

On beginning of chemical fibres' manufacturing in Poland

Jerzy SKORACKI

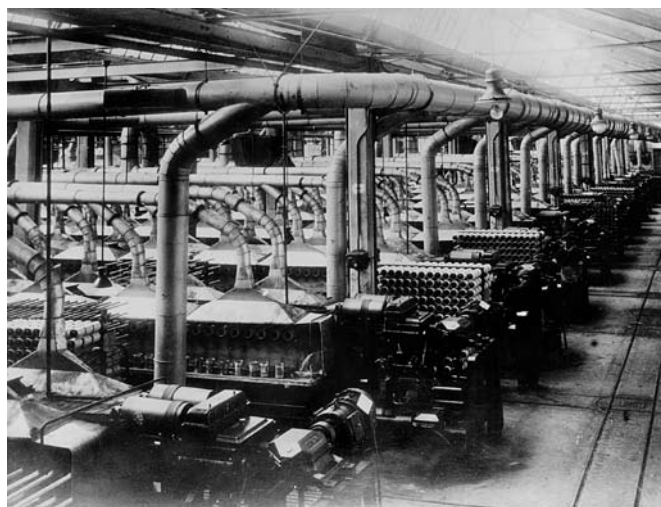
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In the previous article I made the attempt to briefly outline history of chemical fibres in our country as the history dates back to more than a hundred years. However, the key stress was put onto the years after the 2nd World War [1]. Now, I will try to describe origins of that industry on wider background, as much as it is possible.

The 19th century handed us down somewhat a certainty or at least deep hope that daring ideas of Hooke and Reamure expressed more than two hundred years beforehand and anticipating invention of 'artificial' threads shall be successfully achieved in the near future. The history of fibres that are nowadays referred to as chemical ones took roots from several discoveries that took place in the middle of the 19th century. These discoveries seemed to be sometimes accidental with no mutual relationships, but at the end of century they gave rise to a pretty promising form. The chronological history of these discoveries, although limited to the most important events associated with collodion fibres, originally first 'artificial' fibres as well as viscose fibres that are the most important in that group, can be briefly disclosed in the following way:

- 1839 – a French researcher, A. Payen, extracted some white material, free of lignin, from timber and called it *cellulose* from the Latin word *cellula* – a cell
- 1846 – a Swiss, Ch. F. Schönbein discovered that the reaction of nitric acid with cotton produces a product that is soluble in alcohol and in ether. Such a solution was named *kollodium*, from the Greek word *kollodes* – viscous
- 1855 – a Swiss G. Audemars presented the method how to obtain fibres from collodium (the British patent 283 of the year 1855). The method consisted in forcing a thin thread of the solution via thin glass pipes and evaporation of solvent in air
- 1884 – on 17th November Hilaire Bernigaud de Chardonnet was granted in France with a patent (No. 165349) for production of collodion silk that was called *Rayonne*, and in 1889, during a convention of entrepreneurs in Paris the inventor demonstrated the **first** cloth made of new fibres. However, the fibres were extremely inflammable and useless for production of any commodities, in particular garments
- 1891 – the organization called 'Societe Anonyme pour la Fabrication de la Soie' was set up and the **first** plant of collodion silk to the industrial scale was commissioned in Besançon. The plant was owned by Chardonnet and had daily output of 50 to 100 kg. The fibres, after denitrication, were inflammable as much as natural cotton and that made it possible to safely use clothing made of such a material. It is why Chardonnet is called the **father** of the chemical fibre industry
- 1893 – the Englishmen, C. F. Cross, E. J. Bevan and C. Beadle developed the method for production of cellulose xanthate, its dissolving and regeneration in the bath containing ammonium sulphate (British patent 8700, German patent 70999). The company Viscose Syndicat Ltd. was established in 1894 and launched production of fibres called *Viscoïd* that were competitive to collodion ones
- 1898 – the Englishman C. H. Stearn obtained viscose fibres owing to regeneration of cellulose in an acid coagulating bath (British patent 1020, German patent 108511)

