17th International Conference
ENGINEERING MECHANICS 2011
Svratka, Czech Republic, 9 – 12 May 2011

CONTRIBUTIONS OF CZECHOSLOVAKIAN ENGINEERS AND SCIENTISTS TO MODERNIZATION OF IRAN (1851-1938): A HISTORICAL REVIEW AND APPRAISAL

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Abstract: *Contributions of Czechoslovakian engineers and scientists to the development of industry and education in Iran goes back to the year 1851, when August Karel Kříž (1814-1886) from Tábor and Jakub Eduard Polak (1820-1880) from Velká Mořina at Karlštejn were sent to Tehran to teach in the first Iranian technical school of European style (Dar al-Funun). During the two world wars Czech companies like Škoda Work and ČKD built parts of trans-Iranian railway, as well as numerous buildings, bridges, power plants, glass factories, sugar factories, palaces and theater halls in Iran. Working with Iran was so important during the first republic (1918-1938) that Charles University built one of the most prestigious departments of Persian studies in the world and many prominent researchers in the Oriental Institute of the Czech Academy of Sciences in Prague were involved in Iranian studies.*

Keywords: ***History of science and technology, Czech engineers and scientists, first map of Tehran, Vresk Bridge, Dar al-Funun.***

1. Introduction

Today, all nations of the world seek to achieve through development of their resources greater material welfare and higher standards of living that science and engineering have brought to our modern world.

The pathways of the present, it is said, lead out of the past. Study of the past might reveal elements that would aid in clarifying the present problems (Guran and Youssouf, 2000; Guran, 2004).

While, the Persian literature is quite known in Czech lands today (Shaki, 1967; Rypka, 1968; Guran, 2005), very little is known, in open literature, about the contributions of Czechoslovakian engineers and scientists to modernization of Iran.

In this short article we give a brief historical review and appraisal of the past activities. The aim of the presentation is to revisit some parts of, the almost forgotten, history of engineering mechanics before the Second World War.

2. Karel August Kříž (1814-1886) and Dar al-Funun

Despite the fact that Tehran is very often in the media these days, only few people know that the first map of this capital city of an ancient oriental country was created, in the second half of the 19th century, by a native of Tábor, Karel August Kříž. It occurred under very interesting circumstances. It is worth to remembering his stay in not very well known Persia of that time. This almost forgotten Engineer came to Iran in connection with his cartographic enterprise. This last January was the 125th anniversary of his death.

In his youth Kříž served in the Austrian army and as an artillery officer he participated in the Italian campaign of marshal Radecky, 1848-1849. After this campaign he was adjourned to Vídeňské Nové Měst, where he was raised to hetman. In 1851 his promising career as an army officer was interrupted. The military success of Radecky had public acceptance also abroad far away from the borders of the empire. His glory came even to the distant Persia, to the court of shah Násereddin. The king's

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counselor grand vezier Mírza Tagichán came up with the idea of the reorganizing Persian army according to the European standards. The Austrian emperor was asked to offer some experts, who would undertake the task. Vienna, even without official Persian diplomatic relations, willingly met the wishes of Mírza Tagichán Amir Kabir. Kříž was appointed as the head of the group of experts, because of his background, and rich experiences. All of the participants had to leave the army. The reason was the lack of official diplomatic relations. Because the task was not considered government business, it was assumed a private enterprise for each participant.

The expedition set off in August 1851. Besides Kříž and his wife, there were two medical doctors, Polak and Hëntzch, together with a geologist, Czarnotta. The core of the expedition consisted of military experts; hetman Zatti, then an infantry officer, and lieutenant Nemiro. They arrived in Tehran after four months long of rather difficult journey, which cost them a lot of psychological and physical stresses during which all of them fight against various health problems. Besides all these, the circumstances at the Persian court had changed fundamentally, In spite of many intricacies - the pressure from British ambassador also included - the young shah continued in his plan to establish military academy, and this way the so called Austrian experts could undertake their tasks.

