose wasn't well received. At first aircraft designers didn't accept the idea to apply hydraulic drive for aircraft and were suspicious of it.

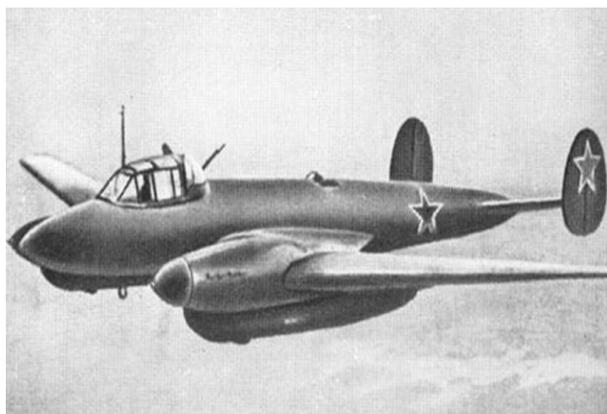


Fig. 1. Twin-engine dive bomber PE-2 of V.M Petlyakov

«Bashta offers to apply the hydraulic system, based on nonexistent pump, equipped with nonexistent units and devices, which, furthermore, should run on nonexistent liquid» – one of the opponents of hydraulic drive appliance mocked.

However, A.M. Tupolev and V.M. Petliakov believed in the advantage of a hydraulic system, and the work started.

Rapid in the form of a twin-engine dive bomber of V.M. Petlyakov PE-2 had successfully passed the tests and was put into production in the spring of 1940. In early 1941 dive bomber of A.M. Tupolev Tu-2 was put into the production. These were the first aircrafts in home aviation in which the strength functions were taken upon hydraulics. Hydraulic "muscles" cleaned and ejected chassis, provided movement of flaps, stabilizer, abruptly

threw the airplane on a target while diving, opened the sash of hatchway for bombs and automatically took out the aircraft from the dive. As usual, the design team, which had successfully coped with the task, was not just dismissed, but was given a pardon.

After the liberation T.M. Bashta worked at plant, where the production of developed bombers began.

The war began. Continuous bombing did not allow to organize the normal operation of the plants, and in 1941 they had to be evacuated to Kazan. A group of leading designers was invited to the plant №22 to organize the front aircraft repair workshops (FARW). The enemy was already near Moscow – Sheremetievo.

Tryphon Maksymovych decided to evacuate his wife, daughter and mother-in-law, and remain himself in Moscow. So work at front aircraft repair workshops began, the repair of the aircrafts was carried out under continuous bombardment. Leading designers lived in barracks on the territory of the former factory.



Fig. 2. Dive bomber Tu-2of A.M. Tupolev

T.M. Bashta recalled: "To take into consideration that all the used aircrafts (PE-2, LaGG-1, Il-2), were launched in the series without sufficient debugging.

At the beginning of combat operation in connection with a considerable number of complaints, which were coming from the front, there was a need for additional flight tests of combat aircraft. We, a group of leading designers were transferred from FARW to the Flight Research Institute (FRI) of aviation industry of the USSR, where I worked during all the war years. There I also received combat awards.



Fig. 3. T.M. Bashta during World War II

On the airfield of FRI a lot of front-line units of the Air Forces were based.

Working conditions at FRI, when it took 30 minutes to get from Moscow to the Front line by car, were front – continuous bombing and shelling, the urgency of the tasks of revealing and eliminating of defects, the maintenance of combat units of the Air Forces".

For the fruitful research activity in the field of improvement of combat characteristics of home aircrafts Soviet Government awarded T.M.Bashta with the Order of the Great Patriotic war of II degree.

Still during the war Tryphon Maksymovych was given the rank of Lieutenant Colonel, and after the war he was sent on a business trip to Germany to take German aircraft machinery.

After the war T. Bashta became a professor of Moscow Aviation Institute (MAI), main designer and chief of research plant. There he was creating new types of wheels for high-speed jet fighters, brakes that diminished distance of mileage of the aircraft. For the first time in the world's aviation practice he invented device which spins the wheel of the plane in the air to reduce dynamic blow of the landing gear during landing. In 1949 for creating new aviation technique T. Bashta not yet rehabilitated was awarded the state prize of the USSR, (besides excluded from Communist party of the Soviet Union). His fundamental book

«Hydraulic drives and units of the aircraft» was translated abroad into nine foreign languages.

