The Beginning of the Machine-Building Industry in the Czech Lands in the First Half of the 19th Century

(A Study of the Influence of the English Industrial Revolution on the Continent) *

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I.

The Czech Lands, Bohemia, Moravia and that portion of Silesia which remained part of the Czech Crown Lands in the 18th century, after the war of 1740-1742, were territories where the manufacture of textiles developed, not only for home consumption, but to a great extent for foreign markets, too. This production was organized on the one hand in the form of domestic industry, by means of the putting out system,[1] and on the other in manufactories. These, in particular, underwent considerable development in the 18th century.[2] At the end of the 18th century, in the year 1798, there were in Bohemia alone 404,237 flax, wool and cotton spinners and, in addition,

* Translated by R. Shepherd.

[1] KLÍMA A., *The Role of the Rural Domestic Industry in Bohemia in the 18th Century*, « Economic History Review », (EHR), sec. series, 1974, no. 1; MAINUŠ F., *Plátenictví na Moravě a ve Slezsku v XVII. a XVIII. století*, (The Linen Industry in Moravia and Silesia in the 17th and 18th Centuries, Ostrava 1959; *Vlnařství a bavlnářství na Moravě a ve Slezsku v XVIII. století*, (The Woollen and Cotton Industries in Moravia and Silesia in the 18th Century), Prague 1960.

[2] KLÍMA A., *Manufakturní období v Čechách*, (The Manufactory Period in Bohemia), Prague 1955; *Die grössten Manufakturen in Böhmen im 18. Jahrhundert*, in Mitteilungen des österreichischen Staatsarchivs, Wien 1959; FREUDENBERGER HERMAN, *The Woollen Goods Industry in the Habsburg Monarchy in the Eighteenth Century*, in « The Journal of Economic History », XX, New York 1960; IDEM, *The Waldstein Woollen Mill, Noble Entrepreneurship in Eighteenth Century Bohemia*, Boston 1963.

another 124,633 employed in the manufacture of textiles — about 528,870 people in all.[3] If we take into account the fact that at that time Bohemia had about 3 million inhabitants,[4] this meant about 17.5% of the population. This number represented 83.8% of all those employed in industrial production which was responsible for 76.3% of the total value of production expressed in money.[5] In Moravia and Czech Silesia, at least 100,000 people were employed in the linen industry and a further 50,000 in spinning wool and cotton. The annual production of the linen industry amounted to over 300,000 pieces and of the woollen industry to about 200,000 pieces.[5a]

In Bohemia there were 59 furnaces and 179 hammer mills at that time. The iron industry was located on the estates of the nobility and served domestic requirements. In addition there was a highly developed glass industry in the country. But of the greatest significance for the further development of industry was the production of textiles which was concentrated in several regions. The woollen industry was mainly based in northern Bohemia in the Liberec (Reichenberg) region, in southern Moravia in the Brno (Brünn) region and in Czech Silesia in the Opava region. The cotton industry was mainly located in northern Bohemia, again in the Liberec region and the linen industry was most widespread in north-eastern Bohemia and in northern Moravia and Silesia. In all these regions, textile production had formerly been carried out for the most part as a domestic industry and had a long-standing tradition. It was based, on the one hand, on the extensive production of good quality flax and the breeding of a large number of sheep. In Bohemia, there were normally about two million sheep, but their wool was suitable only for rougher kinds of cloth and, besides this, it represented a mere third of the raw material requirements for the production of woollen cloth. So wool had to be imported from Hungary and

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[3] PURŠ J., *Struktur und Dynamik der industriellen Entwicklung in Böhmen im letzten Viertel des 18. Jahrhunderts*, in « Jahrbuch für Wirtschaftsgeschichte, 1965, II, p. 107, Berlin.

[4] In 1789 Bohemia had 2,825,455 inhabitants; PURŠ J., *Ibid.*, p. 117.

[5] *Ibid.*, p. 114.

[5a] MAINUŠ F., *Plátenictví* . . ., p. 113; IDEM, *Vlnařství a bavlářství* . . ., p. 32, 98.

Saxony.[6] In Moravia and Czech Silesia in 1798 there was a total of 637,000 sheep. This was considerably less than in 1752, when in Moravia alone there were 720,340 sheep. The wool they provided was only enough to meet a quarter of Moravia's requirements and a third of Silesia's. The rest of the wool required was imported from Hungary, Poland and Upper Silesia.[6a] The cotton industry began to develop rapidly after the lifting of the ban on the establishment of cotton manufactories, i.e. from 1763. This law had been connected with mercantilist policy which emphasized the need to support the production of linen based on the processing of domestic raw materials. From then on (i.e. from the year 1763) the production of cotton developed and in the first half of the 19th century it was the most important branch of textile production in the Czech Lands. Together with the woollen industry it was of decisive importance for the transition from domestic industry and manufactory production, although both also played an important part in the early stages of the industrialization of the Czech Lands.

In contrast to these two branches of production, the linen industry remained a domestic industry for a long time and, at a time when the cotton and woollen industries were already equipped with spinning machines and power-looms, the linen industry was still carried on in its old traditional manner. The number of flax spinners around the year 1825 still amounted to about 400,000 in Bohemia alone and only a quarter of them were exclusively employed in spinning.[7] Around the year 1835, 1,028,000 pieces of linen cloth to the value of 9,747,000 *gulden* were made in Bohemia. Half of this quantity was consumed on the home market while the other 522,000 pieces to the value of 5,485,000 *gulden* were exported from the Czech Lands to foreign markets. Together with payments for transportation, this brought the Czech Lands 6,278,000 *gulden*.[8] In Moravia

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6 KREUTZBERG K.J., *Skizzirte Übersicht des gegenwärtigen Standes und der Leistungen von Böhmens Gewerbs- und Fabriksindustrie in ihren vozüglichsten Zweigen*, pp. 105-106, Prag 1836.

6a MAINUŠ F., *Vlnařství* . . ., pp. 14-16.

7 Schnabel states that up to 1825 there were 447,914 flax spinners in Bohemia of whom 92,557 were full-time spinners. SCHNABEL G.N., *Ueber die Leinenwaaren-Produktion in Böhmen*, in « Jahrbuch des böhmischen Museums », Bd. I., Prag 1830.

8 KREUTZBERG K.J., *Ibid.*, pp. 70-71.

in 1841 about 660,000 pieces of linen cloth to the value of 4,451,000 *gulden* were made for foreign markets.[8a]

In view of the fact that from the 1820s the production of linen in England was being rapidly mechanized, beginning with spinning, the Czech linen industry was unable to keep up with a competitor producing finer and cheaper yarn and cloth and it gradually lost its foreign markets. By 1846, English linen mills had squeezed the Czech linen industry out of overseas markets, particularly the American market.[9] The production of yarn and linen in the Czech Lands in the first half of the 19th century not only failed to develop but actually declined. Despite the fact that the first mechanical flax-spinning mills were established in 1835 by J. Faltis, this branch of the textile industry remained underdeveloped. However, in 1847 there were still more than 350,000 people employed in this industry in Bohemia alone.[10]

While in the first half of the 19th century the linen industry was not significantly affected by industrialization in the modern sense of the word, from the end of the 18th century the other two branches of textile production were drawn into the important process that has come to be known as the industrial revolution.

From the end of the 18th century the cotton and woollen industries were affected by the invention in England of spinning machines which spun much greater quantities of a yarn finer and cheaper than that produced by hand-spinners. Simultaneously a solution was found to the question of manpower, because spinning required such a large number of workers that even in the Czech Lands yarn had to be imported from abroad for use in the weaving of cloth. After Hargreaves's invention of his "jenny" in 1765, spinning machines were able to replace the work of many hand-spinners. From that time on England had a head start over the Continent.

[8a] Dohnal M., *Průmyslová revoluce a počátky dělnického hnutí v severomoravské plátenické oblasti*, (The Industrial Revolution and the Beginnings of the Working Class Movement in the North Moravian Linen Area), p. 10, Ostrava 1973.

[9] Langer E., *Firma Benedicts Schroll Sohn*, p. 64, Prag 1895.

[10] Purš J., *Průmyslová revoluce v českých zemích*, (The Industrial Revolution in the Czech Lands), p. 52, Prague 1960.

