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KER and War: Polish synthetic rubber in American war efforts, 1941–45

(1) Introduction

Perhaps the most eye-catching industrial exhibit in the Polish Pavilion at the New York World's Fair in 1939 was a tire made of synthetic rubber. Many visitors found it humorous that the rubber was derived from potatoes. After Poland was lost in Blitzkrieg crowds of fairgoers fled "the saddest place in the Fairs", as *New York Times* described the Polish exposition.¹ The only place where some smiles were seen and silent laughs were heard was in front of the "potato tire" exhibit. Soon, the Polish method of manufacturing synthetic rubber was brought to the United States, and discussed by scientists, congressmen, generals, and war industrialists.

(2) Rubber shortage

Without rubber every army would be grounded. While a tank does not need tires, hundreds of small rubber parts must be used to keep it in motion. No soldier would fight without shoes, gas masks, raincoats or waterproof tents. All of which need rubber to be manufactured. Still in the late 1930s rubber was produced almost entirely from vulcanized natural caoutchouc. The modern war machine needed large amounts of this raw material, production of which was almost entirely concentrated in the equatorial forests of Southern Asia. With the outbreak of World War II all Asian sources of crude rubber were cut off. By conquering the South Pacific region, Japan captured 90 percent of the world production of natural rubber. All countries, especially the United States in view of their mass motorization, faced a shortage of rubber on an enormous scale. In fact, predicting how things could have gone before Pearl Harbor, Jesse Jones, Secretary of Commerce and Federal Loan Administration stockpiled about one year's supply of crude rubber, some 570,000 tons.² Jones was criticized for not collecting more, but no matter what "more" would mean, some unpopular measures had to be taken, to secure sufficient supply of this material for the military sector. Year by year the Office of Price Administration (OPA), a federal agency established to prevent wartime inflation, had been tightening restrictions on tire distribution. Owners of the vehicles classified as essential to national security were prohibited from obtaining new tires if recapped old tires still met the needs of the vehicle. Also if the rationing board found out that you did not care properly for your old tires, you would not be allowed to obtain new ones.³ Reducing the nationwide speed limit to 30 mph was considered as a means of decreasing wear on tires. Cruising taxi cabs in major American cities were about to be prohibited by law, but luckily for cab drivers and their customers, the municipal powers were unable to provide parking lots for them on time.

Limiting the purchase of new tires was not the only measure undertaken by the government. First the politician leaders and business called for huge investment in guayule, cryptostegia, and other natural American-grown substitutes.⁴ While there was no proper technology or time for the plants grow, the search for synthetic butadiene became the only feasible way to produce rubber, or, other

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¹ Cobb J. "Living and Leisure." *New York Times* (September 24, 1939), p. 55.

² Tuttle W.M. Jr. "The Birth of an Industry: The Synthetic Rubber 'Mess' in World War II." *Technology and Culture*. Vol. 22, No. 1 (1981), p. 38–39.

³ De Vore R. "Senators Hear New Synthetic Rubber Plan". *The Washington Post*, May 1, 1942, p. 7.

⁴ Finlay M., "A brief history of Chemurgy and the American Search for Biobased Materials". *Journal of Industrial Ecology*. 7/3–4 (2004), p. 39.

words, to win the war. The government's goal was to produce 700,000 tons of synthetic rubber annually for a cost of nearly half a billion dollars. The estimate was made on the basis that petroleum would be used as a raw material in the process of synthesizing the butadiene rubber.

In mid 1941 the War Production Board and the Reconstruction Finance Committee allocated \$650 million to the synthetic rubber fund: more than 500 millions went to oil corporations and the rest to the rubber companies. Democratic Senator Guy M. Gillette of Iowa, chairman of the agricultural committee, alleged, that both institutions were dominated by petroleum interests. He was right. The advisory committee that was assigned to report to the RFC consisted mostly of representatives of the oil industry: Universal Oil Product Corporation, Philips Petroleum Corporation, Union Carbide and Carbon, Gulf, and Standard Oil of New Jersey among others. Dr William J. Hale, chemistry research consultant and president of the National Agrol Company complained: "In spite of the fact, that never in this world has there been manufactured more than 50,000 tons of butadiene from petroleum, and yet some 500,000 tons has been made successfully from alcohol, this 'impartial' committee decided that alcohol, unless it issued from petroleum, could not have any place in this picture. Grain alcohol was taboo."⁵ Secretary of Commerce Jesse Jones responded that the allocation had been made before an agricultural commodity process for making butadiene "had been heard about".⁶