«Last monograph of T. Bashta «Aircraft hydraulic devices»», 1946 edition, – a famous scientific, Doctor of Technical Sciences, professor of MAI V.Aleksandrov wrote in the reference to this book, – is a unique work for both home and foreign technical publishing(apart from a number of practical guides for individual units issued by American companies that produce these units). In this monograph, T.M. Bashta summarized the experience and technology in the field of hydraulic devices, summarized his personal experience designing these devices, made an analysis of the kinematics and dynamics of hydraulic units devices, on the basis of which gave the methods of calculations as separate hydraulic units and aircraft hydraulic systems as a whole».

He was awarded the title of Chief designer of the First category in the aircraft industry of USSR for the years of work at the plant.

He diligently cooperated with the design bureau of A. Tupolev, C. Ilushin, O. Yakovlev, V. Miasyshchev, A. Mikoian, P. Sukhoi, M. Mil, working as a director and Chief designer at research aircraft factory created by him. If we analyze retrospectively the results of the work of professor T.Bashta as a Chief designer of the Ministry of Aviation industry of the USSR and the Director of the largest unit plant of the country it turns out that the main fundamentally new machinery developments for Soviet aircraft were performed during this period. Without them the home aviation and to the considerable extent rocket machinery could not fly. Later there were improvements of hydraulic equipment and the further development of the laid back principles. Aircraft corporation «Rubin», the former plant of the Ministry of aviation industry of the USSR created by T. Bashta in 1946, was and is the most powerful enterprise of the Russian Federation on creation and production of take-off and landing devices, hydraulic units and hydraulic systems of modern aircraft and other flying apparatus of all types. More than half a century all flying apparatus, aircrafts, helicopters, rocket and cosmic techniques, including «Buran», well-known to everyone, were equipped and are being fitted with products and systems which are specifically designed on the basis of inventions and developments of T. Bashta.

In 1955 because of the worsening health T.Bashta moved to Kiev and began to work at the Institute of Engineers of Civil Aviation, nowadays it is National Aviation University. At the Institute he was controlling and managing the department of

hydraulics, hydraulic and pneumatic units of flying apparatus, once created by him.

In Kiev T. Bashta continued to head the work on development and implementation of hydraulic actuators in the home machine-building industry. Department and scientific-research branch laboratory, which was created by T. Bashta, became the scientific center of aviation and machine-building hydraulic drive.

He spent a lot of time and effort on training scientific personnel, handing them his knowledge and experience. Under his management were protected more than 120 Ph.D. master's and 20 doctoral thesis. Many students of T. Bashta became well-known scientists and are working in different cities and republics of the former USSR.

On his presentation to the Rada of Ministers of the USSR in 18 universities of the USSR (including KPI) a new specialty was introduced – «Hydraulic drive and hydro-pneumo-automatic», for the teaching of which he had written 4 books. Students have been studying on them up to now.

Regularly, once in 2-3 years, under his management interbranch All-Union scientific conferences on hydraulic drive were held. It is worth mentioning, that the Department headed by T. Bashta had creative relations with more than 250 enterprises and scientific institutions of the USSR.

The results of the scientific activity and the experience of his previous practical work, were regularly summarized by Tryphon Bashta in scientific monographs, articles, and text-books. Monographs of T. Bashta became reference books for several generations of engineers. These books, in our opinion, have not been fully read even by the most diligent of his pupils – such a vast amount of information is contained in these multi-page volumes. Open a desired page, as an encyclopedia, you can always read about the specific question, or, as, his disciples say, to consult with Bashta. Distinctive feature of monographs of Tryphon Bashta is that they always concentrate on the lighted physics phenomena, making them available to scientists, engineers, and students. It is difficult to name a branch of the hydraulic drive, in which professor Bashta and his disciples weren't engaged which are not reflected in his books. His first monograph («Technical diagnostics of hydraulic drives») was released in 1989, after the death of Tryphon Bashta. In total he had published about 30 monographs and textbooks; the volume of each book was often 500-600 pages. Many years of selfless work of professor Bashta had allowed him to create a real encyclopedia of engineering

hydraulics available for students and engineers and useful for eminent theorists.

One should also pay attention to another side of T. Bashta talent – he was a wonderful teacher and lecturer.

Graduates of the Institute remembered his interesting lectures, with examples from his personal practice. When he explained the theoretical material, he without fail, gave examples of its application in practice, using his rich design and production experience. His lectures were often visited by the students not only of mechanical, but also from other faculties of the Institute. He skillfully mastered graphics and had an amazing memory – he was sketching on the board various complex designs without using notes and even from the last row students could clearly see every line.



