

## The Life and Works of W. T. Odhner, part II

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### 1. The Imperial State Paper Factory

On May the 1st 1878 [88], Odhner began his work at 'Экспедиции заготовления государственных бумаг', of which there exist several translations, such as 'the Imperial State Paper Factory' [7], 'the State Paper Manufactory' [71] or 'the Special Office for the Preparation of State Documents' [21], however, in the following, the name 'Expedition' shall be used. This large paper mill and printing house was situated a little bit southwest of the city centre by the canal Fontanka.



Figure 1. A watercolour of the Expedition ca. 1910, ©<http://forum.micex.ru/museum>

After the Russian revolution in 1919, the name of the establishment was changed to Goznak, and the company is still working under that name, see [www.goznak.ru/eng/](http://www.goznak.ru/eng/). A short history of the expedition can be studied at [21], [34] and [www.goznak.spb.ru/eng/about/history/](http://www.goznak.spb.ru/eng/about/history/), although there are also a few books [84], [86]. The Expedition was led during the period 1861–1889 by the energetic F.F. Winberg (see [www.goznak.ru/main.php?page=283](http://www.goznak.ru/main.php?page=283)), who acquired the best machinery available [34] and also made great organizational changes to improve efficiency. The Expedition actively participated in world fairs and received praise for its products. One report from the Vienna world fair of 1873 runs as follows [32]:

"Die Kais. Russische Expedition zur Anfertigung der Staatspapiere ist ein Institut, das jedes, selbst in den graphischen Künsten am weitesten fortgeschrittene Land mit Stolz das seinige nennen würde. Wenn die Jury, indem sie dieser Anstalt das Ehrendiplom zuerkannte, sich dahin äusserte, dass sie durch ihre wahrhaft eminenten Leistungen in photographischen Hoch- und Tiefdruckplatten, durch die geistreiche Combination von Heliographie und Galvanoplastik und durch die mannigfachen wichtigen Anwendungen der verschiedenen graphischen Künste zur Herstellung von Staats- und Werthpapieren so tief eingreifende, bahnbrechende Erfolge erzielt, dass sie der höchsten Auszeichnung würdig ist, so wird sie von keiner Seite Widerspruch zu erwarten haben; sie hat damit nur Einiges von dem andeuten können, was die Staatsdruckerei ohne jegliche Ostentation uns vor Augen führt. Die Fabrikation von Papier mit Wasserzeichnungen in unvergleichlicher Klarheit und Zartheit, sowie von geschöpftem Handpapier mit allen den Eigenschaften, die man von einem zu Werthzeichen bestimmten Papier verlangt, wird in grossartigem Maassstabe betrieben. Stempel und Matrizen, Clichés in Kupfer und namentlich in Eisen, eine Specialität dieses Instituts, die gerade für die Herstellung des farbigen Druckes in grossen Auflagen von wesentlich praktischem Werthe sind, werden in vorzüglicher Qualität geliefert. Buch- und Holzschnittdruck, Kupferdruck, Lithographie, Autographie, Chromographie, Photogalvanographie, Heliographie, Elektrotransformatypie, kurz jeder nennbare graphische Process wird dort nicht allein geübt, sondern zur Vollkommenheit gebracht, so dass die russischen Staats- und Geldpapiere, Brief- und Wechselstempel und dergleichen als Muster für alle gelten können." and continues "Wir geben nur zur Kennzeichnung der geschäftlichen Bedeutung der Anstalt folgende uns mitgetheilte neueste Data. Nicht weniger wie 17

Dampfmaschinen von zusammen 362 Pferdekraft stehen zur Disposition. In der Papierfabrik finden sich 14 Maschinen zur Bearbeitung der Lumpen, 32 Holländer, 30 Schöpfbüten und 2 Papiermaschinen. Die Druckerei besitzt 58 Schnellpressen und 60 Handpressen, nicht zu reden von Photographie, Guillochir-, Couvert, Perforir- und Numerirmaschinen. Sie beschäftigt im Hause 1400 bis 1800 Arbeiter und ausser dem Hause je nach Umständen 300 bis 1200."

The highest prize "Ehren-Diplom" at the Vienna world fair was given to Expedition for its merits in groups 12 (graphic arts) and 11 (paper industry). Besides Expedition only 6 other exhibitors received this honour at class 12 and 13 exhibitors at class 11 [68]. Eleven persons working at the Expedition received personal medals for their contributions. In 1878 Expedition received at Paris world fair following awards: diploma equivalent to grand prize at classes 9 (printing, books), 10 (stationery, book-binding, painting and drawing materials), 12 (photographic proofs and apparatus) and class 25 (bronzes and various art castings and repoussé work) and silver medal at class 11 (general application of the arts of drawing and modeling) [17].

Twenty years later, at the World's Columbian Exposition, the official catalogue of the Russian Section [71] had the following about the Expedition in 1893. "The manufactory was founded in 1818; reorganized in 1861, acting since on commercial basis, the Crown giving orders and paying for their execution mostly at the rate of a copeck per sheet. Half of the clear profit is retained as income by the Treasury for the cost of building and equipment, which amounted at the above mentioned date of reorganisation 1861, to upwards of 4,500,000 roubles. The other half is distributed between the employers and workmen as gratuities. The manufactory is not subsidized by the Crown. Yearly 43,000 poods [704,340 kg] of paper are produced, over 260,000,000 sheets printed, about 850 poods [13,923 kg] of printing type and blanks cast and over 122 poods [1,998 kg] of Galvanic-stereotypes engraved. Annual value of production 2,700,000 roubles. There are 57 steam engines (1000 H.P.), 25 steam boilers, 6 gasmotors (66 H.P.), portable engine (50 H.P.), 8 boilers and 8 bleaching boilers, 120 printing machines, 3 dynamos, 15 engraving machines and appliances. Own water courses, gasworks, electric lighting, mechanical workshop. Employed 2,353 workmen, 717 workwomen and 241 minors. Materials principally Russian, but a small part foreign. Sale to Government offices and private institutions in Russia."

At the Columbian exposition, the Expedition exhibited [71]

1. Typographic, lithographic and other prints,
2. Copper and iron electro types,
3. Banknotes at present in circulation,
4. Postage stamps and post cards,
5. Share certificates and bonds,
6. Municipal and police stamps,
7. Photographs,
8. Samples of paper,
9. Samples of work executed by scholars of the establishment; drawings and engravings,
10. Typographic articles.



Витрина Экспедиции Заготовления Государственныхъ Бумагъ.

**Figure 2.** The display of the Expedition at the World's Columbian Exposition, Chicago, 1893, in [85] ©National Library of Finland. The German report [8] writes. "Die Expedition zur Anfertigung der Staatspapiere in St. Petersburg (Staatsdruckerei) ging mit gutem Beispiele voran, indem sie, wie immer, eine glänzende Ausstellung aus allen Abtheilungen des grossartigen, weit verzweigten Instituts veranstaltet hatte. Lange Papierfahnen, hinter denen elektrisches Licht brannte, fielen dem beschauer in erster Linie auf; es wurden an denselben die verschiedensten Wasserzeichen für Staats- und Werthpapiere veranschaulicht."



## 2. W.T. Odhner at the Expedition

The new job at the Expedition, which Odhner calls a bank, began quite well. However, even though the machines were good, the work was rather inefficient and the accumulated amount of waste considerable. Odhner was able to apply his industrial experience to print products such as banknotes and government bonds more efficiently. On October the 1st (12th) 1878, Odhner wrote to his brother Hjalmar [43] as follows:

"Som du troligen hört har Ryska Regeringen tagit ett inhemskt lån – på 300.000.000, och papperen här till har vi på dessa 2<sup>ne</sup> månader tillverkat – det har varit en kolosal brådska, som haft det goda med sig att jag haft tillfälle att utomordentligt utmärka mig så att jag hos vår Director blifvit en riktig gunstling, ty dels genom egna uppfinningar och tillställningar, dels genom ett förnuftigt ordnande af arbetet har jag bringat det derhän att man i. s. f. 40% – utskott som man förr haft numera ej har mer än 5 a 6% –

Jag har äfven haft mycken heder och glädje af mitt arbete, fått löfte om på ökning på min lön m. m. och tror mig komma med stora steg gå framåt."

The letter continues with news of a numbering device that was combined with printing presses and made possible the numbering of documents in one stage. Earlier, this had to be done separately after the printing. As an assistant, Odhner also received permission to hire his brother, Sannfrid.

"Men nu kommer det som skall glädja dig mäst af allt. Jag håller på med en ny af mig uppfunnen inrättning genom hvilken ett papper af hvilket flera miljoner årligen tryckes, skall kunna tryckas och numreras (hvarje ark med olika nummer) på en gång – för att göra nödiga apparater erbjöds mig en medhjelpare och det har lyckats mig att få Sannfrid antagen härtill – han är sedan några dagar i verksamhet får en för sina förhållanden ganska anständig lön af 62 1/2 Rubel månatl. och som utsigter finnes å mycket arbete så träd han äfven kunna på öfvertid förtjena ganska mycket, (ty öfvertids arbete blir serskildt betalt). Han har nu tagit en liten nått våning mitt emot oss och kan emotse ett lungt, beqvämt och lätt bröd till döddagar, det är ej utan att jag haft betänkligheter att rekommendera Sannfrid en plats under mig, i anseende till hans yttrest sjelfständiga och egenkära karaktär – hans ställning var dock så kritisk och inkomster så små att jag ej kunde låta tillfället gå mig ur händerna hoppas att allt skall gå bra, och att han snart skall få en sjelfständig ställning" [43].

As Odhner wrote to his sister Anna [44], he was content with his permanent job and even with the salary, but to pay his debts he still had to take new loans because everything cost more than before and there had been illness in the family.

"En liten Benifice för att upphjelpa affärerna vore äfven högst önskvärd ty min närvarande ställning är serdeles lysande. Jag har visserligen en plats som jag i alla afseenden kan vara glad åt ty den är säker och jag kan vara viss om att inom ett par år hafva min rikliga utkomst, men f. n. lemnar den knapast dagligt bröd – och om gamla skulder betalas så måste nya göras – härtill har äfven de dåliga tider som här härskar mycket skuld – ty alla förnödenheter kosta det dubbla mot förr – och vi hafva dessutom detta år knappast en vecka haft friskt i huset – ty antingen har jag, Alma, eller barnen varit i behof af Docktor och medicin – f. n. ligga både Alma och Alexander – Dock hoppas jag det ej skall bli någon alvarligare sjukdom."

Odhner does not specify his own salary, but according to the original documents of the Expedition cited in [88], it was originally 1600 roubles a year plus 400 roubles for the rent of a flat. From the beginning of 1881, he received the rise mentioned in the letter [43] above, amounting to 500 roubles. He was also promoted to the head of the specially-established numeration department [3]. After 3 years of work, i.e. in 1881, Odhner also received a great golden medal for his innovations [33]. In addition, Odhner was also highly esteemed in the hierarchy of the Expedition. Although he was officially registered as a master technician, he received the higher salary of an engineer [3], [88].

In 1886, the Expedition hired engineer Ivan Ivanovich Orlov (1861–1928) [51], (see also [www.goznak.ru/main.php?page=284](http://www.goznak.ru/main.php?page=284)), who developed a new printing press capable of producing multicolour images using only one printing plate. This new printing method was immediately implemented by the Expedition and Odhner was chosen as the producer of these and all later Orlovian presses to the Expedition. As late as in May 1917, the provisional government of Russia needed vast amounts of new banknotes and the Expedition ordered several Orlov printing presses from the Odhner factory to be delivered in the spring of 1918 [84], [89].

The Orlov printing press was used for the first time in 1892 to print new 25 rouble banknotes, (see [www.goznak.ru/main.php?page=285](http://www.goznak.ru/main.php?page=285)) and the results of the Orlovian printing method were exhibited by the Expedition at the world fairs of Chicago 1893 and Paris 1900 [51]. A German report [8] from Chicago runs as follows: "Auch ein Verfahren zur Herstellung des Untergrundes bei Werthpapieren in Vielfarbendruck, durch welches jede beliebige Farbenzusammenstellung mit einem Male gedruckt werden kann, wurde gezeigt, allerdings ohne zu verrathen wie es gemacht wird." The details of the printing were still kept secret in 1917 [95]. At the Paris Universal Exposition 1900, the Expedition again received the highest award 'hors concours' at class 11 (typography – various impressions: appliances, processes and products) [16], but it is of course difficult to say exactly what the contribution of the Orlovian printing press was in this.

## 3. The paper business of W.T. and Sannfrid Odhner

In autumn 1882 the Odhner brothers, together with an Englishman also working at the Expedition, founded a common business to produce paper cut in special forms. For example, they made signs for display windows, special papers for cupboards, papers under biscuits and cakes and Christmas decorations consisting of flags of different nations on a thread. Sannfrid Odhner had made such things earlier, but the Englishman had an extra room in his apartment where they employed 1–2 boys to do the work. The business was promising and Odhner was working every day until midnight while designing and constructing different paper-cutting devices for the job.

