

Fig. 1: Section of the water column machine (Heuchler, 1857).

The hidden Machine. A Quest for Traces of a Masterpiece at the *Alten Mordgrube*, Freiberg Mining Region (D)

Jens Kugler

Introduction

From the 15th century onward, the ancient mining industry of Saxony and especially mining, is characterized by the application of numerous machines for extraction and water drainage. These machines are rarely preserved. Nevertheless, from a currently mostly unknown power machine, the water column machine, the installations are partly or fully preserved. The most well known example of a water column machine in Saxony can be observed in the *Mendenschaft* at the *Alten Mordgrube* mine in the Freiberg mining region. This type of machine was not only remarkable because of its technological development, but also because of its size, performance and functionality. Regarding its individual constructive elements the machine was a milestone of technological innovation. Seventy two years the machine worked in a reliable manner without any major disruption. After mining stopped in 1896 the machine stayed behind inside the shaft. Latest in 1969 and after the safety measurements which followed the definite end of the mining, the hidden machine was slowly forgotten. A difficult to determine photograph was printed in the thesis of Wagenbreth about the Saxon engineer *Christian Friedrich Brendel (1776-1861)*.¹ The photograph had been taken on the 18th of February 1930², which makes it the oldest known photograph of the water column machine. Contemporary, this photograph sparked an exciting, decennium long and still running quest for traces of the *forgotten machine*. A search in *theoria cum praxi*.

Fig. 1 (right column): This picture shows a photograph of the water column machine, which triggered the search for the machine at the *Mordgrube* (Moschner, 1930).

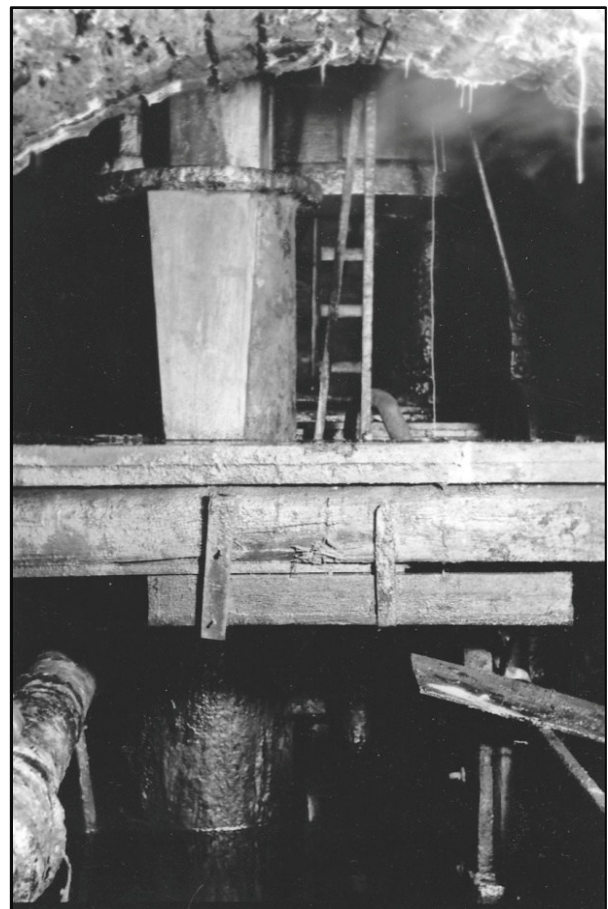
The early history of the

¹ Wagenbreth 1968, figure 41.

² The picture was taken during a tour inside the *Fürstentöllns* seen from the underground power plant of the *Constantin* shaft. It shows, partly covered by a platform, the north motion-cylinder. Obviously, the machine room itself is submerged from the staircase. In this picture, the platform blocks the view on the control-cylinder.

Saxon water column machine

The history of the water column machine started during the 18th century with a model that had been built inside the *Siegfried* mine at Riechberg near Bräunsdorf in 1769. Later, three additional water column machines were built serving the mining industry at Marienberg. These first water column machines were constructed by *Johann Friedrich Mende (1743-1798)* and assembled under his supervision. His replacement, *Karl Gottfried Baldauf (1751-1811)*, also stayed involved in the development of these kind of machines. Nevertheless, his water column machine was never realised. Only the water column machines which were built under the supervision of the next head engineer Christian Friedrich Brendel were convincing in their reliability and functionality.



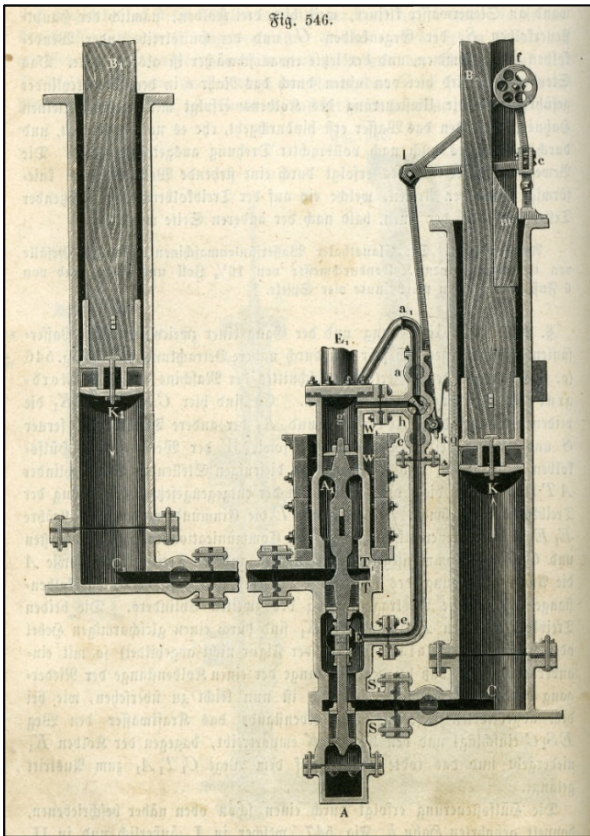


Fig. 3: Drawing of the water column machine at the *Alten Mordgrube* (Weisbach, 1846-1868).



Fig. 4: Potrait by U. Pansy of head engineer Christian Friedrich Brendel (31.01.1847).³

His second machine in the *Mendenshaft* at the *Alten Mordgrube* met the requirements which he set for himself. It followed the practical experiences that were obtained at building the water column machine inside the machine- and transport shaft of the *Reicher Bergsegen* mine at Erbsdorf (1819-1820). The water column machine of the *Alten Mordgrube* mine was equipped with a newly designed interlocking piston control. The machine obtained international fame due to its description in the machine technical books of *Julius Weisbach* (1806-1871).⁴ Head engineer Brendel later built two more water column machines inside the *Joseph Shaft* of the *Segen Gottes* mine at Gersdorf near Roßwein (1832-1833) and inside the *Hörnig Schacht* of the *Einigkeit* mine at Brand Erbsdorf [1845-1847]. These two machine are partly preserved at their original location as well.