- 1900 – yarn and products made of viscose fibres were put on display during the first World Exhibition (Exposition Universelle) in Paris
- 1910 – on 7 July the Russian tsar Nicolous II signed the document called 'Statute of the Artificial Silk Factory Incorporated Enterprise seated in Tomaszów (Piotrków Province)'. In 1912 the company launched production of collodion silk at the factory and in 1930 the business was abandoned
- 1921 – production of viscose silk was launched in Tomaszów Mazowiecki with use of the coiling method and in 1932 – by means of the method of short-cut fibres
- 1925 – the plant of viscose fibres, second in Poland, was commissioned in Myszków
- 1927 – in Chodaków the manufacture of viscose fibres was established, the fibres were spun by means of the centrifugal method
- 1938 – the first manufacture of protein fibres, 'Polana', was launched in Pabianice.

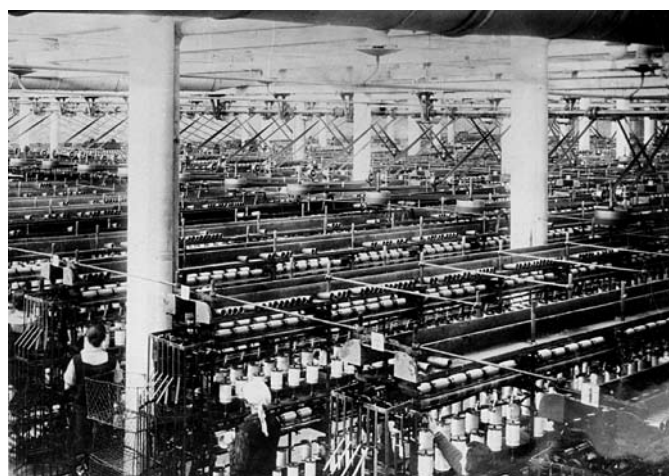


View onto the spinning mill of textile silk; coils of raw silk are placed on carriages and they will be transferred to the wet processing department and then dried

Discoveries of Payen, Schönbein and Audemars were initially only limited to academic field as scientific achievements, but the inventors could have also expected that the time would come when their inventions, similarly to Faraday's achievements, would be used to impose new taxes. However, the beginnings of chemical fibres were far not easy, not only in terms of know-how, but also with regard to economic and political aspects. In the 19th century world markets were dominated by cotton, supported by wool, and natural silk was considered as an emperor. The paupers had to make do with linen or even poorer grades of cloths. In the political field the process of the world sharing out was still incomplete and many hot or cold wars were breaking out very frequently. Eventually, the loots were available only for hardly any and winners imposed their terms on those who were defeated. The British monopoly, both to planting of cotton and breeding of wool as well as to transportation of those commodities

caused similar annoyance as French power in silk production. Day by day, the worldwide market was getting stronger and stronger and business interests of the growing international capital governed that market. However, nobody was satisfied of one's own position and each one vigilantly watched every step of its potential business rival, which could also become a military enemy in the long-time perspective.

The entrepreneurs perfectly knew that many would not afford buying silk even for a long time but silk would still remain the subject of dreams. Therefore it was a reasonable idea and also a business objective to draw attention of researchers just to silk. It is why the efforts were made to develop fibres that would imitate (sufficiently well and in an attractive manner) the most important properties of silk, chiefly its shine and touch. The group of investigators was dominated by French scientists who were still aware of problems associated with breeding of silkworms as well as by Germans who strived to liberate their country from British domination in worldwide trade. However, Englishmen, who made up the elite among the 19th century chemists, were also cautious and kept eye on hand of competitors. As a result of strong competition, these three countries witnessed the largest leap in chemical technology [2].



View onto the throwing mill; dried silk is uncoiled from spinning coils (placed vertically) and rewound onto bobbins (placed horizontally on machines)

Political conflicts were still growing and chemical fibres, being partly the effect thereof, were quickly involved into that fight. The history of first years when production of those fibres was only thriving is not confined merely to scientific experiments and development of new and still more advanced machinery but is also full of personal disasters of inventors as well as attempts to hoodwink competitors, for instance with use of patents submitted by completely unknown persons, with no research or manufacturing backup facilities [3].