"Här begagnas ej eller rättare finnes ej att köpa utskuret papper för kyltar etc. och Sannfrid har varit mycket besvärad af sådant arbete för släkt och vänner, ty han har för sådant verklig talent. Han har derföre

redan länge spekulerat på att till försäljning tillvärka sådant, och vi hafva till och med progekerat en maskin därför. Den blefve dock någödt dyr och arbl[ets]sam att göra, för hand ansåga videt ej löna sig, och dessutom hadde vi ej passande lokal, och det har ej blifvit någödt af saken. För någon tid (3 veckor) sedan talade han dock härom med en ung engländare i banken som liksom Sanfrid skulle behöfva någon biförtjenst. Han var genast lifvad för saken – lemnad ett af sina rum på nedre botten, köpte för någon rubel papper och de började med 1 eller 2. pojkar att för hand hugga ut papper – det gick strykande åt, och det ser ut som om det vore ett verkligt behof, och som det lemnar 100%, torde det blifva en god affär – de hafva äfven af bisquit fabrikanter, sockerbagare etc. blifvit uppmanade att tillvärka papper för deras lådor – men som de härtill behöfva maskiner, så hafva de uppfordrat mig att ingå i bolaget hvilket jag äfven gjordt, dels emedan jag tror att det är en affär och dels emedan jag är öfvertygad att de utan mig knappast skulle kunna reda sig. Jag är därför nu öfverkapad af arbete för att göra rationella verktyg, och sätta affären i gång – och arbetar till 12 hvarje natt." [47]

None of the three companions had any capital to make the necessary investments, so the Odhners discontinued the business with their English friend and found a new companion, Mr. Barwin, who had money. Then Sannfrid hired a large apartment and, employing a mechanic to make the machines needed, started with 5 workers.

"Våra pappers affärer gör med stora steg framåt och det är anledning att hoppas att det skall blifva en stor affär med tiden. Med vår första kompanjon (Sanfrids) hafva vi upphört ty han hadde ej hvad som felade oss – penningar. Vi hafva emellertid börjat med en annan som har penningar tillräckligt och är mycket intresserad för saken, och som dessutom (med Sanfrid på tu man hand) har gifvit Sanfrid 500 Rubel för att trycka 150,000 sty pappersflaggor till Julen. Sanfrid har tagit en våning på 5 rum och kök. Jag har dit flyttat min svarv och verktyger, en mekaniker är angagerad med 50 Rub. månatl. för att göra maskiner och till dess dessa blir färdiga arbetar vi med 5 arbetare för hand. Förr än maskinerna blir färdiga är det ej någon större affär att förvänta. Jag har dock redan den första i arbete och tviflar ej på att den ej skall lyckas, och hoppas om en 2 a 3 veckor hafva den färdig och tror att vi sedan skall förtjena penningar" [48].

The machines were, of course, all designed by Willgodt Odhner. Somewhat later, they even had a salesman and 15 employees working like bees and Sannfrid's wife as a master. Sannfrid writes "Vi hafva nu rysligt mycket att göra ty vi hålla just som best på att göra i ordning 150,000 flaggor för julgranar som Mr. Barwin och jag spekulerar på. Få se huru affären kommer att gå, men enligt hvad som kan synas utaf de beställningar och det omdöme som gjordts angående dem utaf alla som jag wisat dem till. Tycka det som om de skulle få en god omsättning gå de alla åt så har jag för min del förtjenat en 700 a 800 rubel. Dessutom hafva vi nu fått vår första maske färdig för hyllpapperet och den går alldeles utmärkt hvilke ni kunna se af inneligande prof. Jag beräknar med temmligen nogrann säkerhet att vi skola kunna sälja en 4. a 500,000 listor under julen. Vi hafva nu engagerandt en agent som hela dagen igenom sysselsätter sig med att skaffa nya beställningar så att jag slipper nu ifrån en af de swåraste af alla mina göromål. Om ni såge min våning så skulle ni werkligen förundra Eder, ty jag har der sysselsatt hela dagen igenom 15 personer, stora och små alla flitiga som bien och min rara Gumma som mästare för dem allihop" [42].

It is not known what happened to the paper business after 1882, but evidently no great fortune was made with it.

An interesting fact cited above is that Odhner moved his lathe and other tools to this paper workshop [48]. Evidently, Odhner made his first arithmometer at his home in 1875 just with this equipment and this is the only surviving letter where the tools are mentioned. At this stage, the Odhner mechanical factory did not yet exist in contrast to what is stated by the official history [67].

#### 4. Family life

In the summer of 1882, Odhner visited Sweden for the first time since his arrival in Russia. He had with him the entire family, except the youngest child Georg (1880–1910). One of the aims was to teach Swedish to the older children, Alexander (1873–1918) and Alma (1877–1950), because they could barely speak a word of it [46]. Odhner's brother-in-law, Arvid Åhlin, rented a villa near Stockholm for the family, but by November 1883, Odhner had not been able to pay the rent because of great medical expenses and the fact that the 1883 gratuities from the Expedition were small [49]. The family remained in Sweden longer than Odhner, and back in St. Petersburg he became disgusted with life there. He then worked hard in the evenings completing a turnstile (see <http://en.wikipedia.org/wiki/Turnstile>) for counting and controlling ticket sales that he had put to one side for two years. "Wid min återkomst från Mälarens gröna stränder och Stocholms polerade gator och annan herlighet, fann jag här allt så smutsigt och eländigt, och när jag såg huru godt och trefligt alla menniskor lefde der hemma kände jag en sådan bondånger och själförakt öfver att hafva gjordt ett sådant land som Ryssland till mitt hemvist, och utan Gumman och ordning i huset, hadde jag det så otrefligt och tråkigt att jag var halvt vriden, och som jag sjelf insåg, oförmögen att skrifva ett förnuftigt bref. För att rädda mig slog jag mig alldeles förtviflat på arbete, tog i håll med en maskin som jag för 2<sup>ne</sup> år sedan lagt å sido, (för att räkna och kontrollera billjettförsäljning) som jag nu avslutat och som blifvit mycket bra, och praktisk, och möjligen torde blifva en affär. Konstruerade 2<sup>ne</sup> maskiner för Hjalmar (af hvilka jag äfven egenhändigt färdig gjordt en) för tillverkning as franska kardonger, och hvilken jag om några dagar skall skicka till honom" [47]. These turnstiles of Odhner were later widely used for passenger steam ships operating on the canals of St. Petersburg [66], [69] and also in amusement parks.

After the trip, four more children Julie (1882–1970), Nestor (1884–1886), Irma (1887–1942) and Olga (1890–?) were born, see the church record of the family in Figure 3. Of the children, Emilia (1875–1877) and Nestor had died before 1891 and are therefore not found there.

In 1896, Alma Odhner married engineer Valentin Odhner, the son of merchant Aron Odhner, at whose shop W.T. Odhner had worked as a young boy in Stockholm [67]. There was a Swedish elementary school at St. Petersburg, but the Odhners, as did many other well-to-do Swedes, decided to send their children to the German St. Petri school, which was of high repute. Georg Odhner was in the same class as Karl Siewert



whose parents were Baltic Germans from Riga. Georg fell in love with Siewert's sister Martha and they married in 1903. Later there were two more marriages when Karl Siewert married Julie Odhner and Reinhold Siewert married Irma Odhner. After Georg Odhner's death in 1910, his older brother, Alexander, married his widow in 1912, so we can count 3.5 marriages between the Odhner and Siewert families. For Odhner's youngest daughter, Olga, there evidently were no more Siewert sons available, so she married her cousin Konstantin Wildtgrube who was a son of Alma Odhner's sister [58].

876.

Stand och Namn.	Födelse.		Wied. Enka eller skild.	Kommen ifran.	Anmärkingar.
	Ort.	År och dag.			
(Mekan.) Fabrikant † Odhner, Theophil Wilgott	Dalby.	10 3 845.	26 12 71.	Sjöholm 68 71: 55 b.	
536 f. Fränberg, Eleonora Alma Math.	Söbau.	30 4 853.		Koppar.	
f. Alexander Själmar	f. Ö.	30 8 873.			Åb. 1900: 18.
f. Alma Amalia	Ö.	15 8 877.			Åb. 90: 29.
536 f. Georg Wilgott	Ö.	27 8 880.			Åb. 1903: 68.
f. Julie Ida	Ö.	27 8 882.			Åb. 1905: 9.
536 f. Alma Margaretha	Ö.	27 8 887.			
f. Olga Anna Hilda	Ö.	26 12 890.			

Figure 3. Odhner family page in the 1891–1905 church record book of Swedish St. Katarina Lutheran congregation of St. Petersburg, ©National Archives of Sweden. On the opposite page there is information about confirmations and communions attended by the family and also the death date of W.T. Odhner.

All other children except Alma were thus married to Germans and spoke German at home. At least, Georg Odhner moved to the German St. Petri congregation. After the 1917 revolution, the youngest daughters, Irma and Olga, and their families remained in St. Petersburg, then called Petrograd, but the rest of the family, including Odhner's widow, Alexander and Martha Odhner with Georg Odhner's children, Valentin Odhner with his family and Karl Siewert with his family emigrated to Sweden.

Like many families in St. Petersburg, the Odhnors, too, used to live during the summer outside the city in a summer cottage (known as a 'dacha' in Russian). In 1881, they rented one [45], but later built their own in Yukki, situated about 25 kilometres to the north of the city along the railway to Finland. If it had been a short distance farther, like the villa owned by the Nobel family, it would have belonged to Finland from 1917 to 1939 and the Odhner family would have retained ownership of it during that time.

## 5. The mechanical factory of Odhner

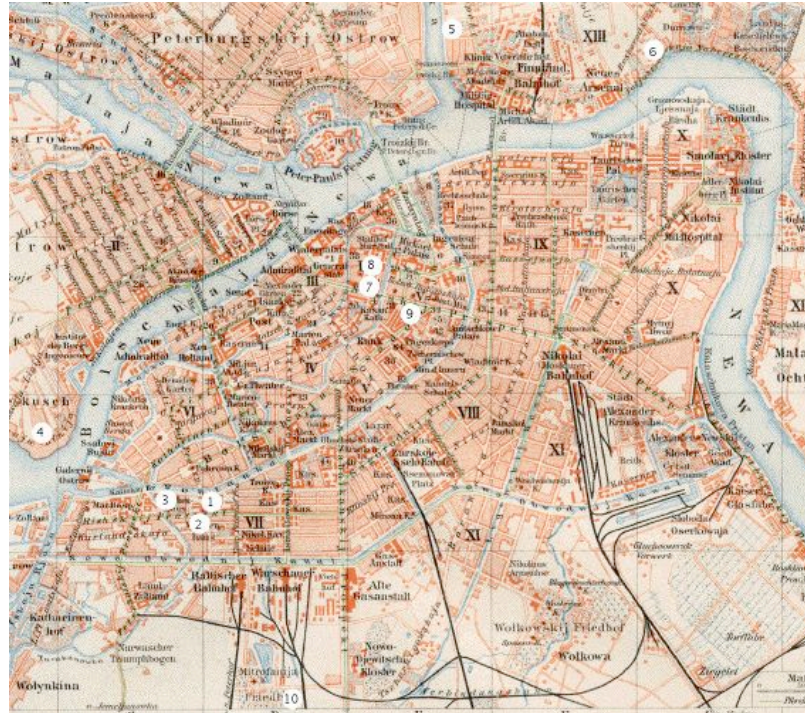
No surviving letters exist from the ten-year period 1884–1894, so the history of the Odhner mechanical factory must be studied by other means.

Odhner liked to work in evenings at his private workshop, where he made different devices for the Expedition. This is described in [13] "Herr Odhner antog nu anställning som mekaniker i kejsarliga ryska statspapper- och sedeltryckeriet och etablerade samtidigt uti sin bostad en mindre mekanisk verkstad, där han utarbetade en massa förbättringar, nya uppfinningar och apparater för tryckeriet i det han samtidigt fortsatte arbetet med sin älsklingsidé – räknemaskinen." The director of the Expedition evidently appreciated this work by Odhner and advised him to start an own enterprise as early as in 1878 [66]. The actual time is difficult to determine, but one can assume that the commercial workshop was founded when Odhner rented an apartment and workshop at Rizhskii Prospekt 26, just opposite the Expedition, see Figure 4.

Because the workshop was so near, Odhner could oversee the work there. Most of the orders must have come from the Expedition at the beginning, so he probably had permission to visit the workshop during his working hours. Odhner himself used 1886 as the founding year in [71] and in advertisements and this is also given in [22], [70] and [97]. The official Russian factory list [94] also states 1886 as the founding year, but later ones, for example [100], [101] and [106], always mention 1887. Of course, Odhner knew the facts better than others, but this contradiction may be caused by Russian bureaucracy. It was quite cumbersome and all entrepreneurs had of course to obey the Russian legislation which was relatively complicated. For example, in Western countries all that is not prohibited is permitted, but in Russia everything that is not explicitly permitted is forbidden [9]. The number of papers to start and also run an enterprise in Russia was considerable and perhaps official permission to open a workshop was only granted in 1887.