Was that true? At the turn of the 1930s very few countries produced synthetic rubber. One of them was the Soviet Union. The Russians had been successfully manufacturing synthetic rubber since the early 1930s. It was known even prior to 1915, that butadiene can be produced from the decomposition of ethyl alcohol by using a catalyst, uranium oxide for instance. In the early 1920s Russian chemist Lebedieff employed a mixture of aluminum oxides together with manganese salts or manganese oxides.⁷ The Russians have been vigorously experimenting with the formula since then, and in 1940 their production of rubber synthesized from spirit reached 80,000 tons.⁸ They selected the alcohol process finding it more satisfactory than other methods⁹, even if that meant a shortage of potatoes for consumption. Eventually Russian scientists developed and perfected a process for distilling alcohol from peat bogs, and cellulose.¹⁰ All that looked very promising and the method could be easily introduced in the United States, but Americans were still unlucky in their efforts to obtain the formula from Russia. Even facing the dreadful threat of being conquered by the Nazis, the Soviets were not willing to share this technology with their allies.

In addition to Russia, synthetic rubber was manufactured on a large scale in Germany. Their method was based on lime and coal as the raw materials. German synthetic rubber, better known under its brand name Buna-S, was produced mainly by Farbenindustrie company, a close business partner of Standard Oil of New Jersey. Formally the American company owned the patents on German technologies of synthesizing Buna-S, but actually it was not allowed to use it even in the United States. In fact Standard was a kind of a junior partner in this venture. According to an agreement between both firms, Farbenindustrie retained supremacy in the chemical field all over the world including the United States; in return the Farben would not compete with Standard in the oil fields anywhere in the world, except in Germany.¹¹ That one-sided relationship as well as Standard's policy of keeping business promises rather than fulfilling its patriotic duties caused the allegations of illegal conspiracy and treason. The failure to supply adequate data to the government regarding German synthetic rubber formula was a subject of charges against the company by Assistant Attorney General, Thurman Arnold.¹²

While neither the Russian nor the German technologies were available, another somewhat surprising solution appeared on the horizon — rubber made from potatoes, presented in Polish

⁵ Trussel C. "Farmers, Rubber in Senate mix-up." *New York Times*. May 20, 1942, p. 12.

⁶ Trussel C. "Distilleries Face Total Conversion to War Production." *New York Times*. May 22, 1942, p. 1.

⁷ Szukiewicz W. "Method for producing butadiene. *US Patent 2,357,855*. Application filed December 15, 1941.

⁸ "Utilization of Farm Crops." *Hearings of a Subcommittee of the Committee on Agriculture and Forestry, United States Senate*, S. Res. 224, (1942), p. 1479.

⁹ *Ibid.*, p. 1540.

¹⁰ *Ibid.*, p. 1467.

¹¹ Tuttle W.M. Jr., *op. cit.*

¹² *Washington Post*. June 4, 1942, p. 25.

Pavilion at the New York World's Fair not so long before. It was KER (and abbreviation of Polish "kauczuk erytrenomowy" — erythrene caoutchouc).

(3) German and Soviet formulas

In the early spring of 1941, a Polish exile in the United States, Antoine Tarnowski, approached American officials with an offer to supply the government with a synthetic rubber formula. Count Antoine Tarnowski was nephew of the last ambassador of the imperial Austria in the United States. Later he served as a diplomat in the embassy of Republic of Poland. When the war broke, he lost his job, and finally got a position in a New York based brokerage firm.¹³ Still having broad diplomatic connections, Tarnowski got in touch with William S.B. Lacy, a chief of the foreign information unit of OPA. He gave Lacy some plans and diagrams inquiring if the government would be interested in the formula for making synthetic rubber out of alcohol. The OPA officer handed them immediately to chemists working for the administration. After brief examination they concluded, that they were missing a vital part of the formula, namely the description of the catalyst. Tarnowski replied that only its inventor, Waclaw Szukiewicz, who perfected the process of manufacturing synthetic rubber out of agricultural products, knew the catalyst. He declared, that if the United States was interested in the technology, Poles in America would raise funds to smuggle the inventor into the country. It took several months. The Polish chemist was at the time in Rio de Janeiro. In November of 1941, after Lacy helped to secure an American visa for him, the inventor finally was brought to the United States by DAL, a company founded and managed by Wiktor Przedpelski, former director of Polish Spirits Association.