The biggest cotton manufacturer in Bohemia in the second half of the 18th century, Johann Josef Leitenberger, who owned several cotton manufactories and employed thousands of domestic spinners, received a confidential report at the beginning of 1796 to the effect that a spinning mill was being established in Copenhagen on the English model and that it would be possible to obtain a model of the spinning machine the export of which from England was strictly forbidden. Leitenberger immediately decided to send to Copenhagen two of his employees, Josef Richter and F. C. Mattausch. The former seems to have been in charge of the commercial side of the enterprise, while the latter was a skilled joiner who looked after the technical side of the business.[11] In Copenhagen they established contact with a Danish mechanic named Rigo who had worked for some years as a machine-builder in England and who was well-informed about the equipment of the spinning mills there. Richter and Mattausch succeeded in obtaining a promise from Rigo that he would come to Bohemia and begin the production of the same kind of spinning machines that the English mechanic Norberg had assembled in Copenhagen on the model they had obtained. In 1796 all three of them came to Verneřice (Wernstadt) where one of the manufactories of the firm of Leitenberger was located and here work began at once on the production of a spinning machine on the English model. The following year, 1797, work was started on the building of a new two-floor spinning mill which was completed and put into operation the same year.[12] This is very important because it proves that even before 1798, when Lieviu Bauweus of Ghent smuggled a mule from England to the Continent,[13] these machines

11 We should not be too surprised that the joiner Mattausch was sent to examine the technical aspects of the machine since « to begin with, machinery was made of wood and was produced at the factories by factory labour ». In PHYLLIS DEANE, *The First Industrial Revolution*, p. 98, Cambridge 1967. See also REDLICH FRITZ, *The Leaders of the German Steam-Engine Industry During the First Hundred Years*, in JEH, vol. IV, no. 2, pp. 145-147, New York 1944.

12 HALLWICH H., *Firma Franz Leitenberger*, pp. 88-89.

13 Mokyr wrote: « In 1798, the same year that mechanized cotton-spinning was introduced on the Continent ». MOKYR JOEL, *The Industrial Revolution in the Low Countries in the First Half of the Nineteenth Century*, in « The Journal of Economic History », (JEH), vol. XXXIV, no. 2, pp. 366-367, New York 1974.

were already operating on the Continent, probably in Denmark and most certainly in Bohemia.

Both the sons of Johann Josef Leitenberger, Franz and Ignaz, who managed the cotton-spinning mills at Kosmonosy and Nové Zákupy (Reichstadt) at once began to install these spinning machines in their enterprises, so that in 1799 there were already three English cotton-spinning mills in Bohemia.

Almost simultaneously with the introduction of the cotton-spinning machine, the wool-spinning machine was also put into operation in Bohemia. In 1800-1803 the technical manager of Berger's woollen manufactory at Stráž nad Nisou (Alt-Habesdorf) near Liberec, Ferdinand Römheld, imported from the Netherlands the first spinning and shearing machines and then carding machines for wool.[14] In view of the fact that in 1798 the firm of Biolley and Simons at Verviers engaged William Cockerill to construct the first spinning mills and carding machines for their wool-producing plant,[15] we can see that Bohemia did not lag far behind Belgium and that, as in the case of cotton-spinning machines, the ban on the export of wool-spinning machines invented in England as circumvented and either the plans or the machines themselves found their way to the Continent.

At the same time as efforts were first made in Belgium to obtain the services of William Cockerill, steps were also taken in the most important wool-producing area in the Czech Lands, the Brno region, to obtain a wool-spinning machine. In 1796 a company was established there, headed by the banker, Jan Herring, Count Hugo Salm, owner of the iron works at Blansko near Brno, and the Irish baron, Thomas Brady, who was a general in the Austrian army. This company endeavoured to obtain a wool-spinning machine. In 1801, two important members of the company, Count Salm and Petke, set out for England. In London they succeeded in obtaining 18 detailed blueprints of English wool-spinning machines for 5,000 *gulden*. In addition they also gained possession of detailed instructions for the machines from an English engineer

[14] Hallwich H., *Reichenberg und Umgebung*, p. 490.
[15] Mokyr Joel, *Ibid.*, pp. 366-367.

who worked in a machine-operated spinning mill. They smuggled the blue prints and instructions to the Continent. With the help of Brady, the company engaged two Irish mechanics called John Stapelton and Samuel Dicky who were then working in Vienna. On February 14, 1802 a contract was concluded with them for the construction of a wool-spinning machine. The work was carried out successfully at Count Salm's iron works at Blansko and the machines were put into operation in Brno woollen manufactories. In 1805, the company reported that efforts to obtain and put into operation wool-spinning machines had cost more than 70,000 *gulden*.[16] This shows that methods of industrial espionage such as those Fritz Redlich described which took place in Germany, as in the case of Carl Friedrich Bückling at the end of the 18th century[17] and Freiherr von Stein at the beginning of the 19th century, who spied on Boulton and Watt's factory at Soho near Birmingham,[18] were quite common at the time. At the same time as efforts were made to obtain English wool-spinning machines, English shearing machines were put into operation in Offermann's factory at Brno in 1803. In a protest lodged by hand shearers on September 5 1803, it was stated that after the introduction of four shearing machines only five out of 44 shearers remained at the factory.[19] At almost the same time as the efforts to introduce wool-spinning machines, an attempt was made in Moravia to construct a flax-spinning machine. Similar attempts were being made at the same time in France, the Low Countries and England. Flax-spinning machines were actually made but none of them was sufficiently perfect to be generally used, until Phillip Girard succeded in 1817 in making a satisfactory machine. Nevertheless in the Czech Lands an attempt was made to construct a flax-spinning machine in 1805. An English mechanic named George Woodward was engaged for

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16 Šindelář B., *K nejstaršim pokusům se stroji v brněnských textilnich manufakturách na přelomu 18. a 19. století*, (Earliest Attempts to Introduce Machinery in Brno Textile Manufactories at the Turn of the 18th and 19th Centuries), « Casopis Matice Moravské » (CMM), Vol. 76, pp. 76-79, Brno 1957.

17 Redlich Fritz, *Das Unternehmertum in den Anfangsstadien der Industrialisierung*, in Redlich Fritz: « Der Unternehmer », p. 324, Göttingen 1964.

18 Redlich Fritz, *The Leaders . . .*, in JEH, vol. IV, pp. 122-123.

19 Šindelář B., *Ibid.*, CMM, vol. 76, pp. 84-87.

this purpose and he constructed a flax-spinning machine with 60 spindles, which was put into operation in 1811 at the flax-spinning mill at Velké Losiny belonging to Josef Klamm and was used there until the firm went out of business in 1815.[20] It clearly had the same shortcomings, however, as the flax-spinning machines constructed before Girard. Nevertheless it provides evidence that the need for such a flax-spinning machine had arisen in the Czech Lands at the beginning of the 19th century as it had in other countries with advanced linen production.

It should be emphasised that before the introduction of the machine-building industry (between the end of the 18th century and about 1830), the majority of large textile plants had their own engineering workshops where locksmiths, blacksmiths, carpenters and joiners were employed, as well as clockmakers who saw to the maintenance and repair of the machines. Such workshops could be found at Offermann's at Brno, Schöll's at Šlapanice near Brno, Berger and Römheld's at Liberec and Breitfeld's in Prague. In these shops, machines were not only repaired and improved but were actually constructed as well.

This had also been the case before the engineering industry had come into being in England where « the machine-making shops... grew up in the shadow of the mills ».[21]

At the beginning of the 19th century it was significant that in the textile plants of the Czech Lands not only were working machines introduced but steam began to be used as well. In 1804 Römheld installed a steam boiler in the wool-dyeing shop and the linen-printing shop of his and Berger's factory at Stráž nad Nisou.[22] Sources refer to a steam engine but it was probably only a steam boiler. Nevertheless, it was Römheld who was the first to use steam in Bohemia for production purposes.[23] It is understandable

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[20] DOHNAL M., *Ibid.*, p. 35. Woodward also constructed various machines for the woollen industry in the Brno region. He died in 1819 at Veverská Bítýšk near Brno where he owned a mill. *Die hundertjährige Geschichte der Ersten Brünner Maschinen Fabriksgesellschaft in Brünn von 1821 bis 1921*, p. 10, Leipzig 1921.

[21] PETER MATHIAS, *The First Industrial Nation*, p. 133, London 1969.

[22] HALLWICH H., *Reichenberg und Umgebung*, pp. 490-491, Reichenberg 1874.

