The life and works of W. T. Odhner, part I

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Abstract

In spite of the importance of the Odhner pinwheel calculating machine (arithmometer) spread in hundreds of thousands of examples over the whole world, not very much is known about its inventor Willgodt Theophil Odhner (1845-1905) and the development process of the device. Probably the only western reference using primary source material is the Odhner history book written by Henry Wassén [46]. Very useful complementary information can be obtained in the Russian books of Apokin & Maistrov [48], [49] and Maistrov & Petrenko [53] but these seem to be quite unknown in the western world. The reference cited most often is the book of Martin [19], but this is based on secondary sources and contains lots of errors. Martin has been cited and interpreted so often that speculations and even errors have gradually become accepted facts. The purpose of the present work is to shed new light on the development history of Odhner's calculating machines using primary sources. Even though much material has been destroyed, several important letters of W. T. Odhner and his brother Sannfrid Odhner from St. Petersburg to their relatives in Sweden have survived. Much new and interesting printed material has also been found scattered in Russian and Swedish journals and newspapers.

Keywords: Pinwheel calculating machines, Odhner arithmometer, W. T. Odhner

1. Introduction

The state of calculating machine design by 1872 can be seen in a note appearing in The Manufacturer and Builder [7]. "If a reliable calculating machine could be manufactured to retail at a low price, say five dollars, with which addition, subtraction, multiplication, and division could be done, it would no doubt find a ready-sale, as all go-ahead business men want such a time-saver. In all wholesale establishments; in banks, government offices, commercial houses, publishing companies, etc., an easily operated calculating machine, simple in construction, reliable in operation, not easily deranged, and substantially made, would be a great desideratum. In looking over the models of calculating machines in the Patent Office last month, we saw none that answered the above description. Some of them were so complicated that it would take an engineer to run them, and a watch-maker to keep them in order, while others were evidently designed by men who knew nothing, practically, of the working of machinery; they having employed small wooden cams operating without friction rollers on sliding rods which would always stick fast; or, in other cases, strings were used to pull on wheels weighted on one side, and expected to return to their proper position by the action of gravitation, but which they never did, owing to friction, for which the inventor had made no allowance. Finally, every machine was out of order, and gave arithmetical results that would bankrupt the most successful business man in two turns of the handle."

Even though numerous calculating machines had been designed until 1872, only the arithmometer of Charles Xavier Thomas patented 1820 had some practical importance. However, it was very expensive and only 800 examples were made since the beginning of the serial production around 1855 until the death of Thomas in 1870 [4]. The production of Thomas arithmometers was thus quite slow and real mass-production of calculators was yet to come. About 1871 the young Swedish mechanic W. T. Odhner, who worked at Ludvig Nobel's mechanical factory in St. Petersburg Russia, had repaired a Thomas calculating machine and was then thinking about the possibility of constructing a better calculating machine than the arithmometer of Thomas [43]. Odhner was not able to construct a calculator satisfying all the needs mentioned in article [7], but solved many problems and was one of the first to mass-produce calculators.

The main sources on the life of Odhner are the books of Martin [19], Wassén [46], Apokin & Maistrov [48], [49] and Maistrov & Petrenko [53]. Martin was not a scientist and his book contains several errors. He seems to have had correspondence with Odhner or his children, and this must have happened before 1910, because he is unaware of the death of Odhner's son Georg in 1910. Wassén, who wrote the anniversary book on Odhner, was an anthropologist, and had at his disposal material of Odhner's family in Sweden. He interviewed Odhner's daughter-in-law Martha Odhner and foreman Eduard Kuikka, who had been working for Odhner since 1900. It is a pity that Odhner's son-in-law engineer Karl Siewert (brother of Martha Odhner), who started his activities in Odhner company in 1905 and acted as its manager in 1912-1917, was at that time employed by Olivetti in Milano and Wassén could not meet him. It is evident that Wassén did not have much time to write the book and by that time he also had to do his military service [45]. For some reason Wassén did not contact Valentin Odhner, who worked at the Odhner factory in 1889-1913 [11] and was still alive in Sweden. He would have been absolutely the best expert on the Odhner calculating machine by that time. Thus the book of Wassén is not as good as it could be, and many details remain to be investigated. The earlier book of Apokin & Maistrov [48] presents some interesting original documents. Many new sources are presented in its later version [49] and its chapter concerning Odhner with slight revisions has even been translated to English [3]. The third Russian reference [53] also contains material not existing in other books. The reference [10] is very important, because it is based on discussions with Odhner about his life. It seems to be much more reliable than the publicity material offered by Odhner factory.

The present author has been able to study about 20 survived letters of Odhner to his relatives in Sweden written between 1873-1905. Even though they consider mostly family relations, they contain important details about calculating machines as well. Of specially interest are several letters from 1878 concerning the first Odhner patent.

There exists much contradictory information about the life of Odhner. In such cases I have tried to found the most reliable alternative, but it is often difficult, because the publicity information of Odhner company is often incorrect. This might be partially caused by the well known priority dispute between Odhner and Baldwin about the invention of the pinwheel system.

Russian dates are given in the old style and corresponding dates of the modern gregorian calender, if available, are put in parentheses. The original language of all letter citations is Swedish.

Special thanks are due to Lennart Odhner for letting me study the letters of Odhner. A. P Romanov at the National Library of Russia in St. Petersburg has been very helpful in supplying the Russian material, although some of it has been found at the library of Helsinki University in Finland.

I have also obtained useful information from Peggy Kidwell at the Smithsonian Institute and Katsunori Kadokura. Sergei Frolov has helped me in understanding old-fashioned Russian text.

2. The Odhner family

The family of W. T. Odhner is described in [23], [37], [38], [39] and there are quite a lot of priests and scholars in the family. The theoretic talents of Odhner were probably inherited from his father. Odhner's grandfather Pehr Odhner (1790-1857) was a priest interested in botany but also in practical issues like establishing schools and draining of seas in order to obtain more field to cultivate. The oldest child of his first marriage was Theophil Dynamiel Odhner (1816-1863), the father of W. T. Odhner. From his second marriage Pehr Odhner got a son Aron (1833-1914) who became a successful businessman in Stockholm where he had a lamp store. Aron's son Valentin Odhner (1867-1956) became engineer and worked at the Odhner factory in St. Petersburg. Valentin Odhner was thus half-cousin and later also son-in-law of W.T. Odhner. In addition to these Pehr Odhner had two more sons, the vicar Herrbed Odhner (1829-1891) and sea captain Ernst Odhner (1843-1869).

Theophil Odhner "was intended for the Ministry, and went through the college at Skara, but he was a practical, mathematical and inventive genius, and had no desire for the ministry. After his graduation he became a book-keeper, and afterwards a forester and surveyor. While surveying in Wärmland he became acquainted with Fredrika Sofia Wall, the daughter of Gustaf Adolph Wall, a land-owner near Karlstad. He was finally appointed amanuensis or chief clerk at the central surveying office in Stockholm" [23]. Theophil Odhner published a small lightning calculator booklet [25] to help to understand new measures with special emphasis on practical calculations needed by sellers and purchasers of grain. He "suddenly died at the age of 47 [should be 46] leaving behind him a poverty stricken widow and five young children, with a sixth to arrive three months later" [23]. His widow died eleven years later in 1874 in St. Petersburg while visiting her son W. T. Odhner.

Schotte [37] believes that Odhner's mechanical talents came from her mother's family and Sundin [39] that they came from the families of both parents. The mother "was a very intellectual and poetical woman and struggled bravely to bring up her children in the midst of much poverty" [23]. Odhner's uncle Arvid Wall was a wealthy man who owned iron-works, sawmills and foundries in Sweden and Finland. He acquired modern machines for his enterprises and was among the early users of telegraph and telephone. Odhner's younger brothers Hjalmar (1846-1936) and Sannfrid (1849-1895) were also technically talented. Hjalmar was lace-maker in Stockholm and was active to his end in constructing and improving lace-making machines. "He was honest and hardworking, but never very successful in business" [23]. Sannfrid worked as a mechanician in Scotland and St. Petersburg but also "wrote poetry continually" [23]. He also had businesses of his own in St. Petersburg [2] but they were not successful. The youngest brother Carl Theophil (1863-1918), who was born after the death of his father, inherited the Swedenborgian theologic interest of his grandfather. He emigrated to USA where he became leading figure of the Swedenborgian New Church in Bryn Athyn. W. T. Odhner would have preferred a practical profession also for his youngest brother instead of "speculative" theology "because Swedenborgian spirit hardly will feed him" [34].