Christian Friedrich Brendel was born on the 26th of December 1776 at the administrative building of the *Peter und Paul* mine in Neustädtel near Schneeberg. He became a miner and worked as a mine-timber worker around 1790. Later, he worked as a face worker at the *Markus Semmler Stolln*. In 1796 Brendel moved to Freiberg where he was active at the *Morgenstern* mine and later at the *Himmelsfürst* mine. In 1797 he was admitted as a scholarship holder at the *Bergakademie* of Freiberg. It was especially in the subject of mechanical engineering where he showed extraordinary achievements. In 1802, he started working as a mining captain at the *Thelersberger Stolln* in the southern part of the Freiberg mining region. Brendel undertook an extended study trip to England from 1802 until Januar 1805 on advice of the highest mining authority *Friedrich Wilhelm Heinrich von Trebra* (1740-1819). The purpose of the journey was to collect knowledge about the English machine technology and especially about machines driven by steam engines. He first applied his acquired knowledge when he was chief civil engineer at the Saxon salt works in Dürrenberg. Here, he built his first steam engine between 1808 and 1811. Construction-wise this machine resembled the design made by Thomas Watt. However, this machine already contained new, by Brendel developed, constructive elements. After the Dürrenberg region came under Prussian rule as a result of the outcome of the 7-Year War, Brendel returned to Freiberg and became the successor of head engineer Baldauf. In this position he became mainly responsible for the machines of the Saxon mining industry and as a result had a voice with all the mining authorities in Saxony.

³ Wagenbreth 1968, figure 19.

⁴ Weisbach, 1846-1868.

Date	Action
1809	First and general proposition by supervisor Wagner suggesting the construction Of a water column machine.
1816	First concrete plan to build a water column machine by the engineers Becker and Brendel.
1820 (8 th of May)	Assembly of the Mining Authority defining the location of construction.
1820 (11 th of July)	First sketches by Brendel concerning the machine's plant.
1820 (9 th of December)	Brendel is assigned to build the machine. He calculates the price of the individual machine parts, like balancer and drains.
1822 (15 th of January)	The building project of the watercolumn machine and final calculation are admitted.
1821-1824	Total building time of the water column machine.
	Head engineer Zeller is the project manager.
	Substitute of Zeller is engineer Zimmermann.
	Construction drawings made by Döring.
1821–1822 (March)	Corrections to the shaft are finished. Water drainage is installed.
1823 (August)	Delivery of the cast-iron parts from the iron foundry at Lauchhammer and start of the assembly.
1823	Machine rooms are finished. Preparation of balancer and drains.
1824 (12 th of June)	At midnight, the water column machine was left turned on as a try-out.
1824 (14 th of June)	The water column machine is taken in permanent operation.
1831	The machine lifts 0.55 m ³ /min groundwater from a depth of 350 m.
1845	The water column machine reaches its maximum capacity.
1899	The water column machine is shut down.

Fig 5a: Construction time table of the water column machine at the Alten Mordgrube. The time table resumes the different stages in the construction of the water column machine at the Mordgrube mine. Comprehensive descriptions concerning the machine's development and construction can be found in several publications, but mainly in Wagenbreth (1968 & 2006).

	Technical	Details	
Machine	Two standing cylinders	Piston speed	Minimum 12.7 cm/sec
Waterfall	101 m		Maximum 34.0 cm/sec
Total machine height	17.3 m	Movements per minute	Minimum 1.5
Width (strenght) of balancer	3.8 (ca. 0.35) m		Maximum 4.5
Length of single drains	5.95 m	Theoretical performance	48.6 kW
Width of inlet tube	Top 214 mm	Effective performance	34.0 kW
	Bottom 177 mm	Efficiency factor	Approximately 67 %
Waterpower	Minimum 1.0 m ³ /min	Max. amount of drains	2 x 22 Stück
	Maximum 2.95 m ³ /min	Amount of lifted water	0.22 - 1.5 m ³ /min
of which raised	ca. 0.136 m ³ /min	Maximum lifting height	300 m
Piston diametre	425 mm	Costs machine rooms	17.811 Taler
Lifting height	2.55 m	Costs of the machine	9.150 Taler
Lifting volume	0.362 m ³	Cost lifting equipment	6.154 Taler
Cylinder weight	2.5 t	Initially estimated costs	15.000 Taler

Fig. 5b: Compilation of data concerning the water column machine after Wagenbreth 2006, 92.

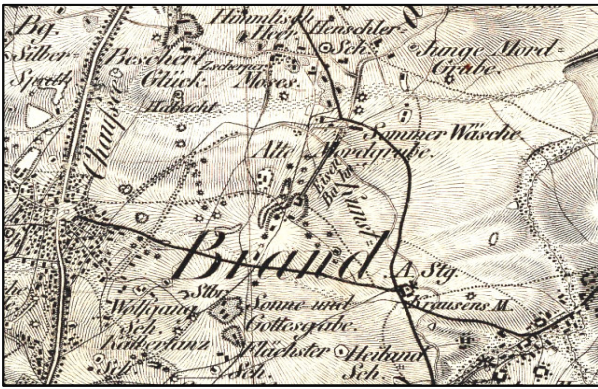


Fig. 6: Position of the Alten Mordgrube on a historic map from the late 19th century.

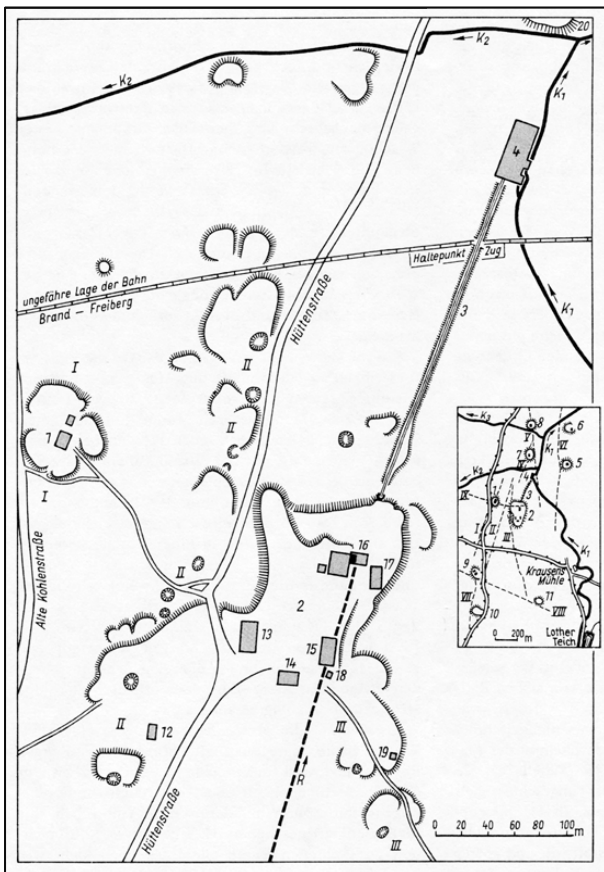


Fig. 7: Overview (r) and historic plan of the Alten Mordgrube, ca. 1860 (Wagenbreth et al. 1986, 211).



Fig. 8: The galleries of the Neuen Tiefen Fürsten Stolln inside the mining field of the Alten Mordgrube (plan section late 18th century).