[23] FUCHS H. und GÜNTHER A., *Die ersten betriebsfähigen Dampfmaschinen in Böhmen*, in « Beiträge zur Geschichte der Industrie und Technik », Vol. V., p. 321, Berlin 1913.

that in the Czech Lands where the textile industry was so advanced after the introduction of working machines consideration had to be given how to replace water power by the steam engines which, after Watt's invention of the double-acting steam engine, caused an upheaval. This ensured that textile plants were freed from the fear of having to reduce production or stop it altogether at times of water shortage or heavy frosts. The first attempts to construct such a steam engine were made in Prague in 1806 by Professor Gerstner of Prague Polytechnic, but his steam engine was only used as a teaching aid. In 1810 and 1814, Count Jiří Buquoy also had steam engines made. These were not, however, engines which worked on Watt's system but were the already outdated atmospheric steam engines, which were constructed predominantly of wooden parts.[24]

The first real double-acting steam engine on the principles of Watt's system was constructed in Moravia by an Englishman named Baildon, a member of a well-known English family who had settled in Upper Silesia. John Baildon had originally been employed at the Carron iron works in Scotland. From there he had been engaged by the German Count Reden to construct coke furnaces for smelting iron at the new iron works at Gleiwitz in Upper Silesia.[25] He had also settled there and one member of this family married into the family of the Czech iron entrepreneur, J.V. Homoláč,[26] who was lease-holder of the iron works at Olešnička in Moravia. Later Baildon became lease-holder of the iron works at nearby Štěpánov and here, in 1814, he constructed the first steam engine in the Czech Lands for Christian Wünsch's textile factory at Brno. This steam engine, however, had shortcomings and was later taken out of operation.[27] Three years later, a steam engine was installed in

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24 Purš J., *Použití parních strojů v českých zemích v období do nástupu imperialismu*, (The Use of Steam Engines in the Czech Lands in the Period up to the Rise of Imperialism), in « Ceskoslovenský časopis historický » (CSCH), Vol. II, no. 3, pp.450-451, Praha 1954.

25 Henderson W.O., *Britain and Industrial Europe 1750-1870*, « Studies in British Influence on the Industrial Revolution in Western Europe », 2nd edition, p. 151, Leicester 1965.

26 Janíček L. and Kruliš I., *British Inventions of the Industrial Revolution in the Iron and Steel Industry on Czechoslovak Territory*, p. 20, Prague 1967.

27 Slokar J., *Geschichte der österreichischen Industrie und ihrer Förderung unter Kaiser Franz I.*, p. 612, Wien 1914.

Offermann's textile factory, also at Brno, by the London machine-building factory of Hague and Topham.[28]

So it came about that the Brno textile producing region had the first steam engines in the Czech Lands and because by 1813 there were already 29 textile factories here, a number of machine-builders from other countries endeavoured to settle here from 1815 on and built their own workshops for the production of machines. In their workshops they trained local workers,[29] locksmiths, blacksmiths, joiners, carpenters and also clockmakers, who became machine-builders. Similarly many of the machine builders of the industrial revolution in England had been trained in the old handicraft sectors.[30] These first workshops, however, did not have the same importance for the area as did the machine-building workshop which came into being at Friedrich Schöll's textile factory at Šlapanice near Brno. It was here that Jan Reiff, who came from Würtemberg, where he had been trained as a locksmith and clockmaker, worked from 1814. Later he studied mechanics. From Germany he came first to Brno where he worked in Offermann's machine-building workshop and from 1806 he was employed at Liberec in the machine-building workshop of Berger and Römheld's factory. From there he went in 1814 to Šlapanice where he established a machine-building workshop which was part of the wool-spinning mill of the firm of Friedrich Schöll and Company. Heinrich Alexander Luz also came there in 1814. He, too, originally came from Würtemberg where he had been trained as a clockmaker although from 1812 to 1814 he had worked in a machine-building workshop. Luz had technical talent and was a great admirer of machinery. It was his dream to produce a steam engine.

At Šlapanice where Reiff was producing textile machines be found good use for his talents and after J. Reiff died in 1820, he married his widow on March 5 1821. Thus he became the joint owner of the firm and at the same time manager of the machine-building workshop. From that time, an important period

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28 Purš J., *Ibid.*, p. 454.

29 Šindelář B., *Ibid.*, CMM, Vol. 76, p. 90.

30 Mendels Franklin, *Proto-industrialization: The First Phase of the Industrialization Process*, in JEH, vol. XXXII, p. 244, New York 1972.

began for the Schöll and Luz machine-building workshop and it was regarded as the basis for the engineering industry, not only at Brno but in the whole of Austria.[31]

In 1824 the first 12 h.p. steam engine was made at this workshop for Offermann's textile factory at Brno. Thus this workshop became the first factory in Austria where steam engines were produced. In 1826 is supplied another two steam engines to Römheld's textile factory in Horní Litvínov (Oberleutensdorf). According to a report of April 26 1830, this workshop was making the following machines: steam engines of 1-20 h.p., steam boilers, hydraulic presses, lathes, drilling and metal-cutting machines, firemen's hoses and other machines according to plans and blue prints supplied. In 1836 the machine-building shop was transferred from Šlapanice to Brno as a separate factory belonging to Luz, while the spinning mill at Šlapanice remained the property of Friedrich Schöll. In 1841, Luz joined forces with the English machine-designer Dobbs. Their factory expanded considerably in the next few decades and in 1851 it employed 150 workers. Their products were destined not only for the Brno textile region but were also sold to Bohemia, Hungary, Galicia and even to Russia.

In the same year that the Schöll and Luz machine-building workshop was established, 1821, the Dutch machine builder, Peter Comoth, who had come to Brno in about 1815, obtained permission to establish a factory for the production of water powered and other machines. This branch of production was extended to cover a number of machines for the textile industry. In addition to water wheels, it made spinning machines, shearing machines and later steam engines as well. Although his workshop was considerably smaller than that of Luz, it was very well known in the 1830s.[32]

II.

We have already mentioned that in 1796 Johann Josef Leitenberger obtained drawings of English cotton-spinning machines and with the help of the Danish machine-builder, Rigo, who had lived

31 *Die hundertjährige Geschichte . . .*, p. 31.
32 Slokar Johann, *Ibid.*, p. 613.

for a long time in England, began to install them in his spinning mills. In 1801 Count Salm and Petke obtained in England drawings of English wool-spinning machines and, with the help of the Irish mechanics, John Stapleton and Samuel Dicky, began to produce them in Moravia in 1802. From 1805 the English machine-builder, George Woodward, began to work on the construction of a flax-spinning machine in Moravia. From the very beginning of the transition from manufactory to factory production in the textile industry in the Czech Lands, then, there is evidence of the indirect and direct influence of the English industrial revolution. But it was only later that a fundamental change came about, which was connected with the activities of English experts and entrepreneurs in machine building in the Czech Lands. The most important of these were Edward Thomas, Thomas Bracegirdle, David Evans and Joseph Lee. And it is to them that this chapter is devoted.

Edward Thomas was born in Bristol and became an engineer. He soon left for Germany where he attempted to set up a workshop at Pempelfort near Düsseldorf.[33] He was joined in 1819 by Friedrich Harkort who, after a trip to England in June 1819 to purchase machines and engage skilled workers, built an engineering workshop at Wetter an der Ruhr. In addition to Harkort, the shareholders were an Elberfeld banker, Heinrich Daniel Kamp, and Edward Thomas. Harkort made a trip to England with Thomas so that, with his help, he could engage more English engineers and workers for his machine-building workshop. Thomas persuaded his father-in-law, Samuel Godwin, to move to Wetter and also recruited other experts.[34] The machinery for this workshop came from England as did the first steam engine. Harkort endeavoured to employ at his works experienced English experts who would be capable of starting the production of textile machines and, in particular, the production of steam engines on the model of those constructed in the most famous workshops — those of Boulton and Watt in Soho.

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[33] Metschoss Edward, *Ein Jahrhundert deutscher Maschinenbau*, pp. 10-11, Berlin 1919.

[34] *Ibid.*, pp. 23-24.

In 1820 the first two such machines were constructed at Wetter. Edward Thomas played an important part in their construction and he was entrusted with the task of putting the steam engines into operation. According to Matschoss, this was a task « which was sometimes more difficult than the actual construction of the engines ».[35] For this reason he often had to travel to the places where the steam engines were put into operation.

In 1823 he came to Bohemia where the owner of a cotton-spinning mill at Markvartice (Markersdorf), Josef Kittel, had purchased a 6 h.p. steam engine from Harkort and Company. This steam engine, which was installed by Edward Thomas, drove 36 machines in four large work—shops on three floors. The firm of Harkort, under Thomas's management, also installed central heating and gas lighting in all rooms of the factory which were all connected to the steam engine.[36] In the following year Edward Thomas installed another steam engine in Bohemia at the Friedrich Pilz cotton-spinning mill a Verneřice, and in 1825 the firm of Harkort and Company supplied another 12 h.p. steam engine to the cotton-spinning mill of Kühne and Tetzner at Červený Hrádek (Rothenhaus).[37]

It is probable that his journeys through northern Bohemia with its scattered textile industry where there was no machine-building plant made Edward Thomas decide to establish a machine-building plant in Bohemia which would supply the local factories with the machinery they needed.