Martin [33] must have known the facts, but using his customary imprecise language, the text claims (according to the English translation) that "The large-scale manufacture of the Original-Odhner did not commence until 1886 when the W.T. Odhner factory, St. Petersburg, Tarakanoffski Per. No. 4, was specially built for this purpose." The incorrect reference to large scale manufacture in 1886 was adopted by Wassén [67] and by all other Western publications except [30]. This short article, [30], is remarkably trustworthy, correcting all the errors of [67] even though it is the only source mentioned.

In the beginning, the only machine in the workshop was a pedal-driven lathe [64], which evidently was the same lathe mentioned above. The number of workers must have been small, possibly former subordinates of Odhner at the Expedition. In 1889, Odhner employed his cousin, engineer Valentin Odhner, who had graduated from Royal Institute of Technology in Stockholm (the same institute where Odhner had studied, but now renamed) in the same year. Before Valentin arrived at St. Petersburg, he completed the compulsory Swedish military service [23]. At Odhner's workshop, Valentin was probably the only engineer, and he acted in technical matters as Odhner's right hand man [13]. According to [13], Odhner's older son, Alexander, was the commercial assistant. No evidence exists concerning Alexander's studies, so it can be assumed that after school he assumed responsibility for the sales and finances of the workshop. The first time he is mentioned is in the Swedish address calendar of 1895, where he appears with the title 'bookkeeper' [26] while in the Russian one [74] he was called a 'cashier'.



**Figure 4.** A map of St. Petersburg showing some important places. Number 1: Expedition at Fontanka 144; Number 2: Odhner factory 1893–1918 at Tarakanovskii Pereulok 4; Number 3: Odhner's apartment 1896–1905 at Fontanka 150; Number 4: Carr & Macpherson shipyard at Vasily island; Number 5: Ludvig Nobel's mechanical factory; Number 6: Rosenkrantz factory; Number 7: German St. Petri church and school; Number 8: Swedish St. Katarina church; Number 9: Gostiny Dvor department store; Number 10: Lutheran part of Mitrofani cemetery. Odhner's workshop was situated between Number 1 and 2.

In 1890, when the production of arithmometers began, the workshop had one 2 H.P. steam engine, the number of workers was 20, and the annual production value was 11,000 roubles [94]. Sources [56] and [105] explicitly mention that Odhner still worked at the Expedition then. The Russian catalogue of the Columbian Exposition of 1893 [71] states that the workshop had one 4 H.P. petroleum motor, 20 various lathes, 25 workmen and 10 children and an annual production value of 30,000 roubles. These figures are evidently from 1892 even though this is not directly stated.

1892 was the year when Odhner finally quit his work at the Expedition and devoted his time entirely to his workshop [13]. After 14 years in a secure position, this was a great change. More room was needed for growing production, but for that purpose capital was also required. Because Odhner did not have money, he took an Englishman, Frank Hill, as his partner. Similarly, other calculating machine inventors needed investors to help them. For example, Frank Baldwin needed the financial support of Jay Monroe, Dorr Felt the support of Robert Tarrant, and Hubert Hopkins the support of James Dalton. We can estimate the time of the beginning of the Odhner–Hill partnership by examining the instructions for arithmometers. The first instruction booklet of 1892 [78] was approved by the censors on February the 5th, and Hill is not yet mentioned there. The second instruction of 1892 [5] was approved on September the 28th and the producer was referred to as the Mechanical Factory of Odhner & Hill. Thus, we can say that the co-operation between Odhner and Hill began at some point in the middle of 1892. Hill was probably an investor, and thus did not participate in the operation of the company. The address book of 1895 [74] lists the owner and manager W.T. Odhner, another owner, F.N. Hill, a chief engineer, Valentin Odhner, and a cashier, Alexander Odhner.

The company of Odhner & Hill expanded swiftly. As noted above, it was now called a factory and the beautiful letterhead shown in Figure 5 was printed. Sources [76] and [98] even claim that a branch factory was founded in 1892 in Berlin.





Figure 5. The letterhead of Odhner & Hill, ©Gösta Sundin. The undated letter by Odhner has been addressed to Odhner's cousin Ernst Wallgren [29] and [58] and it considers Wallgren's rangefinder already patented in Sweden, Germany and Russia.

The company also succeeded in buying the neighbouring building to their workshop at Tarakanovskii Pereulok 4, see the map in Figure 4. In the book [102] listing the houses of St. Petersburg and their owners in 1891, the owner was not yet Odhner or Odhner & Hill. According to the data of [7], the land here was not very expensive, but to begin the operation of the factory one had to invest a significant amount in buildings and machines. The new owners quickly built a new factory which was equipped with all the modern conveniences and was completed in 1893 [13] "Genom energi och inventiös skicklighet i sitt yrke utvecklade Odhner sina fabrikers verksamhet så betydligt att den ständigt fordrade utvidgning af arbetslokalerna, och år 1893 hade den uti hans bostad påbörjade verkstaden vuxit upp till den fabrik, som fotografien utvisar" and further "Den år 1893 nyuppförda fabriken försågs med den tidens modernaste inredning, bland annat ångpannor för naftaledning och de Laval's ångturbiner för såväl kraft som elektrisk belysning". The telephone was installed for the factory in July 1893 [99], and the letterhead of Figure 5 has probably been printed in 1893. There were also apartments at the factory, and Odhner lived there until 1896. Figure 6 shows the factory in 1894.

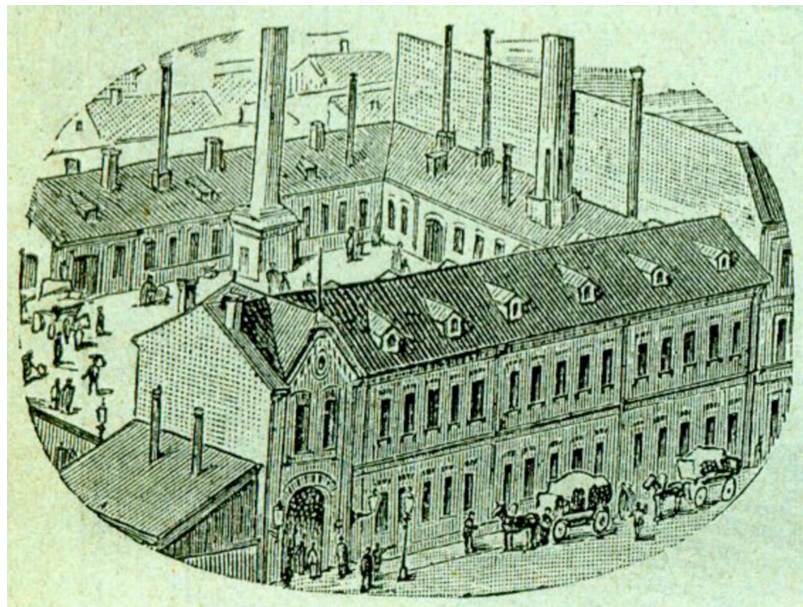


Figure 6. Odhner & Hill factory from a 1894 advertisement, see Figure 25. On the street there is the new 2-storey factory, but the buildings in the backyard are evidently older. Because the building was not situated by a canal, the transport of raw material and products had to be performed by horse carriages.

By 1903, the third storey had been built onto the factory [13], and by 1908 the buildings in the backyard had 2 storeys, too [70]. An interesting photo taken in 1908 is shown in Figure 7.

The factory was equipped with the best-possible machines and the arrangement of work was carefully planned to make mass production of calculators possible [70]. Until that point, calculators had been produced only when ordered [54], but the Odhner factory, together with Felt & Tarrant Co. in Chicago, was the first which used modern principles to produce calculators in quantity without knowing who will buy them. In 1893, the effect of the new factory building and other investments can be seen clearly. According to [76], [88] and [97] there were now 98 workers and two steam engines with a total capacity of 20 H.P., the annual value of production being 123,000 roubles. These facts are evidently from original source Перечень фабрик и заводов, 1897, which I have not seen.



*Здание завода фирмы «Однер В. Т.»*

**Figure 7.** Odhner's factory at Tarakanovskii Pereulok 4 in 1908 [81]. The chapel of the Expedition in the background can also be seen in Figure 1. Odhner started his workshop in 1886 between the factory and the chapel on the corner of the Rizhskii Prospekt and Tarakanovskii Pereulok.

The factory building still exists in a renovated form, but in 1952 the street was renamed Pereulok Ladygina (sic!) after the electrical engineer and inventor of light bulbs A.N. Lodygin (1847–1923) [103].

Many enterprises in Russia hired expensive foreign craftsmen to perform the most demanding jobs. It is remarkable that Odhner only had Russian workers, which he trained to make the precise parts needed [13]. This was not easy, and there were also other difficulties in operating a factory in Russia. "Svårigheter som förstorats genom de tyngder som belasta industrien i Ryssland, såsom t. ex. det stora antalet helgdagar, den råa och svårinöfvade arbetspersonalen, dyra och illa förarbetade materialer och så godt som ingen hjälpindustri för en specialbranch som Odhners" [13]. A public article such as this could not mention the bribery which was so common in Russia.

Odhner was a perfectionist wanting to make excellent products, thus he used the best materials and carefully monitored the quality of the products [61], [70]. As a result, Odhner's factory could produce not only calculating machines, but many other instruments, too, and the factory was highly esteemed in Russia. It also was one of the few Russian enterprises capable of exporting products other than raw materials [66].

The partnership of Odhner and Hill did not last long. In the address book of 1895 [74], the company was still called the Mechanical Factory of Odhner and Hill, but no longer by the publication of the 1897 arithmometer instructions [79]. Because the number of calculating machines made by Odhner & Hill is smaller than the production amount of 500 of the first year, it is natural to assume that the co-operation ended around 1895. One reason for no longer needing the financial help of Hill was certainly the royalty income for patent rights paid after 1892 by Grimme, Natalis & Co. of Braunschweig, Germany [18], [19].

The brief duration of this partnership suggests that Odhner was not a very co-operative person. In addition, his earlier projects with Ludvig Nobel and Karl Königsberger [29] were not very successful. Of course, inventors may be difficult persons, but at least the above-mentioned American calculator developers evidently had better relations with their sponsors.

## **6. Products other than arithmometers**

In the beginning, the Expedition was the most important employer for Odhner's workshop, but the production was quite diverse. During the time the calculating machines were being made, their proportion in the sales represented approximately half. The production palette varied and of the various products, one can mention cigarette machines designed by Odhner capable of producing 4000 cigarettes in an hour, Orlov printing presses, small mechanical precision instruments and castings of brass, aluminium and cast iron [64]. In addition to these, other production included turnstiles for ships and amusement parks [66], [69], control systems for trains [81], and on the military side, sights, rangefinders and munition cartridges for artillery [3], [106]. Very little is known of these products, but an artistic piece produced is shown in Figure 8.





**Figure 8.** A pair of candelabras made by Odhner's factory. Photo ©Gunnar Odhner. The height is 29 cm and the production date unknown. There are no manufacturer marks.

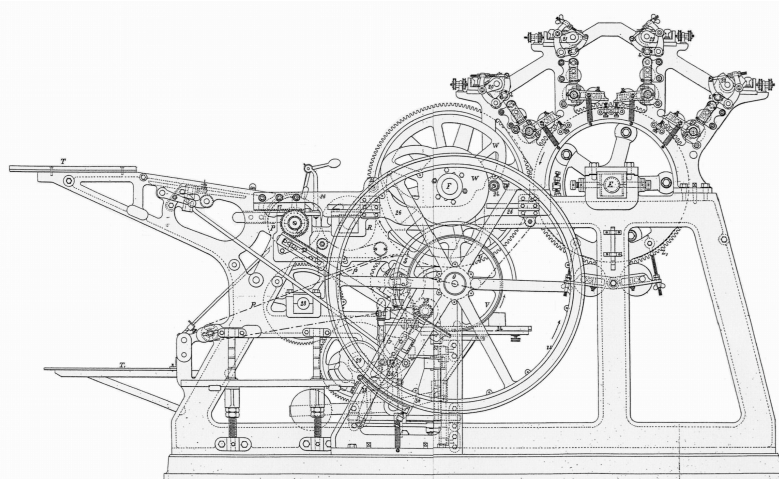
Of the Orlov printing press, there is, fortunately, some data. After the preliminary experiments carried out by Orlov in 1890, the first 25-ruble banknotes were printed, but Orlov wanted still better printing quality and designed an improved press. A few parts for this were ordered from abroad, but Odhner made the rest. As Orlov writes in [92], he was very content with the work done by Odhner, but not at all with the foreign supplier.

