Simon Weber-Unger

5 A Camera Obscura by Voigtländer & Son Vienna

This article treats a camera obscura that, by its provenance, maker and date, can be placed in a direct connection to the early period of Austrian photography and its development.

Description of the camera obscura

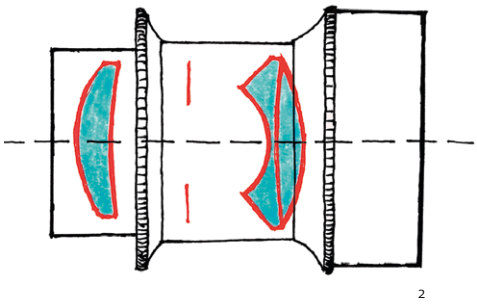
Figure 1: Made in Vienna, c. 1848, signed on lens "Voigtländer & Sohn / in Wien." Mahogany veneer wood corpus, mirror and ground glass (not original), lacquered brass lens with lens hood and brass cap, focussing screw, brass fitted screw-on magnifier glass (fig. 4). Dimensions: wood box c.25.3 x 36.4 x 30.7 cm, total length c.49 cm, lens diameter c.65 mm, focusing screen up to c.22 x 27 cm.

Detailed description of the camera obscura's lens by Dr. Milos Mladek, Vienna

The lens of the camera obscura is an optical system of three glasses in two groups with a fixed intermediate diaphragm, mounted in a beautifully-made, sturdy brass barrel engraved „Voigtländer & Sohn in Wien". It has rack-and-pinion focusing and renders a sharp image with good contrast and no apparent distortion.

As for the optical design: The heart of the system seems to be a positive meniscus in the rear, with a focal length of 12 cm and a fixed diaphragm before it. There is a strongly negative cemented meniscus (consisting of a biconvex lens in front and a biconcave lens behind) in front of these two. The focal length of the whole system is about 25 cm, with an approximate lens register of about 35 cm, the relative aperture is probably about f/9. A suggested cross section of the whole system can be seen in figure 2.

The optical design is uncommon and could not be found in the photographic literature. At best, it may be regarded as a Wollaston Meniscus with an added negative group in front. There is no resemblance to any of the three optical doublets Professor Petzval designed in 1840 (of which, both the portrait lens and the landscape lens were created by combining two of them), and no similar photographic lens was even forthcoming in the following hundred years. Please note that this is only a preliminary description of the lens as, under the given circumstances, some of the data are estimations.



2

fig. 1 Camera Obscura, *Voigtländer & Sohn / in Wien*, c.1848. Austrian National Library, Vienna.

fig. 2 Lens cross section, drawing: Milos Mladek.

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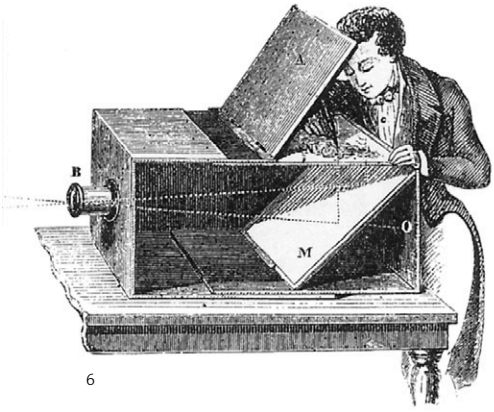


6

fig. 3 Camera Obscura, *Voigtländer & Sohn / in Wien*. Austrian National Library, Vienna.

fig. 4 Camera obscura with attached magnifier. Austrian National Library, Vienna.

fig. 5 Archduke Ferdinand Maximilian, Villa Lazarovich, Triest 1852. Daguerreotype half plate. Austrian National Library, Vienna.

fig. 6 From: Lardner D., *The museum of science and art*, London: Walton & Maberly, 1855.

Provenance

The camera obscura originates from the estate of Archduke Ferdinand Maximilian of Austria, the later Emperor Maximilian of Mexico. After the death of his widow Charlotte of Belgium in 1927 it was integrated, together with other items from the estate of Miramar, into the collections of the Picture Archive of the Austrian National Library (fig. 5).