In all probability this was why he parted company with Harkort who described him as a talented but ruthless man who strayed off into Bohemia.[38] Fritz Redlich wrote that, after parting company with Harkort, Edward Thomas « made a creditable record as an in-

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[35] *Ibid.*, p. 26.

[36] FUCHS H. und GÜNTHER A., *Die ersten . . .*, p. 232.

[37] *Über Maschinewesen im Allgemeinen und insbesondere in Böhmen*, in « Mittheilungen für Gewerbe und Handel » (M.f.G.H.), vol. I, p. 515, Prag 1835.

[38] HARKORT FRIEDRICH, *Geschichte des Dorfes, der Burg und Freibei Wetter, als Beitrag zur Geschichte der Grafschaft Mark*, quoted by FUCHS H. und GÜNTHER A., *Die ersten . . .*, p. 234.

dependent machine manufacturer in Germany ».[39] What is certain is that Thomas went to England after leaving Harkort, but as early as April 30 1829, through the intermediary of a Prague lawyer, Dr. Theumer, he submitted, together with a businessman named Moritz Müller of Chemnitz in Saxony, an application to the provincial governor's office (gubernium) in Prague for permission to establish jointly in Prague, with the help of considerable capital, a machine-building factory « which the local cotton factories and other manufactories sorely need but which hitherto they have had to import at considerable expense mainly from England ». The application goes on to state that Edward Thomas's long residence in England had enabled him to acquire all the knowledge of English machine-building necessary for him to be able to establish a plant in Bohemia which would have a beneficial effect on the country's industry. It also emphasized that a considerable number of machines would need to be imported from England, both for actual production in the factory and as models for local factories because such machines were not known here at all. All this appeared essential for the building of the large enterprise that they had in mind. The total weight of these machines would be about 150,000 pounds, and they requested that these machines be exempted from customs duties because they had involved considerable expense and were to be used for the development of production in Bohemia. The application went on to enumerate the machines and machinery the new factory would make: 1) All machines for spinning mills for worsted, wool and cotton, 2) spinning machines for silk, 3) all kinds of looms, 4) printing machines, 5) steam engines, 6) steam central-heating equipment, 7) steam boilers for dye-shops and bleacheries, 8) gas lighting equipment, 9) mills made of iron according to the English system, 10) water wheels made of iron and 11) everything else coming under the category of mechanics.

The application pointed out that no factory of such scope so far existed in the whole of Austria and it would be of great significance for the development of Czech factories and manufactories. Therefore they again requested that the Czech governor's office (gubernium)

[39] Redlich Fritz, *The Leaders . . .*, p. 130.

should give its approval to the duty-free importation of the following machines for cotton production: 40 spinning machines, 8 bobbin jack frames, 40 carding machines, 8 stretching frames, 2 cleaning machines, 20 winders and one steam engine. In addition to this consignment, which weighed 80,000 pounds there was to be another production of worsted: 4 spinning machines, 4 bobbin jack frames, 6 woolcarding machines, 1 combing machine, 1 shearing machine for cloth and, in addition, 1 winding machine for silk, and various machines for the preparation of cotton, 1 case of water twist spindles for cotton, 1 winding, shearing and sizing machine, 1 loom for weaving linen, 1 loom for ballicos, 1 for mouselins, 1 for jattkens and 1 for bourinets. In addition to these machines which were clearly intended as models for the production of machines for the textile industry, other machines for the factory itself were to be imported: iron lathes, machines for rolling sheet iron, machines for the production of toothed wheels from iron and brass, machines for the production of iron and brass cylinders and machines for the production of screws. Besides this a request was made for personal effects and household requirements to be imported duty free.[40]

This application was submitted to the customs administration which, on May 9 1829, replied that according to the regulations in force, only persons who had been given permission to settle in Bohemia could obtain permission for duty-free imports.[41] This decision was announced on May 17 1829 to the applicants' lawyer, Dr. Theumer. On July 3 1829, six weeks later, Dr. Theumer submitted a new application to the *gubernium* in more or less the same words, only this time it was on behalf of Edward Thomas alone, who requested permission to establish a machine-building plant, as an *immigrant*, on the estate of Liberec.[42] There were three points in which the new application differed from the original. 1. No mention was made of Thomas's partner, Moritz Müller of

[40] This application is filed in the State Central Archives (SUA), CG. Cam. 1826-1835: 21/55.

[41] Nožička Josef, *Z počátku strojírenství v Čechách se zvláštním zřetelem k Libereckú*, (The Early Beginnings of the Machine Building Industry in Bohemia with Special Reference to the Liberec Region), in « Sborník Severočeského muzea », Historica 6, pp. 37-38, Most 1970.

[42] SUA (State Central Archives), C.G. com. 1826-1835, 1/154.

Chemnitz in Saxony. 2. The factory was to be established at Liberec not Prague and 3. No mention was made of duty-free importing. This means that Moritz Müller dropped out after receiving the decision of the customs administration on the need to immigrate, while Edward Thomas decided to go on. As far as the building of the factory at Liberec rather than Prague was concerned, it appears from a letter written by Thomas on May 31 1829 that negotiations in Prague for the purchase of suitable premises had not met with success.[43] On the contrary the new application stated that on June 28 1829 Thomas had received confirmation from the authorities of the Liberec estate that there were no objections to his establishing a machine-building workshop at Liberec and to his settling there. Nothing had to be said in the second application about the duty-free importing of machinery and other effects because Edward Thomas had already applied for permission to enter the country as an immigrant. On July 10 1829, the governor's office passed this second application to the county office at Mladá Boleslaw which recommended its approval. On this basis the governor's office, on July 25 1829, granted permission to Edward Thomas to establish a factory for the production of machines at Liberec.[44]

This same year, Edward Thomas started to build two machine-building plants, the first at Liberec, which he ran with his brother James, and the other at Starý Harcov (Harzdorf) a quarter of an hour from Liberec, which he ran jointly with Thomas Bracegirdle. In this way the foundations were laid for two plants which were of fundamental importance for the machine-building industry not only for this area of northern Bohemia but for the entire country.

Edward Thomas came to Bohemia with his brother James, also bringing with him his partner Thomas Bracegirdle who was born in 1794 in Leeds. He had learned machine-building in Manchester and with his brother had later established a factory for the production

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[43] Nožička J., *Z počátků strojirenství . . .*, pp. 37-38.

[44] Fuchs M. und Günther A., *Die ersten . . .*, pp. 235-236. Henderson W.O., ***Britain and Industrial Europe***, wrote on page 197 that Edward and James Thomas established their works at Reichenberg in 1820. This is not correct. I think that Henderson took this date from Slokar J., *Geschichte der österreichischen Industrie . . .*, p. 614.

of machines in this same town before leaving for Bohemia with Thomas. Thomas Bracegirdle proved to be an outstanding expert and improved many machines. The plant at Starý Harcov aroused considerable interest and as early as 1829 was visited and described by the celebrated topographer, Professor J.G. Sommer. According to this description, on the ground floor of the adjacent factory building there was a forge and a brass foundry, then a workshop for cleaning castings, with presses and machines for cutting screws and metal. On the first floor were a joiners' and a locksmiths' shop. Everything seemed to Sommer to be as perfect « as in the best plants in England ».[45] All the machines were imported from England and were beautifully made. Sommer was amazed to see at the machines boys of from 12 to 15 years old who worked metal with ease on a lathe or drilling machine. He was particularly impressed by a metal cutting machine on which toothed wheels of all dimensions were made from brass or cast iron. On the first floor of this building machines were assembled. Locksmiths worked here cleaning the individual parts of the machine, filing them and then assembling them. There was also a tinsmiths' shop and a pattern shop in this same building.

This plant a Starý Harcov, which was known as a « workshop for the production of spinning machines, looms and finishing machines », made the following machines for cotton factories according to Sommer: willow engines, blowing engines, spreading engines, carding engines, lapping engines, grinding machines, stretching frames, roving frames, fly-roving, bobbin jack frames, spinning machines, box organ mule's, throstles, as well as lacing and pressing machines, dandy-looms, winding and shearing machines etc. For the woollen industry, the plant made wool-spinning machines, preparing machines, shearing machines modelled on the latest English patents and all the machines needed for spinning mills for worsted. Hitherto, worsted which was made of special Merino wool had to be imported from abroad. Now thanks to these spinning

[45] « Alles ist mit der höchsten Volkommenheit und Nettigkeit erbaŭt, wie er nur immer in der ersten Fabrikstadt Grossbritaniens sein kann ». SOMMER J.G., *Die Gewerbsmaschinen-Fabrik zu Harzdorf bei Reichenberg*, in « Jahrbücher des bömischen Museums », vol. I., p. 453, Prag. 1830.

machines it could be made in Bohemia. Apart from England, up to that time it had been made only in France and Saxony. All the machines were made of iron supplied by iron works in Bohemia. As early as 1829, this plant was supplying machinery to factories in Tannwald and Jablonec (Gablonz) in Bohemia.