Teaching at Dar al-Funun, Kříž wrote the first Persian textbooks of mathematics, artillery, fortification, and algebra (Gurney and Nabavi, 1993). (See Fig. 1)

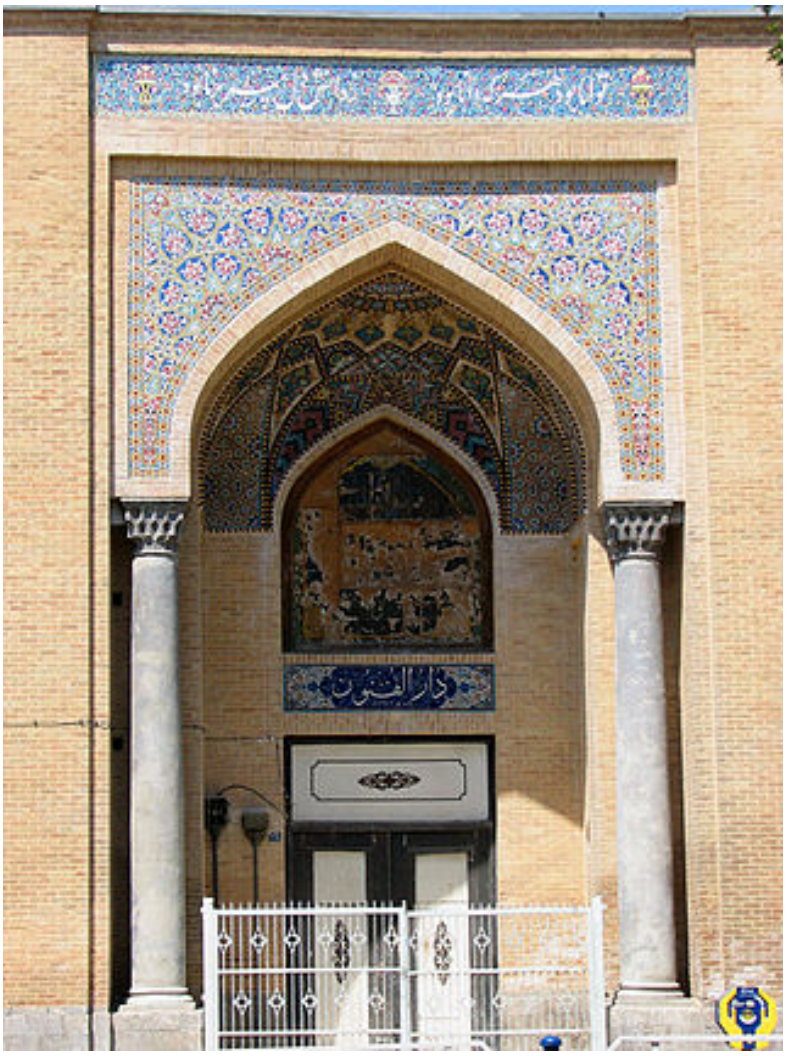

Fig. 1: Eastern gate of Dar al-Funun in the Naser Khosrow Street, Tehran (*Guran, 2011*).

He introduced the first telephone line in Tehran and together with his students he prepared the first map of Tehran and its surroundings, published as lithography (Fig. 2).

Fig. 2: The first map of Tehran (Rozhoň, 2006).

The King awarded Kříž the rank of brigadier general (Sartip) in the Persian army for his merits in the school and other activities. Kříž referred to this after his return to Czech lands and published his memoirs in Czech periodicals (Bečka et al., 1990; Ekhtiyar, 1994; Bečka et al., 2001; Rozhoň, 2005; Rozhoň, 2006). Polak, a physician, became the king´s personal doctor and taught surgery and anatomy at Dar al-Funun. He returned to Vienna in 1860 and published a significant work containing numerous reports about Iran (Polak, 1865). The important role of these two scientists in Iran-Czech cultural relations and in the founding of Dar al-Funun is elaborated by Dr. Jiři Bečka and published recently (Shaki, 1967; Bečka et al., 1990).

Despite the difficulties, within a few months a curriculum had been established and a structure of examinations and grades created. The curriculum was based on the respective specialties of the foreign instructors, students in each discipline wearing uniforms of a specified color. Preliminary subjects like mathematics, geography, history, and French were taught by Europeans. By the beginning of the second year, 1852-53, a system of levels had been introduced for each major subject, each level theoretically lasting three years before an examination to qualify for a higher level; the full cycle of instruction was designed to last twelve years. At each level copper, silver, silver-gilt, and gold medals were awarded for superior performance, though it was also possible for those with outstanding ability to be accepted into higher levels or to move more rapidly through the system.