Chemical fibres, similarly to nearly all the great inventions, had to overcome barricades of doubts and prejudices of potential users and reluctance demonstrated by producers of natural fibres. Initially none of the parties could be sure of success. It is the situation that is outlined in the journal 'Chemik Polski' ('Polish Chemist') in the editorial note printed in the section 'Recent news': *'The competition of artificial silk with continuous growth of its production entailed forceful protests of manufacturers dealing with production of natural silk. The most uncompromising position was taken by the «Silk Association of America» that noted in their report that currently about 4 million kg of artificial silk is circulating on the worldwide markets. In the further part the report accuses the artificial silk of excessive inflammability and demands to ban referring to the material as to «artificial silk» as it leads to mismatching the terms with the silk of animal origin. Also manufacturers of natural silk from northern Germany and France support these accusations and point out, in addition, that manufacturing of artificial silk has led to drop of the price of silk wastes by 50%. They suggest calling the artificial silk «celluloin»*

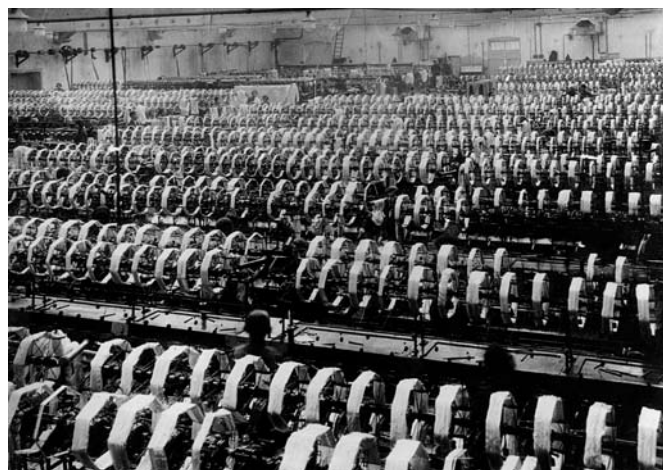
or «celluloin», according to its origin. In Germany, where production of artificial silk has developed to huge sizes, all these fears are considered as exaggerated because artificial silk is unsuitable for production of cloths and only fits for making ribbons and haberdashery, it shall never become a serious competitor to natural silk' [4].

One has to admit that the journal 'dedicated to all branches of both theoretical and applied chemistry', virtually from very early beginnings, comprehensively informed its readers about new chemical products both in reprints from foreign journals and its own invited papers. Authors of the contributions not only described the manufacturing methods applicable to various grades of artificial silk, including those that have never got out from research laboratories, e.g. with use of solutions in zinc chloride, sulfurous or phosphoric acid, gelatin, or even solution of wool in liquors, but also compared advantages and drawbacks of new products.

One has to say that new products had a good deal of shortcomings, where the most important ones included low strength that in the best case was as little as 2/3 of cotton strength, huge drop of strength in wet condition associated with high swelling that made washing of those materials really difficult and, last but not least, inflammability much higher than that demonstrated by cotton. One of authors quotes the following advertisement of French merchants, printed in several professional journals: *'we nevertheless have 4,000 pounds of yarn left that was purchased from Besançon and is still on stock. We have kept it to make a very expensive firework upon a good opportunity; we must afford such a luxury as we can find no other application for yarn of that grade. Anyway we can give anyone a sincere advice not to spend money for similar, really problematic and suspicious endeavours.* [8].

However, the papers appreciate other important advantages of artificial silk, including low price, beautiful shine and easiness of dyeing, in particular to garish colours. The attention was also drawn to high profitability of artificial silk factories, still in low number at that time.