A short history of development of the camera obscura

Since the 15th century, optical drawing aids, so-called *machines à dessiner* have been used by artists including Leonardo da Vinci and Albrecht Dürer who employed glass plates with grids, and similar instruments to achieve a good perspective. More complicated devices, such as perspectographs, were developed in the 17th century. Nicolas Bion described such an instrument in his important mathematical book *Traite de la construction et des principaux usages des instrument de mathematique* (1709). The third edition in German (1726) describes the instrument as follows: "Instrument vermittelt dessen man allerhand Objecta gar leicht Perspektivisch zu Papier bringen kann" [1] (instrument making it easy to reproduce all kinds of objects, in perspective, on paper). Still in the second half of the 18th century, such a perspectograph, possibly made after Bion's instructions, was produced by the Mechanikus Johann Friedrich Voigtländer (1732–1797) in Vienna. [2]

The principle of the camera obscura was already described by Aristotle (c.300 BC) and, before him, by Mzi (lat. Micius 470–c.391 BC). Later, the Arab mathematician, astronomer and optician Abu Ali al-Hasan Ibn Al-Haitham (lat. Alhazen c.965–1039 or 1040) gave the correct analysis of the camera obscura. [3] Alhazen's book Kitab al-Manazir (The book of optics – de

5

Aspectibus oder Opticae Thesaurus), translated into Latin, influenced European philosophers including Roger Bacon (1214–1292 or 1294), who also gave a description of a camera obscura for the observation of a solar eclipse. Until the 15th century, whole rooms or other large constructions with only a hole for the incoming image were used as a camera obscura. Such a walk-in chamber was described in Athanasius Kircher's book *Ars Magna Lucis et Umbrae*[4] in 1646; however, this camera obscura already used a glass lens.
The camera obscura's shape, structure and size as pictured in figure 6 appeared around the 17th century and remained until the 19th century. A lens gave a better picture and the mirror turned the inverted image on the focusing screen.

One of the most famous painters who supposedly used a camera obscura is Jan Vermeer (before 1632–1675). Among his most significant paintings are "Officer and a Laughing Girl" (1657–1659), "The Little Street" (1657 / 58), and "View of Delft" (1660–1661); the last two mentioned are discussed precisely in Heinrich Schwarz's article "Vermeer and the Camera Obscura".[5] Vermeer might have used a *camera immobilis* for his two surviving landscape/town-paintings. An interesting example of an artist's portable camera obscura, Sir Joshua Reynold's (1732–1792), is still in the Science Museum in London – when folded it looks like a large leather-bound book. A camera obscura with the inscription "A. Canal" is in the Museo Correr in Venice and can be associated with Giovanni Antonio Canal (1697–1768). His nephew Bernardo Bellotto used the camera obscura as well. In Austria, Ferdinand Georg Waldmüller (1793–1865) was one of the last users of optical drawing aids just before 1839. In his landscape paintings of the Salzkammergut, he used the camera obscura, the Claude Lorrain-Mirror (a black, slightly

convex, mirror), or the camera lucida. [6] In his famous lecture *Before 1839*, Heinrich Schwarz concludes that the will for photography was given at the moment when the focal point became a part of the aesthetic credo and that the basic idea of this technique can be seen in the fact that *machines à dessiner*, the camera obscura and the mirror, were integrated into the artists' equipment.

The interests and voyages of Archduke Ferdinand Maximilian of Austria

Archduke Ferdinand Maximilian Joseph was born in 1832 as a younger brother of Archduke Franz Joseph Karl, the later Emperor Franz Joseph I. of Austria. He, as well as his brother, was taught by Count Heinrich Franz Bombelles, had drawing-lessons from Ignaz Dullinger and, later, from the painter Peter Johann Nepomuk Geiger. [7] In 1860 the archduke is described as a "geistvoller Kenner und Förderer der Wissenschaften und Künste" (a brilliant connoisseur and patron of the arts and sciences). [8] A reason for this reputation definitely lies in the voyages he made – partly related to his training and function in the Imperial and Royal Austro-Hungarian Navy.