The number of students in the first year reflects the immediate popularity of Dar al-Funun. About 105 students had enrolled in the seven main subjects, though this figure may include some overlap. The breakdown reveals the emphasis placed on the military sciences: infantry 30, cavalry 5, artillery 26, and engineering 12. On the other hand, in medicine there were 20, in pharmacy 7, and in mining 5. In addition, subjects like French and swordsmanship could be studied. Military officers not formally enrolled at Dar al-Funun could benefit from participation in daily infantry and cavalry maneuvers held by the European instructors outside the city walls. Because of the division into levels, classes were usually small, which placed considerable demand on the foreign instructors' time. The more able and experienced students served as teaching assistants at the lower levels.

The roster of subjects, student names, and examination results from August 1858 reveals how quickly the core curriculum of Dar al-Funun had become established. Since the first year the number of students had remained relatively constant, and the subjects taught were similar, the military sciences predominating. The main difference was the larger number of those studying languages. In 858 thirty-five students were learning French and twelve English or Russian (Yaghmaee, 1969-71).

In the first years of the Europeans' service, Dar al-Funun had developed not only a core curriculum, but also an academic routine and administrative framework strong enough to survive the vicissitudes that affected most new initiatives in Nāṣer-al-Dīn Shah's reign. The daily schedule and the pattern of

holidays, punishments, and regular examinations, as well as the administrative posts, were all determined in this first phase. A sense of tradition and some guarantee of respectable academic achievement were created. Much of the credit was also due to the dedication and ability of the instructors and translators. Despite the problems of teaching at widely varied levels, they were still able to produce excellent results. For example, within a few years Polak had trained a number of students who were admitted to medical schools in Paris and completed important research (Polak, 1865). Some returned to teach at Dar al-Funun, establishing a tradition in which the best students remained attached to the institutions (Gurney and Nabavi, 1993; Yaghmaee, 1969-71).

Fig. 3: Jakub Eduard Polak photographed by Julie Hafner. Nationalbibliothek, Vienna, Austria.

Fig. 4: Jakub Eduard Polak, photoghraph of drawing. Nationalbibliothek, Vienna, Austria.

3. Railways, Buildings, Palaces, Bridges, and Armoured vehicles

After the First World War and soon after the creation of Czechoslovakia, the new republic felt an urgent need for a financial base that would facilitate the transformation of the armament factories of the former Austro-Hungarian Empire into a peace-oriented manufacturing concern. Some steps to that end had already been taken before the end of the war when Škoda Works in Pilzen (Plzeň) started production of steam locomotives. Fig. 5 shows a photo of the power plant with steam aggregates built in Tehran. Many palaces were built in Tehran by Czechoslovakian firms decorated by Bohemian crystals. Reza Shah's palace (now made accessible to public) has crystal chandelliers the size of icebergs in the dining room.

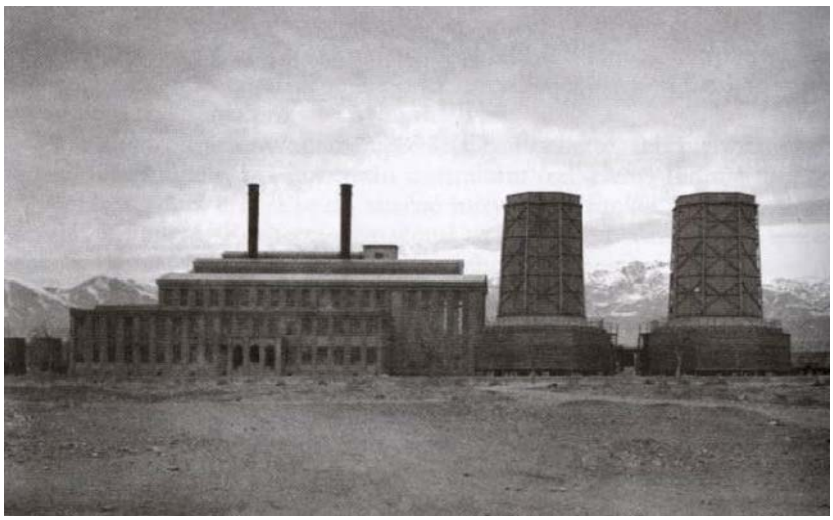

Fig. 5: Power plant with steam aggregates built in Tehran (*Rypka, 1946*).

