

# THE TRANSFER OF MINTING TECHNIQUES TO DENMARK IN THE NINETEENTH CENTURY

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This paper presents main trends in the transfer of minting techniques to the two Danish mints in Altona and Copenhagen in the nineteenth century. Altona was until 1864 the second largest city in the Danish King's realm. Today it is a suburb of Hamburg, Germany.<sup>1</sup>

The nineteenth century was a period with significant changes in minting techniques. Coin production became almost fully mechanized during the century, and it is reasonable to talk about a general industrialization of coin production in Europe. The changes did not only apply to the striking of the coins and the introduction of steam power, since almost all production stages were altered. An extremely important development in the very last years of the eighteenth century and generally in the nineteenth century was the introduction of die hobbing – that is die copying – and the striking of planchets in a collar with convex dies, which improved the quality of the now completely identical coins considerably. The two Danish mints were in the early nineteenth century among the first mints in the world to implement the new coin striking technique, and in the first third of the century they were among the technically most advanced mints in the world.



Fig. 1. The mint in Copenhagen circa 1860-1873. To the left is the mint's main residential building, the one in the back is the mint's main administrative building and it also contained the mint master's apartment. Coin production took place in a long building behind the administrative building, and that building was organized according to the sequence of the different production stages. The building to the right was not part of the mint. The Royal Library, Copenhagen.

<sup>1</sup> Relevant references to archives and literature can be found in Märcher 2010. The present paper is a short summary of some of the arguments unfolded in this dissertation.

Coins have been produced in the Danish capital for 500 years (Fig. 1), and a mint still exists in Copenhagen. Because of its advanced technique in the first third of the century, the nineteenth-century mint in Copenhagen was of international importance, and several foreign mint employees visited it. A new mint was erected in Copenhagen at the beginning of the century. It was the third of the industrialized, primarily steam driven mints, which were built and exported from the last decade of the eighteenth century by Matthew Boulton (1728-1809) in Soho just outside Birmingham, Great Britain.<sup>2</sup> The first of these steam driven mints was the one in Soho, the next was set up in St. Petersburg, Russia, and in operation from around 1807. The third was exported to Copenhagen, and it was in operation from around 1809. The fourth was the Royal Mint in London from 1810. Only four of these advanced steam driven mints were built in Europe. This took place before and during the Napoleonic Wars and before the development of the notable Uhlhorn coining press in Germany in 1817, which would eventually change coin striking forever.<sup>3</sup>

Important parts of the new minting techniques that came from Soho to Copenhagen were around 1810-15 successfully implemented at the mint in Altona by Danish mint employees. This was an extraordinary achievement, and generally little attention is paid to the fact that the new striking technique with collars and convex dies could be effectively adapted to the older hand driven screw presses (Fig. 2).

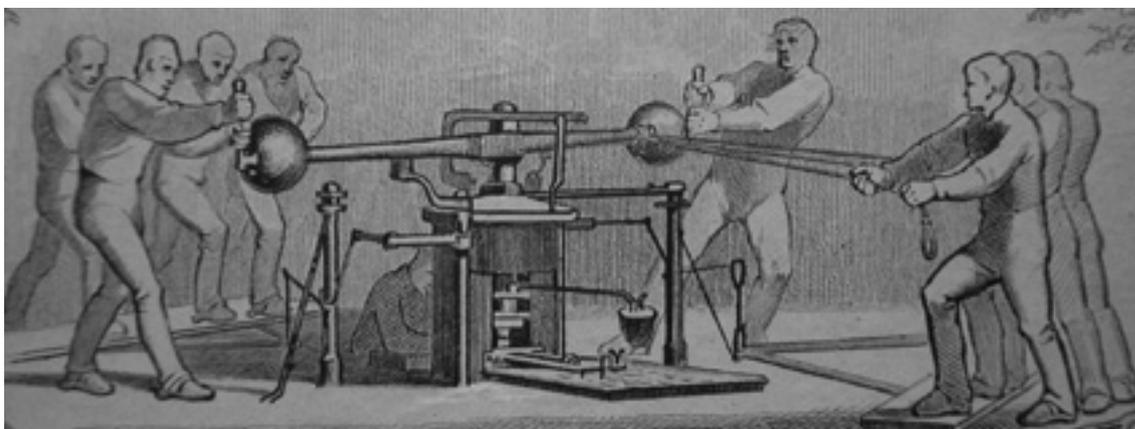


Fig. 2. Hand driven screw presses were used in Altona 1771-1855/56 and in Copenhagen until around 1808. The drawing is probably from the 1840s, and it was used on receipts issued by the mint in Altona. See Märcher 2006.

