The Crematoria Ovens of Auschwitz and Birkenau

CARLO MATTOGNO

1. Authors' Note

The first version of this article, which appeared in German language in 1994,[1] summarized a study on the crematorium ovens of Auschwitz that I had undertaken systematically since 1988 with the precious collaboration of Dr. Ing. Franco Deana.

Over the last 15 years, my historical as well as technical knowledge about this topic has increased to such an extent that it has become necessary to divide my original study into two volumes, the first consisting of the text (with more than 500 pages) and the second consisting of a collection of documents (270 documents and 360 photos).[2] This resulted in increasing difficulties to get said work published to such point that it is still under preparation by my publisher Editioni di Ar while this summary is being prepared. The first, German language version of this article contained errors in formulation and data, above all due to the lack of documentation available at that time, which I could only partly correct in the second, English language version of this article published in 2000.[3] In fact, this contribution demanded a radical revision in order to adapt it to recently acquired information, which, for several reasons, I have not been able to carry out for the first English version of this article. Although the treatment of the cremation pits would also require a radical revision as a result of new knowledge, it cannot be summarized in just a few pages.[4] These new findings will be addressed in a separated study to be published elsewhere.[5] I therefore keep the text already published in 2000, even though I am quite aware of its deficiencies. Although only one author signs responsible for this version of this article – as well as for the both previous versions – Dr. Ing. Franco Deana should really be considered as a co-author, because he needs to be acknowledged for the precious assistance he always gave me.

Carlo Mattogno

2. Introduction

If a monstrous extermination of many hundreds of thousands of people took place in gas chambers in Auschwitz and Birkenau during the Second World War, and if the bodies of the victims were

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1 "*Die Krematoriumsöfen von Auschwitz-Birkenau*", in: Ernst Gauss (ed.), *Grundlagen zur Zeitgeschichte. Ein Handbuch über strittige Fragen des 20. Jahrhunderts*, Grabert-Verlag, Tübingen 1994, pp. 281-320.

2 *I forni crematori di Auschwitz. Studio storico-tecnico con la collaborazione del dott. ing. Franco Deana*; printed by Edizioni di Ar, Italy. Distributor: Libreria Ar, via F. La Francesca 26, 84100 Salerno, Italy (cf. Carlo Mattogno, Franco Deana, *The Crematory Ovens of Auschwitz-Birkenau*, Granata Communications, Palos Verdes (CA) 1995).

3 "*The Crematoria Ovens of Auschwitz and Birkenau*", in: Ernst Gauss (ed.), *Dissecting the Holocaust. The Growing Critique of "Truth" and "Memory"*, Theses & Dissertations Press, Capshaw, Alabama, 2000, pp. 373-412.

4 The version of this article mentioned in the previous note has been criticized with technically dull arguments by John C. Zimmerman ("*Body Disposal at Auschwitz: The End of the Holocaust Denial*", www.holocaust-history.org/auschwitz/body-disposal/. and "*My Response to Carl Mattogno*", www.holocaust-history.org/auschwitz/response-to-mattogno/), that I refuted with my studies "*Supplementary Response to John C. Zimmerman on his 'Body Disposal at Auschwitz'*"; www.russgranata.com/Risposta-new-eng.html, to which is also referred regarding the alleged cremation pits; see also www.russgranata.com/jcz.html.

5 Carlo Mattogno, *Vierteljahreshefte für freie Geschichtsforschung* 7(2) (2003), (vho.org/VffG/2003/2) and *The Revisionist* 1(3) (2003) (vho.org/tr/2003/3), both in preparation.

disposed of in the cremation facilities in those camps, then the 'murder weapon' – the homicidal gas chamber – has an essential counterpart: the cremation oven.