In 1850, he travelled to Smyrna in Asia Minor (today's Izmir in Turkey) which was Greek at the time, accompanied by Geiger. He travelled to Italy and Spain in 1851, to Sicily, Spain, Portugal, Madeira, Morocco (Tangier), Algeria, Medeah, and Malta in 1853 and, as commander of the ship S.M. Corvette Minerva, to Albania and Dalmatia. In 1854, as a 22-year old, he was appointed Commander-in-Chief of the Imperial and Royal Navy and soon accomplished many important reforms. In 1855, he commanded a squadron comprising 17 ships on a naval exercise to Italy, Greece, Lebanon, Palestine (where he went to Jerusalem) and Egypt to inspect the Suez Canal project that was planned by the Austrian engineer Alois Negrelli (1799–1858). Negrelli became technical director of the Suez Canal Company in 1857. The 1855 voyage was documented by the young photographer Franz Mai and 38 impressive photographs have survived. [9]

After marrying Princess Charlotte of Belgium in Brussels in 1857, he was named Governor-General of Lombardo-Venetia and moved his court to Milan.

He supported the circumnavigation of the globe by the S.M. Frigate Novara (1857–1859) although he was unable to participate due to illness. On Ferdinand Maximilian's orders, the number of arms on board was reduced to create more space for the expedition and collected objects. The scientific commission, headed by Karl Scherzer, comprised Ferdinand Hochstetter, Anton Jellinek, Georg Fraunenfeld, Johann Zelebor, Eduard Schwarz, and the painter Joseph Selleny. In almost two-and-a-half years, they collected about 23,700 individual natural specimens, including animals (or parts), minerals and ethnographic objects.

Lombardo-Venetia was lost after the battle of Solferino in 1859. In 1860, the Archduke travelled on board the steamer S.M.S. Elisabeth to Brazil, where he made an expedition to the jungle (Cachoeira) in mid-January. He later visited his cousin Dom Pedro II., Emperor of Brazil – the son of Dom Pedro I. and Maria Leopoldina of Austria, Maximilian's aunt. The voyage was

7

fig. 7 A. Jellinek, *Erzherzog Ferdinand Maximilian in Tropenadjustierung während seiner Brasilienreise 1859/60* (Archduke Ferdinand Maximilian in his tropical outfit during his Brazil trip 1859/60). Albumen print, 18 cm oval. Austrian National Library, Vienna.

accompanied by Wilhelm v. Tegetthoff, as well as navy surgeon Heinrich Wawra von Fernsee and the gardener Franz Maly. On their field trip, they collected seed and rootstocks for the Imperial and Royal Garden in Schönbrunn, Vienna. [10] Botanical research results were published in 1866. [11]

Ferdinand Maximilian's interest in architecture was first shown in his "Chalet Maxing" which was built after he received his first allowance in 1848. Later he played an important role in the construction and design of the Votive Church in Vienna 1856–1879 and the castle of Miramar near Trieste 1856–1860. [12]

The Archduke was proclaimed Emperor of Mexico in 1864 and crossed the ocean to his new realm on the S.M. Frigate Novara. The local photographer M. Rizo made photographs of the Emperor's inauguration in Puebla and Maximilian sent seven copies to his brother Emperor Franz Joseph I. in Vienna. [13]

In 1867 Emperor Maximilian of Mexico was executed after his capture by Republican forces led by Benito Juárez.

The optical instrument makers Johann Friedrich and Peter Wilhelm Friedrich Voigtländer in Vienna

In 1756, Johann Christoph Voigtländer (1732–1797) founded a company for scientific instruments in Vienna. He produced miners', surveying, and drawing instruments. After his death, his third son Johann Friedrich (1779–1857) travelled to Germany and England. He was first taught by Mechanicus Siebrecht in Berlin (1800) and, then, Mechanicus Baumann in Stuttgart (1802/03), before staying in London in 1805 / 06. He established his company for optical and mechanical instruments in 1807 and married Amalie Franziska Tiedemann, the daughter of the famous Stuttgart Optikus and Mechanikus Johann H. Tiedemann. [14] During his stay in Stuttgart in 1802 / 03, Tiedemann and his daughter might have had an important influence on Voigtländer's optical interests.

The company was named "Friedrich Voigtländer Optikus und Mechanikus" until Johann Friedrich Voigtländer's son Peter Wilhelm Friedrich took it over in 1837 and it was renamed "Voigtländer & Sohn in Wien". Peter Wilhelm had studied at the *K.k. Polytechnisches Institut* in Vienna and guided the company towards photography and photographic instruments. As a result of the March Revolution in Vienna and the increasing export-market, Voigtländer opened production facilities in Braunschweig in 1849. After that, all instruments were signed "Voigtländer & Sohn in Wien und Braunschweig". In 1868, the remaining branch in Vienna was closed and Voigtländer continued producing cameras in Braunschweig.