The mint in Altona was erected in 1771 and was closed in 1863. Throughout most of this period it played an important role in Northern European trade and payments (Fig. 3). Huge amounts of gold and silver coins were struck in Altona for the international market. The customers were primarily merchants, merchant bankers and other businessmen from Hamburg and Altona. They often functioned as commission agents, especially for companies in London, Amsterdam, Berlin and St. Petersburg. Hamburg had one of the most significant European markets for precious metals, and large quantities were melted down or coined. There was only a small unimportant mint

<sup>2</sup> See Doty 1998.

<sup>3</sup> About the Uhlhorn press, see e.g. Cooper 1988.

in Hamburg in the first half of the nineteenth century, and it was destroyed in the great city fire in 1842. Hence, the mint in Altona undertook most of the coin production, which was needed to facilitate the international trade in Hamburg. Great Britain used Hamburg as a port for its export of industrial products to the European market, and Great Britain bought lots of grain, wool and other raw materials for the emerging British industry from Russia, Prussia, and other areas. This placed Hamburg – and the mint in Altona – in the very centre of the vast, mainly east-west going, streams of precious metals.

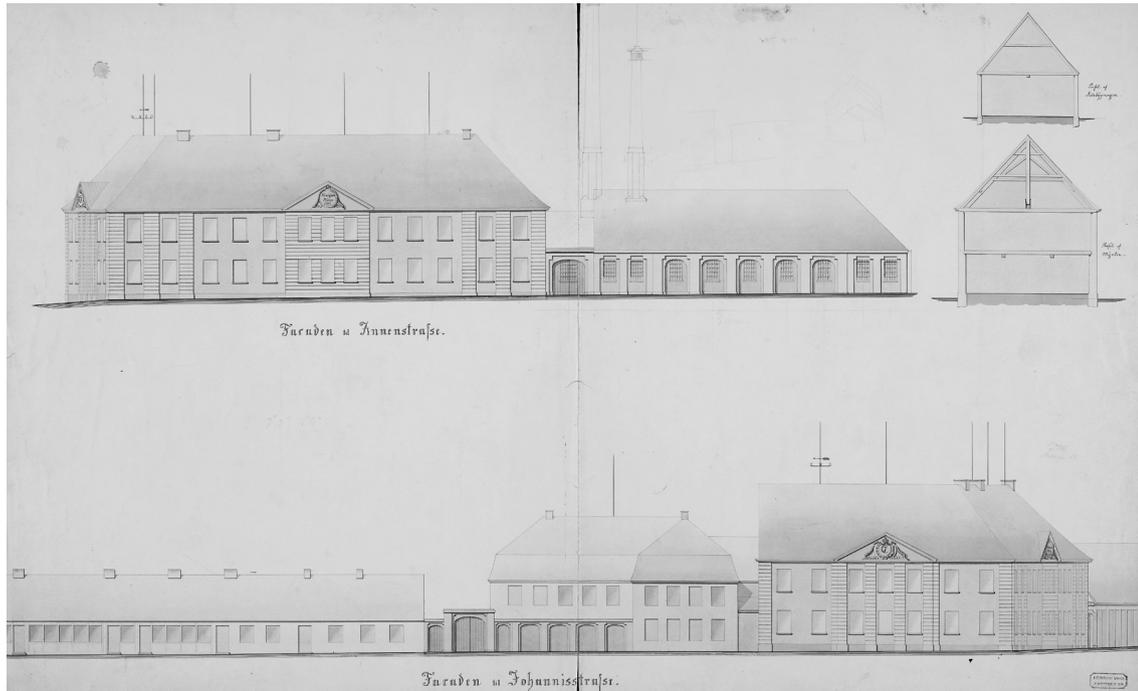


Fig. 3. Architectural drawing of the mint in Altona from 1770-71, probably by the architect Gottfried Rosenberg (1709-1776). The drawing, which is in colour, was used during the rebuilding in 1855-56, and this explains the added chimneys. The Royal Collection of Coins and Medals, The National Museum of Denmark.