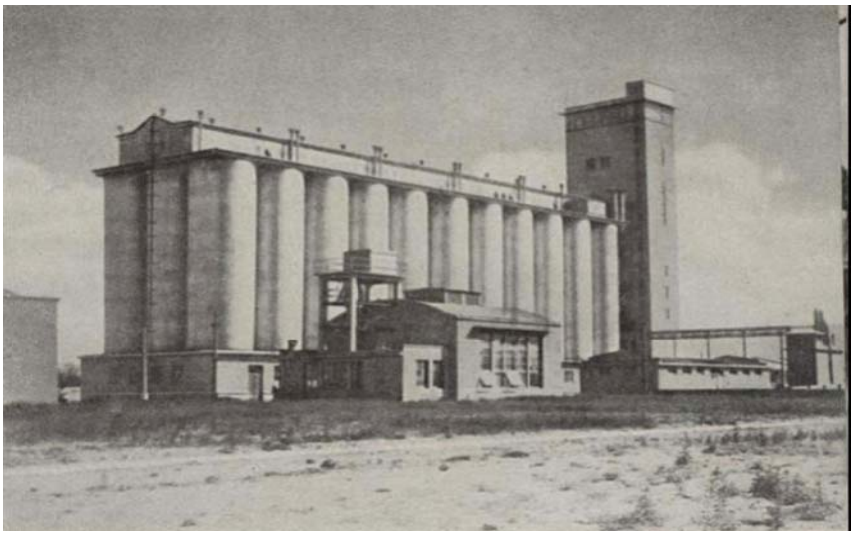

Fig. 6: Silo for storage of cotton seeds built in Tabriz (*Rypka, 1946*).

During the years 1929-31 Škoda did not export anything to Iran. The following year it received orders amount to 7.9 K millions (which was about 2% of the all its orders). The year 1932 was not particularly successful for Škoda. The only growing export was that to South America and the only a new potential market discovered in Iran. In the year 1933 it was already 92 K millions which was 14.25% of all the orders, except production of car, mining, and Iron factories. From this year the Persian market became one of the most important markets for Škoda.

The Czechoslavakian firms were part of the consortium committed itself to finish the Northern railway line, planned to reach Tehran no later than mid-1937. The first one hundred and fifteen of which were to pass through Talar River Valley and make a steady ascent into the Elburz mountains to reach Gaduk, the highest-placed railway station of the line, at 2,100 m above sea level. Obligated to follow a circuitous route in order to navigate the natural obstacles of the landscape and tackle the steep rise of the highlands, the intervening distance and line of track running to the peak was deemed to rival the famed St. Gothard railway in Switzerland, as to the beauty of its scenery and the boldness of its concept. Such asserted parallels were warranted by the complexities of the construction project that required the building of seventy-five tunnels; many partly spiraled as the line cut its way up through the mountains, and at one point boring a passage more than 3 km long. Hundreds of bridges were similarly needed to carry the line across rivers and gorges. The most notable of these structures was the Vresk Bridge whose 66 m wide masonry arch spanned a deep river valley and, by the time of the Northern line's completion in 1937, would stand as the tallest rail bridge in the world at 120 m. Fig. 7 shows a close view of Vresk Bridge in *Savadkuh* county. Fig. 8 shows the Bridge photographed by Professor Jan Rypka.

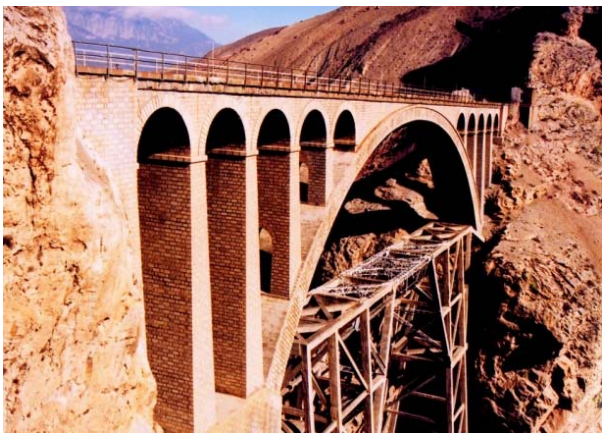

Fig. 7: Vresk Bridge viewed having Orim and Arfekuh in the backgound (*Guran, 2011*).