In 1817, Brendel was granted the new title of mechanical engineering manager. At the machine building workshop of Halsbrücke which was subjected to him, several machines and models were constructed on behalf of the Saxon mining- and smelting industry, the water column machine from the *Mordgrube* mine included. Next to his extended practical work for the mining industry, Brendel was active in other fields as well, like the construction of railways and steam navigation. In 1846, he was promoted into the Mining Authority until his retirement in 1851. At the 20th of November 1861, Brendel died in Freiberg. His grave is still located at the *Donats* cemetery in Freiberg.⁵

The Alten Mordgrube

Situation and Objects

The mining field of the *Alten Mordgrube* is located at the Freiberg ore deposits, approximately one kilometer from the market square of Brand-Erbisdorf (c. 495 m ü NN). Next to numerous small spoil heaps, the large spoil heap of the *Mendel shaft* dominates the landscape directly east of the so called Coal road or *Kohlenstraße*. Today, the big heap is covered with wood. Its large dimension are shown by its slopes, which are orientated in either eastern or northern direction. In the vicinity of this spoil heap the administrative building of the *Alten Mordgrube* as well as the refurbished building of the *Mendenshaft* miners, which originates from the 19th century, are preserved and in use as domestic houses today. There are several buildings directly related to the timbering of the *Mendenshaft* in its function as central machine- and transportshaft; the mine's administrative building (1822), the equipment building and chapel (1853), a blacksmith's workshop (1856), a washhouse and the kettle- and machine building (1845), which is currently used as a restaurant.

After the mine closed in 1896, the processing buildings which are situated about 360 m NE of the shaft, were bought and extended by the *Lederwerk Stecher* company for the processing of leather products. The mining buildings came in use as domestic houses. In their vicinity several new buildings were erected since then. The whim shaft house and chimney of the steam engine did not survive.

⁵ The information was mainly taken from the following sources:
http://de.wikipedia.org/wiki/Christian_Friedrich_Brendel
www.freundeskreis-stadtarchiv.net/brendel_christian.pdf



Fig. 9: The building to the right, which did not survive, contained the water powered whim (Reymann, ca. 1900).



Fig. 10: View of the steam powered whim installation at the Mendenschaft as seen from the chapel's bell tower. The chimney was demolished after the mine was shut down (Reymann, ca. 1900).



Fig. 11: The legendary collapse of the Alten Mordgrube in a 19th century drawing (Collection: author).

History

The intensive and shallow mining which took place in this region most likely dates back to the earliest mining phases of the Freiberg mining industry. Especially, the ore veins *Gott Hilf in der Not* -, *Alte Mordgrube* - and *Leander Stehender* and the crossing *Schlüssel Spat* have been worked with great effort. Nevertheless, there are no sources of early mining in this region. The existence of the *Mordgrube*, which was first mentioned in 1516, leads back to a legend in the *Freiberger Chronik*.⁶ It is unclear whether the name *Mordgrube* refers to an old collapse of galleries with many victims⁷ or to an ancient and difficult to access gallery. Related to the construction of strongholds the term *Mordgrube* referred to a covered passage underneath a defensive moat which was constructed in order to damage the enemy should he try and cross the moat.⁸ At this time, the *Brandstolln* and the *Thelersberger Stolln* breached into the range of the *Alten Mordgrube* from the SW. Later, the deeper *Neue Tiefe Fürstenstolln* (1814), the *Moritzstolln* (1838) and finally the *Rothschönberger Stolln* (1877) breached the *Alten Mordgrube* from the north. Already in the 16th century, the water drainage was managed

by two underground machines. After the Thirty Year War, mining came to a hold. In 1808, it was considered to reactivate the submerged mining inside the *Thelersberger Stolln*. As a result, a connection was made with the *Neue Tiefe Fürstenstolln* and the hading *Mendenschaft* was extended into a central shaft, which was brought to the highest level of technical achievement with large subsidies. A whim was installed for extraction. Originally there was a multiple manned winch, which was first replaced by a horse-whim in 1815 and by a water powered one in 1824. There was a major discussion concerning the type of machine power that was needed to be able to process the calculated amount of groundwater. It was concluded that the machine needed at least three power wheels. However, because there was not enough water power available for three wheels, the choice was made to built a water column machine inside the level of the *Fürstenstollns*, which at that time hadn't been breached yet. The extraction through the shaft as well as the extension of the shaft and later the installation of the water column machine was done with the help of a horse-whim. Initially, the wrought-iron work could be managed by the mine's own blacksmiths (1820), while some part was done by external labour. The cast-iron machine parts were produced at Lauchhammer in Brandenburg. The production of wooden machine elements was done at site. In June 1824, the water column machine was taken in permanent operation. After the many investments, the successful mining enterprise required the extension of the processing capacity and the building of a new ore wash with shaking table (1828/29). The transport of the ore started at a pull hole at the shaft and continued over a 268 m long dam, which was equipped with a rail-based conveyor belt that ended inside the wash (1829/30).⁹ Around 1854, a high-performance steam engine was built. The water powered whim was connected to a machine- and kettle room and a chimney and coalshed were erected. Eventually, the *Alte Mordgrube* merged with the neighbouring *Neu-glück und drei Eichen* and the *Vereinigt Feld im Buschrevier* mines. The merger consecutively produced under the new company name *Vereinigt Feld bei Brand*. From 1886, the authorities took over several mines, like *Vereinigt Feld bei Brand*, *Beschert Glück*, *Junge Hohe Birke* and *Kröner*. Thus, mining came under national rule until the last tour on the 30th of June 1896.¹⁰

⁶ Möller, 1653.

⁷ Wagenbreth et al. 1986, 220.

⁸ Grimm 1854/1960-XII, 2546-2550.

⁹ Iron rail-based conveyors already existed in England since 1789, at Clausthal in the Harz region (Grube Dorothea) since 1806 (Ließmann 1992, 70) or at Schneeberg (Grube Gesellschaft) since 1785.

¹⁰ Wagenbreth et al. 1986, 220-225.