It has been claimed by Odhner company that the inventor John Ericsson, who received fame in US civil war, was a relative of Odhner's [19]. The brother of Odhner's grandfather Pehr Odhner was

married with the sister of Ericsson, which means that strictly speaking Ericsson is not a relative of Odhner's. On the other hand the mother of the industrialist Sven Wingqvist (1876-1953) who invented spherical ball bearing in 1906 and founded the famous SKF ball bearing factory at Göteborg in 1907, was Pehr Odhner's granddaughter and thus Odhner's cousin. Another grandchild of Pehr Odhner and half-cousin of W. T. Odhner was captain Ernst Wallgren (1864-1950) who had several patents, the most important of them a distance measuring instrument for artillery.

3. Willgodt Theophil Odhner

Willgodt Theophil Odhner was born in Westby, parish of Dalby in northern Wärmland province, on August 10th, 1845. The home was poor, but the marriage of his parents was "exceedingly happy" [23]. By the time of Odhner's birth, his father was inspector of merchant Dickson's forests and took care of their timber sales. Besides of this he had rented a farm in the neighbourhood. In 1848 the family moved to Karlstad but Theophil Odhner's occupation there is unknown [37]. Willgodt attended the school of Karlstad for two years in 1854-1856. After that he moved to Stockholm to work at the lamp store of his uncle Aron Odhner. Soon he changed to a more challenging position as an employee of the instrument maker Georg Lyth. Lyth made maritime and mathematical instruments for example planimeters. In 1859 also Theophil Odhner moved with the family to Stockholm where he announced in the address calender to be a revisor [38] and in the following year 1860 he got the post at the central surveying office. On September 3rd 1864 Willgodt Odhner matriculated at the Royal Institute of Technology in Stockholm to study practical mechanics and mechanical technology of available three alternatives. His father had died in the preceding year but his uncle Aron Odhner helped him and the rest of the family [23]. Odhner was promoted to the third year's class in 1866 [46], but never finished his studies [16], [37], [45]. The course that he did not pass was the construction of roads and bridges which was in that time compulsory even for mechanical engineers [45]. Maybe Odhner did not consider the subject interesting, maybe the reason was lack of money, but certainly he did not need to build any roads and bridges during his later life. It is probable that he left the school during spring 1867 [45]. In the records of the congregation [36] Odhner calls himself strictly as a "mechanician" and later in Scandinavian address calenders of St. Petersburg [1], [2] "mechanician and manufacturer" but in commercial brochures [43], and the one cited in [19] he appeared as an engineer.

It is difficult to estimate the level of education at the Institute of Technology. At least Odhner learned to make technical drawings which he needed later while preparing the construction drawings and patent applications for his inventions. It is probable that Odhner learned the secrets of serial production in practice.

The financial situation in Sweden was quite bad in 1868 and it was difficult to find a job. Thus Odhner decided to try for his luck in St. Petersburg. He arrived to St. Petersburg by steamboat at the age of 23 without knowing a word of Russian language and having only 8 roubles with him [10]. According to congregation records [36] this happened in 1868 even though many secondary sources claim that it took place in 1869 [23], [44], [47]. The church records are generally very reliable and we can trust on them. Ships from Stockholm to St. Petersburg sailed via Turku, Helsinki and Vyborg. The last ship left Turku heading for St. Petersburg on October 30th 1868 before the sea was frozen, whereas the first ship in 1869 sailed on 28th April, so we can say that Odhner arrived in St.

Petersburg 1868 in August - October. From the harbour Odhner walked to the Swedish consulate where secretary Damberg, who later became consul, arranged him a job at the small mechanical workshop [10] of Macpherson [44] at a salary of 1.1 rubles a day [10]. After some months Odhner changed to work for his countryman Ludvig Nobel on the recently started rifle conversion project [10]. The time that Odhner worked for Ludvig Nobel was very important for Odhner's later career and that is why we dedicate a special chapter to Nobel's factory.

Figure 1. W. T. Odhner at the age of 33 in 1878, © Tekniska Museet, Stockholm

4. Ludvig Nobel's mechanical factory.

The history of Ludvig Nobel's mechanical factory has been described in the anniversary volume [54], and more general books which also consider his other enterprises, have been written in Swedish by his daughter Marta Nobel-Oleinikoff [22] and in English by R. Tolf [40]. Ludvig Nobel (1831-1888) was, as his better known younger brother Alfred Nobel, son of the inventor and factory owner Immanuel Nobel, whose most important innovations were sea-mines. As a businessman he was not successful and was bankrupt in Sweden 1833 and again in St. Petersburg 1859. Ludvig's formal education consisted of three years of school in Sweden before the rest of the family emigrated in 1842 to St. Petersburg where Immanuel Nobel had some years earlier fled his creditors. After that Ludvig was instructed by tutors in engineering and languages in 1842-1850. He also had to work at his father's workshop founded 1842, which had grown to be a factory, moving from one position to another learning how to run a business. The products included mines, cannons, wheels, steam engines and metal window frames. In 1854-1855 there were as much as 1000 employees, but after the peace of the Crimean war in 1856, the military orders ended and it was not possible to manage the rapidly grown factory. Immanuel Nobel returned to Sweden in 1859 and the creditors turned over the management of the factory to Ludvig in 1859, but sold it in 1862. Already in the same year Ludvig first rented and soon bought the Isherwood repair shipyard, which also contained small brass and iron foundries. It was situated on the Finnish or Vyborg side of Neva river near the Finnish railway station. He expanded the plant gradually into a large mechanical factory and showed extremely good technical and managerial skills. In 1862 the size of the factory lot was 3500 square meters, which was enlarged to 13800 in 1872 and 20800 in 1882. The total volume of the buildings grew at the same time from 9700 cubic meters first to 18200 and then 77400. The first great success of Ludvig Nobel were cast-iron artillery shells, which replaced the German ones made by Krupp. 920000 shells were produced until 1878. The factory also produced wheels, gun carriages and cannons. In 1867 the Russian government decided to convert 100000 old-fashioned muzzleloader rifles to breechloaders using the design of Sylvester Krnka and awarded this contract to Nobel. In 1872 he was also brought into a rifle production project with a fifty-fifty basis with Peter Bilderling who had rented for 8 years the state rifle factory at Izhevsk about 2000 kilometers east from St. Petersburg. Nobel factory supplied the machine tools and engineering expertise to this old fashioned plant. The initial order was 200000 rifles of Berdan type, but many more were made.

Ludvig Nobel designed many machines and work processes to make the production efficient. For example, he is said to have designed 75 different lathes for fabrication of breechloader rifle [40], but it is evident that he could not have done that alone. Altogether 1000 machines for the rifle production were made at the St. Petersburg factory [22]. It is quite probable that also Odhner and many others participated in this development work, even though Odhner's name is not mentioned in the above sources. Anyway in 1874 Odhner writes that after a couple of weeks he is going to plan and draw a new and grand rolling-mill, which will cost nearly 1000000 [27]. At Nobel factory Odhner saw how a modern well managed mechanical factory operates and this must have been of utmost importance.

Ludvig Nobel also took care of the welfare of his workers in many ways; the work day was shorter than it used to be in Russia, he built houses and recreation facilities for his employees, refused to employ children and even had a profit sharing program. He was awarded several high medals by

the Russian state for his merits even though he remained a Swedish citizen all his life. Nobel also wrote several papers in Russian for the journal of Imperial Russian Technical Society and took some patents (hermetically sealed hubs of wheel axles with diminished lubrication demand ca. 1865, continuous petroleum distillation 1882 together with Alfred Törnquist).

Cannons, carriages and rifles were assembled on the principle of interchangeable parts, a system that demands extreme accuracy of the parts. This was difficult in Russia because the workers were unskilled and the education and technical level was far below European standards. The emancipation of serfs in 1861 provided lots of cheap labour, but it was totally unused to the requirements of the factory life. Ludvig Nobel tried to hire as many Swedes and Finns as possible for supervisory positions and to train the employees in order to fulfill the new work requirements. In 1868 or 1869 Nobel recruited W. T. Odhner and his first project consisted of participation in the recently started rifle conversion project [10] and this also confirms that Odhner's arrival to Russia took place in 1868. Nobel did not appreciate diplomas and final examinations [22] and thus it did not matter that Odhner had not completed his studies. He advanced soon to be a foreman and chief foreman [10].