Being aware of so different opinions, mutually contradictory and frequently very critical, additionally magnified by thrilling gossips about deathly burns of ladies who worn skirts made of collodion silk, one has to pay tribute to courage of inventors who were overcoming subsequent technical obstacles and then were able to find arguments to persuade financial stakeholders to undertake quite risky projects. One of them was Feliks Wiślicki who jeopardized his personal freedom when he came to the Polish Kingdom with somebody else's passport to seek a location for a future plant of fibres and, due to his actions, could be easily accused of spying. Anyway, he accomplished to erect in Tomaszów Mazowiecki the factory of artificial silk, which was the **sixth** plant of the branch worldwide. [9, 10]. In that way Poland was included into the pool of first manufacturers of artificial silk, with production of collodion silk from 1911 to 1930 and viscose silk from 1930 onwards.



View onto the reeling room; dried silk is uncoiled from spinning coils (invisible) and then rewound into reels and forwarded to the dye-house

It may seem strange that Russian authorities exhibited no interest in artificial fibres despite the fact that even Mendeleev himself was a dedicated enthusiast of viscose fibres and starting from 1900 he encouraged to get interested in that invention. Perhaps the decisive factor was the common belief about sufficient reserves of wool and cotton or the publicity for artificial fibres was unfavourable, as is mentioned in the foregoing examples. It also cannot be excluded that the decision was made by virtue of political motives as results of the experiment were still uncertain and the responsibility for possible failure could be shifted to the government of the farthest province within the Russian Empire. Russian authorities issued the permission to erect a factory of artificial fibres on the area of then Polish Kingdom and made staying of Mr. Wiślicki legal, at that time as the engineer-in chief for construction of the factory. For that purpose Mr. Wiślicki resigned from his post of the managing director at the factory of fibres in Tubize, Belgium, which deserves the highest appreciation.



View onto the stripe finishing shop; silk in reels, after dyeing, is processed on Gerber machines

In parallel to erection of the factory in Tomaszów the kick-off for construction of a new factory in Myszków took place. The initial intention was to produce fibres with use of the copper technology by due to delays in construction the factory could not be commissioned by the breakout of the 1st World War. Only in 1925 the factory was furnished with equipment for the viscose method that enabled to launch small-scale production of viscose silk with the volume of 400 tons per year [12].

The breakout of 1st World War retarded the technological progress in production of artificial silk for several years but the lesson learned from the war entailed revision of the attitude to artificial fibres, also among European politicians who, till then, were hesitating. Firstly, it was spotted that Germany, during the war, was able to meet the demand for textiles on account of short-cut viscose fibres [13]. It was the example that was followed by a number of countries, including Poland that launched production of such fibres in 1932.

However, practical consequences from the war experience could not be immediately implemented under the Polish conditions. Although the Polish industry of artificial fibres in 1914 was pretty well developed, not worse than the similar sector in Germany or in France, it suffered much during the war and was nearly completely ruined, deprived also of the technical staff. The first new chemical engineers, such as J. J. Liwowski, St. Wydrzycki or T. Rosner, turned up to the Factory of Artificial Silk in Tomaszów as late as in 1926 [14]. It meant that the industry had to catch up more than ten years of devastation and technological stagnation afterwards. Neither Polish state nor the industry had sufficient financial reserves and research facilities that could have become the driving power for new technological solutions. Therefore, out of necessity, we were doomed to imitate solutions that had already been developed abroad. It was the delay that could never be caught up and became even deeper due to the subsequent war.

The first years after the war made up the time when most attention was paid to reconstruction of the state that had been in disastrous condition as well as to make order in the state economy. However, these were also the years when debates about the future of the Polish textile industry also begun, in particular about the structure of available raw materials. As usually, two trends clashed: the traditional one that preferred development of natural fibres' production as well as the 'modern' one that talked into assignment of really modest financial reserves to development of the artificial fibres industry.