At the beginning Szukiewicz was unwilling to reveal the catalyst without securing a patent for it. He spent some time in a research plant in Peoria, Illinois, working to set up a demonstration of his process. Meanwhile Dr. Lewis H. Marks of the Publicker Commercial Alcohol Company advocated the Szukiewicz's method before the Senate Agricultural subcommittee on April 30, 1942. He stated that it was possible to reach the 700,000-ton level within eight months. It would be produced for \$75 million compared to the 490 million planned by government. According to Marks, his company could convert its production lines at the Philadelphia plant in an even shorter time and reach its full annual capacity of 200,000 tons in only six months. Senator Gillette attempted to call Szukiewicz before the committee, but it turned out that Polish scientist was busy in the Peoria laboratory. Was there a problem with coming to the Senate for a day or two? "We called up there and received the reply that he had got a wire from Washington to get out of there and keep his mouth shut", Senator Gillette said. That good advice came up actually from friends and supporters of his process, who wanted to keep the inventor out of the sight of those pro-oil oriented agencies.¹⁴

The opponents of Polish formula claimed that it had many disadvantages. Firstly, its mode of operation required the use of copper for coils in large quantity, and the shortage of this metal was a severe problem in the country. But they forgot to add that the plant producing rubber out of petroleum needed mostly steel that was also hard to obtain in wartime. In fact, a plant for making rubber from grain alcohol required much less in the way of critical materials.¹⁵ And it could be erected in one-third time it takes to put up factories for the petroleum process. But that statement had also been questioned by promoters of oil-based formula, Jesse Jones among them. They expressed serious objections that Szukiewicz's process had not yet been proved effective. Well, not exactly. It was a fully elaborated and workable plan of converting agricultural products into rubber.

(4) Polish synthetic rubber

Poland started her synthetic rubber program in mid 1930s. Especially as rapidly developing as Poland was, like any other country, it needed rubber. But unlike other European powers it had neither colony nor influences overseas that would help with an easier and more predictable supply of some crucial raw materials. Besides, after the First World War the production level and thus the price, of natural

¹³ Harmon D. "About the Town." *Washington Post*. April 3, 1940, p. x14.

¹⁴ De Vore R., op. cit.

¹⁵ "Rubber from the farm." *The Nation*. May 16, 1942, p. 561.

rubber was controlled by a syndicate.¹⁶ Perhaps it was the rubber questions that lead interwar Poland to an idea of acquiring a colony in Africa. The discussion, which involved politics, industrialists and army officials, spread across the country in mid 1930s.¹⁷ The most active on this field was Sea and Colony League (LMiK — Liga Morska i Kolonialna). One of the possible targets was the last continent's independent state Liberia, rich in rubber, diamonds and other minerals. It is worth mentioning that Poland acted as a commentator on Liberian matters in the League of Nations. It was not an easy task, especially in view of alleged forced work or even slavery on Liberian plantations. The negotiations between some Liberian officials and LMiK's directors resulted with tightening the economical and political relations. Polish industrialists and merchants gained an access to the resources and markets of that African country. Several large farms were established, mostly producing crude rubber. All of those were private enterprises and did not mean colonization. The Polish government was not involved at all. It could lead to a confrontation with the United States, always engaged economically and politically in Liberia.



Fig. 1 A cartoon from a Philadelphia newspaper. A “Russian process” ship can be seen far on the left but “Baruch report” refuses to take a life-saving wheel being thrown from “Polish process” ship on the right. The “Synthetic Rubber Program” pontoon is sinking because of “Loss of Priorities”. Source: Spyra A. „KER: polski kauczuk — historia marki” (Krakow: Matuszek Hamiga s.j., 2005).

¹⁶ The syndicate was very effective in its policy. In the second quarter of 1938 it decided to drop export limits to 60 %, which rocketed the prices of crude rubber. See: Wankowicz M. ”Sztafeta: książka o polskim pochodzie gospodarczym.” Lublin: Polihymnia, 1999, p. 111–124. Reprint from the first edition, Warszawa 1939.

¹⁷ Kowalski M.A. “Kolonie Rzeczpospolitej.” Warszawa: Bellona, 2005, p. 303–346.

In fact, the Polish rubber program had started before Poland regained her independence in 1918. Dr. Stanislaw Kielbasinski, who worked in Russia in early 20th century, played a leading role in this Polish quest to synthetic rubber. In 1913 he published a paper dealing with the possibility of making an artificial rubber from agricultural alcohol.¹⁸ In already free Poland he led the laboratory financed by the Ministry of Military Affairs. After several years he gained some practical results but achieved a 7.5 % efficiency in the process was not enough for payable industrial production. In April 1933, in the Warsaw-based Chemical Research Institute the Department of Rubber Synthesis had been formed. Wacław Szukiewicz was named its director. There were also Witold Klonowski and Kazimierz Cybulski besides two other engineers, two technicians and eight laboratory employees. During the next two years several thousands of catalytic tests were conducted, still with no result. The high demand for the formula caused an enormous pressure on the team and on Szukiewicz personally. It was the President of Poland, Ignacy Moscicki, a celebrated chemist himself, who agreed to one more year of financing the rubber program. Eventually, after several months of intense work the Polish chemists achieved a 25 % output of butadiene in laboratory experiments. In 1937 the construction of a plant for an annual production capacity of 1000 tons was started in Debica, near Tarnow in the Central Industrial Region. The capital of the company was 1.1 million Polish Zloty (then some 200,000 USD), 90 % of which was raised by Association of Spirits Manufacturers, and the rest by Stomil S.A. company, both interested in the enterprise for obvious reasons. Stomil, the biggest national supplier of tires and other rubber goods, also erected a tire factory in the very same town of Debica.