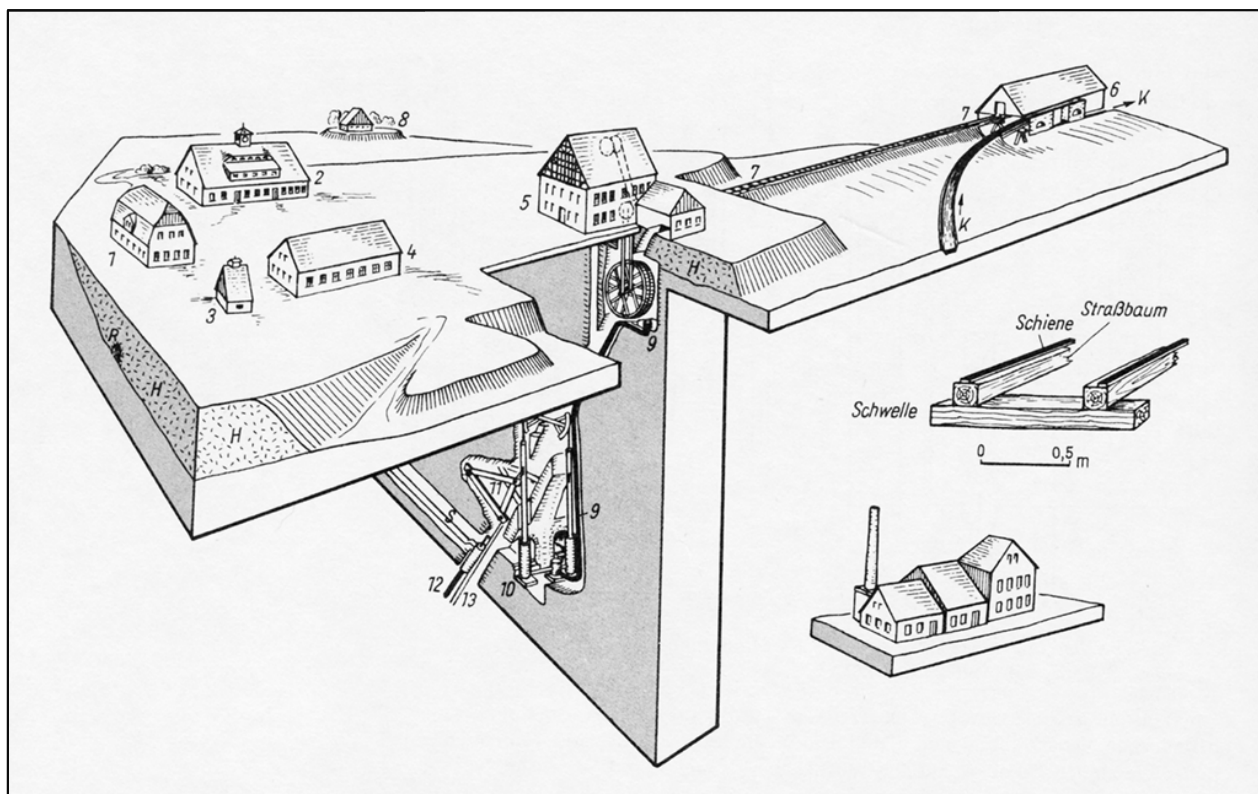


Fig. 12: Slightly simplified overall view of the *Mendenschaft* at the *Alten Mordgrube* around 1850 (Wagenbreth 1986, 224).

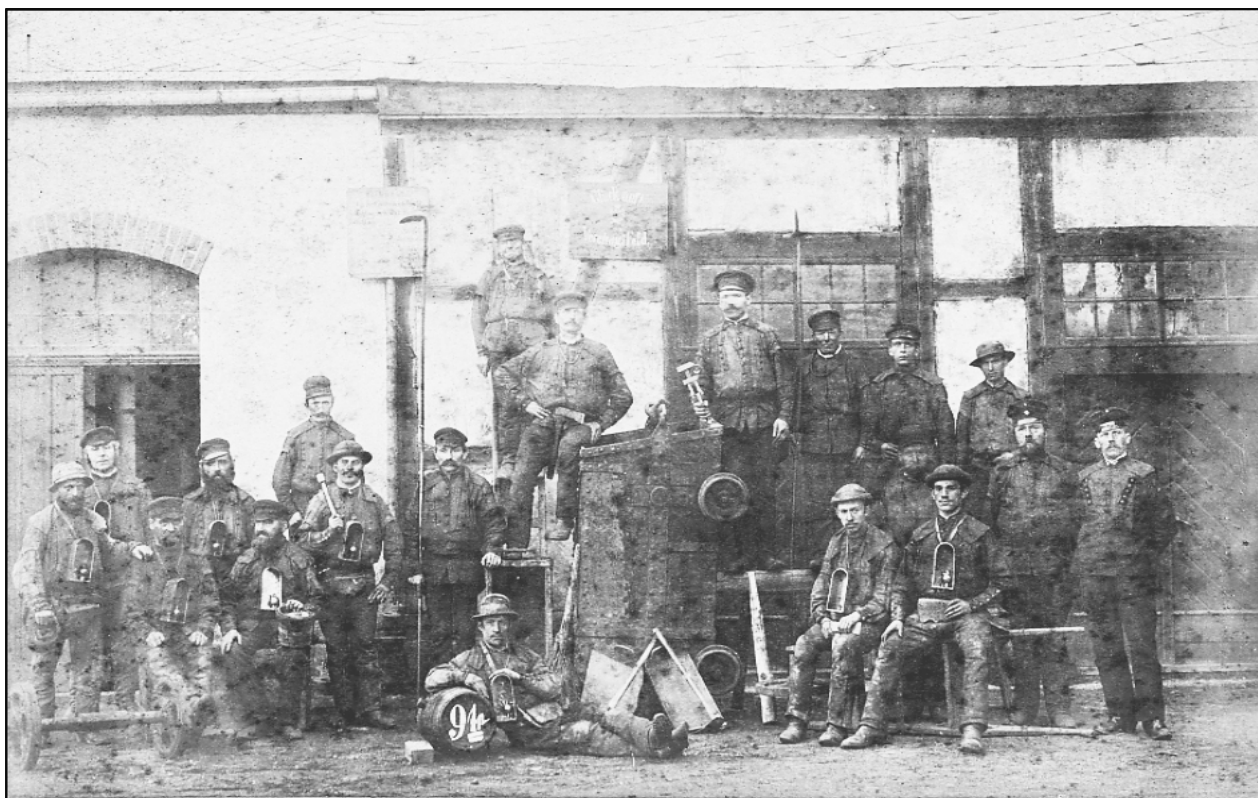


Fig. 13: Work force at the *Alten Mordgrube* predating 1896 (Photo: collection author).

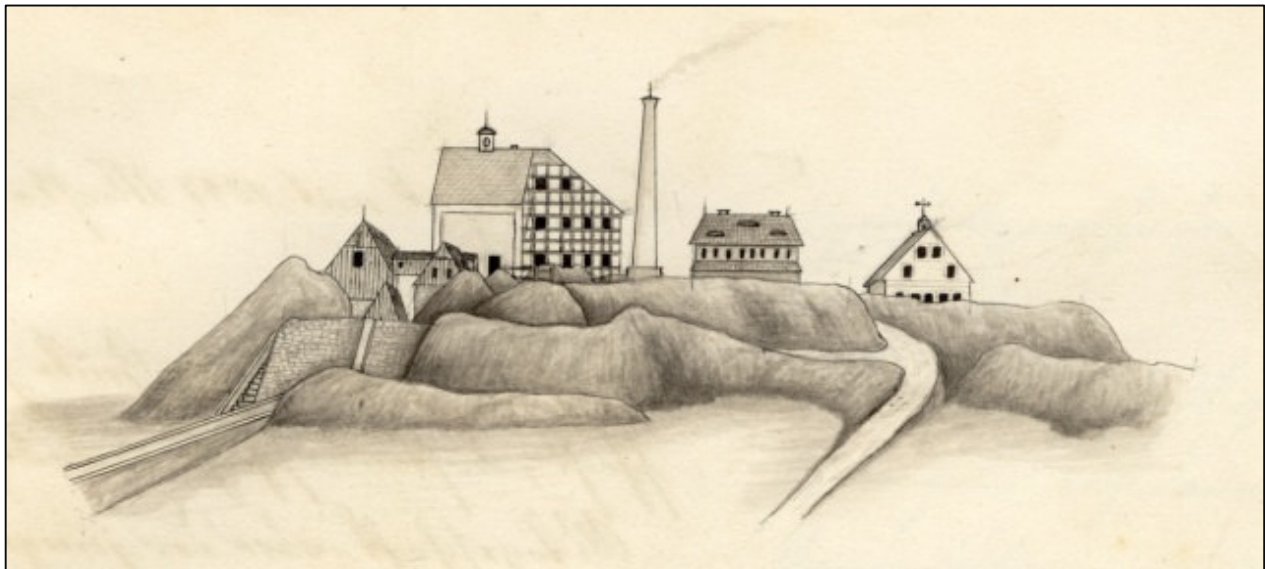


Fig. 24: 19th Century drawing of the mining buildings of the Mendenschaft (Richter, 1856).