Nobel's first wife died in 1869 and he went to Sweden for some time. In the following year 1870 he married again and made a wedding trip of 9 months to southern Europe and north Africa. Meanwhile the factory was taken care by Ludvig's older brother Robert (1829-1896) who completed the rifle conversion project. The climate of St. Petersburg was not good to Ludvig's health and he often traveled in Europe with his wife and some of the children. Even though the mechanical factory of Ludvig was profitable, he earned still more money from the Izhevsk rifle factory, which made him a rich man. From ca. 1872 Harald Berg Sr. acted as the manager of the St. Petersburg factory staying in the position until 1886. The chief engineer specialized in artillery orders was Mihail Ya. Belyamin with whom Nobel had been acquainted to at the Imperial Russian Technical Society and who had been working for Nobel since the start in 1862.

In 1873 Ludvig sent Robert Nobel to Caucasus to buy walnut for riflestocks and he was given 25000 roubles for the purpose. On the way he heard stories about the oil rush in Baku and decided to use Ludvig's money to buy some parcel of oil-rich land and a small oil refinery instead of riflestocks. After a trip back to St. Petersburg to explain to Ludvig how the "walnut money" was used, Robert returned to Baku where he concentrated on technological improvements of oil refinery. He built a new kerosene refinery, again with the money of Ludvig, in 1875. Ludvig visited for the first time Caucasus in the spring 1876 together with his oldest son Emanuel and became convinced about the future of oil business. While Robert as a chemist concentrated on the refinery, Ludvig planned the logistics of the distribution and storage of kerosene. Instead of horses, donkeys and camels the petroleum was then transferred to the refinery by tubes ground in the earth in 1876. In the same year the first 300 barrels of Nobel's kerosene arrived at St. Petersburg. The first tanker ship in the world to carry the kerosene from the refinery was also the idea of Ludvig. Because no Russian shipyard wanted to build this tanker called Zoroaster, it was made in Motala, Sweden in 1877. Nobel also had difficulties with the Russian railroads and had to build himself tanker carriages and locomotives to pull them. In a very short time Russian kerosene of Nobel replaced the American alternative at the Russian market.

Kerosene brought much money, but demanded great investments. Ludvig owned alone the factory at St. Petersburg, but the oil business was too much for one man. By 1876 the business had already taken 450000 roubles of which 150000 had to be lent. After taking some loans from Ludvig's industrialist friends, the joint-stock company Nobel Brothers Petroleum Production Company (often

called Branobel) was finally formed in 1879. Its total capital at the beginning was 3000000 roubles, 1610000 of this by Ludvig Nobel, 115000 by Alfred Nobel, 100000 by Robert Nobel, 25000 by Mihail Belyamin and the rest by 6 other persons.

5. Odhner's first calculating machines

Somewhere in St. Petersburg worked also a Swedish founder called Fredrik Skånberg, who had first moved from Stockholm to Libau (nowadays called Liepaja in Latvia) where he married a local girl and moved with the family to St. Petersburg in 1862. It can be thought that Skånberg was also employed by Nobel, because Odhner fell in love with his daughter Alma (1853-1927). They were married on the Boxing Day of 1871 at St. Katharina Swedish lutheran church and for that purpose Odhner enrolled to the congregation a little bit earlier [36]. Two years later Odhner writes "when the priest and musicians were paid at the wedding feast, my funds were so small that if my mother-in-law during the return trip had not given to me 10 roubles, we could not have eaten bread with our coffee on the following day" [26]

The preceding quotation is quite describing. One of the main issues in Odhner's letters is money or more precisely the lack of money. He had a bad conscience, because he could not assist in any way his youngest brother Carl Theophil who was brought up by his brother Hjalmar and sister Anna [23]. Even though Odhner was a technical genius, he clearly was not a very economic character and had difficulties in paying the expenses of his family and later also the salaries of his employees. According to his letters the invention of a calculating machine was for Odhner a means of acquiring money and becoming wealthy.

There are many legends [46], [44] about how Odhner became interested in calculating machines at a young age. However, calculating machines were so rare at that time that it was not even easy to have any idea of the existence of a calculating machine. It is thus quite probable that a real interest arose in St. Petersburg even though Odhner had seen his father working with figures. There are two stories about that told by Odhner himself. According to material delivered by Odhner company for the bilingual book describing the products exhibited at Paris World Exposition 1900 "as a quite young engineer Odhner had in 1871 an opportunity to repair a Thomas calculating machine and then became convinced that it is possible to solve the problem of mechanical calculation by a simpler and more appropriate way" [43]. Year 1871 is probably imprecise because other dates in the same source are false, but otherwise the story appears to be trustworthy. The other story appears in the speech that Odhner gave about his improved calculator at the meeting of Deutscher Polytechnischen Verein on September 27th 1890 [20]. According to the speech in 1875 Odhner had read an article about Thomas arithmometer in Dinglers Polytechnisches Journal and thought it might be possible to construct a simpler calculating machine. The article was probably "Die Thomasche Rechenmaschine" of F. Reuleaux that appeared in Volume 165 p. 334-362. The two stories could be combined so that Odhner had to repair a Thomas arithmometer between 1871-1874 and for that purpose he read the article about it. At the meeting of a learned society Odhner wanted perhaps to stress his theoretical knowledge and did not talk about the repair. If the arithmometer did not belong to Nobel, he must have arranged the repair through his friends in the Imperial Russian Technical Society.

Ludvig Nobel knew several languages and at later stages of his life subscribed to several foreign trade magazines from which his secretary chose the most interesting articles for him to read [22] and

it is possible that his staff also had a possibility to study them. In any way, Odhner seems to have been unaware of Baldwin's calculator because it was patented in February 1875 [17] when Odhner was already working on his calculator project. It also took time before the patent was printed and information spread to Russia. If Odhner knew about Baldwin's invention, why did he make in his patent application of 1978 several claims that were rejected because they were earlier invented by Baldwin [13]. Odhner may have known about the pinwheel of David Wertheimber patented 1843 and resembling very much Odhner's pinwheel [4].

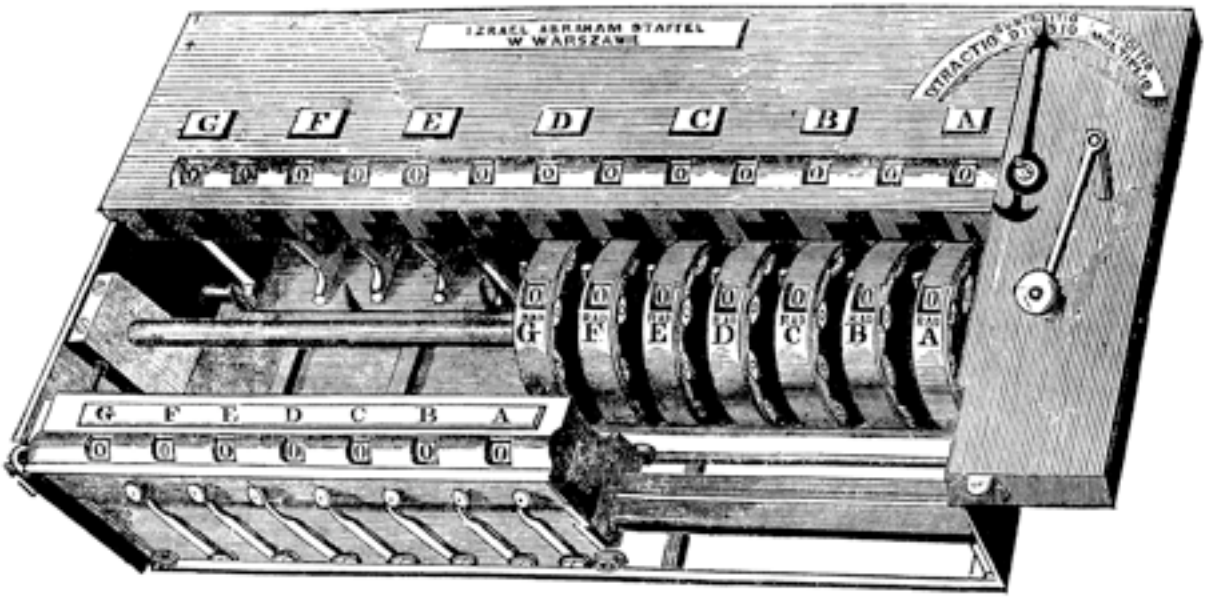
Franz Trinks who later bought the licence to produce calculating machines of Odhner's revised 1889 design suspects that Odhner may have used the calculating machine of Israel Staffel in his design. "Die [Odhner] Maschine, von der nur ein Stück gebaut wurde, ist der obengenannten Universal-Rechenmaschine von Staffel in mancher Beziehung so ähnlich, dass die Annahme naheliegt, Odhner habe sie gekannt und sie beim Bau seiner Maschine zum Vorbild genommen" [42]. Trinks must have held some correspondence with Odhner, but evidently he never asked about the details of the development history of the arithmometer.