Sommer went on to say that in the Liberec factory run by Edward Thomas and his brother James, which was a workshop for the production of larger machines and motive-power engines,[46] were made steam engines, steam central heating, water wheels, mills, English fulling machines, combining and washing machines for cloth, cylinder printing machines for printing in one, two and three colours, such as were used for printing cloth in the best English factories. Also made here were pumps, water supply equipment, equipment for bleacheries and fulleries, dyeworks, equipment for gas lighting, for foundries and hammer mills and for rolling mills for sheet metal, hydraulic presses and suction and pumping machines.[47] Edward Thomas and Thomas Bracegirdle remained at Liberec and Starý Harcov only for a few years, but in those few years they made a great number of machines. Up to 1835, the plant at Starý Harcov made 336 different machines for cotton factories, from mule-jennies and power looms to shearing and other machines with which nearly all the factories in the Liberec region and in other parts of Bohemia and Moravia were equipped.[47a] It also made machines for the manufacture of worsted in Vienna and for the production of silk yarn at Gorice near Trieste. In 1833, the plant employed 125 workers.[48]

Edward Thomas soon decided to transfer his Liberec factory to Prague however. We know that in 1829 he had wanted to establish his factory in that city but had come up against obstacles. In 1832, however, he moved his factory to Karlín (Karolinenthal), a suburb of Prague, where he had purchased a three-storey building which had been used as a spinning mill and established a workshop

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46 Hallwich H., *Reichenberg und Umgebung*, pp. 517-518.

47 Nožička J., *Z počátku strojírenství* . . ., p. 41.

47a *Die hundertjährige Geschichte* . . ., p. 74.

48 Vrbová Pavla, *Hlavní otázky vzniku a vývoje českéhp strojírenství do roku 1918*, (The Principal Questions of the Origin and Development of the Czech Machine-Building Industry up to 1918), pp. 33-34, Prague 1959.

for the production of larger machines and motive-power machines, as well as his own iron and copper rolling mills.[49] Two reasons are given for Edward Thomas's decision to move his machine-building plant from Liberec to Karlín. One was that Prague was better situated. It was in the centre of Bohemia and therefore communications were better in all directions. The second reason, connected with the first, was that Thomas bought the iron he needed from Czech iron works which were a long way away from Liberec so that transport was much more costly. Even after the transfer of his Liberec plant to Karlín, he remained the joint owner of the machine-building factory at Starý Harcov until 1835 when the two partners parted company. Edward Thomas expanded his plant at Karlín and, from 1835, the workshop at Starý Harcov became the property of Thomas Bracegirdle alone. It was run from 1835 to 1839 by his son James who was born in Leeds in 1819. After his break with Edward Thomas, Thomas Bracegirdle decided to build a new plant at Jablonec (Gablonz), an hour distant from Liberec, which was to be one of the most modern machine-building plants.

Edward Thomas's plant was outstanding: up to 1835 it produced 10 steam engines which were installed in textile factories, in the iron works at Nový Jáchymov, at mines at Rychnov (Reichenau) and at chemical works in Prague as well as in his own machine-building plant. They were low pressure steam engines and their boilers were imported from England. Apart from steam engines, this plant made steam boilers for bleacheries and dye-shops, also steam central heating for several cotton-spinning mills, steam drying equipment for textile factories, water wheels, double-lever callenders, iron plunger and lifting pumps and hydraulic presses. An article published in the journal *Mittheilungen für Gewerbe und Handel* in 1835 [50] spoke of the merits of Edward Thomas, who had brought newly invented machines to the country and improved older ones so that the plant kept pace with progress made in England in the machine-building industry. With this in mind, Edward Thomas

[49] Fuchs M. und Günther A., *Die ersten* . . ., p. 238.
[50] *Ueber Maschinenwesen* (M.f.H.G.) Jg. I., pp. 517-518, Prag 1835.

made study tours of countries where the machine-building industry was highly developed. In the winter of 1838-39, he made one such trip to Belgium, England, Scotland and Ireland which he himself described.[51] After what he saw, particularly in England, he came to the conclusion that Czech industry needed the improvements he had seen there, both in the machinery with which textile factories were equipped and the equipment used for mining and in the iron industry. It is interesting that, apart from what he saw in England, nothing especially impressed him. In his opinion, Belgium was better equipped than Germany, particularly as far as the coal mining industry was concerned. But he emphasised that there both machinery and experts were from England. It is also of interest that he wrote that he found nothing special about John Cockerill's works.[52] On the other hand he saw a great deal in England. He was greatly impressed by Maudslay's engineering works in London where he admired the locomotives and 465 h.p. steam engines, steamers and cranes. All this had such an effect on him that he either made drawings himself of the best machines he saw there or purchased them, for he wrote that « their use in machine-building made industrial production in all branches better and easier ». Thomas also obtained the plans of what were then the best lathes, planing machines, drilling machines, riveting presses, machines for cutting cylinders, milling cutters, cranes and so on. A great impression was made on him by the Guest Iron Works where 14 blast furnaces were in operation and another two were under construction. There were 10,000 workers employed at this plant. At other iron works he also saw the latest equipment for blast furnaces, puddling furnaces and rolling mills. All this showed him how much ought to be constructed in Czech iron works, and he obtained plans for complete works with rolling mills and noted the entire production process with all its advantages and shortcomings. Among textile factories, he admired the Orels cotton mill at Stockport near Manchester with its 48,000 spindles and 1000

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[51] *Maschinenwesen in Böhmen*, in « Mittheilungen für Gewerbe und Handel », (M.f.G.H.), vol. III., Prag 1839, pp. 86-89.

[52] « . . . selbst John Cockerill's Etablissement, so betuetdent es im allgemeinen erscheint bietet im Einzelnen nights bedeutendes », (M.f.G.H.), vol. III, p. 87.

power looms, driven by two steam engines. In Leeds he looked over the flax spinning mills of Mr. Marshall, where one mill was equipped with 30,000 spindles. While visiting Mr. Loosen's workshop for the production of flax spinning machines, he noted particularly all the machines for the preparation of flax for spinning as well as the spinning machines themselves and the whole process for the production of flax yarn.

From what Thomas included in his article we can see that he was well aware of the shortcomings of Czech industry. Indeed flax-spinning here was underdeveloped and the first machine-operated spinning mill had only come into being a few years earlier.

And what about the iron industry? It is true that the first attempts to use English discoveries had been made in 1830, when the Viennes banker Solomon Rothschild sent Professor Riepl of Vienna Polytechnic to England on a study tour. Professor Riepl not only made new findings there but brought back with him three English masters of puddling furnaces, David Evans, David Thomas and William Jones, to introduce puddling methods at the Vítkovice Iron Works.[53] These works had been producing rolled rails for the Northern Railway since 1837. From then on it was no longer necessary to import rails from England for they were made at these works on the English pattern. This was at almost the same time as Edward Thomas visited England. He made good use of his visit, and particularly of everything he saw in England connected with the iron industry, as soon as he returned. In the years between 1838 and 1842, he received an order to build a modern rolling mill at Stará Huť near Beroun. This was one of the largest and oldest iron works in Bohemia. The rolling mill that Edward Thomas built was linked with a puddling works and the cost of these works amounted to what was then a considerable sum of money—nearly a quarter of a million gulden. The cast iron for the parts of the machines was supplied by the iron works itself, but the cylinders were purchased in England. The rolling mill had 26 cylinders and was powered by two huge water wheels measuring 6.3 metres in diameter and an output of 100 HP. In the furnace building which

[53] JANÍČEK J. and KRUTIŠ I., *British Inventions* ., pp. 23-24.

measured 100 × 20 metres, there were 7 welding and 6 puddling furnaces. It was the most modern rolling mill in the whole of Austria and was built according to the English model. Its operation was in the hands of two English experts, the Whitehouse brothers from Staffordshire.[54] After 1843, Thomas supplied the first large lathe for the Wallenstein Iron Works at Sedlec, and in 1847, he himself became the owner of a small iron furnace near Benešov.[55]

The works of Edward and James Thomas at Karlín were undoubtedly the biggest machine-building plant in Bohemia in the first half of the 19th century. Up to 1846 the works produced fifty-two 842 h.p. steam engines and, together with the Luz and Dobbs works at Brno, made practically half of all the steam engines produced in the Czech Lands and 29% of all those produced in the whole of Austria.[56] Of course this was far from being the only work done at this large plant. In 1850 it was combined with another machine-building plant in Prague which had been established later, also by two Englishmen, Ruston and Evans. In 1869, this enterprise was transformed into the Prague Engineering Stock Company (Prazská strojírenská akciová společnost). After further mergers and combining with various engineering works in the second half of the 19th century and in the 20th century, it became part of the giant Škoda engineering concern. It is true to say that Thomas's machine-building plant was the oldest works in this concern.