Fig. 4. T.M. Bashta in 1987. The life is spent to aviation

In 1987, the 84 year of life after a serious illness Tryphon Maksymovych Bashta passed away...

On the facade of the main building of the National Aviation University (former Kyiv Institute of Civil Aviation Engineers), a memorial plaque was placed. Cast dark bronze-willed face of a man with a high forehead of thinker and with calm look. Tryphon Maksymovych Bashta. Here he had been working between 1955 and 1986.

Students and colleagues honor the memory of Professor Tryphon Maksymovych Bashta. His scientific works are still topical now. Textbooks written by him still remain the main manuals on issues of hydraulics and hydraulic drive for students of technical colleges, where they study the

application of hydraulics on aircraft and in general engineering. Created design of systems and elements of hydraulic drive form the basis of modern developments in the branch of aviation and machine-building.

The publication of this article, devoted to the 100th anniversary of the birthday of Tryphon Maksymovych is a tribute of respect to his great merits as an outstanding scientist, designer and teacher.

Monographs and textbooks authorship of Tryphon Maksymovych Bashta remain topical up to our times. The design of systems and elements of hydraulic drive having been created are considered to be fundamental for creating projects in the field of aircraft building up to now.

A scientist, a teacher, a designer, an extraordinary personality Tryphon Maksymovych Bashta is a phenomenon common to all mankind. His name is rightly included in the almanac "Born in Ukraine".

О.Т. Башта¹, О.В. Джурик², В.Г. Романенко³, Н.О. Джурик⁴. Життєвий шлях та наукові досягнення Т.М. Башти

Національний авіаційний університет, просп. Космонавта Комарова, 1, Київ, Україна, 03680

E-mails: ^{1,2}kafpgkg@ukr.net; ³romane@ukr.net; ⁴djudi@inbox.ru

Розглядається життєвий шлях Головного конструктора авіаційної промисловості, фундатора вітчизняної наукової школи промислової гідравліки Башти Трифона Максимовича. Дві стратегічні галузі – верстатобудівна та авіаційна – своїм прогресом, певною мірою, зобов'язані саме йому.

Ключові слова: Башта Т. М.; верстатобудування; гідравлічні приводи; літальні апарати.

Е.Т.Башта¹, Е.В. Джурик², В.Г. Романенко³, Н.А. Джурик⁴. Жизненный путь и научные достижения Т.М. Башты

Национальный авиационный университет, просп. Космонавта Комарова 1, Киев, Украина, 03680

E-Mails: ^{1,2}kafpgkg@ukr.net; ³romane@ukr.net; ⁴djudi@inbox.ru

Рассматривается жизненный путь Главного конструктора авиационной промышленности, фундатора отечественной научной школы промышленной гидравлики Башты Трифона Максимовича. Две стратегические отрасли – станкостроительная и авиационная – своим прогрессом, в определенной мере, обязаны именно ему.

Ключевые слова: Башта Т. М.; гидравлические приводы; летательные аппараты; станкостроение.

Bashta Olena (1954). Candidate of Engineering. Associate Professor.

National Aviation University, Kyiv, Ukraine,

Education: Kyiv Polytechnic Institute, Kyiv, Ukraine (1978).

Research area: cavitation in liquid systems and ergonomics.

Publications: 90.

E-mail: kafpgkg@ukr.net

Dzhuryk Olena (1960). Associate Professor.

National Aviation University, Kyiv, Ukraine,

Education: Kyiv Civil Aviation Engineers Institute, Kyiv, Ukraine (1984).

Research area: cavitation in liquid systems and ergonomics.

Publications: 80.

E-mail: kafpgkg@ukr.net

Romanenko Viktor (1964). Candidate of Engineering. Associate Professor.

National Aviation University, Kyiv, Ukraine,

Education: Kyiv Civil Aviation Engineers Institute, Kyiv, Ukraine (1988).

Research area: cavitation in liquid systems and optoelectronics.

Publications: 30.

E-mail: romane@ukr.net;

Dzhuryk Natalia (1985). Postgraduate.

National Aviation University, Kyiv, Ukraine,

Education: Kyiv Civil Aviation Engineers Institute, Kyiv, Ukraine (2007).

Research area: ergonomics.

Publications: 10.

E-mail: djudi@inbox.ru