Staffel was a watchmaker living in Warsaw, Poland being then a part of the Russian empire. Staffel's calculating machine was finished in 1845 after a work of ten years taking all the free time and a great part of his material resources [52]. It was presented at the expositions of Warsaw in 1845 and London in 1851 and it was awarded silver medal in both of them. The jury in London wrote in their report of 1852 that "the best machine of this kind exhibited is that of Staffel" [18] even though the arithmometer of Thomas was also exhibited. Staffel also presented his calculating machine to Russian Academy of Science in 1846. V. Ya. Bunyakovski and B. S. Jacobi studied the device and praised it in their statement [52]. They remarked that the calculator consisted of several identical simple parts, which could be serially produced by machines, so that the price of the the machine could be lowered. It would be very useful for institutions where long and precise calculations consisting mostly of multiplications and divisions had to be performed. The arithmometer of Thomas is not mentioned in the statement and it is evident that the referees did not know it. Staffel received a 1500 rouble state award for his invention, but there exists no information that it was patented. Evidently Staffel invented his calculating machine at a time when there still was no demand for them.

At the beginning of 1876 Staffel wanted to deposit his calculating machine at Russian Academy of Science in St. Petersburg. According to Staffel his calculating machine presents the first attempt to solve exactly by mechanical ways the arithmetical operations and could serve as a model for constructors of similar machines. He also wished that his invention would not be forgotten and the honour of inventing the first calculating machine would not be seized by any foreigner. The device was sent from Warsaw on January 13th 1876 and on February 9th the Academy of Science sent a letter thanking about the donation and told that the device was placed in the physical cabinet, so that it would be easily available [52].

As we shall see, Odhner's first calculator prototype was already finished at that time, but he may have seen and studied the printed description of Staffel's machine, which was in 1846 available both in Russian and in Polish [52], and used it in his work. Unfortunately this document has not been found. According to [21], relying on information supplied by London Times, in 1851 Staffel's calculating machine was placed in the Russian court, probably after the London Exposition. This must also have made Staffel's invention more known at St. Petersburg.

Figure 2. Staffel's calculating machine



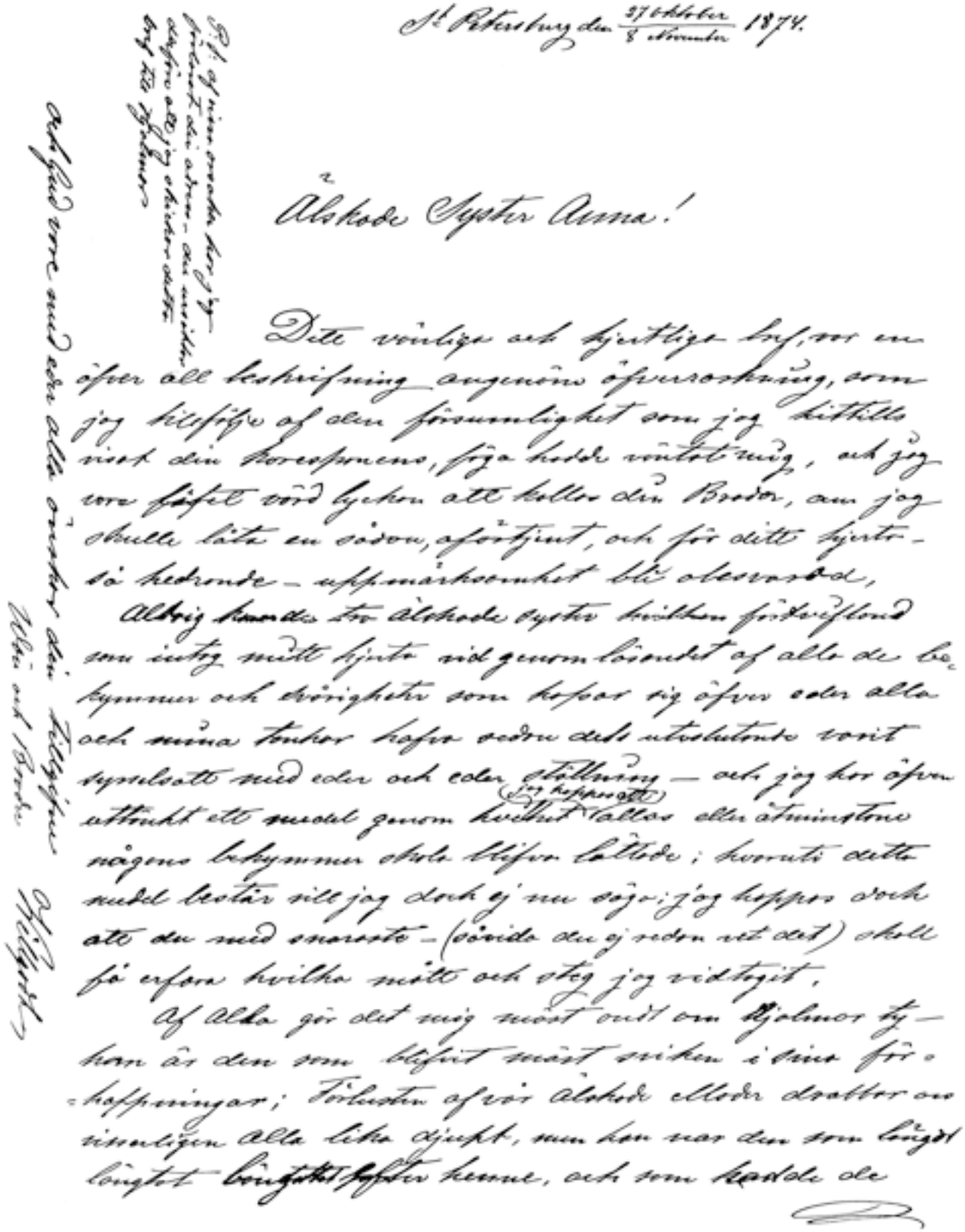
Staffel's calculator had a capacity of 13 digits and it also could draw square roots in addition to the usual arithmetical operations of addition, subtraction and division. It is interesting that this capacity later became a standard in pinwheel calculating machines of Odhner type. A picture of Staffel's calculator is presented as figure 2 to compare it with early versions of Odhner's arithmometer given in figures 35 and 36 of [19]. Trinks describes the calculator "Verlegbare Einstellscheiben waren auf einer gemeinschaftlichen Achse nebeneinander angeordnet. Die eingestellten Ziffern erschienen jeweils hinter Schauöffnungen an den Einstellrädern in einer geraden Linie. Ebenso verhielt es sich auch bezüglich der Ziffern im festen Produkten- und Umdrehungszählwerk. Für positive bzw. negative Rechnungsarten galt wie beim Antrieb der Leibniz-Maschine dementsprechend entgegengesetzte Drehrichtung der Kurbel. Beim Überschreiten der Leistungsgrenze ertönte ein Warnungssignal." [42].

We could also pose the question: Did Baldwin know about Staffel's calculator and did he use Staffel's ideas in his calculator. Besides the sources cited above, there must have been much more information about it in different magazines and and books concerning London Exposition.

The first hint in the survived letters of Odhner which may refer to calculating machines, appears in his letter to his sister Anna dated on October 27 (November 8) 1874. He writes that he had thought out a means by which he hopes to be able to lighten the [financial] troubles of all or at least some of

his sisters and brothers, but will not yet tell more about it [27], see figure 3. An indirect way of deducing the starting time of Odhner's calculator project is, however, to subtract the project duration time of 15 years, which Odhner himself reported in the first edition of his calculator instructions [5], from the finishing date. This duration has also been reported in [41]. Unfortunately the latter time is not known exactly but the first instructions were approved by Russian censors on May 16th 1890 and then the revised model of the calculator must have been ready. Odhner himself told moreover [8] at the meeting of Deutscher Polytechnischen Verein on March 30th 1889 that he still had some work to do to make his calculator perfect. Thus we can say that the calculator was completed at the second half of 1889 and by simple subtraction we can state that Odhner began his calculating machine construction in 1874. This coincides well with the letter cited above. It is interesting to note that the researchers of the Polytechnic Museum of Moscow also claim that Odhner started his calculator construction in 1874 [12] but their arguments are not known. The article [10] which appeared at the very end of 1903 claims that Odhner started his calculator construction 30 years ago, but we can think that this figure had been rounded upwards.