Searching for the machine

The water column machine at the Mordgrube, being the most famous water column machine in Saxony, left a vast amount of written sources like drawings, sketches of machine details and their function and also many pictures. Furthermore, there are numerous publications about the machine and its builders. One of the main authors on the subject is Bernhardt Wagenbreth, who wrote some major articles about the *Alten Mordgrube*, its water column machine and in biographical context head engineer Brendel. Especially, the prehistory and construction of the machine have been described extensively due the presence of the mines archives and those of the machine's building directors. Wagenbreth reconstructed the position, working and control of the machine very clearly in several drawings and sketches.

Searching for traces in archives and literature

Considering the amount of publication about this subject, it is amazing that there are still numerous files which have not been used or looked at yet. Several mining technological studies, the so called *Spezimina*, remain in the old files of the library at the *TU Bergakademie Freiberg*¹¹, which mention or describe the machine and the mine. A comprehensive description in two volumes of the construction of the machine and all its elements exists. The volumes, including a costs statement, were made by *Moritz Ferdinand Gätzschmann*

(1800-1895), who later became to be a professor at the *Bergakademie*.¹²

There is an extensive range of technical pictures of this machine, like two lithographs which were revised by the builder Brendel. The drawings show eight separate sections; the motion-cylinder, the control cylinder as well as the internal and external steering system of the machine.¹³ These Lithographs might be inspired by a drawing of a machine which is kept at the mining archive in Freiberg.¹⁴ In the extensive files of the mining archives of Freiberg several drawings of machine elements as well as complete drawings of the machine can be found in the separate files *Generalrisse* and *Rissbestand der Oberdirektion Erzbergwerke*. One example consists of five detailed drawings of the iron-cast segments of the water column machine, which were produced in 1824.¹⁵

¹² M. F. Gätzschmann, *Beschreibung der auf dem Berggebäude Alte Mordgrube Fdgr. erbauten Wasser-säulen-Maschine 1* (1824). Library of the TU Bergakademie Freiberg, Wissenschaftlicher Altbestand; Bergmännisches Spezimen Nr. 1919; *Beschreibung der Erbauung der Wasser-säulenmaschine auf Alte Mordgrube Fdgr. nebst noch dazu gehörigen Angaben als der Beschreibung der auf dem Berggebäude Alte Mordgrube Fdgr. erbauten Wasser-säulenmaschine 2* (1825). Library of the TU Bergakademie Freiberg, Wissenschaftlicher Altbestand; Bergmännisches Spezimen Nr. 1922.

¹³ C. F. Brendel, Drawing of the water column machine at the *Alte Mordgrube* mine near Freiberg (with 3 p. Description of the Lithography). Also: Lithography by A. Kneisel (Leipzig, ca. 1850) 40044-1 (Generalrisse) I 20028.

¹⁴ E. Backofen, Drawing of the water column machine at the *Alte Mordgrube F.* near Freiberg. (25th of August 1843) BergAFG 40044-1 (Generalrisse) BergAFG 40044-1 (Generalrisse) I 20037.

¹⁵ F. G. Pilz, *Alte Mordgrube Wassersäulenmaschine betr. Blatt IV* (1824). BergAFG 40044-1 (Generalrisse) I 20113.

¹¹ Most of the works have been mentioned by Wagenbreth in: Wagenbreth 2006, 239.

Several undated and unsigned drawings show pictures and cut view drawings of the machine and the machine rooms.¹⁶ There are also pictures of the machine in other archives and collections, like an original drawing and short description which is kept at the *Hauptstaatsarchiv* in Dresden. A similar drawing is kept in the collection of the *Stadt- und Bergbaumuseum* in Freiberg. Not only the documents and technical plans of the water column machine and the machine rooms survived, but those concerning the shaft installation as well. A by Zeller revised design of engineer Zeller was handed down of the original wheel powered installation, wheel house and engine room. The design shows the underground wheel house, the wheel with bent double blades and the engine room which had to be built¹⁷ in different drawings.¹⁸ There even exists a very detailed plan of the shaft, showing many cross sections. The plan also shows a lay-out of the machine rooms.¹⁹ The first known reliable picture of the water column machine was made by *Johann Eduard Heuchler (1799-1879)*. Heuchler, art master and professor at the *Freiberg Bergakademie*, shows in his *Die Bergknappen in ihrem Berufs- und Familienleben* a part of the *Mordgrube* water column machine (Figure 1). An original drawing of the machine is kept in the collection of graphics at the *Stadt- und Bergbaumuseum* in Freiberg. This drawing might have been the submission for Heuchler's publication. Heuchler wrote about the water column machine: „[...] The deafening noise of a wheel and a turbine form a huge contrast with the smooth and silent motion of this machine and power it performs in silence.“

The drawing shows the machine room with the impact water tube (I), the two motion-cylinders and the control elements included their internal and external steering.²⁰ The seated person in the

picture is probably head engineer Brendel. Additionally, the drawing shows a section-wise stone-wall machine room²¹, which is being described in a standard work about bricklaying in mines.²² The first photographs were published in 1989 in a 3-D picturebook called *Von Bergwerken und Kristallschätzen*.²³ These picture were taken during the first expeditions. More recent pictures were printed in the Saxony mining calendar between 1999 and 2010.²⁴

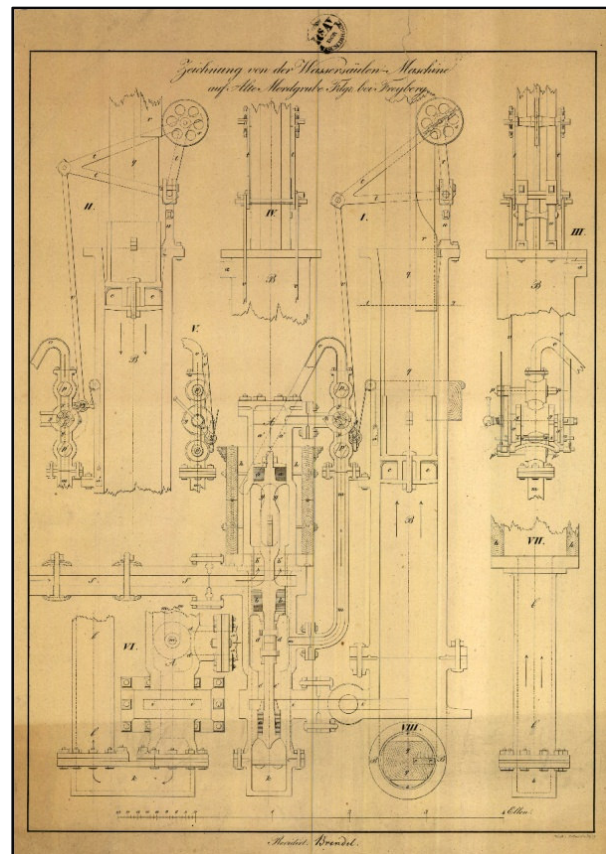


Fig. 15: Lithograph revised by Brendel of the driving- and control cylinders of the water column machine (Collection: Stadt und Bergbaumuseum Freiberg).