### The transfer of minting techniques

It is reasonable to talk about an import or transfer of techniques to Denmark, because the Danish mints did not have mint engineers among their different employees, as for example the mints in Berlin, London, Paris or Stockholm. Consequently, very little innovative work was done at the two mints in the nineteenth century, and almost all new techniques and bigger or more advanced machinery were imported, primarily from England and Germany. The two mints became aware of new techniques through employees, who travelled to and/or corresponded with foreign mints. Almost all new minting techniques transferred to Denmark had been seen at work in foreign mints by Danish mint employees, before they were tried in Denmark. It is a general trend in the industrialization of Denmark that few inventions were made in Denmark and that the new techniques and the first machines came from Germany or Great Britain.

The Danish mint employees were often able to copy tools or minor imported machines, as for example simple adjusting equipment or milling machines. They did not build more advanced machinery. Figure 4 shows an early milling machine, which was probably built by one or two gifted Danish mint employees in Kongsberg, Norway, at the end of the Napoleonic Wars – just before Denmark ceded Norway to Sweden in 1814. The one or two mint employees used the new English machines at the mint in Copenhagen as a model.



Fig. 4. Double milling machine from the nineteenth century; probably built 1813-14 in Kongsberg, Norway. Norwegian Mining Museum, Kongsberg. Photo by Frode Sæland. See Cooper 1988, p. 194.

The mints had obvious reasons to be interested in new techniques: improvements of the business economy and the quantity and quality of the coins. The initiative and intensity in implementing or searching for new techniques changed over time and was affected by internal reasons, for example worn-out equipment, or external reasons like wars or the development of important techniques.

### Rebuilding

New techniques were often implemented when the two mints were rebuilt, and this happened three times in the nineteenth century. As part of the planning of new mints, Danish mint employees were sent on study tours to foreign mints. The import of an almost complete mint to Copenhagen from Boulton in Soho around the year 1806 is a special case, which included several problems, especially the English export legislation and the troublesome relationship between Denmark and Great Britain during and after the Napoleonic Wars. In the 1790s the Danish government knew about Boulton's new minting techniques from the coins produced in Soho and from Danish government officials in London. However, it took more than fifteen years before the rebuilt and advanced mint consisting of new English machinery was fully operational in 1810 (Fig. 5). Its machinery was set up in Copenhagen, primarily by English craftsmen and a few Danish mint employees, who had been trained in Soho to operate the machinery. The Danish mathematician and professor of Astronomy Ole Warberg (1759-1821), who closed the deal with Boulton and became mint master at the new mint in 1810, had stayed for several years in Great Britain, and during his stay he learned about the many new techniques included in the working processes of the advanced, steam-run and extensively mechanized mint. The steam-run machinery replaced the previous horse- or man-powered rolling, planchet shaking, edge rimming, punching presses, coining presses, other machines, and also the old striking technique without collar and convex dies.

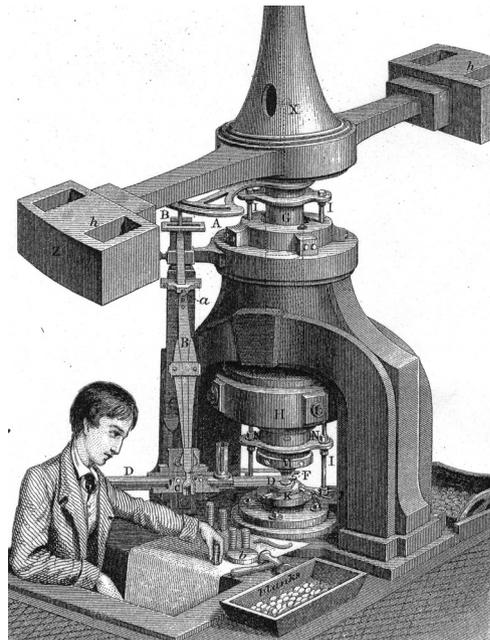


Fig. 5. Steam-driven coining press of the Boulton type at the Royal Mint in London. The same type was used at the mint in Copenhagen c. 1809-60s. Illustration from Ansell 1870, p. 52f.

As mentioned, parts of these new techniques were transferred to the mint in Altona at the end of the Napoleonic Wars. However, the old and generally busy mint in Altona was driven by horse and man power until the 1850s, when the worn-out and now – after European standards – outdated mint was rebuilt and equipped with new techniques. A steam engine and a big rolling mill for silver were bought in Berlin at Freund's machine works. This company cooperated with and had manufactured several machines for the mint in Berlin. From different study tours, several Danish mint employees knew the big and efficient mint in Berlin, to which the Danish mints had good connections. The rolling mills at the Berlin mint were a success, and this was the main reason for choosing Freund's machine works, but there were also two other reasons. There were few alternatives for the Altona mint, and there was an important family connection, because the eminent mint master J.F. Freund (1785-1857, mint master 1819-56) in Altona was actually an elder brother of the Freunds in Berlin.