Sources
Dr. H. Harting, 'Zur Geschichte der Familie Voigtländer, ihrer Werkstätten und ihrer Mitarbeiter' in: *Central=Zeitung für Optik und Mechanik*, Berlin: 1924/25.
Prof Dr. E. Stenger, '175 Jahre «Voigtländer»' in: *der Satrap*, Heft 8, 1931.
Voigtländer*: 200 Jahre 1756–1956*, Sonderdruck aus: *der Photohändler* 1956.

The first photo cameras in Vienna

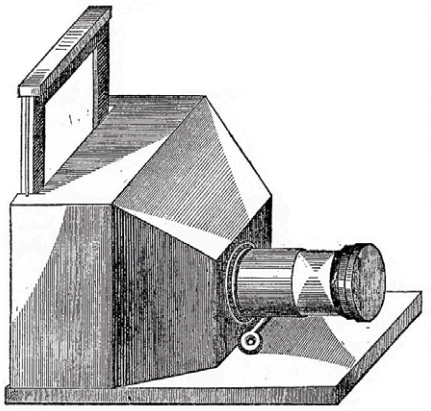
After Louis Jacques M. Daguerre had sent two of his first Daguerreotypes to Emperor Ferdinand I. of Austria and Count Klemens Wenzel Metternich, Andreas v. Ettingshausen travelled to Paris to study this new invention and buy a Daguerre camera. [15]

In summer 1839, Anton Martin had already studied the new technique and was using a camera built by Simon G. Ploessl (lost). Simon G. Ploessl (1794–1868) worked from 1812–1823 as an assistant to Johann Friedrich Voigtländer and he still offered "Daguerreotyp-Linsen" of 3 Paris inch diameter [16] in his 1856 catalogue.

An article in the *Österreichischer Zuschauer* [17] (16.12.1839) says that the instrument makers Eckling and the university supplier Hanaczek were constructing cameras. Johann Michael Eckling and Hanaczek (or Hanacek) mainly made philosophical demonstration apparatus. At Ettingshausen's suggestion, Joseph Petzval mathematically developed a portrait lens, which was produced by Voigtländer & Sohn. Two corporals ("Oberfeuerwerker") and eight bombardiers from the Imperial and Royal Bombardiers Corps assisted in the calculations (on the orders of Archduke Ludwig).

The brightness of this "Porträtobjektiv" was much higher than the Daguerre (Chevalier) lens. In 1840, Anton Martin was still being asked to make portrait-daguerreotypes with this lens that was fixed to a simple, square-conical cardboard back with a "baumschraube" mounting screw (usually used for telescopes). [18] Today, this prototype camera is in the Vienna Technical Museum.

At the end of 1840, Voigtländer produced the first all-metal camera and published an extensive description in the "Verhandlungen des Niederösterr. Gewerbevereins" [19] in 1841. A portrait-camera had already been described in an interesting article by Dr. Joseph Berres, [20] who made daguerreotype studies himself. [21]



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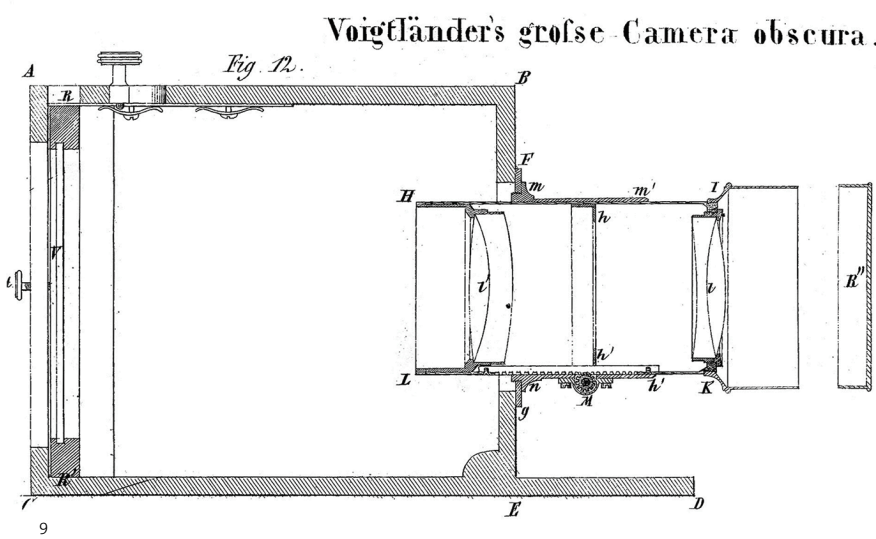
Voigtländer's early wooden cameras compared to Archduke Ferdinand Maximilian's camera obscura