Beside financial problems the authorities of that time during long years had to cope with 'eradication of the export-preventing psychosis' [15] and reorganize the structure of foreign trade as, due to unavailability of own seaports, export and import had to rely on numerous and expensive agents [16]. The so called 'grey area' was also a considerable problem. The long economic crisis led to 'disastrous turnover drop in textile industry and trade, not only shrinking of sales opportunities on the domestic market and drop of export sales, not only reduction in the number of employees involved in production. Besides these general properties of a cyclical crisis some other phenomena clearly appeared that had grown up worldwide during the after-war years and that also in Poland recently developed in the field of textile industry under the name of the anonymous sector'. That anonymous sector was the reason that the demand for products of the official industry dropped down with reduction of employment therein. For instance, the number of workers in the cotton industry that exceeded 50,000 in 1930 dropped down to 36,000 in 1932. The similar situation was also taking place in other branches of the textile industry. 'That industry, perfectly adapted to the weakened purchasing power of population, manufacturing small batches of goods on a daily basis on hired workshops, failing to pay wages, failing to observe limits of workers' salaries established by collective agreements, escaping to burden tax encumbrances in such a size as large industry is obliged to do so – has completely disorganized the market'.

The author of the quoted article expresses the viewpoint that large industry, in a paradox manner, is also responsible for development of that 'grey area'. The large factories, facing drop of orders, had let their workshops for use of small entrepreneurs. 'In that way small manufacturers take advantage of the newest technical equipment of large industry that feeds with own blood and sustains that anonymous industry. It may seem strange that goods, manufactured commercially by small entrepreneurs on workshops of the large industry are cheaper than own production of those factories. It must be noted here that the small industry, due to its elusive nature, is incredibly flexible. As the small entrepreneurs are able to pay cash for all the jobs and cash is extremely desirable in our times, they can bring the prices down to the minimum level. As they evade from paying benefits and taxes, avoid administrative expenses and are satisfied with only slight profitability, they finally are capable of offering goods at very cheap prices although of poorer quality than standard production of the large industry. The structural crisis in the textile industry in Łódź, as described above, has developed in parallel to the depression of the boom cycle on the sales market' [17].

During 20 years between the 1st and the 2nd World Wars the worldwide textile industry used mostly cotton for production of garment. Production of cotton amounted to 4.7 million tons in 1920 and grew to ca. 6.9 million tons in 1940, whilst the respective figures for production of wool were 816k. tons and 1.134 million tons for the same years [18]. These both fibres also in Poland made up the most important raw materials for the textile industry, which is evidenced by the number of spindles installed at textile plants. In 1938 the spinning mills used 1.694 million spindles for cotton, 177k. spindles for cotton wastes, 36k. spindles for linen and 3.4k spindles for hemp [19]. The import of cotton amounted to 65k. tons per year and, due to high overall price, nearly as high as 200M of Polish zloty, represented the most important import item of the foreign trade balance [20, 21].

The Polish government used a variety of measures to encourage manufacturers of fibres and textiles to more widely apply both artificial fibres and natural ones of the domestic origin. These pressures even increased in pace with growing tension in international relationships that forced economies of nearly all European countries to get ready to diminished supplies of imported goods or even to complete lack of supplies. Obviously, the actions of Germany were the matter of the highest concern as that country gradually increased production of short-cut cellulose fibres and at the beginning of 1939 the country was self-sufficient in 50% in the field of textile raw materials [22]. Results of research studies on more sophisticated technologies for manufacturing of synthetic fibres became known for the Europe only after the 2nd World War had finished.

The desire to become independent on overseas cotton and wool could be spotted in all countries; that resulted in rapid growth in manufacturing of artificial fibres with the production volume of only 15k. tons in 1920 and more than 1.1 million tons in 1940 [18]. The trend to become self-sufficient appeared in 1933 and became clearly visible in 1935 [23].

Insufficient jump in production of artificial fibres, in particular short-cut fibres, was the result of little interest to those fibres demonstrated by the textile industry. In turn, the industry excused itself with technical difficulties and the need to make substantial investments to adapt cotton plants to process artificial fibres [24]. However, in 1938 4.2k. tons of short-cut fibres were delivered by plants in Tomaszów (Argona and Tekstra) and Chodaków (Chostra) with the anticipated consumption for the year 1939 amounting to 6.0k. tons. The assessment of the attitude demonstrated by manufacturers of yarn must take account of the fact that unit price for 1 kg of artificial fibres was by 0.75 Polish zloty higher than the unit price of cotton, which made up the loss of ca. 4.5M of Polish zloty for the entire sector.