"Осенью же 1891 года с этой целью мной была конструирована уже целая машина, главная часть которой была заказана здесь в Петербурге на заводе "Однер" и выполнена под моим личным наблюдением; остальная же часть машины была заказана за границей. Надо заметить, что часть машины, построенная у нас, была выполнена удачнее и скорее, чем заграничная, в которой некоторые части я даже вынужден был переделать; вследствие этого печатание на этой машине оборотной прописи на кред. билетах 10-р. д. образца 1894 года началось только в Августе 1893 года.

На основании вышеприведенного я окончательно решился строить машины целиком в России, под своим наблюдением.

Здесь я остановлюсь на том, насколько важно это дело, т.-е. постройка таких специальных машин в России.

Нужно заметить, это дело было сопряжено с массой хлопот и взяло много труда и времени. На мое счастье, нашелся преданный своему делу маленький фабрикант, по происхождению швед, который, с присущей иностранцам аккуратностью, как начал, так и до настоящего времени продолжает изготовление моих машин. Из маленькой мастерской теперь, благодаря постройке этих машин, образовался приличный заводик; в настоящее время он имеет более чем на 300.000 руб. заказов на новые машины, но, очевидно, дело этим далеко не ограничится."



**Figure 9.** The Orlov printing press in [93], ©Russian National Library.

From that point on, Odhner built all Orlov presses without outside help and in 1898 the Expedition already had 30 of them in operation [93]. At the time of the Paris world's fair, the Expedition already had 33 presses and some were sold to foreign countries [64]. A drawing of an Orlov press capable of printing 500-800 sheets in an hour is shown in Figure 9. The construction is rather complicated and the prize must have been considerable. According to the Russian factory list printed in 1912, the sales of printing presses were

then greater than that of arithmometers [101].



Figure 10. The department of Orlov presses at the Expedition ca. 1900 from [90], ©Russian National Library.

### 7. Improved 1890 arithmometer

When Odhner established his workshop, it was of course easier for him to continue with the development of the calculating machine. Now he had workers for making the parts needed and Odhner himself could concentrate on planning.

On March the 30th 1889, the slide rule inventor and associate professor Arthur Hasselblatt of St. Petersburg Practical Technological Institute gave a talk at a meeting of the 'St. Peterburger Polytechnischer Verein' about calculating devices evidently without knowing anything about Odhner's 1877 first calculating machine version. Odhner, who was also a member of the society, attended the meeting with the present version of his calculating machine with him and participated in the discussion after the speech. "Herr Odhner führt hierauf eine von ihm selbst construirte, hoch interessante Rechenmaschine vor, deren Princip im wesentlichen mit dem der Thomasschen Maschine zu Grunde liegenden übereinstimmt. Indem Herr Odhner bemerkt, dass sein Apparat, mit dessen Vervollkommnung er noch beschäftigt sei, sind zunächst am besten für Multiplikationen und Divisionen eigene" [12]. Thus, the design of the calculator was not as yet then finished. Even though the exact time of the completion of the design is not known, we can call it Odhner's revised 1890 model or more briefly, the 1890 model.

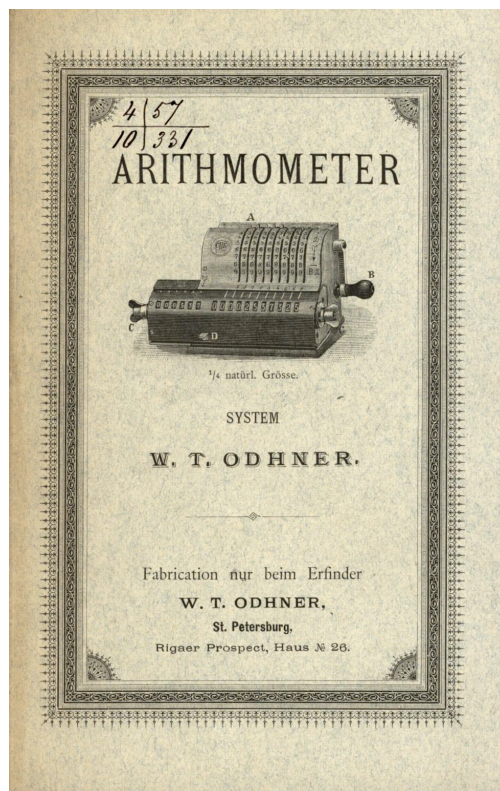


Figure 11. The title page to the first Odhner instructions, ©Russian National Library.



On May 16th 1890, the censors approved Odhner's combined advertising brochure and instruction manual [4] consisting of a one-page preface and 7 pages of instructions. The instructions contain a short description of the arithmometer and 8 simple numerical examples of calculation, where the extraction of square roots is not yet considered. The booklet was published simultaneously in Russian and German. The Russian version has a place for the prices of 11-digit and 13-digit machines, so a capacity of 13 was already planned at this stage, even though the patent drawings and first surviving arithmometers have a capacity only of 11. See Figure 11 for the cover of the German version of the instructions owned by the National Library of Russia. Its interesting preface, cited without the date by [33], [52] and [62], follows.

## VORWORT.

Das Bedürfniss, nach einem einfachen, sicheren und billigen Apparat, mit Hilfe dessen unsere Zahlenrechnungen ausgeführt und controllirt werden können, ist ein längst empfundenes. Viele, theils für allgemeine, theils für spezielle Rechnungszwecke eingerichtete Apparate wurden bereits hergestellt. Von allen diesen Maschinen jedoch fand nur eine, der von dem Elsasser Thomas 1820 construirte sogenannte „Arithmometer“, im praktischen Rechenwesen Anwendung. Indess blieb, der complicirten Construction und des hohen Preises wegen, seine Verbreitung eine sehr beschränkte.

Nach 15-jähriger Arbeit und stetigen Verbesserungen, gelang es mir endlich einen Apparat herzustellen, der seinen Vorgängern gegenüber sehr wesentliche Vorzüge besitzt, die mich hoffen lassen, dass er allen gerechten Forderungen genügen und mit der Zeit in keinem grösseren Geschäfte fehlen wird.

### Die Vorzüge meines Arithmometers sind folgende:

1. Kleines Volumen, die Grundfläche beträgt nur  $7 \times 5$  Zoll.
2. Einfache und unzerbrechliche Construction.
3. Unfehlbar richtige Wirkung, also Garantie einer mathematischen Genauigkeit der Rechnung.
4. Elegantes Aussehen.
5. Einfache und leicht zu erlernende Behandlung.
6. Oelung ausgeschlossen.
7. Billiger Preis.

W. T. Odhner.

St. Petersburg, 1890.

Figure 12. The preface to the first Odhner instructions, ©Russian National Library.

Thus, there must have been some functioning Odhner arithmometers at the beginning of 1890. A little later, on June the 9th, Odhner received the following official certificate signed by the public notary confirming his rights to the calculating machine [88]:

### "Удостоверение

1890-го года июня месяца 9-го дня мы, нижеподписавшиеся Кенигсбергер и К°, сим удостоверяем, что счетная машина под названием "Арифмометр", на которую нами взяты привилегии в России в 1879 году и за границею в 1878, 1879 и 1880 годах, есть изобретение господина Вильгодта Однера в С.-Петербурге, с которым мы хотели эксплуатировать его изобретение, но так как в настоящее время г-н Однер желает самостоятельно приступить к эксплуатации своего, теперь улучшенного, изобретения, то мы передали ему взятые нами привилегии на его счетную машину, вообще отступаем от этого дела и свидетельствуем, что мы к г-ну Однер никаких претензии по этому делу не имеем и впоследствии заявлять таковых не будем.

С.-Петербургский первой гильдин  
купец Карл Августович Кенигсбергер,  
торгующий под фирмой Кенигсбергер и К°."

This document was needed because the Russian 1879 patent of the calculating machine was registered by Königsberger & Co. After a few days, on June the 21th, Odhner filed his Russian patent application for the new design with several important improvements and changes [76], [88].

"В Департамент Торговли и Мануфактур  
Шведского подданного  
Вильгодта Теофиловича Однер.  
ПРОШЕНИЕ

В 1878 году выдана Департаментом Торговли и Мануфактур господам Кенигсбергер и К<sup>о</sup> 3-х летняя привилегия на изобретенную мною счетную машину, и так это изобретение до сих пор еще не приведено к исполнению и эксплуатация его теперь представлена мне господами Кенигсбергером и К<sup>о</sup>, согласно прилагаемому при сем нотариальному удостоверению, то покорнейше прошу Департамент Торговли и Мануфактур выдать мне, как изобретателю этой счетной машинки, 10-ти летнюю привилегию на таковую. Вследствие сделанных мною значительных улучшений и изменений в конструкции этой машинки прилагаю при сем новые чертежи и описание оной.

Вильгодт Теофилович Однер.  
С.-Петербург/ 21-го Июня 1890 года.  
Жительство имею: в С.-Петербурге по Рижскому проспекту, д. № 26."

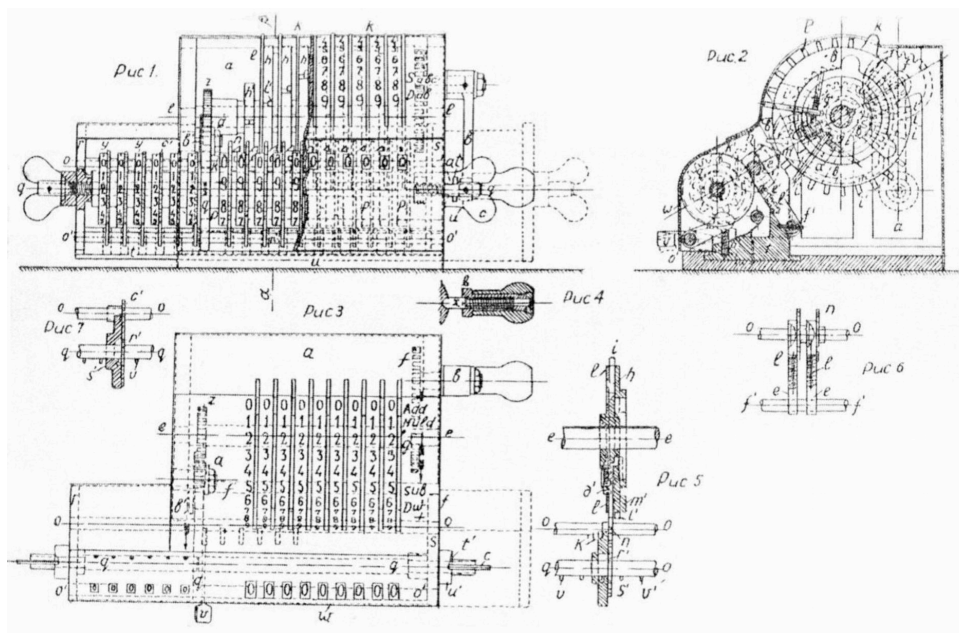


Figure 13. Russian 1890 patent drawings taken from [76].

For the new version, Odhner had read the criticisms of Kirpichev [87] and evidently also studied the patents of Baldwin and Wertheimer. The input was now read from the cover, not from the pinwheels and the clearing mechanism of the revolution register (counter) was better etc. Inside the calculator Odhner had added an extra pinion between the pinwheel and the number wheel, see Figures 13 and 14.

The pinwheel is also more compact than the previous version and resembles much David Isaac Wertheimer's 1843 English patent, see Figure 15. Wertheimer was a sales agent of French Dr. Didier Roth, and he let several scientists among them Charles Babbage inspect Roth's two calculators. Babbage expressed "the most unqualified admiration at their unparalleled ingenuity of construction" [63]. Wertheimer also succeeded in selling four Roth's calculating machines to Queen Victoria [63]. The pinwheel of Figure 15 was in fact patented in France by Roth on 24th November 1842 as the third addition of his first calculator patent, but the patent was never printed [39].

The application for a 10-year patent in Russia was admitted as number 315 for the year 1892 [104]. The patent drawings scanned from [76] can be seen as Figure 13. In addition to Russia, Odhner simultaneously applied for a patent in several European countries. The patent was admitted on 29.8.1890 in France (Nr. 261806), 30.8.1890 in Luxemburg, 15.9.1890 in Belgium (Nr. 91812), 26.9.1890 in Sweden (Nr. 3264), 9.10.1890 in Norway (Nr. 2117), 15.12.1890 in Austria-Hungary (Nr. 45538 in Austria and 69363 in Hungary), 29.8.1891 in England (Nr. 13700), 13.11.1891 in Germany (Nr. 64925) and 15.6.1892 in Switzerland (Nr. 4578). In the USA, the patent was filed on 3.1.1893, just before the arithmometer was exhibited at the World's Columbian Exposition in Chicago. The patent was admitted on 13.2.1894 (Nr. 514725). The German patent document can be studied at [www.geocities.com/SiliconValley/Horizon/1404/patodh2.html#strt](http://www.geocities.com/SiliconValley/Horizon/1404/patodh2.html#strt) and the US patent at <http://v3.espacenet.com/origdoc?DB=EPODOC&F=0&IDX=US514725&QPN=US514725>. The drawing in the German patent shown in Figure 14 does not contain as many details as the Russian one and is therefore much easier to understand. It is interesting that it shows the alarm bell not yet included in the Russian patent and in the first arithmometers.