The first detailed and illustrated description of a wooden camera by "Voigtländer & Sohn" can be seen in Dingler's Polytechnical Journal [22] from October 1842; this camera "Voigtländers neue große Camera obscura" (Voigtländers big new camera obscura) [23] was obviously double the size of the one previously available ("… bei welchem die Dimensionen der Hauptbestanteile noch einmal so groß sind wie bei dem früheren") and could make pictures of up to 5 ½ x 4 ¼ inches – that is c.14.9 x 11.5 cm, assuming the Paris inch is meant. The box-shaped corpus is made of walnut-wood and there is the slot for the focussing screen or the plates in the upper back. This slot can be closed using a brass plate supported by clips. The diameter of the Petzval portrait-lens is 35 ½ Paris lines – that is c.80.08 mm (fig. 9). Another illustration of a wooden "Voigtländer & Sohn" camera can be seen in Anton Martins *Handbuch der gesammten Photographie,* 1852 [24] as part of the catalogue *III. Beschreibung und Preistarif der neuesten Voigtländer'schen photographischen Apparate* and is described as the "neueste Form" (newest shape) with the "gewöhnlichen übrigen Einrichtung" (other standard equipment) (fig. 8).

fig. 8 *Voigtländers neue große Camera Obscura*, from: Anton Martin, *Handbuch der gesammten Photographie*, 1852.

fig. 9 *Voigtländers neue große Camera Obscura*, from: Dingler (ed.), *Polytechnisches Journal*, October 1842, 128ff.

fig. 10 Peter Britt (Jacksonville, USA) with his first Voigtländer & Sohn camera, 1865. Southern Oregon Historical Society.



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According to an article on the Voigtländer Company, [25] a similar camera was rediscovered in Jacksonville (Oregon, USA) in 1956 and has been identified as the first camera of the famous Swiss emigrant Peter Britt, who ordered it directly from Voigtländer in the 1840s. The Petzval portrait lens on the camera is signed "No. 2115 / Voigtländer & Sohn / in Wien". After crossing the plains, Peter Britt opened his photographic studio in Jacksonville in 1852 and became one of the most important photographers in Oregon. One of the reasons for this career – particularly for him – might have been his first Voigtländer camera. This could be why Britt portrayed himself with it as late as in 1865 (fig. 10). The camera is in the collection of the Southern Oregon Historical Society.

10

The front of the box and type of wood of this "newest shape" remind us of the Archduke's camera obscura and make it possible to date it. Knowing that the signature on Voigtländer's instruments changed in 1849, we can assume that year as being the latest one possible for the production of Britt's camera and the Archduke's camera obscura

Voigtländer and Simon Stampfer

It appears likely that Prof. Simon Stampfer (1792–1864) might have had an important scientific influence on W. Fr. Voigtländer's mathematical calculations. During his studies at the *K.k. Polytechnisches Institut* in Vienna, W. Fr. Voigtländer was taught by Stampfer [26] who already had scientific relations with his father Johann Friedrich Voigtländer.
Stampfer invented various instruments such as the Stroboskop or Fantaskop (built by Johann Friedrich Voigtländer [27] and, still in 1851, by Wenzel Prokesch [28]), an Optometer, (built by Simon Plössl [29]), an improved surveying level developed together with Starke and, in collaboration with Miller, a Polar-Planimeter [30] (both built by Christoph Starke in the workshops of the *K.k. Polytechnisches Institut* and, after 1866, by Starke & Kammerer) and seems to have been a

kind of a mathematical brain for many Viennese instrument makers and opticians. Harting [31] published a drawing including calculations for a dialytic telescope lens that Stampfer sent to W. Fr. Voigtländer in 1839 and describes other calculations made for Voigtländer, including those for telescope lenses in 1844 and 1855 and an undated microscope lens.
It is possible that Stampfer made the calculations for the lens of this camera obscura not only because of his long-time scientific relationship with the Voigtländer family but also because Petzval had stopped his collaboration with Voigtländer in 1844/45.