Arteks department; roving of short-cut fibres is subjected to throwing and wound onto coils

Improper proportions between prices were probably the main hindrance that prevented from wide application of products with content of short-cut fibres. In 1937 the price of fibres was as much as 3.80 zloty per 1 kg whilst the price for cotton of higher quality was only 1.5 zloty. However, it was not only the Polish problem because in Germany and Italy the price of short-cut fibres was also higher than the price of cotton; however, the first one never exceeded 2.5 zloty per 1 kg. In reverse, the assessment of fibre quality was pretty good. *'In terms of technology there are no difficulties when Tekstra fibres are to be admixed. Goods with admixture of Tekstra fibres loose some strength but they acquire more noble appearance. The drawback was the fact that 'during boiling tekstra fibres dissolve, thus goods with more significant admixture of that fibres are vulnerable to boiling, which prevents the mixture from use for underneath goods, used by the predominant ratio of clients'* [25].

Hence, reluctance of the textile industry resulted from both objective reasons, i.e. properties of artificial fibres that differed from cotton ones, as well as, to some extent, from customs of Polish users of yarn and textiles. Therefore a number of actions were undertaken in order to promote use of products with admixture of short-cut fibres among the Polish society. Herein, one has to mention Mr. Tadeusz Zamoyski who was the Deputy Director for the Union of Chemical Industry. Not only did Mr. Zamoyski write related papers for the sector-related professional newspapers, but he also delivered speeches during meetings of the Union or even delivered lectures by radio, which attracted attention of the entire society [26, 27].



View of a cloakroom

The political issues substantially affected production of chemical fibres, also in another manner. When economic sanctions were imposed on Italy, the country started suffering from the lack of wool that had to be substituted by launching production of casein fibres, i.e. lanital. Popularity and success of those fibres was the reason of the interest thereto also in Poland. On 14th May 1938, in witness of directors from SNIA Viscosa and Antonio Ferretti himself, the inventor of that fibre, the 'Polana' factory of casein fibres was started up in Pabianice [28]. The outset of the factory was accompanied with commencement of technical casein production at several dairies, such as the plants in Grodzisk Wielkopolski, Buk and Krotoszyn. Total output of these plants amounted to ca. 3.0k. kg of casein per day, which was enough for the 'Polana' factory [29]. Also dairies from Kościan started preparations for production of casein.

The production of wool substitute called 'Polana' entailed hostile reaction of sheep breeders who started foretelling total collapse of sheep breeding. Their arguments and concerns were exemplified in detail in the article written by B. Kaczowski, director of the Polish Wool Institute, published in the newspaper 'Codzienna Gazeta Handlowa' ('Commercial Daily Gazette') as the response to the questionnaire requested by the newspaper [30]. According to information provided by the author of the article, the annual production of non-scoured wool amounted to 4÷5k. tons whilst the demand of the textile industry reached nearly 26k. tons. It is why the author suggested providing special care for sheep breeding, the more that the population of sheep and the amount of wool produced had been increasing for several years. In June 1936 the number of sheep amounted to 3 million of animals; anyway, it was still insufficient to cover domestic needs with wool of own production. Since the author was aware that missing natural fibres must be replenished with chemical ones, he suggested further investigation on the same *'for the sake of the society, so that new synthetic fibres would resemble, to the maximum possible degree, ideal fibres, which, for the specific case, is the natural fibre, i.e. sheep wool'*. Concerns of sheep breeders were somewhat justified as *'fibres demonstrate all the features that are typical for sheep wool, i.e. strength and thermal insulation. Technical obstacles in spinning of lanital as well as initial difficulties in dyeing the fibres have already been overcome. The manufacturing cost of lanital shall not exceed the prices of domestic wool'* [25].