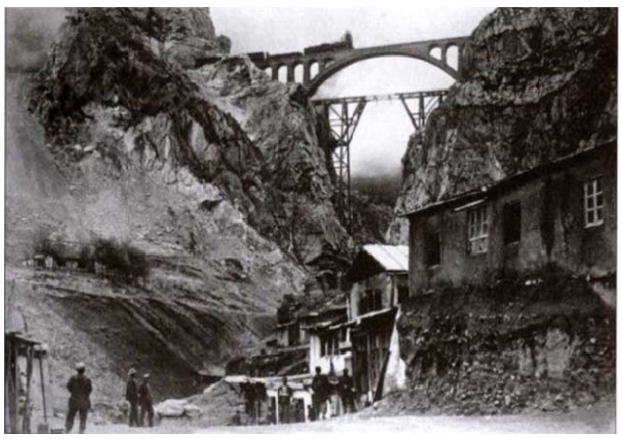

Fig. 8: Vresk Bridge in Northern line railway (*Rypka, 1946*).

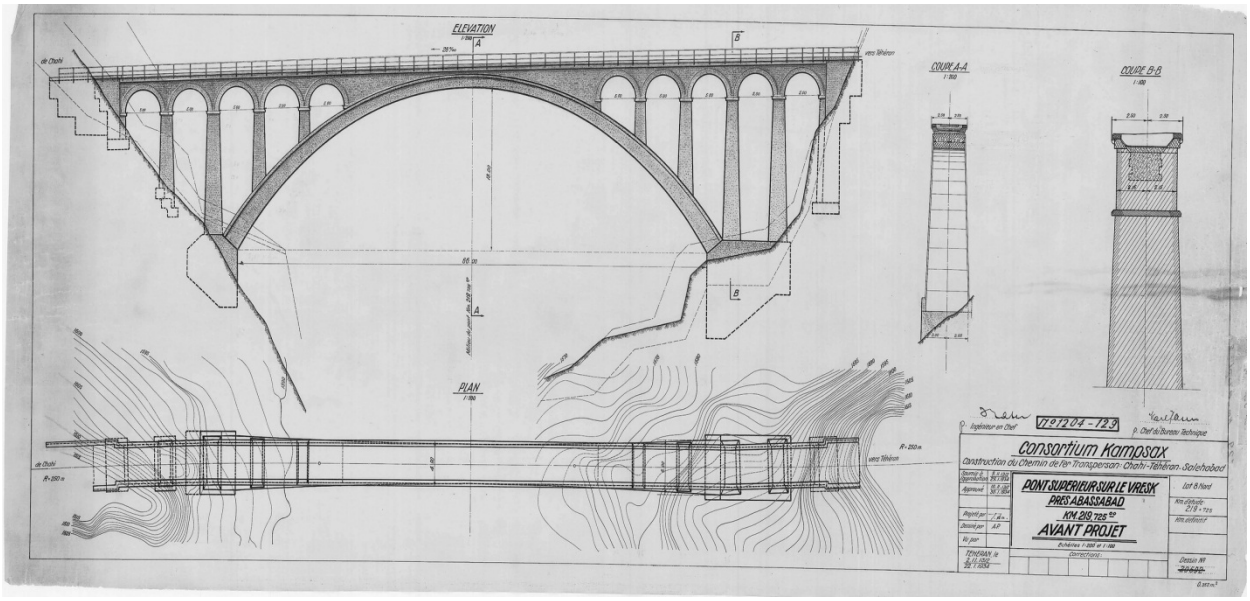

Fig. 9: Vresk bridge: Plan and Elevation, Designed and drawn in 22.1.1934 (*Courtesy Consortium KAMPSAX*).

During World War II, the Vresk bridge was known as the bridge of victory. The Vresk bridge honored by appearing on the face of a Persian postage stamp. There are enough of this stamp around today that collectors are still able to find them (Fig. 10).

Fig. 10: Fig: 1942-46 Vresk Bridge post stamp (Face value 10 dinars).

Fig. 11: An old bridge replaced by Skoda in Mazandaran (*Rypka, 1946*).

The porous soil, saturated with moisture from the persistent rainfall of the North, also presented the engineers with a great challenge as extensive drainage works and protective, artificial tunnels were needed to prevent and protect against mud slides. Fig. 11 shows a picture of a bridge constructed by Škoda.