As I have already mentioned, Thomas Bracegirdle built his new machine-building plant in 1835 at Jablonec. According to pictures of the factory and plans dating from the year 1837, it must have been an outstanding plant for its time: The main factory building consisted of three floors. On the ground floor the heaviest machines, such as lathes and drilling and cutting machines were installed and here too was the huge shop where the machines were assembled. On both upper floors there were locksmiths' and joiners' shops. The plant had its own forge, tinsmiths' shop and foundry. It em-

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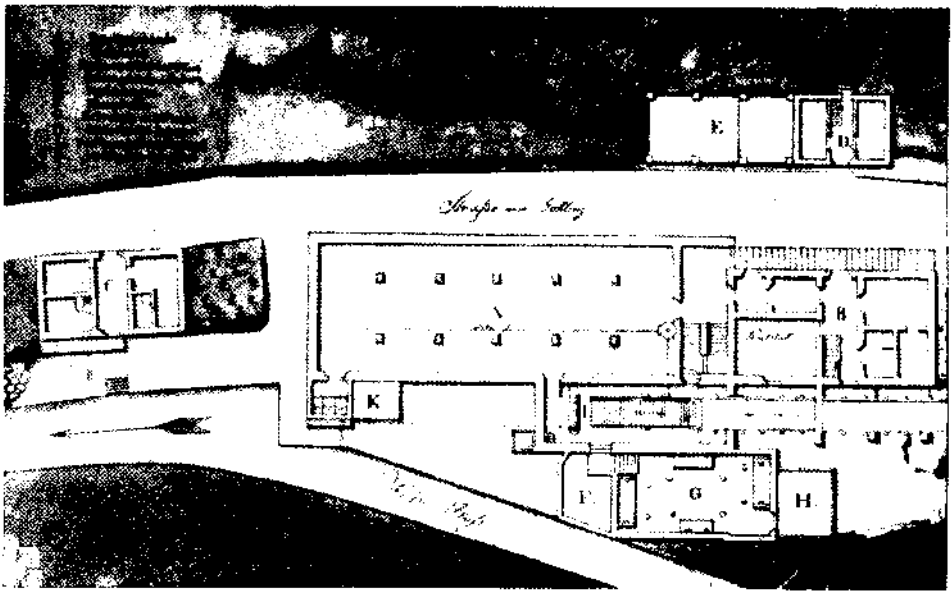
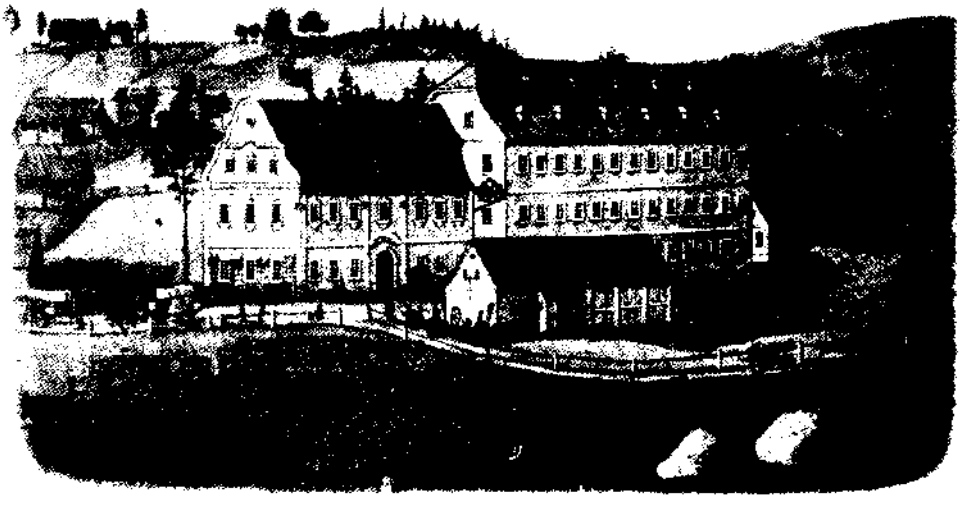
54 Kořán Jan, *Z dějin českého železářství v počátcích kapitalismu,* (From the History of the Czech Iron Industry in the Early Stages of Capitalism), « Sborník pro hospodářské a sociální dějiny (SHSD), II, pp. 133-134, Prague 1947.

55 Vrbová Pavla, *Hlavní otázky* . . ., p. 37.

56 Purš J., *Použití parních strojů* . . ., CSCH), 1954, p. 472.



The plan of Bracegirdle's Machine Building Factory at Jablonec (Gablonz) 1837. The picture was made by Roman Pfeiffer.



Bracegirdle's Machine-Building Factory at Jablonec (Gablonz) 1837. The picture was painted by Roman Pfeiffer.

ployed blacksmiths, locksmiths, carpenters, joiners and unskilled labourers. In 1840 there were more than 170 people working here.[57] All the shops had steam central heating, while the machinery was driven by a huge water wheel. It appears that Bracegirdle calculated that the use of water power was cheaper for him and that he could use the steam engine that had been installed only when the water level was low or in times of necessity. This plant was then producing the most up-to-date English machines for cotton, wool and worsted spinning mills and for textile factories in general and not in Bohemia alone, for it made the entire machinery for the cotton-spinning mill of the firm of W. and D. Moline in Lublyana and supplied the machinery for the cotton-spinning mill of Hofer and Stief at Rammesdorf near Vienna. Special emphasis was placed on power looms which were made here and which were improved by Thomas Bracegirdle in 1839. In 1841, Thomas Bracegirdle constructed a new carding machine which could be used in spinning mills for wool, cotton and silk.[58] In addition to these machines, the plant made Dandy-looms, sizing machines, warping machines and shearing machines with which the big textile factory of Porges Brothers in Prague was equipped.

In 1843, Thomas Bracegirdle decided to move his machine-building factory from Jablonec to Brno, the biggest centre of the woollen industry in the Czech Lands. Perhaps he was prompted to take this step by his close links with the big Brno factory-owner Offermann. The new machine-building plant of Thomas Bracegirdle and Son then came into being. The plant grew from year to year. To begin with it made machines only for the textile industry, but it soon went over to the production of steam engines, water wheels, cranes and equipment for gas works, mills and rolling mills. For this reason the factory's own foundry, puddling shop and rolling mill were built. In 1845, this factory constructed

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[57] Dr K.-G., *Die K.K. landesbefugte Maschinenfabrik des Herrn Th. Bracegirdle zu Gablonz in Böhmen* », in « Zeitschrift für und über Österreichs Industrie und Handel », Jg. III, 1840, Wien. The author of the article was Dr Kreutzberg.

[58] *Die hundertjährige Geschichte der Ersten Brünner Maschinen Fabriksgesellschaft in Brünn von 1821 bis 1921*, p. 76.