It was also anticipated that self-sufficiency of Poland in the field of textile raw material would be achieved by enhanced utilization of linen and hemp fibres that had been subjected to the cottoning process, i.e. splitting coarse fibres into single elementary ones. Consequently, their properties, i.e. appearance and touch, would be very close to those of cotton. However, application of cottoned fibres also encountered hindrances, even more serious than in case of artificial fibres. Firstly, process properties of the obtainable product were far away from encouraging for further processing; not only did the technology require to adapt the existing cotton spindles to spin more rigid fibres but also to considerably increase the number thereof [19]. Entrepreneurs could not avoid those expenses as the authorities imposed the official requirements to admix cottoned fibres to textile products. To encourage industrialists to undertake such endeavours and due to the still more and more realistic forecast of war the state authorities offered substantial loans offered for that purpose [21]. These loans were used to enhance combing mills of linen and to purchase equipment for cottoning that were installed chiefly in the province of Wilno. It was also expected that these loans would indirectly stimulate the growth of agriculture on the relevant areas.



Mandatory physical exercises of workwomen at the throwing mill during a break

Such an economic policy was justified by the fact that Balkan states, with very similar climatic and soil conditions, produced linen of better quality since farmers in those countries widely applied better agricultural technology and linen combing was commonly applied. It was also pointed out that the technical issues related to the cottoning process had been successfully resolved in a number of countries and that technology was getting more and more popular. The example of Italy was frequently referred to, where the content of cottoned fibres in some products ranged from 10% to 50% and total throughput exceeded 10k. tons [21].

However, the use of that raw material could not find sufficient number of supporters in spite of numerous incentives and obligations as well as efforts intended to adopt solutions described in purchased patents. The developments were carried out in several largest textile factories; nevertheless, the achieved results were not satisfactory, the more that the officially established price from 1.80 zloty to 2.20 zloty per kg, exceeding the price of cotton, was too high to guarantee profitability of production [25]. Even the special commission established by the Board of the Union of Textile Industry to promote the cottoning technology failed to remedy the situation, although the commission was in power to supervise all the experimental efforts and to select the most suitable technology [31]. Opinions of experts in a number of research fields, such as Jan Liwowski, the spinning mill manager at the Factory of Artificial Silk in Tomaszów, partly influenced by personal involvement in development of the short-cut fibre technology, were also more than modest [20].

Therefore, the lining industry and derivative sectors played no important role until the end of the period between the 1st and 2nd

World Wars. Such a result was not a surprise as problems of that branch were nothing new. It was the industrial sector that was very vulnerable to weather fluctuations, which considerably disturbed the operation cycle of manufacturing plants, e.g. spinning mills. Adverse phenomena, leading to lack of profits from that production, occurred within the entire Europe and, in consequence, entailed shrinking of areas where flax was planted [32, 33].

Poland also used to have pretty significant, as for that time, industry of natural silk, initiated in 1924 by the siblings of Henryk and Stanisława Witczak, founders of the Central Experimental Station of Silk Production in Milanówek. Their activities, regardless of the initial indifference or even reluctance of business circles, was so effective that in the 30's of the 20th century the number of silkworm breeders exceeded 2 thousand. Since 1933 also a weaving mill existed and products of the factory gradually gained more and more international popularity.

However, the attempts to support that industry, being completely marginal in terms of the total output as it consumed only a dozen tons of raw material per year, by a favourable custom policy, encountered resistance of a part of producers who preferred to import ready-made yarn from abroad. Production of natural silk was described as *an idée-fixe* or *a freak of autarkic thinking* that resulted solely from the will 'to produce all possible and impossible raw materials locally, in the country'. In response, the supporters of silkworm breeding and development of that industrial branch pointed to the experience of a very frosty winter 1928/29 that ravaged nearly 50% of fruit trees whilst mulberry trees survived unexpectedly well. In 1933, only in the Eastern Małopolski Region as much as 60 million mulberry trees were planted that could serve as the background for development of silkworm breeding [34]. In addition, indoor breeding was also initiated at that time, which mitigated the effects of climate fluctuations. At that time silkworm breeding was being developed chiefly in Italy and in Balkan states. However, sceptics were right as the production of natural silk has never achieved any substantial economic importance. Also, some attempts to revive that production sector already after the 2nd World War at the break of the 40's and 50's of the 20th century completely failed with no significant results. During the season 1937/38 only 40k. m of silk were obtained from the domestic product, but that still meant doubling of the production during the past decade [35].