Figure 3. The first of the four pages of letter [27] to Anna Åhlin. When Odhner had written the sheets, he usually continued on margins in reversed order. Here the end of the letter with signature can be seen on the left margin. The referred part of the letter can be seen to the right of the signature.



It was not very easy to design a calculator at one's scant spare time. "To work from 7 in the evening to 8 in the morning [should evidently be from 7 in the morning to 8 in the evening] is not very nice for a newly wed poor man having a young and beautiful wife" [26]. Twelve or fourteen hours a day was a common workday in Russia but Nobel reduced it to 10.5 hours [40] but maybe somewhat later. Odhner's first child Alexander was born 1873. His mother had come to St. Petersburg to see the birth of her first grandchild and died there in 1874. The progress of Odhner's efforts was reported in the following article that appeared in St. Petersburger Zeitung on wednesday 10 (22) September 1875.

"**[Eine neue Rechenmaschine.]** Wir hatten Gelegenheit, eine Rechenmaschine ganz neuer Konstruktion kennen zu lernen und uns von ihrer praktischen Anwendbarkeit zu überzeugen. Die uns von ihrem Erfinder vorgestellte Maschine ist ein elegant gearbeitetes Kästchen von dem Umfang eines kleinen Cigarrenkistchens. Auf den Mechanismus können wir nicht wohl eingehen, wir dürfen aber konstatiren, dass in unserer Gegenwart Exempel aus allen vier Species mit grosser Schnelligkeit und Genauigkeit ausgeführt wurden. Der Erfinder ist jetzt mit Herstellung einer Maschine beschäftigt, die alle möglichen Berechnungen in den Grenzen von 999,999,999 auszufuhren im Stande sein wird. Mit diesen wenigen Worten bezwecken wir lediglich, Fachmänner auf diese interessante Erfindung aufmerksam zu machen und die weitere Prufung derselben anzuregen. Der Erfinder ist ein junger Schwede Namens Willgodt Odhner, der in der Fabrik von Rosenkranz auf der Wyborger Seite, Quai der Grossen Newa Nr. 25, als Techniker beschäftigt ist." [9]

According to the researchers of Moscow Polytechnic Museum, Odhner's first calculating machine was finished at the end of 1875 [12] and it must then have been just the device described in the preceding article. The arguments for that statement are again unknown.

Odhner's employment at Rosenkranz factory must have been of short duration and unimportant, because it is not mentioned in article [10] and obituaries [44], [47]. Rosenkranz produced copper and brass tubes and sheets and some products made of these. This product palette is not very challenging and it is possible that Odhner was temporarily employed by E. Rosenkrantz to install the rolling mill mentioned above or some other machine produced by Nobel. It is of course possible that he wanted to learn some special procedure that was not possible at the Nobel factory. Soon after the publishing of the article [9] Odhner was again employed by Nobel.

Even though explicitly not mentioned, it is evident that the computing capacity of the calculator described in the article was smaller than the capacity 9 of the forthcoming model. As Odhner used to increase the capacity at each stage by 1 (1876: 9, 1877: 10, 1889: 11), we could guess that this 1875 arithmometer prototype calculated with 8 digit precision. Because of the comparison to a cigar box, one may also think that the device was housed in a rectangular wooden (caviar?) box. The forthcoming model is clearly the one which Odhner calls his first calculating machine when he writes to his sister Anna the well known message [28], published in English in [46] and in German in [13].

"...aber das ständige und mühsame Arbeiten an meiner Maschine hat meine Zeit und meine Gedanken so in Anspruch genommen, dass ich keine Neigung verspürte, irgendetwas anderes anzufangen. Diese Sorgen sind jetzt jedoch vorüber, den meine erste Maschine ist fertig und in jeder Hinsicht gelungen. Es war meine Absicht, sie zur Physikalischen Ausstellung nach London zu schicken, aber ich habe es mir anders überlegt; denn ich hoffe, dass ich die Maschine weiter verbessern und noch bequemer machen kann, und ich möchte sie nicht der Öffentlichkeit verstellen, bevor sie ein Höchstmass an Perfektion erreicht hat; zweitens glaube ich nicht, dass ich auch nur den

geringsten Nutzen von ihrer Ausstellung hätte, wenn ich nicht gleichzeitig einige hundert Maschinen fertig zum Verkauf hätte; drittens wäre es unklug, sie zu zeigen bevor die Idee patentiert ist. Ich arbeite jetzt an einer neuen und in vieler Hinsicht verbesserten Maschine, die hoffentlich in einigen Wochen fertig ist und mit der dann das Geschäft hoffentlich anfangen wird." [13]

Odhner must have been quite excited when he wrote this message. It appears in the beginning of the letter, whereas he usually wrote about his calculators somewhere near the end. When one looks at the figure 35 of Martin [19] and compares it with the newspaper article and the letter cited, there is only one possible conclusion confirming the theory of Kadokura [13]. The "first" arithmometer with calculating capacity 9, which Martin claims to stem from the year 1874, is the one that was finished in 1876 and depicted in the newspaper article [9] and the letter [28]. There are several explanations for the errors of Martin. He had some communication with the Odhner family around 1904 [17], but then Odhner himself was old and sick, so Martin probably corresponded with Odhner's sons or son-in-law Valentin Odhner. It is even possible that he met Georg Odhner, who then studied electrical engineering in Berlin. Both Martin and members of the Odhner family often give non-correct information and in addition to that there might have been misunderstandings during the communication because the years 1874 and 1876 given by Martin seem to be the starting times of the constructions.

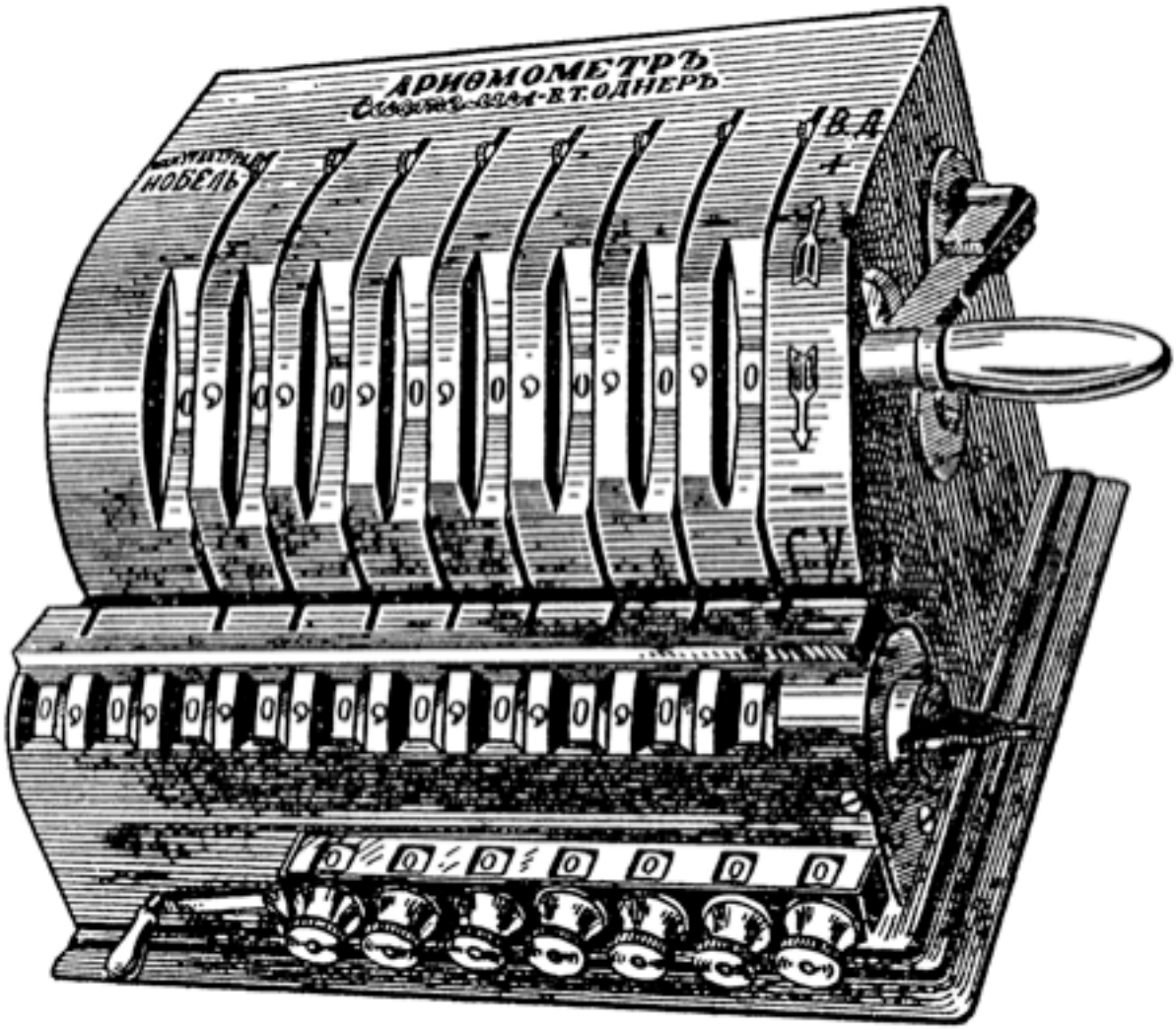
Odhner was a perfectionist striving for the best possible design and that is probably the reason, why Odhner called the 1876 model as his first calculator and did not count the prototype of the autumn 1875. It could have also been based too much on the ideas of Staffel or somebody else, and therefore Odhner could not call it his machine. It is also possible that Odhner used the pinwheels or some other parts of the 1875 prototype for the 1876 calculator so that the prototype did not exist any more.