Other mints were visited in relation to the rebuilding of the Altona mint in the 1850s; significant were study tours to the mints in Utrecht and Brussels. The Dane E.D. Ehlers (1812-93) had a degree in engineering and travelled to Utrecht to study the more than twenty new coining presses (Uhlhorn presses) that were being set up there, especially to strike copper coins for the Dutch colonies. The end result for the mint in Altona was that a couple of big Uhlhorn presses were bought from the Uhlhorn factory in Germany. At the mint in Brussels Ehlers studied the melting works, which were new and after French design. It used iron crucibles instead of graphite, e.g. plumbago, crucibles and the design of the ovens was different. Essential parts of the melting works in Brussels were copied and set up in Altona with vital help from the Brussels mint. The mint in Altona rebuilt in 1855-56 was impressive with lots of modern equipment, but the investment ended as an economic tragedy, since the mint lost almost all its business because of the international monetary crisis in 1857. The mint was closed in 1863, just before the war of 1864 in which the Kingdom of Denmark lost the two duchies Schleswig and Holstein, which included Altona.



Fig. 6. Early twentieth-century photograph of the mint in Copenhagen 1873-1923 taken by Frederik Riise (1863-1933). The building still exists at *Herluf Trolles Gade 11*, but one or two supplementary storeys were added after 1923. The Royal Library, Copenhagen.

After the war, only the smaller, now worn-out and outdated mint in Copenhagen was left in the small Kingdom of Denmark. A new mint was needed; it was built at the beginning of the 1870s (Fig. 6), and many valuable machines came from the Altona mint that was dismantled in 1863. The process of rebuilding included study tours to a few German mints, and as usual the Berlin mint was the most important foreign mint for the development of Danish minting technique. In Berlin the Danish mint master learned new central techniques for adjusting and sorting the planchets, which resulted in new investments. An internationally very successful sorting machine – the Seyss machine (Fig. 7) – was bought from the Austrian inventor Seyss & Co. in Atzgersdorf just outside Vienna, and a couple of adjusting machines were bought from Anton Hubert's machine works in Munich.