Actively building up its army between the two world wars, Iran needed armored vehicles. Between 1931- 41, Iran purchased over 300,000 rifles, some 6,000 light and heavy machine guns, and about 350 cannons of various types. As for armored vehicles, the Czech CKD AH-IV and the TNH was selected. The Iranian order was initially for 50 TNH light tanks. Purchased on August 17 1936, the TNH light tanks were delivered to Iran in 1937. Fifty of these tanks and fifty of AH-IV tankettes equipped the First and Second divisions of the Imperial Iranian Ground Forces, twenty five of each type per division. These tanks were on active duty up until 1947.

In closing the author would like to mention some very modest collaborations with his Czech colleagues (Guran and Valášek, 2004; Guran and Nekvasilova, 2011; Guran, 2011). Of course, these are nothing when compared with the past glories. Nevertheless, it is hoped that readers will gain an understanding of this almost forgotten technical and cultural exchange, and maybe encouraged to carry out research work of their own on this subject under history of science and technology. The main purpose of this paper is met if this hope is realized.

Fig. 12: 3rd International Congress on Mechatronics edited by A. Guran and M. Valášek, ČVUT *v Praze 2004.*

Fig. 13: Institute for Theoretical and Applied Mechanics, Academy of Sciences of the Czech Republic *9th, March 2005.*

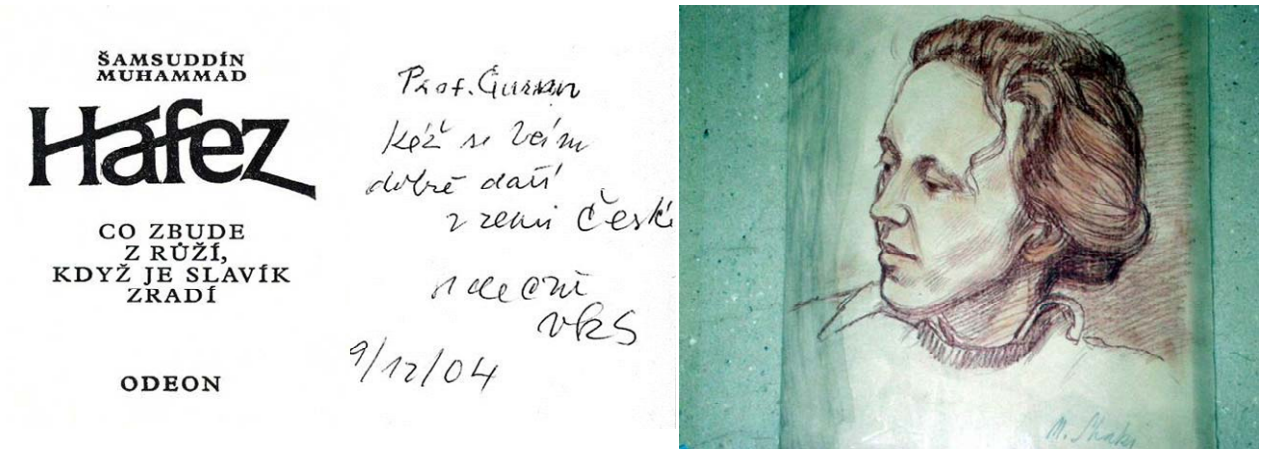

Fig. 14: Dr.Věra Kubíčková Orientální ústav, Akademie věd ČR (1918-2009). Drawn by Dr. Mansour Shaki in 1955.

Acknowledgement

Many conversations with Drs. Věra Kubíčková, Jiří Bečka, Jan Marek, Mansour Shaki, and Yaroslav Folta were useful in preparation of this article.

I would also like to thank the staff at the Archive of the Czech Academy of Sciences in Prague, the Škoda Museum in Pilzen, and the Technical Museum in Prague allowing me access to their sites. The work was completed during my visit to the Institute for Theoretical and Applied Mechanics, Academy of Sciences of the Czech Republic during 2004-2005, and House of Uranus (1921-1994), a private

archive for history of technical science and medicine, in Vresk village (Iran), during 2007-2008. I am indebted to my colleagues at ITAM, in particular Prof. Ondřej Fischer, Prof. Ladislav Fryba, and Prof. Miroslav Škaloud for their friendship and kind hospitality during the preparation of this work.

The paper is dedicated to memory of our wonderful colleague Dr. Věra Kubíčková (1918-2009) to honor her monumental contributions in Persian literature, poetry, and Iran-Czech cultural relations.

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