Odhner's first machine was made by him personally during his spare time, but he tried to convince Nobel to start the production of the calculator. In a letter dated in June 1876 he writes: "My machine is so extraordinarily successful and good that it is not easy to imagine else than it becoming a very big business. After a month Mr. Nobel returns home, then the affair will be decided, and because I am almost sure that his intention is to begin the production at once on a large scale, so I believe in a couple of months to be able to get Victor a somewhat more promising job" [29]. His brother Sannfrid Victor Petrus was then living in Scotland, but arrived in 1877 to St. Petersburg with his family. After some time Odhner managed to arrange a job at the Nobel factory also for his brother.

The trip of Nobel mentioned in the letter was this time to Sweden [22], soon after the aforementioned visit to Caucasus, where he got acquainted with the oil business. After his return Nobel made a deal with Odhner for producing 14 calculating machines. The capacity of these was 10 instead of 9 of the "first" calculator. Odhner's brother-in-law Arvid Åhlin was then a sea-captain and happened to have a voyage to St. Petersburg, from where he wrote on May 30th 1877: "About the machine. It is a really ingenuous invention, and in my conviction it has a great future. Willgott has the one at home that he first made by hand, which therefore is not so fine and neat-looking as those he is now making at the factory, but still it is beyond my expectations... He is now making 14 machines which are nearly finished, and it is his intention to send them out in the world to be tested and inspected and by means of the newspapers to make the machine known to the world. Nobel has given Willgott the use of a small portion of the factory to work with his machine. Nobel and Willgott have made an agreement that Nobel shall carry all costs to see the business started and until then he is

paying Willgott a salary on the condition that when the business has started they shall share for better or worse and take one-half of the profits each... The reason why the going has been so slow at first is that in order to make machines profitably on a large scale, Willgott has had to design and make special machines for manufacturing each part. I was at the factory with him for four hours, and you can well imagine I had not a little pleasure out of seeing everything. I have reserved one machine for myself and also the agency for foreign sales" [46] [13, partially] These calculators finished at the later half of 1877 are machines that Martin [19, figure 36] claims to be from the year 1876. In the picture of Martin one can with some difficulty even read the cyrillic text "Arifmometr sistemy W.T. Odhner" behind the setting levers and "Mehan. zavod Nobel" on the left. The text can be seen better in a Russian picture of figure 4.

Figure 4. 1877 model of Odhner arithmometer made at the Nobel factory.



This series of 14 calculators is called in the following 1877 model. Obviously Odhner worked full time on the calculators and had his brother Sannfrid and maybe some others to assist in his work. It is interesting that Åhlin does not write anything about the 1875 prototype and it is not sure that it existed any more.

One month earlier in April 1877 Odhner himself wrote: ”Life is a steady fight against difficulties, and when one is overcome the other arrives, this experience I have got to know specially during the work with my machine. A thousand of difficulties I have conquered, and am now so far that I have my work finished and hoped to obtain a reward for my toil. However, now comes the inhuman war, everybody has time and interest only for those shocking affairs, and probably I must postpone the release of my invention until more quiet times arrive” [30]. This is the only letter where Odhner’s address is Nobel factory i.e. Odhner lived at an apartment of Nobel in the backyard of the factory. This is also the only survived letter with Nobel’s letterhead.

One of these difficulties was in the contacts with the managers of the factory. Even though Odhner evidently came well along with Nobel, Nobel had many other businesses and also traveled much so that the mechanical factory was lead by others. The relations of Odhner with the directors of the factory were quite bad.The project of making 14 calculators and some machines for manufacturing them was very challenging and the directors surely would have liked to use these resources in another way. They thought the calculator project took too much time [31]. In the autumn 1877 (five weeks before the winter interrupted the building of a bridge where Odhner’s brother Sannfrid got a new job) the situation had gone so far that Odhner and even Sannfrid were forbidden to arrive to the factory territory because the relations of Odhner with the director and most of the foremen were unfriendly [24]. It is possible that all of the calculators were not finished then, because at least one of them does not have the stamp of Ludvig Nobel on it [12]. By that time Nobel was for a long time traveling in Europe and spent christmas 1877 in Wien [22]. Thus Odhner was unemployed and had to make debt to finance his living. At this time he had two children to take care of, Alexander born 1873 and Alma (later married to Valentin Odhner) born in 1877. Earlier in 1877, Emilia the second child of Odhner died at the age of two years.

The war cited above was the 1877-1878 conflict between Turkey and Russia and this of course meant more military orders for the Nobel factory. Probably Nobel also began to think that the business potential of the calculators was not too good. In a letter dated in March 1878 Odhner writes ”As you of my last letter heard, I had written to Mr. Nobel to hear whether he, to continue the business with my machines would do some further sacrifices or not. His answer to this was, because of a number of other duties and enterprises, for which he in spite of his bad health is responsible, no. Because my machine according to my and almost every other person’s opinion is remarkably good and practical, and has a future ahead of it, so I could not leave the affair here but have during 2 months time made a fuss and mess to get some businessman to be associated with the affair. This has been far from easy because partly here exists no businessmen that have any idea of the value of an invention of public utility, partly one is afraid of showing too much of a thing before it is patented, and partly because of the war and weak conjunctures here is not even a smallest desire for speculation. After negotiating a couple of months with a few persons, and becoming quite tired, so to get rid of the affair at once and to be able to think about a new job, I have given the affair to a wealthy and as i believe particularly energetic local businessman a certain Königsberger, on the condition that he takes the patents and pays all expenses and afterwards divides with me the future profits. However, it was not

possible for me to get anything in cash. This would have been so welcome because I now am unemployed" [31]. The purpose of Karl Königsberger as a merchant was thus not to produce anything but to sell the invention as such. The first selling efforts after patenting the invention were directed to United States, but these were not successful. A representive of Königsberger succeeded in selling the licence to German Grimme, Natalis & Co to produce Odhner calculators for Germany, Belgium and Switzerland, but that did not happen until 1892.

Even though Nobel did not want to continue the production of calculating machines, he promised Odhner a special project at his factory but when he traveled away from St. Petersburg, his "masters" hired another Swede to do that. Odhner believed though that with patience he would get a better job and hoped every day to obtain one [31]. That job was offered at the expedition for producing state papers where Odhner started on the 1st of May 1878 [53] and staid for the following 14 years [10].

As a businessman Nobel knew that all projects are not profitable. He was for example a partner in Lupikko iron mine by lake Ladoga near St. Petersburg which brought considerable losses [22] but his investments on Odhner's calculator were not so great. It is evident that Odhner never paid anything to Nobel, but maybe Nobel got some of the 14 arithmometers, which he surely needed in his business. It is known that in December 1891 Nobel oil company (Branobel) already had 10 Odhner arithmometers [6] which was quite much at that time. Some of them might have been of the 1877 type.

6. The applicability of the 1877 calculator model

At the beginning of 1878 Odhner left one of his calculators to be refereed by the Imperial Russian Technical Society. He might have hoped to receive a state prize like the earlier Russian (in fact Polish but Poland belonged to the Russian empire) calculator inventors Slonimsky and Staffel had got. The minutes of the meeting of the second section of the society on 30th January 1878 [50] tell that Odhner presented there his calculator. It was decided that V. L Kirpichev and Mihail Ya. Belyamin should give a testimonial of the calculator and also compare it to other existing calculating machines. The referee report of Kirpichev [51] appeared in the May number of the notes of the society. Maybe Belyamin as a chief engineer of the Nobel factory did not want to participate in the refereeing process.