Epilogue

After getting his first allowance in 1848, Archduke Ferdinand Maximilian possibly used part of it to purchase a range of scientific instruments for his own interests and as equipment for his future voyages. In the collections of the Picture Archive of the Austrian National Library, there is another special instrument from his estate which was made at about the same time by Simon G. Ploessl – a projection-microscope. Such a microscope can be used to project specimens in microscope slides onto the wall. He could have used this for his botanical interests. In addition, there are two early telescopes [32] and an 18th century electrostatic demonstration box.

1 Nicolas Bion, *Mathematische Werck=Schule, oder gründliche Anweisung wie die Mathematischen Instrumenten… auf die beste und accurateste Manier zu verfertigen…*, 3rd ed., translated from French, 1726, ill. plate VIII.
2 Auction, *Historische wissenschaftliche Instrumente*, Lot #67, Dorotheum Vienna, 29.04.2008.
3 N.J. Wade & S. Finger, 'The Eye as an Optical Instrument: From Camera Obscura to Helmholtz' in: *Perspective 30*, Pion, London 2001.
4 A. Kircher, *Ars magna lucis et umbrae in decem libros digesta, Ludovico Grignani for Hermann Scheus*, Rome 1646.
5 Heinrich Schwarz, 'Vermeer und die Camera obscura' in: Anselm Wagner (ed.), *Heinrich Schwarz, Techniken des Sehens – vor und nach der Fotografie, Ausgewählte Schriften 1929–1966*, Salzburg: Fotohof edition 2006, 239.
6 Schwarz, 2006 (note 5).
7 Wladimir Aichelburg, *Maximilian, Erzherzog von Österreich, Kaiser von Mexiko in zeitgenössischen Photographien*, Vienna: Orac 1987.
8 Constantin v. Wurzbach, *Biographisches Lexikon des Kaiserthums Österreich*, vol. 6, Vienna: Universitäts-Buchdruckerei v. L.C. Zamarski 1860.
9 Ulla Fischer-Westhauser, *Photography and its role at the court*, manuscript, Vienna 2008 and Aichelburg, 1987 (note 7).
10 Karl Vocelka, *Kultur und Geistesgeschichte der Gärten am Beispiel der Habsburgermonarchie*, lecture, Institute of History, University of Vienna, March 2003.
11 Heinrich Wawra von Fernsee, *Botanische Ergebnisse der Reise Seiner Majestät des Kaisers von Mexico Maximilian I. nach Brasilien (1859.1860). Auf allerhöchst dessen Anordnung beschrieben und hrsg. von Heinrich Wawra*, Vienna: C. Gerold's Sohn 1866.
12 Wurzbach, 1860 (note 8).
13 Gerda Mraz, 'Sammeln aus historischem Interesse? Fotografien im Kaiserhaus' in: Uwe Schögl, *Im Blickpunk., Die Fotosammlung der Österreichischen Nationalbibliothek*, Innsbruck: Haymon 2002.
14 Johann Heinrich Tiedemann (1742–1811) produced microscopes and achromatic telescopes in Stuttgart; Tiedemann, *Beschreibung der von ihm verfertigten achromatischen Fernröhren, zusammengesezten Vergrößerungsgläser, und anderer zur Mathematik und Physik gehörigen Werkzeuge: nebst zwey Kupfertafeln*, Stuttgart 1785.
15 Monika Faber, 'Das erste Jahrzehnt eines neuen Mediums 1839–1850' in: Monika Faber, Klaus Albrecht Schröder, *Das Auge und der Apparat, eine Geschichte der Fotografie aus den Sammlungen der Albertina*, exh. cat., Vienna: 2003, 62.