However, the textile business started going worse in 1938. The demand for artificial fibres started decreasing even at the end of the preceding year, which led to the growth of unemployment. The major reason for that was probably overproduction, but more and more intense switchover of individual national economies to military productions seems to have been also of some importance.



Reading room at the plant library

The decrease of economic prosperity was also sensed by the Polish economy. The production of viscose silk during the first half of 1937 was 3,588 tons with only 2,178 tons during five subsequent months. Even more considerable weakening was observed in sales,

where 3,521 tons was sold during the first half of 1937 year and only 1,711 tons from July to November of that year. The conditions for short-cut fibres were equally poor as 681 tons of them were produced during the first half of 1937 with 287 for the period from July to November. The reasons for that distortion were searched in lowering of duty tariffs for Italian fibres that were cheaper than the Polish ones, which put the already commenced investments in question. These investments from the preceding years, although being a stimulus for substantial technical progress, improvements in the quality of fibres and advance in work conditions, led to growth of fibre prices and worsening of their competitiveness [36]. At that time the Polish market was already so closely tied with the European markets that no calls to establish new custom barriers were heard but to wisely use the existing ones. The import of woven fabric was deemed as the most unfavourable factor for the domestic textile and garment industries as it affected both the manufacturers of yarn and woven fabric; therefore, immediate intervention of the government was indispensable. The total value of woven fabrics imported in 1936 was 12.759M zloty and in 1937 as much as 14.797Mzloty. The import of ready-made clothing also increased, from 1.467Mzloty in 1936 up to 1.788M zloty in 1937. As the import of luxury goods increased to the most degree it was considered that such import benefits from unfair preferences [37].

The use of substitutive fibres for the textile industry was deemed as an equally important issue. The objective was achieved by means of a regulation issued by the Ministry of Industry and Trade that imposed the requirement to admix 10% of cottoned linen and tekstra to cotton goods. Simultaneously, the price of tekstra was reduced by 0.25 zloty per 1 kg. Unfortunately, these steps proved to be too late to improve the condition of the textile and military industries [38]. September 1939 and breakout of 2nd World War were the reasons that all the discussions and endeavours had to be postponed and future events changed the world more than anyone could imagine.

The quoted papers use the term 'synthetic fibres', but it is understood in another meaning than the one spread out in the 50's of the 20th century and later on. During the period between the 1st and 2nd World Wars nobody in Poland worked with fibrogenic synthetic polymers; such polymers fell into the scope of interest where German and American chemists were involved. Poland, after relocation of state borders after the war, became the owner of remnants after a factory of polyamide fibres in former Landsberg (nowadays in Gorzów). The success of polyamide fibres was probably the factor that tipped the scales in favour of chemical fibres, but it is the history of the post-war time period.

The real flourishing of artificial and synthetic fibres, which are nowadays referred to as chemical ones, began only in the 50's of the previous century. During the recent 50-69 years the amount of manufactured artificial materials increased to nearly 250 million tons [39], save the fibres dedicated for production. To that number one has also to add 40 million tons of synthetic polymers that were used to produce three major grades of fibres for clothing, i.e. polyester, polyamide and acrylic [40]. Since the day when the war ended the world has been being poured with still newer and newer fibres. Even if there were no differences between some grades, they had more and more attractive names that now are completely forgotten. Nowadays, when we purchase any textile product we can be nearly sure that the product contains either polyester or cotton. These are two unsurpassed fibres that are incomparable to any other ones.

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The photographs of facilities of the Factory of Artificial Silk in Tomaszów were taken in 1937 and come from the collection of Zygmunt Dziedziński

Jerzy SKORACKI Ph.D., graduate of the Szczecin University of Technology, he worked for Chemitex-Wistom in Tomaszów Mazowiecki since graduating from the university until the shutting down of the plant. Afterwards he was an associate professor at the Institute of Footwear and Clothing Materials Technology of the Technical University of Radom.