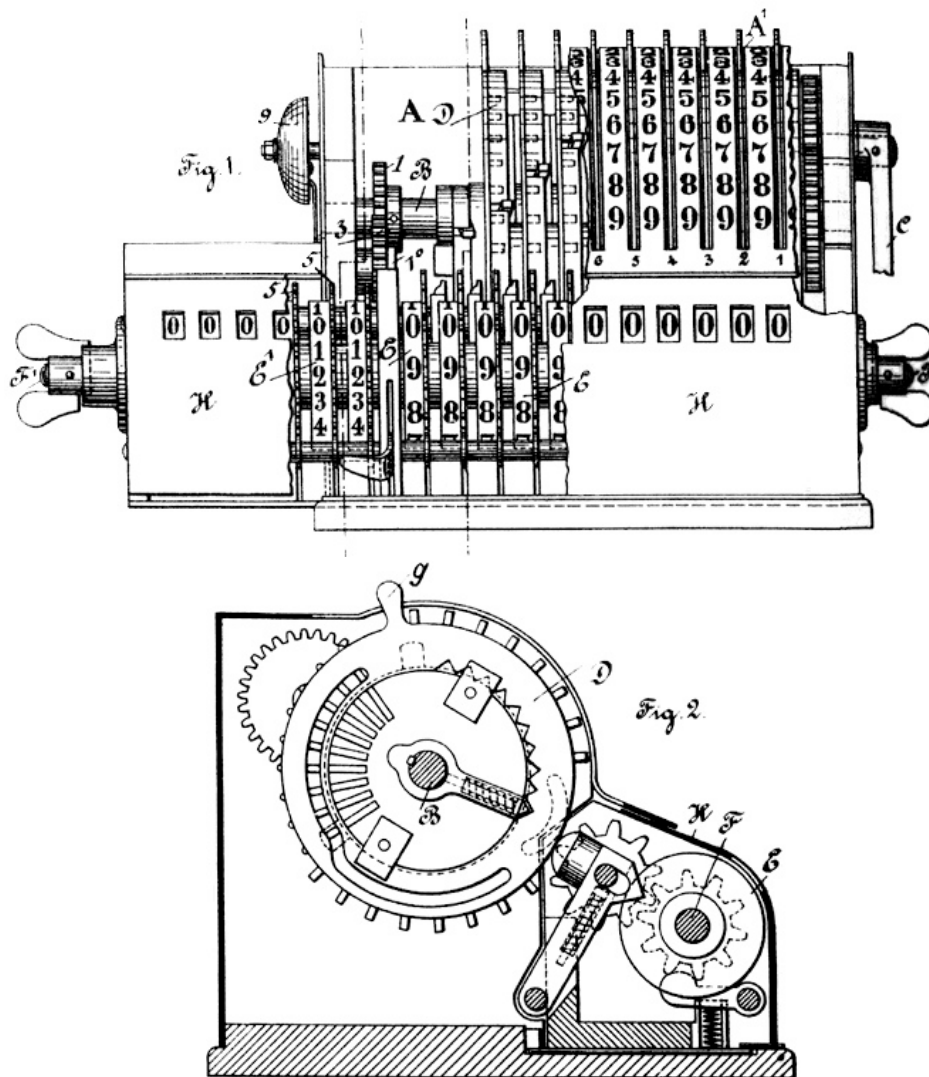


Figure 14. The improved 1890 version of the Odhner arithmometer according to the German patent drawing at [www.geocities.com/SiliconValley/Horizon/1404/fpatodh2.html#re](http://www.geocities.com/SiliconValley/Horizon/1404/fpatodh2.html#re), ©Andries de Man. The alarm bell already exists here.

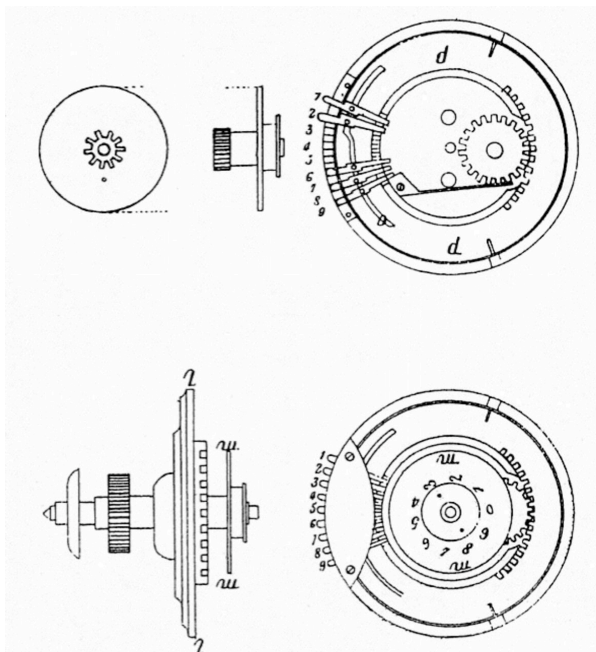


Figure 15. The pinwheel of Didier Roth was patented in England by Wertheimer in 1843 but not printed until 1856 [24], ©Åbo Akademi University Library.



As Odhner himself noted, the calculator was sent to market in 1890 [13] and this is also known by [30] and [83]. The sales thus began in the summer of 1890, and at first Odhner sold arithmometers from his workshop. Some prototype models were probably tested outside the factory before the official beginning of the sales. Thus O.G. Spennemann writes in his recommendation letter dated November the 16th 1891, that he bought an Odhner arithmometer two years ago and that it has been used in his office since that time [5]. The earliest information of a mass-produced Odhner arithmometer in use is from July 1890 when the insurance company 'Российское Общество застрахования капиталов и доходов учрежденное в 1835 году' started to use one and found it especially useful in interpolation and in computing percentage tables and differences [5].

The first exported calculator apparently went to Odhner's brother-in-law Arvid Åhlin, who exhibited it at the hotel Göta Källare in Göteborg on September the 5th 1890 [56]. In Moscow, the sales agent for Odhner was T. I. Hagen [77]. The sale of calculators was difficult at that time and soon the firm of Emanuel Mietens at the department store Gostiny Dvor (it is still in existence) in St. Petersburg took care of it. Mietens' firm remained as the general agent for Odhner in Russia from 1892 [78] until 1917 and Odhner sales were directed by Albert Menge [59]. Odhner arithmometers were also sold in St. Petersburg through the journal Schetovodstvo [105] and O. Richter's store selling optical, mechanical, meteorological, physical, technical, chemical, medical and other instruments at Moika № 59 [96].

Odhner started a powerful publicity campaign for his new calculator and succeeded in the autumn of 1890 in having news of it included in, for example, the Russian accounting trade journal Schetovodstvo [105], the general scientific magazine Nauka i Zhizn' [77] and the newspapers Novosti [75] and St. Petersburg Herold [31]. Because they were news, Odhner was not required to pay for this publicity. We cite the Petersburg Herold of September 9th (21th) 1890 [31]:

"Arithmometer nennt sich ein intressanter, handlicher Rechenmechanismus, wie er von der Firma W. T. Odhner in St. Petersburg construiert und in den Handel gebracht ist. Viele, theils für allgemeine, theils für specielle Rechnungszwecke eingerichtete Apparate wurden bereits hergestellt. Von allen diesen Maschinen jedoch fand nur eine, der von dem Elsasser Thomas 1820 construierte sogenannte "Arithmometer", ein praktischen Rechenwesen Anwendung. Indess blieb, der complicirtem Construction und des hohen Preises wegen, seine Verbreitung eine sehr beschränkte. Langdauernden Bemühungen des gen. Constructeurs ist es nun gelungen, einen einfacheren und billigeren Apparat herzustellen, mit Hilfe dessen unsere Zahlenrechnungen ausgeführt und controlirt werden können. Wir hatten Gelegenheit, die Leistungen des Apparates in Augenschein zu nehmen und können nur die Vorzüge des neuen Arithmometers von W. T. Odhner als da sind: kleines Volumen, einfache und unzerbrechliche Construction, richtige Wirkung, elegantes Aussehen, einfache und leicht begreifliche Behandlung, sowie billiger Preis u. a. m. bestätigen und möchten hiermit die Aufmerksamkeit unserer Leser auf diesen neuesten automatischen Rechenmeister gelenkt haben, welcher vom Geschäfte H. Odhners, Rigascher Prospect 26, zu beziehen ist."

As in all other articles of this type, the information on the instructions [4] was used. Odhner also gave a talk about his calculator at the meeting of the 'Polytechnischer Verein' on 27th September 1890. He had with him not only an arithmometer, but also drawings and a demonstration model [37]. Because German was not Odhner's native language, the paper was probably written by Arthur Hasselblatt, who was the editor of the journal.

The prices of 11 and 13-digit arithmometers were 75 and 100 roubles [77], [105], but the subscribers of Schetovodstvo received a 10% discount if they bought the arithmometer at the office of the journal where a specimen was available to be tested.

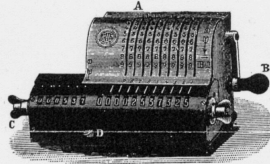
Odhner's general agent in Sweden, Norway and Denmark was his brother-in-law Arvid Åhlin, who also did active marketing. He printed two Swedish brochures in 1890, photos of which can be seen in [67, page 44; English version page 40]. In addition to these, the picture shows brochures printed by Åhlin's Norwegian agent, Captain Adolf Beckman, in Oslo and his Danish agent, Borgerson & Co., in Copenhagen. Of these four, a reprint of the other Swedish brochure [72], see Figure 16 and the short Danish brochure [50] have been found. In 1891, Åhlin published a 39-page Swedish instruction booklet [73] of 120 calculating examples containing, for example, the calculation of square and cubic roots. There are also examples where the calculation is different on 11-digit and 13-digit arithmometers. The first facsimile edition of it appeared 1899, when Åhlin no longer worked as an agent for Odhner. This collection of examples was intended as supplementary material to the Swedish instruction manual which has not yet been found.

In addition to the Russian publicity news cited above, the instruction brochure [65] published in Swedish by Odhner's Finnish agent, Aksel Paul in January 1891, cites parts of articles published in the Swedish magazines Göteborgs Handels- och Sjöfartstidning [56], Skånska Aftonbladet, Göteborgs Posten and Vännerborgs Tidning and states that there are many more.

Some Finnish newspapers also noticed Odhner's invention. Hufvudstadsbladet on 13.9.1890 [40] and Östra Finland on 16.9.1890 [57] copied parts of Swedish article [56] without seeing the calculator and a little later on 23.9.1890 Hufvudstadsbladet [41] translated Russian information from [75]. In Finnish language an interesting newspaper article [6] published on 2.12.1890 considered also the construction of the arithmometer and even elementary calculations. Sales of the Odhner arithmometer began in Finland at the beginning of 1891 and there were large advertisements on the first page of the Finnish newspaper Uusi Suometar on January the 9th (see <http://digi.lib.helsinki.fi/sanomalehti/secure/showPage.html?conversationId=2&action=entryPage&id=426525>), 11th, 13th, 14th, 15th and 17th accompanied by a short article [28]. An identical advertisement appeared in Swedish in Hufvudstadsbladet on 8.1, 9.1 and 10.1, see Figure 17. The price of an arithmometer was given as 350 Finnish marks [14], and the present value of this would be € 1330 according to the calculator provided by Nordea Bank. However, it is not specified whether this is for an 11 or 13-digit version. The price could be compared with the 550 marks budgeted in May 1890 for the Central Statistical Office of Finland to buy a French arithmometer (probably Payen), see <http://digi.lib.helsinki.fi/sanomalehti/secure/showPage.html>?

STOCKHOLM i Oktober 1890.

S. H. T.



Härmed öfverlemnande till Eder beskrifning å den **Odhnerska Räkmaskinen**, som öfver allt, der den förevisats, väckt allmän beundran, beder jag få fästa Eder uppmärksamhet på nedanstående ovanligt *billiga prisnotering* för en så nyttig och tidsbesparande apparat.

Af den Odhnerska Räkmaskinen tillverkas för närvarande endast tvänne storlekar:

*Mindre storleken* inrymmande till och med följande tal

i den ena factorn:	999.999.999	} Pris 160 kronor.
i den andra »	999.999	
i produkten:	99.999.999.999	

*Större storleken* inrymmande till och med följande tal

i den ena factorn:	999.999.999	} Pris 210 kronor.
i den andra »	99.999.999	
i produkten:	9.999.999.999.999	

Framdeles kommer att tillverkas en *största storleken*, inrymmande till och med följande tal:

i den ena factorn:	9.999.999.999	} Priset ännu ej bestämdt, troligen cirka 300 kronor.
i den andra »	999.999.999	
i produkten:	9.999.999.999.999.999	

Allt fritt ombord eller å jernväg i Stockholm och mot extra kontant liqvid. Hvarje maskin förvaras uti en prydlig polerad låda.