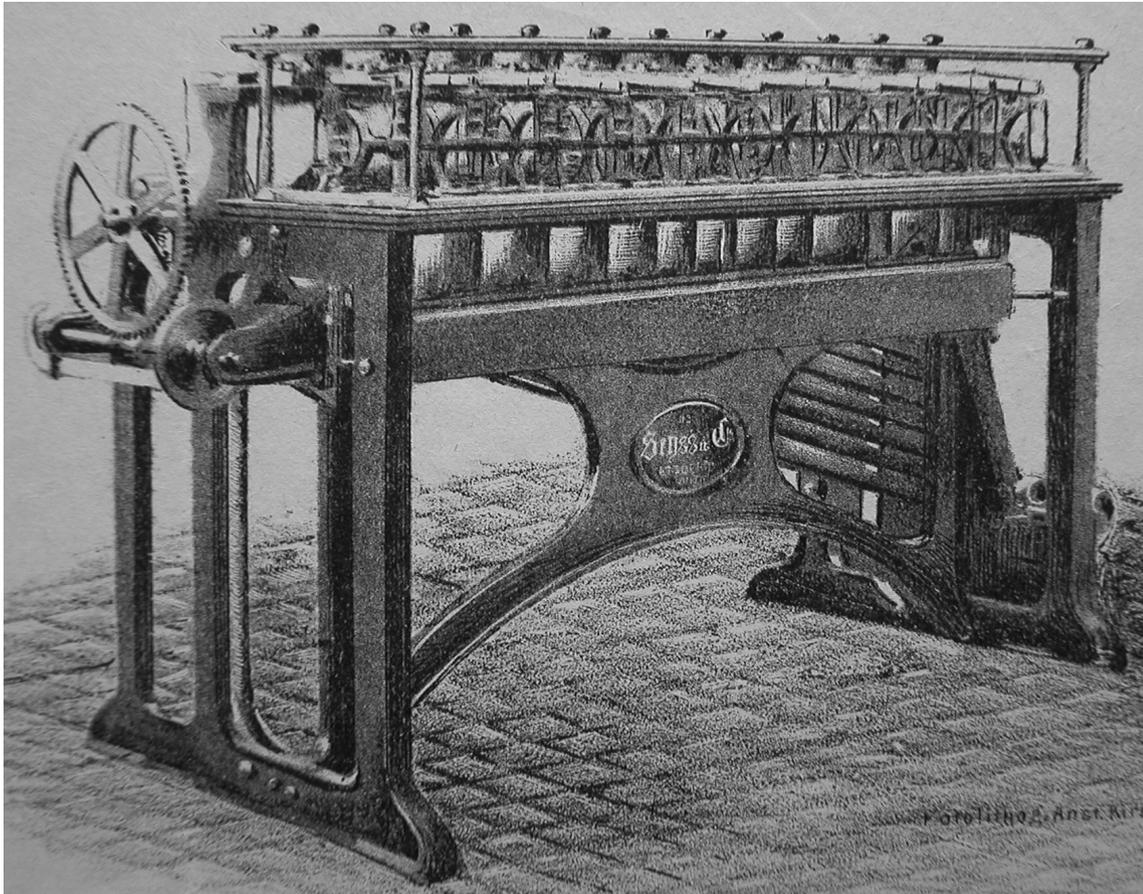


Fig. 7. Planchet sorting (weighing) machine from Seyss & Co. Ten automatic scales could sort forty or more planchets per minute. Danish National Archives, The Royal Mint, The mint in Copenhagen, 1873.

### New inventions

Sometimes new inventions were so essential that the two mints invested in them, even though the mints were not worn out. This was, after a while, the case with the Uhlhorn coining press from 1817. Only a few Danish mint employees had seen them at work at different mints – especially

Berlin – in the 1820s and 1830s, before the first two were bought in the beginning of the 1840s. The Danish mint employees had been sceptical, because the first machines they had seen were a bit unstable and used a completely new technique, but when the Uhlhorn press from the 1830s clearly proved to be very efficient and reliable, it was acquired as the need arose. In total five Uhlhorn presses were imported, two for Copenhagen and three for Altona in the 1840s and 1850s. When the Altona mint was closed in 1863, its three Uhlhorn presses were transported to Copenhagen, where all five presses were used long into the twentieth century.

With regard to the chemical aspects of minting, the mint in Paris was always very influential. An amazing new assaying technique was developed around 1830 at the mint in Paris, especially by the chemist J.L. Guy-Lussac (1778-1850). The chemically skilled Dane P.R. Hinnerup (1803-68), who later became assayer (1830s-1860s) and mint master (1861-68) in Copenhagen, was quickly sent to Paris to learn more, and later on Ehlers learned about the new technique in the Paris mint laboratory, before it was gradually decided in the 1840s to implement the new technique at the two mints. Actually, Denmark was one of the last European countries to implement it, because Denmark waited until the market in Hamburg started recognizing the new technique as a base for trade with precious metals. The new, more accurate assaying technique based on modern chemistry with different acids and titration quickly made the old technique obsolete. The old one was, expressed in a simplified way, based on the melting of a silver sample with lead. This change in assaying was part of the chemical revolution of the nineteenth century, and also one of several examples of how medieval minting techniques were quickly replaced in the nineteenth century as coin production was mechanized and modernized.

### **Main trends in the transfers**

On the basis of the few given examples on transfers of minting techniques to Denmark in the nineteenth century, it is possible to draw up several main trends in the transfers, which in many ways follow the general pattern of the industrialization of Denmark.

The Danish mints did not have engineers developing machines or techniques, so all new techniques were imported. Danish mint employees regularly went on study tours to foreign mints, and almost all new techniques were studied in foreign mints before they were transferred to Denmark by learning or buying at foreign mints or machine manufactures.

Techniques were especially transferred to Denmark from Germany, and in this perspective the most important foreign mint was the one in Berlin. Techniques from England dominated in Copenhagen in the early and middle parts of the century, because almost an entire mint was imported from Boulton at the beginning of the century.

Besides the general import from Germany, certain mints were sometimes leading in specific areas or were newly rebuilt. This attracted the Danish mint employees. The many Uhlhorn presses in Utrecht and the new melting works in Brussels were studied, for example, before the Altona mint was rebuilt in 1855-56. The mint in Paris was leading in the chemistry of minting, and a couple of Danish mint employees were trained at the Paris mint laboratory, before they returned to and used their skills at the Danish mints.

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