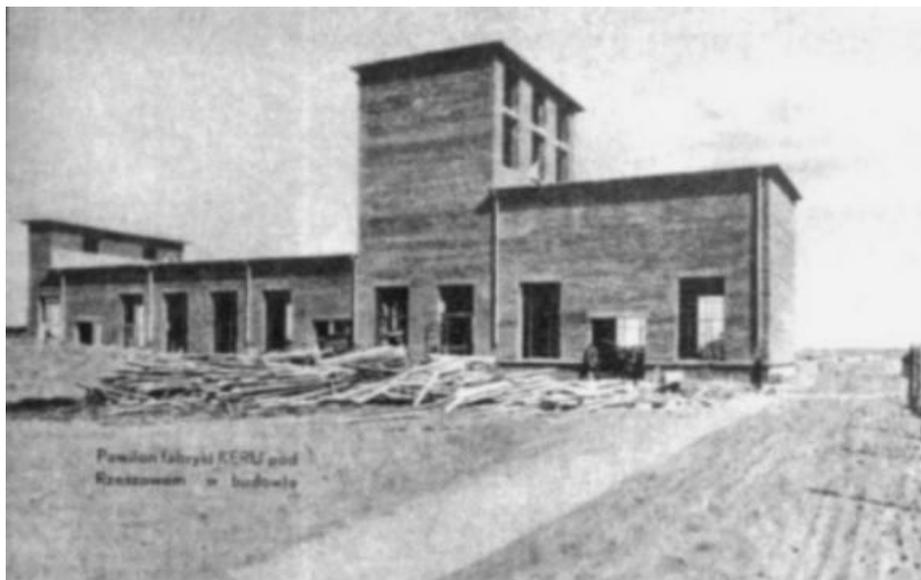


Fig. 2 The first Polish factory of synthetic rubber in Debica under construction.
Source: Wankowicz M. "Sztafeta: ksiazka o polskim pochodzie gospodarczym."
Lublin: Polihymnia, 1999. Reprint from the first edition, Warszawa 1939.

When Germans attacked Poland in September 1939, the retreating Polish troops blew up the biggest Stomil tire factory near Poznan shortly before the approaching Wehrmacht. The plant that had produced tires under the license and supervision of the General Tire & Rubber Company. It looked like Germans had more luck in southern Poland. They seized the plant in Debica, but although the factory was almost intact, there was no catalyst, which was indispensable in the process of making rubber out of alcohol. As an army officer, Szukiewicz retreated with other surviving troops to Romania, carrying the vital details of the technology in his head. By permission of the Polish government on exile in Paris, Szukiewicz was helping Italians to launch the synthetic rubber plant in Ferrara. After Mussolini entered the war and the fall of France, Szukiewicz, harassed by Germans left Europe for Brazil.

¹⁸ Spyra A. "KER: polski kauczuk – historia marki." Krakow: Matuszek Hamiga s.j, 2005, p. 20–41.

(5) Epilog

In 1942 the rubber crisis was severe. In August President Roosevelt appointed a Rubber Survey Committee to investigate and make recommendations for solving the problem. The committee, headed by financier Bernard M. Baruch, made its recommendations very quickly — the report was ready in one *month*; *it was* not a good report for Senator Gillette, his farmers and Szukiewicz. Baruch ordered an immediate construction and operation of 51 plants based on oil technology.

In the report of the Committee on Agriculture and Forestry of the US Senate published in 1942 one can read “We feel that sooner or later the value of this Polish process would be recognized”. It was not. Szukiewicz’s method was eventually employed in a single plant completed shortly before the war was over. But then it was not remembered as “Polish” or “Szukiewicz’s” formula any more. It was known as “Publicker’s”. Ironically, in post-war Poland, after few years of successful manufacturing rubber using originaly Polish technology, and based on abundant and actually renewable resources, the oil based method has been introduced.¹⁹

¹⁹ Szukiewicz W. “Historia KER’u.” Manuscript, not published. Author would like to thank Dr. Alina S. Szczesniak, a niece of Waclaw Szukiewicz, for providing the manuscript of inventor’s diaries, for kind assistance and encouragement.