Emedan uppfinnaren är bosatt i St Petersburg och der å egen fabrik tillverkar maskinerna, som redan vunnit stor efterfrågan inom alla länder, så torde skriftliga requi-sitioner snarast insändas till undertecknad under adress Mäster-Samuelsgatan 41 B, 1 tr. upp, Stockholm, der maskiner komma att finnas till påseende.

Ehuru jag skall beflita mig om, att göra allt, för att inom kortaste tid effektuera inkomna order, nödjas jag af förut anförda skäl, att, nu till en början, betinga mig cirka sex veckors leveranstid, räknadt från orders ingång.

Öfverlemnande den sinnrika apparaten uti Eder välvilliga hägkomst tecknar

Högaktningfullt  
**Arvid Åhlin**  
Generalagent för Sverige, Norge och Danmark.  
Kontor: Mäster-Samuelsgatan 41 B.

Figure 16. Facsimile of the original 1890 one-page brochure printed in October 1968, ©National Museum of Science and Technology Stockholm. The price of an 11-digit arithmometer is 160 crowns (corresponding to 8110 crowns in 2006, see www.myntkabinettet.se/räknare.htm) and that of a 13-digit arithmometer 210 crowns (corresponding to 10645 crowns in 2006). The time of delivery is said to be about 6 weeks. The price of a 15-digit arithmometer was not yet determined but estimated to be about 300 crowns.

Tjugondejunde Årgången.

# HUFVUDSTADSBLADET.

1891

<p><b>N<sup>o</sup> 7.</b></p> <p><b>Annons- &amp; prenumerationskontor</b> Fahlstagsgatan 59 A. Öppna lördagarna kl. 10-12 &amp; kl. 2-4. Fr. kl. 10-12 lördag &amp; söndag kl. 10-12.</p>	<p><b>Annonspris:</b> 15 pennar för postfritt. 75 öre för öfrigt, utgående 20 pct. Kjörkostnad öfver 4 öre 25 pct.</p>	<p><b>Prenumerationspris:</b></p> <table border="0"> <tr> <td colspan="2">i Helsingfors:</td> </tr> <tr> <td>12 mån.</td> <td>10.00</td> </tr> <tr> <td>6 mån.</td> <td>5.00</td> </tr> <tr> <td>3 mån.</td> <td>2.50</td> </tr> <tr> <td>1 månad.</td> <td>0.80</td> </tr> </table>	i Helsingfors:		12 mån.	10.00	6 mån.	5.00	3 mån.	2.50	1 månad.	0.80	<p style="text-align: center;"><b>HELSINGFORS</b> Fredagen den 9 Januari.</p> <p style="text-align: center;">A. S. FRENDEL. Helsingfors.</p>	<p><b>Prenumerationspris:</b></p> <table border="0"> <tr> <td>12 mån.</td> <td>10.00</td> </tr> <tr> <td>6 mån.</td> <td>5.00</td> </tr> <tr> <td>3 mån.</td> <td>2.50</td> </tr> <tr> <td>1 månad.</td> <td>0.80</td> </tr> </table>	12 mån.	10.00	6 mån.	5.00	3 mån.	2.50	1 månad.	0.80	<p><b>Redaktionsbrå</b> Första sidan kl. 1-12, andra kl. 1-12, m. m. Tryckeri Boktryckeri i Skånings t.</p>
i Helsingfors:																							
12 mån.	10.00																						
6 mån.	5.00																						
3 mån.	2.50																						
1 månad.	0.80																						
12 mån.	10.00																						
6 mån.	5.00																						
3 mån.	2.50																						
1 månad.	0.80																						

**Nytt! Nytt! Nytt!**

**En ny storartad uppfinning - Ingeniör W. T. Odhner's räknemaskin - (Arithmometer) - Enkel och solid konstruktion - Gåfver absolut riktigt resultat - Behandlingen enkel och lättlärd - Smörjning obehöfvtig - Liten voly (7 1/2 x 5 x 2 tum) - Elegant utseende - Frisbillig**

Förrens apparat. Skilles sig utmärkt från alla andra beräkningsapparater, som endast i utseendet och i konstruktionen liknar den. Den är absolut riktig och verkar mycket till af säker, så till utmärkt nog.

Odhner's räknemaskin är afsedd och oändligt användbar för **banker, ränteräknare, allmänna och enskilda kassor** af alla slag - vid uppgiften af **bokslut** - alla slags **tabeller** m. m. m. m.

En oskattbar hjälp för **kassörer - bokförare - kontorsföreståndare - revisorer m. m.**, - en omöjlig kontrollant för **principaler.**

**Behandlingen af apparaten inläres på 10 minuter.**

**Obs! Obs!** Biv ej förföras ned de s. k. "Kassakontrollapparater".

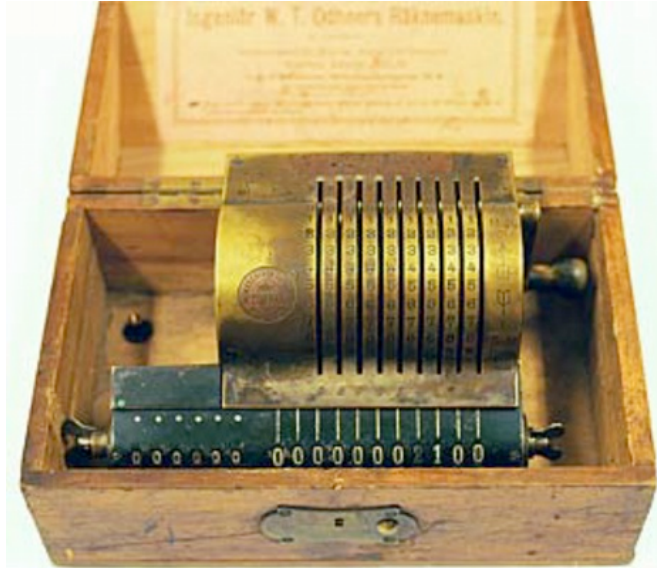
**AKSEL PAUL,**  
Lagerhuset vid Fålan, Helsingfors, telefonnummer 10

Figure 17. The advertisement for the Odhner arithmometer in Hufvudstadsbladet 9.1.1891, ©The Finnish Historical Newspaper Library 1771-1890 at <http://digi.lib.helsinki.fi/sanomalehti/secure/main.html?language=en>

According to the preface of [78], 500 calculators were produced during the first production year. This number seems to be quite trustworthy, so we can estimate that arithmometer nr. 500 was made in the middle of 1891. Some of these have even survived to this day. The calculator with the smallest serial number about which there is information is number 50 with a capacity of 11 digits and the script on the coverplate in German. It was originally bought by Mälaremejeriet dairy near Stockholm. The company was quite satisfied with the calculator, and had in 1911 bought a new model of Odhner calculator [15]. Probably the Hadar Schmidt company, which at that time was Odhner's agent, wanted to have an ancient arithmometer in their office and therefore took the old one as an exchange. The arithmometer was then exhibited at the business show held in Stockholm on 15-24 September 1911, which included a special

department celebrating 25 years of activity of Odhner's company [15]. Later, arithmometer nr. 50 belonged to Odhner's grandson Willgodt Odhner, [67, Swedish version page 26] who sold it at the end of the 1950 to the Original-Odhner factory at Gothenburg. It was then exhibited at the entrance hall of the factory, but its present location is not known.

Arithmometer nr. 52 at National Museum of Science and Technology, Stockholm and nr. 57 at Ätvidabergs Bruks- och Facit Museum, both with a capacity of 11 have also survived. The former has been slightly refurbished, but the latter is in its original form, see Figure 18.



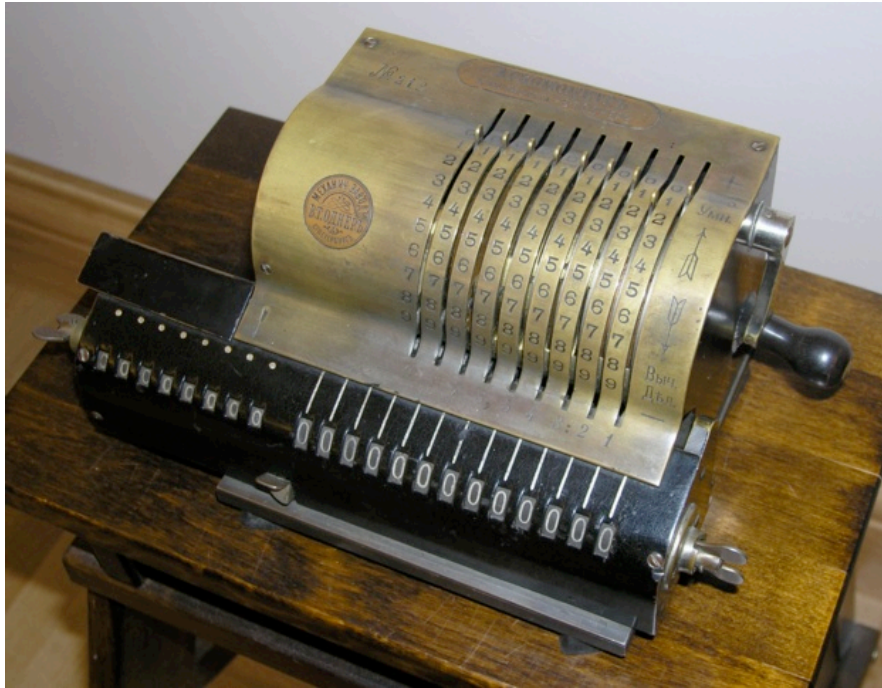
**Figure 18.** Arithmometer nr. 57 in its original case, photo ©Christofer Nöring. Its capacity is 11 and the script is in German. The paper glued to the lid is in Swedish and provides contact information for Arvid Åhlin and it also requests users to read the instructions carefully before using the arithmometer.

It is possible that the wooden cases made during three first years were constructed by Sannfrid Odhner, who then was part owner of a box factory [1], [25]. The wooden case where the calculator should be kept when not in use is inconvenient for everyday use. Grimme, Natalis & Co., who made sewing machines previously, bought the Odhner license in 1892 and built their calculators like sewing machines on a wooden plate with a separate cover. Odhner later adopted this system. The first known arithmometers with a capacity of 13 are nr. 147 (see <http://rk86.com/frolov/odhner-147.htm>) and nr. 216 shown in Figure 19. Depicted arithmometers 57 and 216 have the typical brass coverplate with copper inlays, but arithmometers nr. 52 and 147 have a nickel plated cover and a different logo, similar to one seen in Figure 26.

Of the production in the first half of 1891, arithmometer nr. 313 (capacity 11) was used in Odhner advertisements in 1950 and arithmometer nr. 324 (also capacity 11) belongs to the National Museum of Science and Technology, Stockholm. Of the 13-digit models, there remain but two, arithmometer nr. 468 at a small Finnish parish museum, and arithmometer nr. 525 at the National Museum of Science and Technology, Stockholm.

Of the production from the latter half of 1891, only arithmometer nr. 765 (capacity 13) at the Arithmeum in Bonn and arithmometer nr. 780, owned privately, are known. The only early calculating machine which can be precisely dated is the special arithmometer, nr. 852, donated by Odhner to Crown Prince Gustaf, later King Gustaf V of Sweden when he visited St. Petersburg from January 26th to February the 3rd 1892 (new style) and met the Swedish colony in St. Petersburg. The stages of the visit can be studied in both Swedish and Russian newspapers, and also in the department 'court circular' of The Times. This luxury arithmometer has a front plate of silver, a decorative penholder, a special velvet-lined case, instructions bound in leather, and the engraving "H. K. H. Kronprins Gustaf underdånigast af uppfinnaren". King Gustaf donated the arithmometer to the National Museum of Science and Technology in 1946 [27]. This 13-digit calculator is the last known made by Odhner alone without Hill and its serial number matches well with the information of that 500 arithmometers were produced during the first year [78].





**Figure 19.** Arithmometer nr. 216 with a capacity of 13 and Cyrillic script at Nordea Bank Museum, Helsinki. The bank is the original owner, although its name has changed several times over the years. The device was evidently bought in January 1891, when marketing began in Finland, even though no documents regarding the acquisition exist. When the museum was established in 1938, this calculator already belonged to its collection [38].

The second printing of Odhner's instruction manual [78] was approved by censors on February the 5th 1892 and only the Russian version of it has been found. The size of the brochure is 16 pages and the cover claims that the invention has been patented in all countries. This kind of exaggeration in advertisement seems to be typical for Odhner products. As we saw above, the US patent application had not yet been filed at that time. The number of numerical examples provided is now 26, including one example of the extraction of a square root. The main agent for Odhner for the entire Russian market was already Emanuel Mietens at Gostiny Dvor department store on Nevskii Prospekt. He maintained the agency to the end of the activity of Odhner factory in St. Petersburg.