In the 1840s, Voigtländer & Sohn was very famous – not only in the scientific community but also at court – for their photographic cameras and especially their Petzval portrait lens. Emperor Franz II. (I.) granted Johann Friedrich Voigtländer an "imperial charter" on periscopic glasses in 1815 and, in 1823, on the "Theater-Doppelperspektiv" binocular or opera-glasses. It would not be surprising if Voigtländer was commissioned to construct a camera obscura for an archduke who, by the way, was an admirer of Canaletto. [33]

At that time, the common term for a camera was still *camera obscura* (see fig. 8) and it must have seemed all the stranger when the archduke ordered a *real* camera obscura. This meant that Voigtländer was not allowed to demonstrate his special capabilities as one of the leading camera makers in the world but had to *rewind* camera history and build the ancestor of the photo-camera. He created a technically and optically extraordinary instrument with the skilful combination of the *newest camera* (see figs. 8 and 9) and a completely new and ingenious lens in the brass tube of a classical photo objective (see fig. 2).

We can say that, with this camera obscura, Peter Wilhelm Friedrich Voigtländer, one of the most productive revolutionaries in photography, set an outstanding monument to this kind of drawing device that was indeed the basis of the photographic camera as we know it today.

16 *Verzeichnis der optischen Apparate welche von Simon Plössl, Optiker und Mechaniker in Wien (...) verfertigt werden*, Juli 1856. (Plössl was especially famous for his dialytic telescopes and achromatic microscopes).

17 J.S. Ebersberg (ed.), *Der Österreichischer Zuschauer. Zeitblatt für Kunst, Wissenschaft und geistiges Leben*, 16.12.1839.

18 Josef Maria Eder, *Geschichte der Photographie*, 4. ed., Halle: Wilhelm Knapp 1932.

19 F. Voigtländer, 'Beschreibung des Voigtländerschen Apparates zur Darstellung photographischer Porträte, nach der Berechnung des Herrn Professor Dr. Petzval' in: *Verhandlungen des niederösterr. Gewerb-Vereins*, Heft 5, Vienna: Gerold 1841.

20 Dr. Berres, 'Über die Verbesserung der Camera obscura und die Fortschritte in der Erzeugung der Lichtbilder' in: J. & E. Dingler (eds.), *Polytechnisches Journal*, vol. 79, no. 2, Stuttgart, Augsburg: J.G. Gotha'sche Buchhandlung 1841, 156f.

21 Faber, Schröder, 2003 (note 15).

22 Reindl, 'Über Daguerreotypie und Voigtländer's neue große Camera obscura' in: J. & E. Dingler (eds.), *Polytechnisches Journal*, vol. 86, no. 2, Stuttgart, Augsburg: J.G. Gotha'sche Buchhandlung 1842, 128ff., plate IV.

23 Till the late 1850s, it was common to call a photo camera a *camera obscura*.

24 Anton Martin, *Handbuch der gesammten Photographie*, 3rd. ed., Vienna: Gerold 1852.

25 Voigtländer, '200 Jahre: 1756–1956', Sonderdruck aus *Der Photohändler*, 1956, 8: "Schon die Pioniere im goldenen Westen haben photographiert".

26 Dr. Peter M. Schuster, 'Simon Stampfer, der Vater der österr. Feinoptik' from: R. & A. Rost (eds.), *Festschrift zum Simon Stampfer Symposium*, Vienna: GeoInfo Series Vienna 2004.

27 Voigtländer, '200 Jahre: 1756–1956', special-print from: *Der Photohändler*, 1956

28 V.F. Gottfried, *Adressen-Buch der Handels-Gremien, Fabriken u. Gewerbe der k.k. Residenz- u. Reichs-Hauptstadt Wien*, 1851.

29 One specimen is at the University Innsbruck Inv.No: VII – 37 [0 – 88] (c.1839).

30 Prof. J. Simon Stampfer, *Eine Lebensskizze*, Vienna: K.k. Hof- und Staatsdruckerei 1865.

31 Dr. H. Harting, *Zur Geschichte der Familie Voigtländer, ihrer Werkstätten und ihrer Mitarbeiter*, Braunschweig: Voigtländer & Sohn 1924 / 25.

32 One of the telescopes has a special lacquer and light wood case for expeditions.

33 Information by Gabriele Praschl-Pichler; see also the chapter 'A short history of development of the camera obscura' in this essay and note the resemblance of Maximilian's camera obscura to the one which is inscribed "A. Canal" in the Museo Correr in Venice.