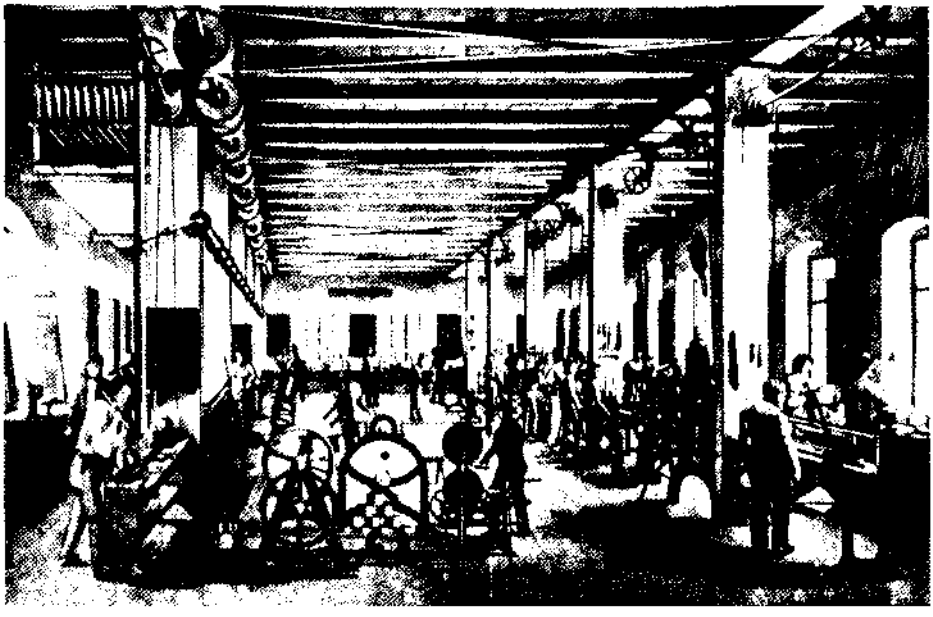
equipment for the Brno gas works and the same year, the engineer of the works, George Topham, patented his saw which could be driven by water, steam or other sources of power, by means of which it was possible to saw through up to 12 deal planks at once, using less power than was necessary for driving other saws.[59] In 1847 the production of weapons, particularly rifles, was started at the plant. Thomas Bracegirdle remained in regular contact with his native England, introducing all new English discoveries into his factory. As can be seen, he also persuaded such English experts as George Topham to join him. At the end of the 1840s he was employing from 300 to 350 workers. Thomas Bracegirdle died at Brno on January 22 1865. In 1872, his factory was combined with that of Luz and Dobbs to become « The First Brno Engineering Works » (První brněnská strojírna), one of the largest engineering plants in the Czech Lands.

In addition to Edward Thomas and his brother James, Thomas Bracegirlde and his son James, who owned and ran the first big engineering plants in the Czech Lands, mention should also be made of other Englishmen who came to Bohemia in the first half of the 19th century and who had a considerable influence in laying the foundations of this important branch of industry, without which modern industrialization would have been unthinkable. Among the most outstanding were David Evans from Nottingham and Joseph Lee. These English mechanics came to Prague at the beginning of the 1830s. They first worked in the machinery shop of K.B. Breitfeld's textile factory where machines were not only repaired but very soon constructed as well. And it was not only a matter of textile machines. It was here in the Breitfeld and Evans workshop that one of the future great entrepreneurs of the Czech engineering industry,Čeněk Daněk,[60] learned his trade. In 1834, David Evans and Joseph Lee obtained permission to establish their own machine-building workshop in Prague, where they began production of

[59] *Ibid.*, p. 80.

[60] Kořán Jan, *Výrobní prostředky českého průmsyslu v prvé polovině 19. století*, (Means of Production of Czech Industry in the First Half of the 19th Century), in « Sborník pro dějiny přírodních věd a techniky », p. 16, Prague 1954.

The workshop on the ground-floor of Bracegirdle's Machine-Building Factory at Jablonec (Gablonz) 1837. The picture was painted by Roman Pfeiffer.



The workshop on the first floor of Bracegirdle's Machine-Building Factory at Jablonec (Gablonz) 1837. The picture was painted by Roman Pfeiffer.

power looms for bobinet. This type of loom was invented in England in 1809 and and its export was strictly forbidden. Soon, however, they started to produce other machines, too, even steam engines and agricultural machines, such as threshing machines.[61] In the 1860s, Evans's factory was combined with that of Čeněk Daněk in Karlín and so another great engineering works came into being. After various mergers in the second half of the 19th century and in the 20th century, this works became part of the giant *Českomoravská Kolben Daněk* concern. So it is true to say that the machine-building workshops of Edward Thomas, Thomas Bracegirdle and David Evans are among the oldest works within the three biggest Czechoslovak engineering concerns, Šoda, ČKD and the First Brno Engineering Works.

Of course, in addition to these important works, smaller ones also came into being in Bohemia. In 1847, Schnabel listed a total of 21, of which 7 were in Prague and 2 at Karlín which was a suburb of the capital city, and 6 were in the Liberec region.[62] This shows that at the end of the first half of the 19th century, two industrial areas, Prague and its surroundings and the Liberec region, had been established in Bohemia. In Prague and its suburbs, which then had about 500,000 inhabitants, textile production was concentrated — there were spinning mills, the largest factories for cotton printing and from 1832 also important machine-building plants. The Liberec region was not only an old-established textile area but, from 1829, an important centre of machine-building, too. It is, of course, interesting that in addition to these two large industrial areas, there were also smaller machine-building workshops established by Englishmen. For instance there was Richard Holmes's workshop at Nejdek, the machine-building shop of L. Thomas at Kraslice (Grasslitz) in north-western Bohemia and James Park's machine-building workshop at Beroun in central Bohemia.[63] Schnabel ended his study of 1847 by saying that the most important machine-

61 KREUTZBERG K.J., *Skizzirte Übersicht . . .*, p. 118.

62 SCHNABEL G.N., *Betrachtungen über die Manufaktur-Industrie Böhmens*, in « Encyklopädische Zeitschrift des Gewerbewesens », p. 591, Prag 1847.

63 *Ibid.*

building plants in Bohemia were established by foreigners, in particular by Englishmen.[64]

The production of textile machines naturally resulted in considerable changes in the textile manufactories or in the establishment of new spinning and weaving mills equipped with machinery. Kreutzberg, in his study, cited many figures for the year 1835. According to him, the number of cotton spinners in Bohemia fell from 40,000 at the beginning of the 19th century to a mere 2,000 in 1835, but with the help of spinning machines production rose 150 fold.[65] Cotton yarn to the value of 7,300,000 *gulden* was spun. One of the most important spinning mills, that of the firm of Kastner and Richter at Luby (Leibitschgrund) had 85 spinning machines with nearly 20,000 spindles and employed 400 workers. For the weaving of cotton at that time, 75,000 looms were in use in Bohemia and there were over 100,000 people working in this branch of production. The firm of Hanke and Sons at Lochovice (Lochowitz) had 100 power-looms and 70 dandy-looms in operation and employed 300 workers.[66] There were 140,000 workers employed in the Czech cotton industry at that period and annual production was to the value of 24 million *gulden*. This trend of development continued until the middle of the century. When after 1840 the Austrian cotton industry had a leading position on the Continent, having more spindles than there were in the lands of the German Customs Union (Deutcher Zollverein),[67] Bohemia played a considerable part in this. According to statistics for 1848, there were in Austria, leaving out Hungary and Lombardy, 167 cotton spinning mills of which 81 — that is to say half — were in Bohemia.[68] The biggest of these, belonging to the firm of Tetzner and Sons at Červený Hrádek (Rothenhaus) employed 410 people. In the 81 cotton spinning mills there was a total of 1,944 spinning machines with

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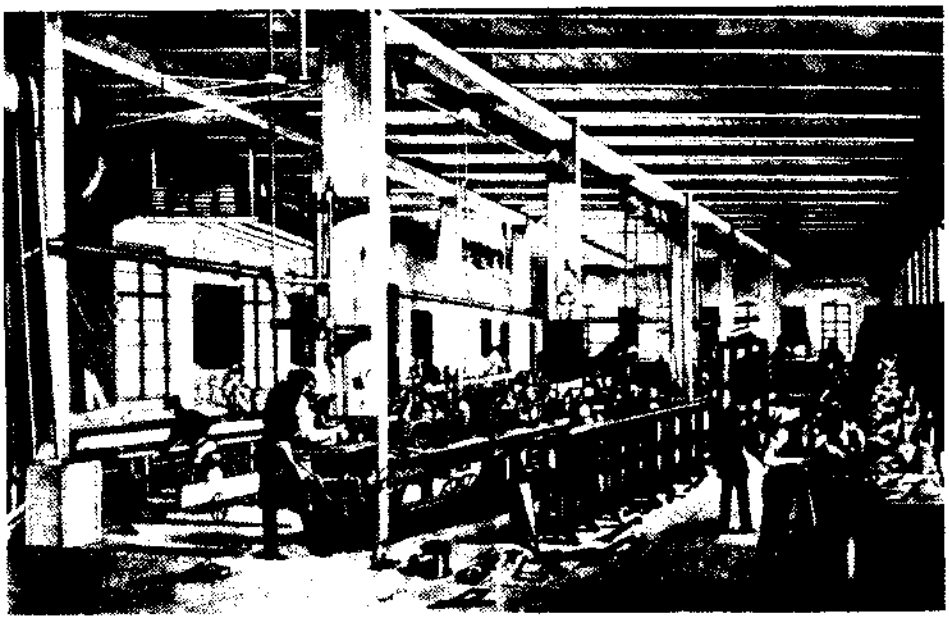
64 « In der That sind auch die bisher bedeutendsten Maschinenfabriken in Böhmen meist von Ausländern, vorzüglich Engländern gegründet », *Ibid.*, p. 589.