According to this interesting statement the same four basic arithmetic operations as with the Thomas arithmometer can be performed, even though the mechanism is different. Odhner arithmometer is much simpler with less different parts so that the price of Odhner's device will be much lower, the price being one of the reasons of the scarcity of calculating machines. Odhner's device, with the same capacity than the Thomas arithmometer, also demands much less space. The arithmometer is only the first prototype and it can certainly be improved, even though it is praiseworthy in its present form. One must also note that some of the defects of the device are caused by the fact that until now the machine has been made manually without any special machines for producing different parts. A final statement on all the details of Odhner's device can be given only after a long-time use, but at least following remarks can be made.

The durability of the revolution register clearing crank knob and the hook that moves the carriage is not sure.

Sometimes the dial wheels of either the result register or the revolution register (counter) stop halfway between two values and it is impossible to know which of the two digits partially showing in

the window is correct. The same defect appears also in Thomas arithmometer, but there you can jerk the device slightly to obtain a correct outcome in the window. This does not work in Odhner's machine, but the dial wheel trigger mechanism could be be changed to correct this defect.

The turning of the crank is rather hard. To start the motion it may be necessary to use so much power that one must hold the device with the other hand to prevent it moving on the table. The greatest power is needed when all the input values are set to nine. In the Thomas machine the effort is also greatest when all the input values are nine, but even then it requires much less effort than the device of Odhner.

The size of the greatest possible multiplicand is 8 and the greatest possible multiplier 7, but the product can be calculated only with 10 numbers instead of the possible 15. This defect restricts remarkably the use of the device, but can no doubt be corrected. The tens carry operation is restricted so that only the 5 rightmost numbers of the product register are correct. By small modifications which do not increase the size of the device this defect could be corrected.

In multiplication and division the crank is often turned too many times. To correct it, the crank has to be turned once more but in the opposite direction. Then the value of the result register is corrected, but the value of the revolution register shows a defective value of two revolutions from the correct value. This defect which does not appear in the Thomas machine should be corrected so that the reverse turn corrects both the value of the result register and the revolution register.

In some cases the clearing of the revolution register is quite difficult. If the values of all the seven digits are equal, the small size of the clearing crank makes the clearing heavy. The defect could be corrected by introducing clearing by a spring analogous to one used in the Thomas arithmometer.

The setting levers are so small that the design could be modified so that the fingers of the operator would not get tired so easily. This might be important during long calculations.

Odhner certainly studied this statement very carefully and tried to correct the defects in the improved version of his arithmometer. It is interesting that Kirpichev must have been familiar with the Thomas arithmometer, also in practice.

There exist some information about long-time use of two Odhner 1877 calculators in the office of the United States government actuary in spite of their deficiencies [14]. One of the arithmometers, now belonging to the collection of the Smithsonian Institution, was used first by the actuary Ezekiel Brown Elliott (1823-1888). After his death, it was purchased by Mrs S. Wollard, an assistant actuary. This machine has number 4 stamped in several places, so it is evidently the serial number of this calculator. The second arithmometer (evidently Nr. 9) was used by Joseph McCoy (1863-1931), who began working with Elliott in 1887 and succeeded him in as actuary in 1889. Thus it is evident that even the calculators of Odhner's first series were useful in spite of the defects noted by Kirpichev. Other modestly priced calculating devices were not available by that time and the actuaries had to buy the arithmometers by themselves. The history of Odhner arithmometer Nr. 11 [53] belonging to the Polytechnic Museum in Moscow is not known to the author. The photos of all these three arithmometers can be viewed at http://mywebpages.comcast.net/wtodhner/calcs.html. It is interesting to see that the whole clearing crank is missing of the arithmometer in Moscow, though Kirpichev was only suspecting the strength of the knob.

Werner Lange has thoroughly analyzed the differences of the designs of Odhner and Baldwin [15] and notes that the system of Odhner, where the result register is moving and the input wheels are

fixed, is mechanically better. Staffel's calculator is in this respect similar to the Baldwin calculator, but the input wheels are much smaller.

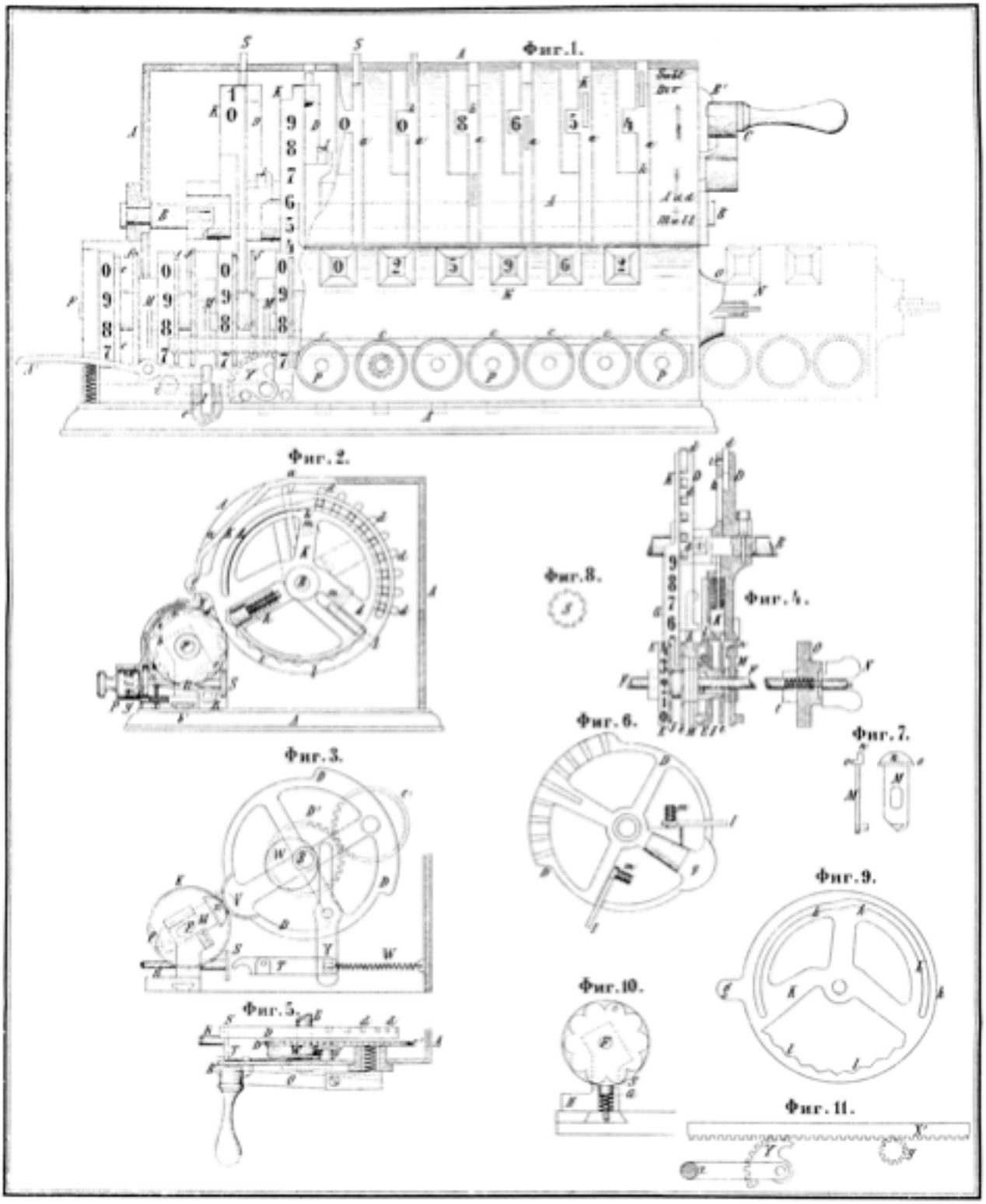
7. The patents of the 1877 model

The efficiency of Königsberger was quite evident. In the same letter of March (April) 1878, where Odhner writes about his selection, Odhner also notes that "my machine has already arrived to America and I wait to hear very soon what the Americans think about it" [31]. This arithmometer must have been the patent model sent first to patent attorneys. The machine was left in the US patent office on June 27th 1878 [12]. The patent application was filed a little later on July 13th 1878 and it contains 16 claims. The signature has been written by Odhner himself, but otherwise the paper has been written in a completely different handwriting, so Odhner must have signed a blank paper and sent it with the patent model to USA. On August 1st the patent office sent to the attorneys a letter stating that "the 1st - 2nd - 3rd - 4th - 5th - 6th - 7th - 8th and 14th claims are found to be anticipated in patent of F. S: Baldwin Febr 2/75 No 159244, the 16th claim appears to be substantially met in the same patent in view of the fact that spring arms are shown in the patent A. Johnson Dec 22/68 No 85229. The above claims are rejected." [35] By that time the telegraph connection to St. Petersburg was already functioning, but experienced attorneys probably did not need any help in making the modifications needed. Already on August 14th they filed a modified application [35] where 8 first claims were changed into 4 claims and claims 9-13 and 15 enumerated as claims 5 - 10. The signature of Odhner has been written by the same handwriting as the application and not by Odhner himself. The patent No. 209416 was granted on October 29th 1878 and the whole process took thus only 3.5 months. If the quality of calculator patent models was in 1878 still as poor as it was in 1872 [7], the fast treatment of Odhner's patent application can be understood.