The search for traces in collections

Only few traces of this machine are to be found in the mining historical archives. The two most important objects are models of the machine. One is kept at the *Bergakademie* in Freiberg, the other at the mining academy of St. Petersburg. Both models focus on functionality on a 1:15 scale.²⁵

¹⁶ Undated view of the machine room from N to S (Table 4). BergAFG 40102-2 (Risse der Oberdirektion Erzbergwerke) K 1451; Undated drawings of the water column machine (Table I.). BergAFG 40102-2 (Risse der Oberdirektion Erzbergwerke) K 1544; Unknown spaces where the machine was installed. BergAFG 40102-2 (Risse der Oberdirektion Erzbergwerke) K 1629; Unknown and undated view of the machine rooms from E to W (Table 3). BergAFG 40102-2 (Risse der Oberdirektion Erzbergwerke) K 1730.

¹⁷ Interesting is the option, that the power wheel was used simultaneously for the operation of a six-stamp pounding plant.

¹⁸ J. C. Zeller (revised by C. F. Brendel), *Grund- und Seiger-riss von dem bey Alte Mordgrube zu erbauenden Wasser-Göpel* (February 1824). BergAFG 40044-1 (Generalrisse) K 19701.

¹⁹ E. Horn, *View of the Mendenschaft at Vereinigt Feld bei Brand* (1886). BergAFG 40102-2 (Risse der Oberdirektion Erzbergwerke) C 2034.

²⁰ Heuchler 1857, 16.

²¹ Heuchler shows us the machine in a perspective, which can not be photographed due to the limited space in the room.

²² Gätzschnmann 1831, 121 § 103 (Fig. Table XXV, 151).

²³ Schreiber et al. 1989. The same pictures were later also published in: Kugler et al. 1992.

²⁴ Comp. Balck 2003, 123.

²⁵ Zaun 2009, 60.

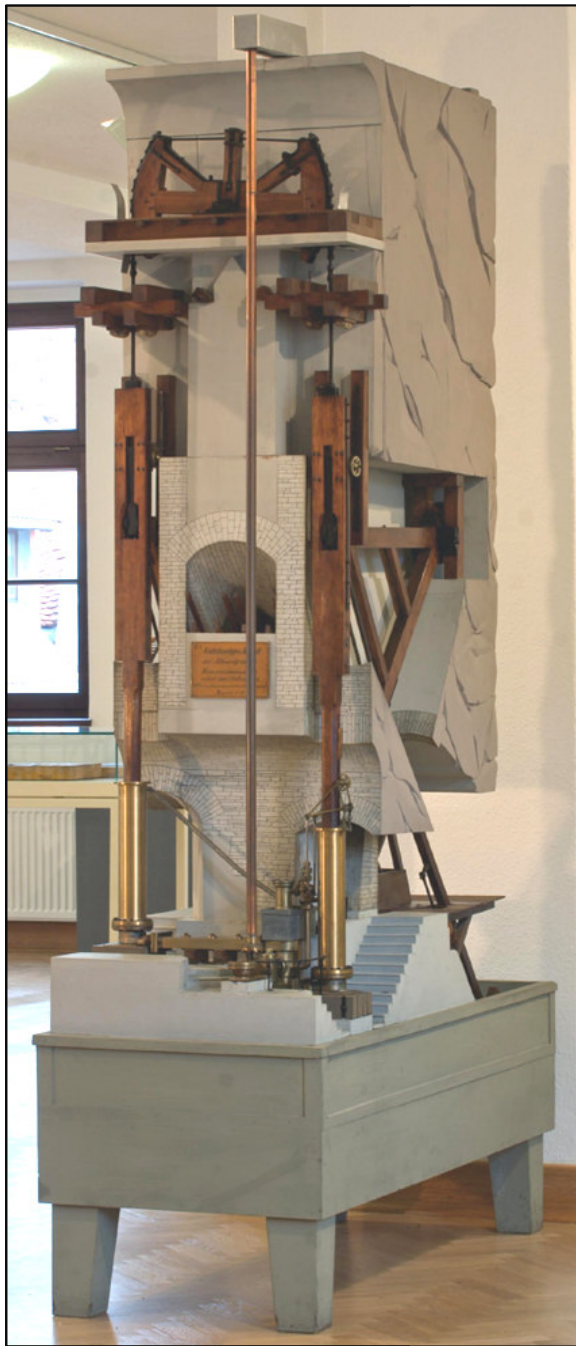


Fig. 16: The educational model of the water column machine which was purchased in 1834 and added to the models collection of the TU Bergakademie in Freiberg.

However, both models are slightly different.²⁶ The model, which was delivered to Russia also came with a description of the machine. Both models were produced at the mechanical engineering workshop in Halsbrücke and would be set in motion by water pressured for which the models were equipped with a small water basin that was installed at an elevated position over the model. Differences can be observed at the balancer, pump-rod arm or the piping. These were not a result of inaccuracy of the model's builder, but

merely a result of technical adjustments during the time the machine was in use.

The search for traces at site

At the end of the 1970's, a young group of active mining bigots became aware of the existence of the machine in combination with archive research. In that time, the possibilities for investigating underground mine galleries were looked upon very restrictively by the Eastern German (DDR) Mining Authority and the organisations which were responsible for mine safety under the regional council. A situation which has not really changed since. Under these conditions several groups of researchers with different goals have been visiting the abandoned galleries in the Freiberg mining region often under very difficult, partly very adventurous circumstances. The visits mostly were illegal and one would gain access through the little amount of known entrances and sometimes even through selfmade new passages. Especially, the water outlet galleries served as driveways over distances of many kilometres. Inside the mine itself one would overcome the differences in mining levels with the help of selfmade rope ladders or climbing ropes mostly through hading shafts. Sometimes, the original staircases of the shafts which were in use until 1968 could still be used. Many tours took several days. At suitable locations underground base camps were set up from which the explorations would be executed. During these tours, many galleries were opened up and visited again for the first time in ages. Problems like the journey to the mine, parking the vehicles near the adits, acquiring maps, suitable protecting gear, durable lighting or climbing- and safety gear as well as photo equipment may seem marginal today, but were very severe in those days. In the 1970's, under these difficult conditions, the search for the *Mordgrube* water column machine commenced from the adit of the *Thelersberger Stollns* which lay 4 kilometers away as the crow flies. Because it turned out that there was no accessible connection from this level into the level of the *Alten Mordgrube*, later prospections were planned from the *Neuen Tiefen Fürstestolln* level. During an expedition on the 27th and 28th of August 1977 the water column machine could finally be reached through the *Goldene Schelle* shaft. A detailed description of this expedition and the discovery of the water column machine by Andreas Becke still exists.