**Figure 20.** Odhner arithmometer nr. 852 (capacity 13) at the National Museum of Science and Technology, Stockholm. This calculator was produced in January 1892 and is the gift of the inventor to Crown Prince Gustaf.

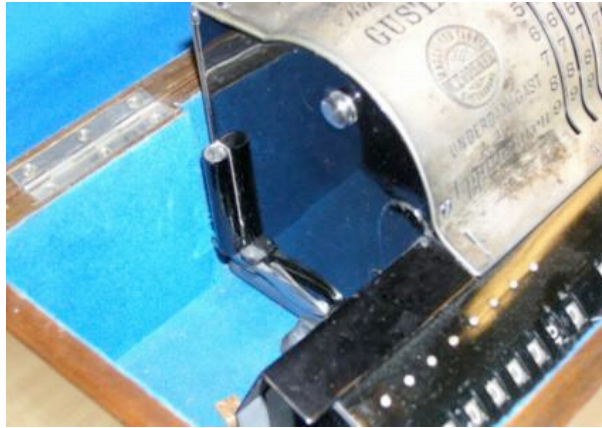


Figure 21. The penholder of arithmometer nr. 852.

Königsberger & Co was not able to sell the patent rights of the 1877 version of the arithmometer, but in spring 1892, the production license of the improved 1890 version was sold to Grimme, Natalis & Co. in Braunschweig, Germany which chose the name Brunsviga for the calculator. This sale of the patent rights of Odhner in Germany, Belgium and Switzerland has been considered in several sources [18], [19], [54], so not much need be written here. The investment cost 10,000 German marks plus 10 marks royalty for each calculator sold. This was quite good income for Odhner even though source [61] claims that Odhner sold the licenses too cheaply. When Grimme, Natalis & Co. also had to start their production from scratch, it is no wonder that the company did not pay any dividends in 1890–1903 [18], [19]. The first Brunsviga instruction booklet [52] is a modification of the first Odhner instruction [4] and does not contain any new material from the second edition [78] which was then available. The Brunsviga instructions are 9 pages long and there is one extra example included; the other 8 examples have been taken from the Odhner instructions [4].

### 8. Odhner–Hill arithmometers

The third printing of the instructions [5] was approved by the censors on September the 28th 1892 and it was already published by Odhner & Hill. The manual mentions a new 15–digit capacity model even though the image used is still that of an 11–digit arithmometer. Because the German production licence was already sold, a German version of the instructions was no longer needed. In order to sell a production license to France, a French version was now printed simultaneously. The brochure includes 11 testimonials from arithmometer users, among them the Oil Company of the Nobel brothers (10 arithmometers in December 1891), the Putilov factory (9 arithmometers in use and one more ordered to be delivered as quickly as possible), two insurance companies, a bank, the Associate Professor G. Depp, the engineering office of A. Kister, the St. Petersburg arsenal, the O.G. Spennemann office, a pharmacy wholesale company and the architect B. Prussakov. All testimonials are of course very positive. The beginning of the preface is following.

"Il m'a paru nécessaire, dans la troisième édition de cette brochure, de donner un développement beaucoup plus considérable au chapitre contenant les exemples d'opérations. De cette manière, chacun pourra rapidement et sans peine s'habituer à l'emploi de l'arithmomètre pour résoudre les divers problèmes sur les quatre règles ainsi que sur les opérations qui s'y rattachent: extraction de racines, solution de formules, etc.

La rapidité avec laquelle mes arithmomètres se sont répandus, – il s'en est vendu 500 dès la première année, – est la meilleure preuve de leur valeur pratique et de la commodité de leur application.

Après avoir, durant 15 années, porté mes constants efforts sur l'amélioration de cet appareil, je l'ai amené à un degré de perfectionnement qui ne laisse rien à désirer sous tous les rapports."

Four Odhner–Hill arithmometers are known. Of these, nrs. 1078 and 1209 belong to the Polytechnical Museum, Moscow, nr. 1148 to the National Museum of Science and Technology, Stockholm and nr. 1326 to Sergei Frolov, St. Petersburg, see <http://rk86.com/frolov/odh-hill.htm>. These serial numbers match quite well with the information given above and arithmometer nr. 1078 was probably made early in the second half of 1892. The first known non Odhner–Hill calculator is arithmometer nr. 1341 of Walter Szrek, see [www.calculators.szrek.com/#\\_ftnref17](http://www.calculators.szrek.com/#_ftnref17). Because no arithmometers with serial numbers between 852 and 1078 are known, the maximum number of Odhner–Hill arithmometers is 488, assuming that they were enumerated continuously. Evidently the financial situation in Russia, which was the main market area was not very good, because this amount could have been produced in a shorter time at the new factory. Another reason might be that the production of Orlov printing presses took most of the production capacity. In any case that is the reason why the earliest possible time of 1895 was assumed above for the end of the partnership of Odhner and Hill even though the Russian source [98] claims, that this happened in 1896 while sources [3], [76] give the year 1897, each without providing any evidence.



**Figure 22.** The logo of arithmometer nr. 1148 at the National Museum of Science and Technology, Stockholm with the Russian text 'Mechanical factory of Odhner and Hill, St. Petersburg'. In arithmometers made before the outbreak of the First World War, the inscription is either in Russian or German. When Russia and Germany were at war, the public use of the German language in any form was forbidden. Thus, there are a few arithmometers dating from that time with English script.

Odhner–Hill arithmometers are easily recognized from the logo, where instead of 'Odhner' one can read 'Odhner and Hill', see Figure 22. In other respects, the arithmometers are similar to those produced earlier. Of the four Odhner–Hill arithmometers, the one surviving in Stockholm has a capacity of 15, see Figure 23. The others are normal 13–digit models.



**Figure 23.** Odhner–Hill arithmometer nr. 1148 of the National Museum of Science and Technology, Stockholm in an original case. This is the first known 15–digit model. The coverplate here is nickel–plated, which was at that time cheaper than a lacquered coverplate [96], see also Figure 26.

The cases have survived for arithmometers nr. 1148 and 1326, and they are similar to the case of the special arithmometer, 852, in Figure 20, but there is no velvet lining, the wood used is cheaper and the finishing rather coarse, see Figures 23 and 24. At that time, the case does not yet contain the warning for turning the crank too fast mentioned in [67].

Brunsviga was more innovative and their calculators were already equipped with long cranks in 1893 [11], but Odhner continued to build their arithmometers with a short crank for some years. The new carriage shift system in Figure 24, which also can be seen in arithmometer 1209, is evidently also copied from Brunsviga. There are, however, later Odhner arithmometers with the original system of Figure 11 and Figure 26.

For the Columbian Exposition of 1893 in Chicago, the Russian government paid for the transport of the exhibited items, their insurance during the transportation and the exhibition space [71], and it was thus easy for Odhner to send his arithmometer there. The space given to Odhner was probably relatively small and many of those interested in new office machines probably had difficulty in finding it since the Russian department certainly wasn't the first place to seek new innovations. For example, the official American report [20] mentions the Brunsviga stand, but not Odhner's at all. The German reporter Berthold Pensky was more careful because he had been selected as the one–man jury awarding calculating machines. Thus, he also looked at the Russian department but notes only briefly that the Odhner calculator is similar to the Brunsviga [53]. Odhner received an award called 'first prize' in the 1895 advertisement in [74], see Figures 25 and 27. The justification for the award was "for simplicity of construction and convenience of form" [55]. Brunsviga, too, which at this time was still quite similar to the Odhner arithmometer [11], was rewarded [2] because "the design is novel and the form convenient" [55].



One of the Russian commissars at the exposition was V.L. Kirpichev, who had made a statement [87] concerning the first version of the Odhner arithmometer in 1878. He had now advanced from being a teacher at the St. Petersburg Practical Technological Institute to being the first director of the Kharkov Technological Institute in Ukraine, (see <http://smitu.cef.spbstu.ru/kirpichov.htm>), and he possibly had contacts with Pensky. It is unlikely that Odhner himself visited the the exposition.



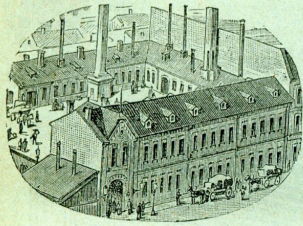
**Figure 24.** Odhner–Hill arithmometer nr. 1326 of Sergei Frolov, photo ©Sergei Frolov. The case is original, but the long crank, decimal pointers and input lever clearing system have evidently been refurbished later. The number wheels here (as in arithmometer nr. 1209) have black numbers on a white background.

To date the Odhner–Hill arithmometers we can examine some advertisements printed in 1894–1895, see Figures 25, 26 and 27. According to the advertisement of Figure 25 printed in January 1894 more than 1200 arithmometers were produced.

In 1895, the price of the 13–digit model was still 100 roubles, while the 15–digit model cost 125 roubles. For 10 roubles extra, one could obtain a coverplate lacquered black, see Figure 26. In Germany, the price of the Brunsviga was 300 marks, corresponding to 150 roubles [3], [88]. Thus the production costs in Russia were already at that time cheaper than in Germany, but the transportation costs lowered the ability of Odhner arithmometers to compete on the European market.

At the same time the price of a 16–digit Thomas arithmometer in St. Petersburg was 300 roubles while a 16–digit Layton arithmometer (system Tate) cost as much as 800 roubles [96].

МЕХАНИЧЕСКІЙ  
И  
МѢДНО-ЛИТЕЙНЫЙ ЗАВОДЪ  
ОДНЕРЪ И ГИЛЬ.



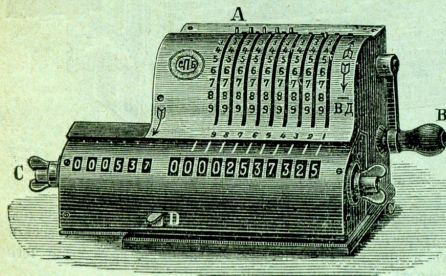
С.-ПЕТЕРБУРГЪ,

Таракановскій пер.. 4.

Телефонъ № 1387.

!!! АРИѠМОМЕТРЪ !!!

(СЧЕТНАЯ МАШИНА).



СИСТЕМЫ

В. Т. ОДНЕРЪ.

Болѣе 1200 штукъ уже про-  
дано въ Россіи.

1-я награда на выставкѣ  
въ Чикаго 1893 г.

Спеціальное изготовленіе Американскихъ рабочихъ машинъ и инстру-  
ментовъ, точныхъ аппаратовъ, коллекторовъ и другихъ приборовъ.

Отливки изъ мѣди, фосфористой бронзы и чугуна.

ХУДОЖЕСТВЕННОЕ ЛИТЬЕ.

Брошюры, описанія и прейсъ-курранты высылаются бесплатно.

Figure 25. Whole page Odhner & Hill advertisement from January issue of Zapiski Imperatorskago Russkago Tekhnicheskago Obshchestva 1894, ©National Library of Russia.

The advertisement of Odhner & Hill in the address calendar of 1895 in Figure 27 claims that more than 1500 arithmometers were in use. This number is somewhat greater than could be expected from the serial numbers given above, but the facts given in the advertising of Odhner products often are quite unreliable. The advertisement also claims that that a first prize was received at the World's Columbian Exposition 1893 even though only one kind of award was granted there.

In Sweden, Odhner calculators were advertised by the slogan "Swedish invention – Swedish Steel" and reason for the longevity of the arithmometer was claimed to be the use of Swedish steel [15]. Source [61] states that the steel used by Odhner came from the Sandviken factory. It is interesting that still in 1963 Sandviken steel was considered as the best for Danish Contex calculating machines [10].



**АРИОМЕТРЪ В. Т. ОДНЕРА.**  
(См. 25—26 ва 1890 г.).



Цѣна для произведеній до 13 чиселъ—100 р., до 15 чиселъ—  
125 р., безъ пересылки. За черную крышку на 10 р. дороже  
Подписчики получаютъ скидку въ 10<sup>о</sup>/<sub>100</sub>.

**Figure 26.** Advertisement in *Schetovodstvo*, 1895, № 11–12, ©National Library of Russia. The image is still of an 11-digit model even though it was no longer produced, as can be seen from the text. Subscribers to *Schetovodstvo* still received a 10% discount.



**„АРИОМЕТРЪ“**  
(СЧЕТНАЯ МАШИНА)  
**В. Т. ОДНЕРА.**  
1-я награда на выставкѣ въ  
Чикаго въ 1893 г.  
Болѣе 1500 шт. уже въ употребленіи.  
Брошюры высылаются по пер-  
вому требованію бесплатно.  
С.-Петербургъ, Тарахановскій пер.  
д. № 4.

**Figure 27.** The advertisement for a 13-digit Odhner–Hill arithmometer (calculating machine) from 1895 in [74], ©National Library of Finland.

### 9. Expert opinions about the Odhner arithmometer

Even though Odhner and Brunsviga arithmometers sold very well, calculating machine authorities did not like them. For example, R. Mehmke felt he needed only the words "billig aber minderwertig" to describe the Brunsviga in [35], but later he was more explicit "Ist nicht zuverlässig, weil die Bewegungen nicht hinreichend gesichert und die Zehnerübertragungen nicht weit genug geführt sind, hat sehr schweren Gang und andere Mängel" [36]. A more detailed article about the defects of early Brunsviga models was written by H. Sossna [60].