65 KREUTZBERG K.J., *Skizzirte übersicht . . .*, p. 85.

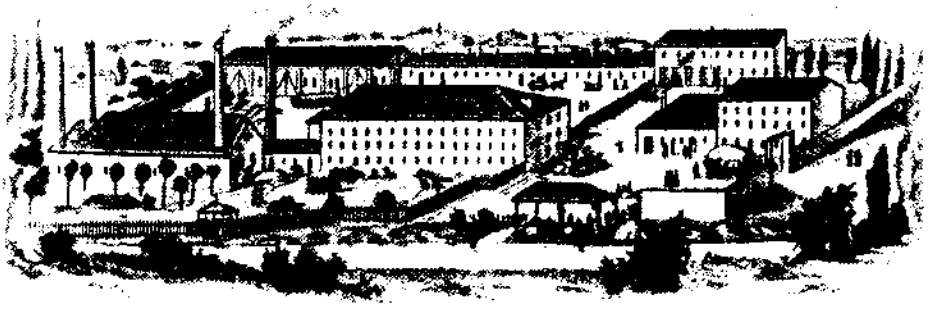
66 *Ibid.*, p. 90-91.

67 BRUSSATI ALOIS, *Oesterreich am Vorabend des industriellen Zeitalters*, in « Die Wirtschaftsgeschichte Österreichs », p. 140, Wien 1971.

68 *Tafeln zur Statistik der österreichischen Monarchie für die Jahre 1847-1848*, II, Tafel 4, p. 28, Wien 1853.



The workshop on the second floor of Bracegirdle's Machine-Building Factory at Jablonec (Gablonz) 1837. The picture was painted by Roman Pfeiffer.



Bracegirdle's Machine-Building Factory at Brno (Brünn) 1851.

458,740 spindles and they employed 8,284 people. One of the largest cotton mills in Bohemia — that of Benedict Schroll and Sons — employed over 3,000 people in 1848.[69] What industrialization meant for cotton spinning in Bohemia can be seen from the fact that in the principal cotton area in the Liberec region 82.9% of all the spinning mills were factories and 95.8% of the total number of machines and 98.3% of total production were concentrated in them.[70]

The import of raw cotton to Bohemia, which between 1821 and 1830 amounted to an average of 39,000 tons per year, had increased by the period 1841-1850 to 215,000 tons a year, that is by five and a half times.[71]

Closely connected with the cotton industry was cotton-printing which was also an important branch of industry in Bohemia, and its development went hand in hand with progress in industrialization in the first half of the 19th century. It was an old branch of industry which already existed in Bohemia in the second half of the 18th century when these workshops were usually attached to cotton spinning and weaving mills. What the introduction of machines for cotton printing meant for the development of productivity can be seen from data from the year 1843 which show that two printers and three labourers, with the help of a printing machine, could produce as much as was formerly produced by 200 printers and 200 labourers.[72] According to statistics, at least 1,400,000 pieces of cotton cloth were printed annually in Bohemia. Of these more than half — 800,000 pieces — came from 15 Prague cotton-printing factories. One of the biggest was that of Porges Brothers at Smíchov — a suburb of Prague — which then employed

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69 LANGER E., *Firma* . . ., p. 142.

70 PURŠ J., *Použití parních strojů* . . ., ČSCH 1954, pp. 464-5.

71 PURŠ J., *Průmyslová revoluce v českých zemích*, (The Industrial Revolution in the Czech Lands), p. 28, Prague 1960.

72 *Technisches Wörterbuch oder Handelbuch der Gewerbkunde. Bearbeitet nach Dr. Andrew Ure's Dictionary of Arts, Manufactures and Mines* . . ., Prag 1843, II, p. 143. Quoted from TOBOLKA ZDENĚK, *Textiláci první průkopnici dělnického hnutí*, (Textile Workers, the First Pioneers of the Working Class Movement), p. 29, Prague 2nd edition, 1950.

550 people. This factory, which printed about 100,000 pieces a year, was part of a large textile plant which had its own weaving mill with 1,962 looms and employed about 4,000 people.[75] In 1835, it was estimated that cotton-printing brought Bohemia 14 million gulden a year and that some 22,000 people were working in this branch of production. The products were sold not only in Bohemia, but also in Moravia, Galicia and Hungary where no such works existed at the time.[74] According to statistics for 1846, Austria, which printed more than 2 million pieces of cotton cloth annually, was in third place in Europe surpassed only by England and France. Production in the Czech Lands accounted for more than 60% of this and the 1,262,000 pieces printed here were equal to half the production of France. This was more than the production of Prussia, Switzerland or Saxony.[75]

As in these two branches of production, industrialization in the first half of the 19th century also meant great changes in the production of wool. In 1796 in the Liberec region, Czech centre of this branch of production, there were about 30,000 people producing 35,534 pieces of cloth annually by the old methods. In 1832, after the introduction of machinery, when there were 850 spinning machines in operation with 51,000 spindles and 1,500 looms, as well as preparing machines, carding, cleaning, opening and other machines, 58,000 pieces were produced to the value of 4,710,000 *gulden*. This quantity was made by 8,985 workers. Formerly it would have taken at least 50,000 to make this quantity.[76] Until 1840 Austria was one of the greatest producers of wool in the world, and wool made up 20% of all its exports.[77] The Czech Lands were Austria's main producer of woollen cloth. The Brno region which, according to Brusatti, was responsible for 45% of this production, sold woollen cloth to the value of 13 million *gulden*, while the

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[73] KREUTZBERG K.J., *Skizzirte übersicht* . . ., p. 95.

[74] *Eine Stimme aus Böhmen über die neuesten industriellen und Merkantilischen Verhältnisse dieses Landes*, pp. 132-133, Leipzig 1846.

[75] HORSKÁ PAVLA, *Kapitalistocká industrialisace a středoevropská společnost*, (Capitalist Industrialisation and Central European Society), p. 48, Prague 1970.

[76] HALLWICH H., *Reichenberg und Umgebung*, p. 520.

[77] BRUSATTI ALOIS, *Österreich* . . ., p. 140.

Liberec region earned another 10 million *gulden*.[78] According to Brusatti, the Brno firm of Soxlett with its 1,000 employees was the biggest on the Continent.[79]

Expressed in money, industrial production in the Czech Lands in 1841 represented more than 220 million *gulden*. Bohemia was responsible for 64.2% of this and Moravia and Silesia for 35.8%. In Bohemia alone in 1846 there were 539,700 people employed in industrial production.[80]

It is then possible to state that developments in the Czech Lands in the first half of the 19th century were quite similar to those in Belgium which, according to Mokyr « underwent a process of rapid industrialization in the first half of the nineteenth century, emerging in the 1840s as the most industrialized country of the Continent ».[81]

I have attempted to show that in the first half of the 19th century the Czech Lands also underwent an important period of industrialization and that even then they were « beginning to industrialize, imitate or borrow from the accumulation of skills, techniques, experiences, liquid capital and institutional innovations of these more advanced nations ».[82] The Czech Lands in the centre of Europe, with an old tradition of craft production and large domestic industry, were in the first half of the 19th century an important territory as far as industrial production was concerned. Only thus can we understand the words of an English traveller who said in 1830 that « Bohemia can feel flattered that it can be for the Continent a little England ».[83] And it is in this spirit that we should understand the words of Johann Wolfgang von Goethe when he said of Bohemia that it was a « continent within the Continent ».

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78 Horská Pavla, *Kapitalistická industrializace* . . ., p. 47, states that these two areas were responsible for half of all woollen production in Austria.

79 « . . . die Firma Soxlett in Brünn galt in dieser Branche mit 1000 Beschäftigten als die grösste des Kontinentaleurope », Brusatti A., *Österreich* . . ., p. 140.

80 Purš J., *Průmyslová revoluce* . . ., p. 21.

81 Mokyr Joel, *The Industrial Revolution* . . ., (JEH), XXXIV, pp. 365-366.

82 Rondo Cameron, *Banking and Economic Development*, New York, 1972, p. 3.

83 « Böhmen . . . von dem schon im Jahre 1830 ein durchreisender Engländer sagte, dass es sich schmeicheln darf, für den Continent noch ein Engländ im kleinen zu werden . . . », in *Eine Stimme aus Böhmen* . . ., p. 1.

It is undoubtedly to the credit of the many Englishmen who came to Bohemia and Moravia in the first half of the 19th century that they made a considerable contribution to this process of industrialization. The establishment of modern machine-building plants to produce the machines England had given to the world they ensured that in the first half of the 19th century the Czech Lands became industrially important. The influence of the English industrial revolution on the Continent would have been incomplete without its effect on Bohemia and Moravia.