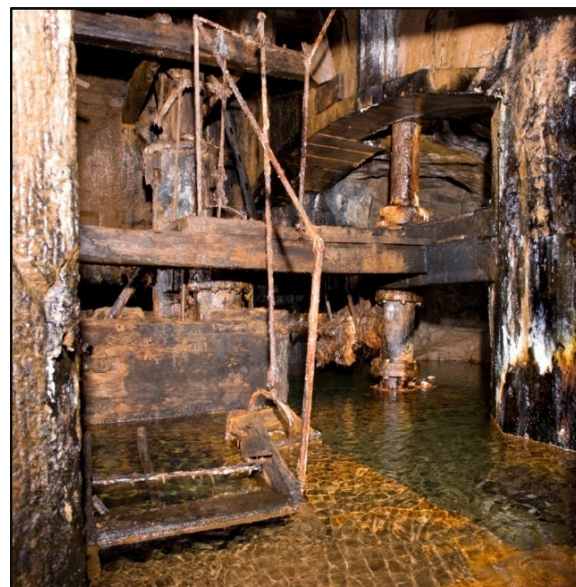
²⁶ Jentsch, et al. 2003, 24-26.



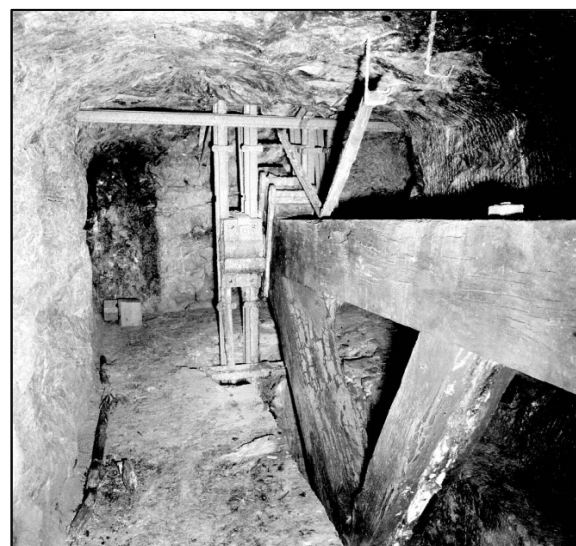
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Fig. 17: Filling station of the Mendenschaft at the Alten Mordgrube in the vicinity of the Neuen Tiefen Fürstenstollns (2009).

Fig. 18: Lothar Riedel at the machine (Becke, 1977).

Fig. 19: The submerged engine room (2009).

Fig. 20: South pump-rod arm room with trowel drain (1984).

„[...] Lothar sah plötzlich, zu unserer Freude, eine Holztafel - Alt Mordgrübner Sth.[Stehenden J.K.] - . Jetzt war es fast sicher, daß wir auf dem Schlüssel Sp. [Spat J.K.] waren. Wir gingen also weiter in östl. Richtung, um den Leander Sth. zu erreichen. Tatsächlich kam wieder ein Gangkreuz – allerdings wieder ohne Beschriftung. Auf meinen Rissen war der Schlüssel Sp. Aber weiter geradeaus und kurz hinter dem Kreuz die Jahreszahl 1824 eingetragen. Wir gingen also geradeaus um die Jahreszahl zu suchen. Wir fanden sie auf Anhieb. Nun war es sicher, daß wir nur noch wenige Meter bis zum Mendenshaft laufen mußten. Schnell gingen wir auf dem Leander Stehenden und auf diesem in südl. Richtung. Hier lag wieder Gerinne und die Firste war teilweise verwahrt. Nun kam der schönste Augenblick, wir kamen in den Schacht. Das erste was wir sahen waren die tonnenlängigen Eisenbahnschienen im Schacht und die Örter zur Wassersäulenmaschine. Dann erkannten wir auch darin die Maschine. Wir konnten es nicht mehr erwarten –zuerst mußte ein Blick in den Maschinenraum, welcher im Liegenden des Leander Stehenden unter dem Schacht liegt, geworfen werden. Im Hintergrund konnten wir eine Schachttafel erkennen. Vor Freude riefen wir uns großes „Hallo“ zu. Nun war der Weg geebnet. Wir konnten also schnell zu Helmut u. Reiner zurückgehen, um sie zu holen.

Als wir dann alle hier im Mendenshaft standen und diese 1824 von Brendel erbaute Maschine bewundern konnten, war die Freude groß. Wir hatten ein großes fast unglaubliches Ziel erreicht. Nun schlugen wir auf dem Schlüssel Sp. unser Lager auf und gingen dann Fotos machen. Während dessen malte ich die Tafel mit Englischrot neu aus. Der Schacht selbst ist stark tonnenlängig und offen. Nach dem Rothschnberger Stolln zu liegt viel altes Eisen und vermodertes Holz, während über dem Tiefen Fürsten Stolln noch die Seilwalzen zu sehen sind. Mit der Tonnenlage laufen die 2 Fördertrümer – an den Schienen zu erkennen. Der Maschinenraum steht voll Wasser, so daß gerade noch eine Stufe der gemauerten Treppe.²⁷ Die Wassersäulenmaschine selbst steht noch genauso, wie Heuchler sie um 1823 zeichnete. Selbst das an dem Gewölbe angebrachte Rad hängt noch da – allerdings ohne darüber laufende Kette, Man hatte wohl zur Wartung der Anlage später eine über absetzende Treppen zu erreichende kleine Zwische-nbühne eingebaut, die jetzt herunter gebrochen ist (bei Heuchler ist sie jedenfalls noch nicht zu sehen). Leider konnten wir noch nicht zu den Kunstkreuzen vordringen, da diese über die schmalen Stangen-schächte bisher noch nicht zu erreichen waren (Mal sehen was darüber im Rißarchiv zu finden ist?!). Dafür kann man durch die Stangenschächte zu den Kunstkreuzen hindurch sehen. Das Balancier ist allerdings nicht sichtbar. Ob es überhaupt zu erreichen sein wird ist sehr fraglich. Sehr gut zu betrachten sind die Kunststangen, welche

jetzt an den Enden der eisernen Verstärkung abgebrochen sind und früher in den Schacht nach unten in die Pumpenröhren liefen. Sie waren aus Holzbalken und wie schon erwähnt, mit Eisenplatten statisch verstärkt. Darunter, über der Stollnsohle befand sich früher das Holzgerinne, welches die Wasser im Stolln abführte. Am südlichen Schachtstoß befindet sich die von mir nachgemalte Tafel, die die Stollnsohle auf dem Leander Stehenden angibt. Weiter in südlicher Richtung ist der Stolln auch noch offen, jedoch liegen hier alte Preßbaue über dem Stolln, unter denen man lieber nicht entlang gehen sollte. Im südlichen Durchgang zum Maschinenraum liegen noch alte Werkzeuge und im Wartungsraum dahinter ebenfalls, herum (Schraubenschlüssel usw.). Nachdem wir unsere Fotos gemacht hatten, ging es zurück zum Schlafplatz auf dem Schlüssel Spat. Dort machte Lothar und ich alles fertig zum essen und schlafen, so daß wir uns von nachts (0°-2°) hinlegten, aber kaum schliefen. Hierbei dienten die Kinderluftmatratzen wieder als Unterlage. Schließlich etwas durchgefroren, nahmen wir Abschied und gingen unseren alten Weg (einen anderen gibt es noch nicht...) zurück.²⁸

During the first expeditions, the water column machine turned out to be in an unexpected good condition. The wooden podium, which had been built in the engine room, was removed at once. During following expeditions, the balancer room with the huge balancer and later the pump-rod arm were discovered. The submerged engine room was temporarily pumped dry using old air pressure hoses.