Russian calculating machine expert Waldemar von Bohl [80] (see also the photo at [www.nekropolis.ru/index1.php?id=61&r=19&f=192](http://www.nekropolis.ru/index1.php?id=61&r=19&f=192)), who was the inspector of the Alexandrov Military Academy in Moscow, first wrote that Odhner makes calculators patented by Brunsviga [82]. When he revised his articles for the well-known book [83], he corrected that error. In the book he compares the arithmometers of Thomas and Odhner and lists following advantages of the Odhner arithmometer:

1. меньшій объем,
2. более простое устройство и
3. меньшая цена."

However, he also lists its shortcomings compared with the calculating machines designed by Thomas,



Chebyshev, Selling and Bollée.

"1. Большое число пружин в подвижной части и особенно спиральных пружин, легко ослабевающих и ломающихся, через что механизм для перенесения десятков легко может дать отказ или ошибку; поэтому в отношении точности арифмометр Однера уступает арифмометру Томаса, не говоря уже об арифмометрах Чебышева, Зеллинга, Болле, не дающих ни ошибки, ни отказа. Вообще подвижная часть составляет самую слабую сторону арифмометра Однера.

2. Прибор дает при манипуляциях значительный стук, превосходящий стук, происходящий при действии арифмометра Томаса, особенно усовершенствованного Бургардтом; в этом отношении арифмометр Зеллинга представляет машину наиболее удовлетворительную.

3. Хотя замена механизма, служащего для перехода от сложения и умножения к вычитанию и делению простым изменением направления вращения рукоятки и послужила к упрощению устройства арифмометра, но замена эта вызывает невольные ошибки, так как требует всегда внимания: в какую сторону надо вращать рукоятку. Постоянное вращение рукоятки в одну сторону при употреблении арифмометра Томаса, как показала практика, не дает тех ошибок, которые нередко случаются при употреблении арифмометра Однера."

The third 'shortcoming' is interesting. Because von Bohl certainly had performed many calculations with a Thomas arithmometer, he was accustomed to rotating the crank in only one direction. Thus, he did not approve of the system employed by Odhner where the direction of rotation must be reversed when changing from addition/multiplication to subtraction/division; this despite the fact that it is very convenient, leaving the left hand free. However, the famous chemist Dmitrii Mendeleev claimed that it is easier to learn the use of an Odhner arithmometer than a Thomas arithmometer [91].

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#### Appendix 1. Letter [43] of W.T. Odhner to Hjalmar Odhner

S<sup>t</sup> Petersburg den 1/12 Oktober 1878

Sarodnaja Strasse №13. kv 5

Heders Broder Hjalmar!

Wäl för 4<sup>e</sup> gången fattar jag pennan för att besvara dina bägge för så länge sedan erhållna bref – denna gång med den orubbliga föresatsen att ej förr sluta än mitt hedervärda namn är underskrifvet ty alla föregående bref har ej kommit mer än halfväges dit – och så otroligt det än låter så är det verkligen brist på tid som varit orsaken hærtill – ty jag har en par månaders tid varit så verksam att jag hvarken haft en enda qväll eller söndag till min disposition.

Som du troligen hört har Ryska Regeringen tagit ett inhemskt lån – på 300.000.000, och papperen här till har vi på dessa 2<sup>ne</sup> månader tillverkat – det har varit en kolosal brådska, som haft det goda med sig att jag haft tillfälle att utomordentligt utmärka mig så att jag hos vår Director blifvit en riktig gunstling, ty dels genom egna uppfinningar och tillställningar, dels genom ett förnuftigt ordnande af arbetet har jag bringat det derhän att man i. s. f. 40% – utskott som man förr haft numera ej har mer än 5 a 6% –

Jag har äfven haft mycken heder och glädje af mitt arbete, fått löfte om på ökning på min lön m. m. och tror mig komma med stora steg gå framåt.

Men nu kommer det som skall glädja dig mäst af allt. Jag håller på med en ny af mig uppfunnen inrättning genom hvilken ett papper af hvilket flera miljoner årligen tryckes, skall kunna tryckas och numreras (hvarje ark med olika nummer) på en gång – för att göra nödiga apparater erbjöds mig en medhjelpare och det har lyckats mig att få Sannfrid antagen hærtill – han är sedan några dagar i verksamhet får en för sina förhållanden ganska anständig lön af 62 1/2 Rubel månatl. och som utsigter finnes å mycket arbete så träd han äfven kunna på öfvertid förtjena ganska mycket, (ty öfvertids arbete blir serskildt betalt). Han har nu tagit en liten nått wåning mitt emot oss och kan emotse ett lungt, bekvämt och lätt bröd till döddagar, det är ej utan att jag haft betänkligheter att rekomendera Sanfrid en plats under mig, i anseende till hans yttrest sjelfständiga och egenkära karaktär – hans ställning var dock så kritisk och inkomster så små att jag ej kunde låta tillfället gå mig ur händerna hoppas att allt skall gå bra, och att han snart skall få en sjelfständig ställning.

Från America har jag haft underrättelse att min maskin är patenterad – återstår således endast att se om någon vill gifva några Dollar för detsamma – samt att introsera dem – (det svåraste af allt). Alma och Barnen äro friska och raska de sednare så söta att du skulle glädja dig åt att se dem. Poijken är stora karlen som i qväll underhållet mig ett par timmar med sagor, diktade af honom sjelf och berättade på renaste Ryska – Samt har provfat i qväll sin första Herr kostym bestående af Jacka väst och Byxor, som Mamma sytt af Pappas gamla kläder – med ett ord jag är lycklig och belåten, och skull vara det ännu mer om Jag viste huru det stoge till med eder derhemma.

Straffa derföre icke min långa tystnad med en lika lång utan skrif med omgående och berätta huru det är ställt för eder alla. Serskildt väntar Jag och Alma med otålighet på att få höra att du tagit mod i bröstet och skaffat dig en duktig helft som kan en smula hjelpa dig fram i werlden – Min fulla öfvertygelse är den att en man alldrig kan wänta sig en större framgång innan han blifvit familje fader, tag derföre mod till dig, lef ej som en enstöring hvars enda nöje är att i mellan åt med syster gå på theatren, utan sätt vigelongsen i gång uppträd som en liten fin gentleman i borgare familjerna inbilla dig ej att du är hvarken för liten eller för

simpel för den bästa – utan kom i hog att i små kroppar alltid bor stora själar – och en sådan kan ju intaga – icke alenast ett svagt och skräpligt qvinnohjerta utan hela världen, fundera ej för länge utan sätt maskinen i gång Herr kapten – och om du styr kosan riktigt – så skall du inom år och dag lefva i en hem som är ej för rik och ej för fattig – ej för skjön och ej för ful – icke för stormig och ej för lungn. Tro mig, en hustru är ej så dyr som du tror att föda.

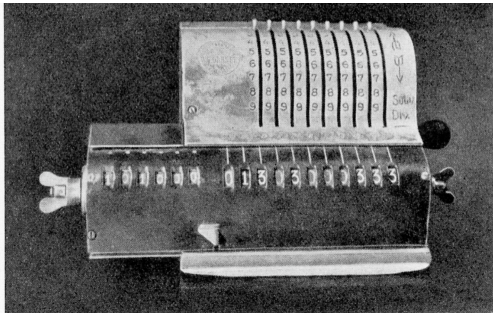
Huru är det ställt för Theophil – har Du eller Arvid bördan af honom f. n. lefver jag till våren hoppas jag kunna taga uti denna sak, med ett kraftigt tag, han är det enda samvets ogg jag äger – men hvad är att göra – villjan hafver jag, men förmågan hafver jag icke, vore han här – så vore det önskvärda. Halsa honom hjertligen. Halsa äfven Hildegard på det innerligaste – det var min mening att genast besvara såväl hennes som ditt bref och grattulera Dig till din födelsedag, men jag hadde just då en mängd funderingar för mig och så blef det om intet. Så snart jag får det litet lungnare skall jag emellertid skrifva till henne.

Säg mig äfven huru Arvid och Anna har det ställt. Jag skref till honom för en 3<sup>e</sup> månader sedan till Rotterdam men har sedan ej hört någödt från dem.

Alma och Barnen äfvensom Sanfrids helsar eder alla på det Hjertligaste. Skrif snart Beder din trogne Vän och Broder

Willgodt

## Appendix 2. Photos of some Odhner arithmometers 1890–1895

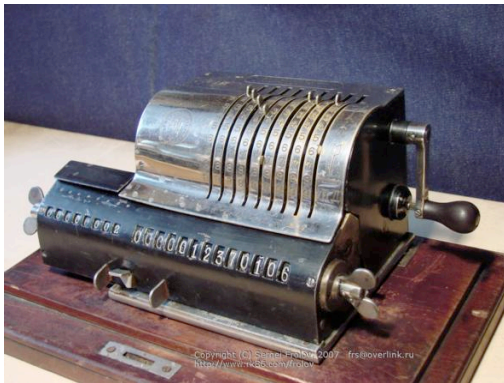


Exemplar nr 50 av Odhners första arithmometerserie. Ägare ingenjör Willgodt Odhner, Stockholm.

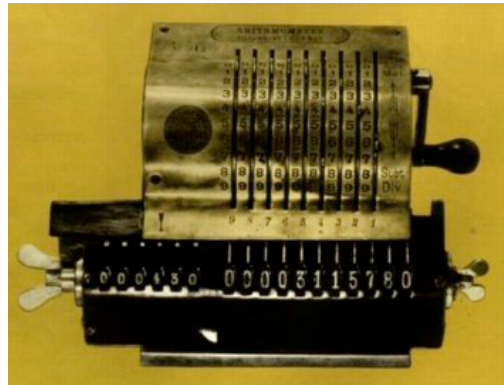
Arithmometer nr. 50 in original Swedish version of book [67]



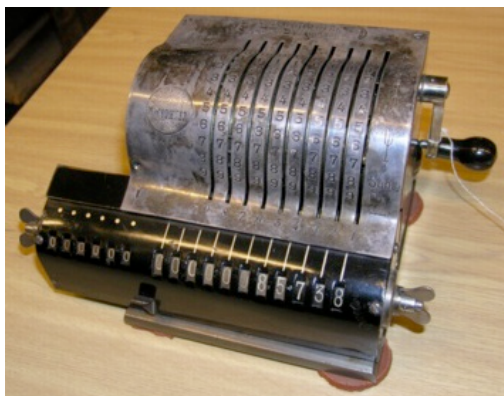
Arithmometer nr. 52 at National museum of Science and Technology, Stockholm



Arithmometer nr. 147, photo ©Sergei Frolov



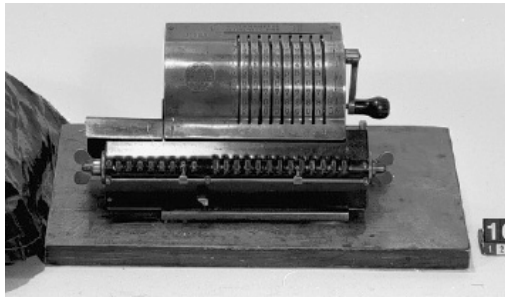
Arithmometer nr. 313 used in advertisements of Odhner



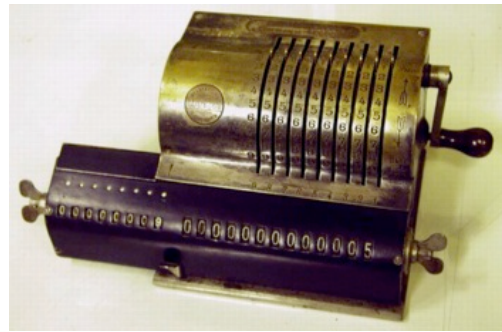
Arithmometer nr. 324 at National museum of Science and Technology, Stockholm



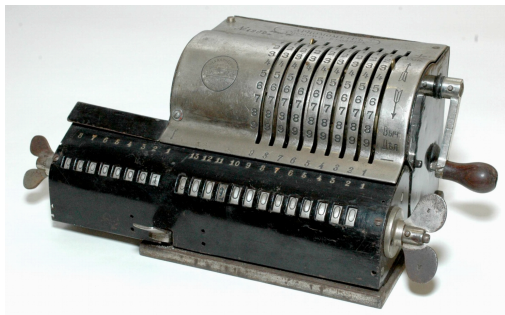
Arithmometer nr. 468 at a Finnish parish museum, photo ©Museum



Arithmometer nr. 525 at National Museum of Science and Technology, Stockholm, photo ©Museum



Odhner-Hill arithmometer nr. 1078 at Polytechnical Museum, Moscow, photo ©Museum



Odhner-Hill arithmometer nr. 1209 at Polytechnical Museum, Moscow, photo ©Museum