Odhner wrote to his brother "from America I have got information that my machine has been patented - remains thus only to see if somebody will give some dollars for it - and to introduce it - which is most difficult of all" [32]. A little later he wrote "I have now in America obtained the patent for my machine and Mr. Königsberger (my companion in the affair) has commissioned a business partner living in America to try to sell it. The said gentleman, a big and energetic businessman called Straus - has visited Europe and seen the machine here - he was very excited about my machine and thought that he in America, where he already has returned will do something of the affair, and Königsberger encouraged by this has now taken patents in all European countries. I have prepared a very much simplified drawing of the machine which together with 2 machines has been sent to America. In a word, the affair is going ahead at full steam - and in energetic and good hands - so we can hope for the best" [33]. If Straus succeeded in selling these two calculators and possibly some more, the amount obtained by Odhner certainly was not very great.

The patent process was so fast and easy that Königsberger decided to apply for the patent in other countries as well and it was granted "in all countries" [10], [20]. The German patent was filed on November 19th [13] and granted as No. 7393 of 1878. The corresponding Swedish patent is No. 123 of 1879 [45]. The Russian patent No. 148/1879 for three years was filed on February 14th 1979 and granted December 31st 1879. It was published in [55].

Figure 5. The patent drawings of Odhner's 1879 Russian patent.



Even though Odhner arithmometer was patented, it was not an easy task to sell the licence to produce it. ”Da sich aber keine Käufer für die Patente fanden, schlief die Sache ganz ein, bis er [Odhner] in März 1889 durch einen im Pet[ersburger] Pol[ytechnischer] Verein gehaltenen Vortrag wieder auf den alten Gedanken gebracht wurde, den er auch unter wesentlichen Veränderungen und Verbesserungen nicht ohne erhebliche Opfer an Zeit und Geld durchführte” [20].

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Appendix 1. St. Petersburger Zeitung, 3. (17.) September 1905

W. Th. Odhner †. Am 2 September ist nach schwerem langem Leiden ein Mann aus dem Leben geschieden, ein Mann der Arbeit, der sich im Gedächtnis derjenigen, die mit ihm gearbeitet haben, ein dauerndes Andenken bewahren wird. Wilgodt Theophil Odhner ist im Jahre 1845 in Karlstad (Schweden) geboren, und kam nach Absolvierung als Ingenieur, fast mittellos nach Russland. Aber in seinem Innern bewahrte er einen reichen Schatz - seine Erfindungsgabe. Die Idee zum Arithmographen, deren jetzt Tausende in alle Welt hinausgehen und wachsende Verbreitung finden, hatte der junge Ingenieur damals - im Jahre 1869 - bereits entworfen. Er fand eine Anstellung im technischen Geschäft von Macpherson und lernte während seines hiesigen Aufenthalts in seines Landsmann, dem verstorbenen Ludwig Nobel, einen Beraten und einen Förderer seiner Ideen. Eine Anstellung in der Numerationsabteilung der Expedition zur Anfertigung von Staatspapieren gab seinem Erfindungsgeist die gewünschte Richtung. Nach seinen Angaben wurden die Präzisionsapparate der Expedition, die in Russland schwer herzustellen und auch aus dem Auslande mit vielen Unständlichkeiten zu beschaffen waren, vervollkommnet. Der damalige Verwalter der Expedition, es war vor 27 Jahren, machte Odhner den Vorschlag, seine eigene kleine Werkstatt für Numerationsapparate und zu Reparaturen der Maschinen an der Expedition einzurichten. In dieser Zeit wurde die Orlowsche Vielfarbendruckmaschine für die Herstellung der Staatspapiere eingeführt. Infolgedessen war Odhner genötigt, seinen Betrieb bedeutend zu vergrössern. Er erwarb ein eigenes Grundstück bei der Expedition, auf dem dann seine Fabrik - die Maschinenfabrik ”W. T. Odhner” - im Jahre 1893 entstand. Unter solchen Verhältnissen, die sich der selfmademan durch eigene Arbeit geschaffen, konnte er seine urigene Idee - den Arithmographen - ausgestalten. Diese Apparate fanden immer grössere Verbreitung, sie werden - eine Seltenheit für ein russischer Fabrikat - sogar ins Ausland exportiert. Die Erfindungsgabe Odhners beschränkte sich jedoch nicht bloss auf diese einzige Idee: die zahlreichen Präzisionsapparate, Zählwerke, die Tourniquets (wie sie an den Finnländ. Dampferanfahrten eingeführt sind) sind seine Erfindung. Nur durch seine Energie und seine Fähigkeiten ist es ihm im Laufe von 30-40 Jahren gelungen, ohne Mittel, seine Fabrik zu schaffen. Sie ist auch ”sein Kind” bis an sein Lebensende geblieben. Und wie er sein eigenstes Werk väterlich liebte, so liebte er auch die, die an diesem Werke mitgearbeitet haben - seine Arbeiter und seine Angestellten. Für seine Arbeiter ist er unablässig besorgt gewesen. Ein einziger Zug mag dieses Verhalten illustrieren. Venige Tage vor seinem Tode liess sich der Schwerkranke durch alle Fabrikräume tragen, um noch einmal seine Arbeiter, alle ohne Ausnahme, sehen, noch einmal den Betrieb, den er geschaffen, überblicken zu können. - Aber auch alle anderen, die den Verstorbenen ausserhalb seiner Arbeit kennen gelernt haben, werden sein herzlichkeit, gewinnendes Wesen nicht vergessen.

Appendix 2. St. Petersburger Herold, Montag 4. (18.) September 1905

Mit Wilgodt Theophil Odhner, der hier am 2. September nach langen, schweren Leiden verstarb, ist eine in gewisser Hinsicht markante Persönlichkeit aus dem Leben geschieden, da er sowohl in Europa als auch in Amerika als Erfinder der Arithmometers und einer Numerationsmaschine sich eines Rufes erfreute. Er wurde 1845 in Karstadt, in Schweden geboren, von wo er 1869 als Ingenieur nach St. Petersburg kam. In der Expedition zur Anfertigung von Staatspapieren begründete er die Numerationsabteilung für Kreditbillete. Seine Tourniquets für Dampferanfahrten haben eine weite Verbreitung gefunden. Seine mechanischen Wahlkästen für geheimes Ballotement sollen in der

Reichsduma Verwendung finden. Seine Arithmometer finden in allen Ländern Absatz und Verwendung.

Appendix 3. Extract of [23]

Willgodt Theophil Odhner, the first child of Theophil Dynamiel, and the first born of the fourth generation of Odhners, was born in Wärmland, Aug. 10th, 1845. He studied at the Technological Institute in Stockholm and graduated as a civil engineer. In 1869 he emigrated to Russia, and was employed by Mr. Nobel, the great Swedish engineer who afterwards founded the ”Nobel Prizes”. Afterwards he was employed as engineer at the Imperial Bank in St. Petersburg and invented a wonderful counting machine, the ”Odhner Arithmometer”. This, and many other inventions, brought him fame and wealth, and he established a great mechanical factory, which is still running very successfully. Great orders from the Government, during the Russo-Japanese war for fine machinery connected with guns, made him quite a wealthy man. He was a kind and good man, but had no idea of the New Church. I never saw him after he left Sweden, when I was but six years old. He died in 1905. With his wife, Alma Skånberg, he had seven [should be 8] children, all of whom are Russians.