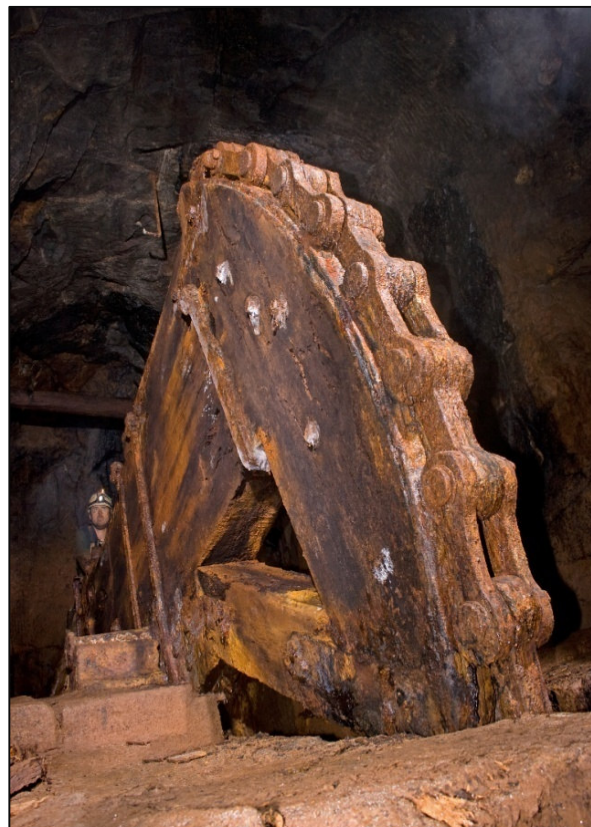
The original shaft support at the shaft bottom of the *Neuen Tiefen Fürstenstolln* was gone. The descending shaft rods had been broken off and fallen down the shaft. The shaft over the water column machine was empty. Merely, the water inlet tube at the shaft's north timber has been preserved at least into the *Thelersberger Stolln*. The wood and metal which once has been thrown down the *Mendenshaft* in order to secure it, got caught in the slide casing compartment and formed a knot by which one can reach the north side of the shaft to descend by abseiling into the pump-rod arm room. The passage there is blocked by wood and metal. At the first exploration into the pump-rod arm rooms, the desolate flutter valve just over the pump-rod arm was still present. The existing grease bowl has been salvaged and is kept today at the Museum *Huthaus Einigkeit* in Brand-Erbisdorf. The two pump-rod arms do currently still exist, but the wood is actually in such a bad condition that they will deteriorate soon.

²⁷ It hardly could be recognized that the staircase, which at that time was submerged, had been cut out of the rock instead of been walled-up.

²⁸ Becke 1977-1984.



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Fig. 21: Trowel drain for keeping the wood of the balancer moist (2009).

Fig. 22: Balancer of the water column machine (2009).

Fig. 23: The north motion-cylinder (l) and the control-cylinder (r) inside the drained machine room. In the bottom left corner two persons are visible, which gives an impression of the machine's size (2009).



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Fig. 34: Shaft level plaque of the Mendenschaft (2009).

When this happens, it must be feared that the unevenly loaded balancer will most likely be destroyed too. During the last decennium, the north pump-rod arm has been broken off already near the bearing. Contradictory to the surviving plans and models, the bearing blocks are not made of wood but of iron rails. The two pump-rod arm rooms have been cut out of the rock in so called *Schlägel und Eisenarbeit*, while the shaft bottom which lies between them is partly walled up. Via a connecting passage over the clotted wood and metal parts, one can reach the balancer room straight over the pump-rod arms, which has also been cut out of the rock. The currently entirely preserved and utterly desolate balancer is very large. Especially, the iron chain bolts and chain links are very impressive. Both inside the balancer room as well as inside its entrance lie several spare parts like rods, bolts, chain links and tools. The wooden pressurised water pipe at the ceiling of the entrance has been preserved. It originally led to a trowel drain directly over the balancer, which would keep water dripping over the wood in order to slow down the rot.

Since the first expedition, it has not been possible to determine at site how the miners moved between levels for control or maintenance purposes during operating time. Only the surviving drawings at the mining archives could clarify this issue.²⁹ It turned out that a wooden staircase from the south motion-cylinder room use to lead to a wooden platform. The platform connected to small spaces inside the shaft from which the miners could reach the pump-rod arms and balancer. During every expedition, the condition of the machine has been documented using different kind of photographic materials and methods. It concerns small format slides, stereo slides, small- and middle format black and white pictures. The pictures which were

taken decennia ago also possessed an extraordinary quality.

The Alte Mordgrube today

In the last ten years, the mining buildings of the *Alten Mordgrube*, which are protected under the Historical Buildings and Monuments Act, were redeveloped extensively and exemplary with the help of private commitment. Today, people are invited to a visit to the restaurant and small park. The site of the *Mendenschaft*, which is popularly called the *Zugspitze*, has currently developed again into a popular excursion site. The large amount of historic sources and archaeological details offers a great opportunity to establish a scientific book about the history of the *Mordgrube* mine and its water column machine. Regrettably, this work has not been started yet. Meanwhile, due to their meaning, the monumental parts of the *Mendenschaft* at the *Alten Mordgrube* as well as the difficult accessible water column machine were chosen to participate in the UNESCO-project *Montanregion Erzgebirge*. Finally, it seems bold to share a vision of redeveloping the shaft over the consolidated wheel shed down to the monumental water column machine in order to create accessibility for touristic purposes. The extraordinary machine, which is commonly hidden for the general public, would certainly deserve this.

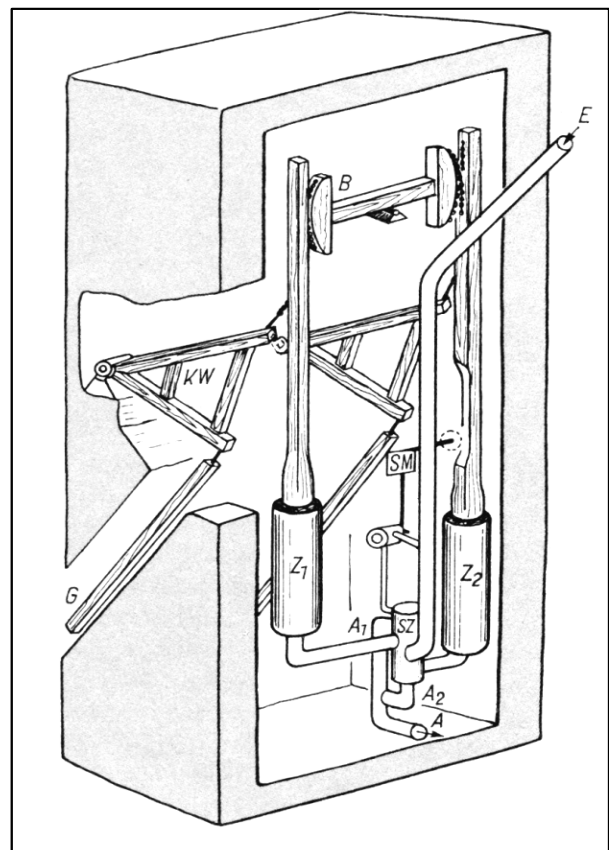


Fig. 25: Sketch of the individual parts of the water column machine (Wagenbreth et al. 1986, 58).

²⁹ (Risse vom Bestand Oberdirektion Erzbergwerke: K1629, K 1730, K 1544 und K 1451).

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