The 'eyewitnesses' have tried to persuade us that the crematoria ovens of Auschwitz and Birkenau were satanic contraptions operating above and beyond the realm of physical laws,[6] not ordinary cremation facilities subject to the same laws of chemistry, physics and heat engineering as all other such installations. Historians have chosen to trust blindly in these witnesses, and in the process have let themselves get carried away into making entirely erroneous claims.[7]

Aside from the Revisionists, Jean-Claude Pressac is the only researcher to have approached the historical problem of the cremation of bodies in Auschwitz and Birkenau from a technical perspective. In his book *Auschwitz: Technique and Operation of the Gas Chambers*[8] he comes to the following conclusions:

- The three double-muffle ovens in crematorium I of Main Camp Auschwitz had a capacity of 340 cremations in a 24-hour period.[9] In 1993, he reduced this figure down to 200-250 per day.[10]
- The five three-muffle ovens in crematoria II and III of Birkenau each had a maximum capacity of between 1,000 and 1,500 cremations per 24 hours,[11] but their normal capacity was 1,000 to 1,100 cremations each per 24 hours.[12] In 1993, he reduced this figure down to 800-1,000 per day.[13]
- The two eight-muffle ovens of crematoria IV and V each had a capacity of 500 cremations per 24 hours.[14]

Pressac thus puts the total capacity of the crematoria of Auschwitz and Birkenau at 3,540 cremations per day. From a technical perspective this figure is completely unrealistic.[15]

Among the Revisionists it was particularly Fred A. Leuchter who, in his well-known *Leuchter Report*,[16] turned his attention to the issue of the cremations. Relying primarily on the statements of

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6 We shall restrict ourselves to giving a single representative example. The eyewitness Dr. Miklos Nyiszli sets the daily cremation capacity of the crematoria of Birkenau at 20,000! M. Nyiszli, *Boncolóorvósa voltam az Auschwitz-i krematóriumban*, Világ, 1946, p. 38.

7 As late as 1992 Franciszek Piper, historian at the Auschwitz Museum, claimed that the "*factual capacity*" of the four Birkenau crematoria had been "*up to 8,000 bodies per day*". He based his assertion on the eyewitness testimony of Alter Feinsilber, *alias* Stanislaw Jankowski *alias* Alter Szmul Fajnzylberg: F. Piper, *Auschwitz. Wieviele Juden, Polen, Zigeuner... wurden umgebracht*, Universitas, Krakow 1992, p. 21.

8 Jean-Claude Pressac, *Auschwitz: Technique and Operation of the Gas Chambers*, Beate Klarsfeld Foundation, New York 1989; similar in his later book *Les crématoires d'Auschwitz: La machinerie du meurtre de masse*, CNRS Editions, Paris, 1993.

9 J.-C. Pressac, *Auschwitz:...*, *ibid.*, pp. 131, 158, 244.

10 J.-C. Pressac, *Les crématoires...*, *ibid.*, p. 49, 80.

11 J.-C. Pressac, *Auschwitz:...*, *ibid.*, pp. 179, 475.

12 *Ibid.*, p. 244.

13 J.-C. Pressac, *Les crématoires...*, *ibid.*, p. 39, 80.

14 J.-C. Pressac, *Auschwitz:...*, *ibid.*, pp. 244, 384; J.-C. Pressac, *Les crématoires...*, *ibid.*, p. 80.

15 Werner Wegner has devoted considerably more care to this problem than Pressac has, but the results of his study, which was published in very brief summary form, are even less well-founded in technical respects than the French historian's. Wegner writes that in the Birkenau crematoria it was possible to cremate three bodies in one muffle in half an hour, which would have amounted to a capacity of 6,624 bodies per 24-hour period: W. Wegner, "*Keine Vergasungen in Auschwitz? Zur Kritik des Leuchter-Gutachtens*", in U. Backes, E. Jesse, R. Zitelmann (eds.), *Schatten der Vergangenheit. Impulse zur Historisierung des Nationalsozialismus*, Ullstein-Propyläen, Frankfurt/M., Berlin 1990, p. 460 (online: vho.org/D/dsdv/Wegner.html). Another superficial study of this topic was published by Fritjof Meyer in 2002: "*Die Zahl der Opfer von Auschwitz*", *Osteuropa*, 52(5) (2002), pp. 631-641; see Carlo Mattogno, "*Auschwitz. The new Revisions by Fritjof Meyer*", *The Revisionist*, 1(1) (2003), pp. 30-37 (online: vho.org/tr/2003/1/Mattogno30-37.html).

16 Fred A. Leuchter, *An Engineering Report on the Alleged Gas Chambers at Auschwitz, Birkenau and Majdanek, Poland*, Samisdat Publishers Ltd., Toronto 1988(online: www.zundelsite.org/english/leuchter/report1/leuchter.toc.html).

Ivan Lagacé, the manager and operator of the Bow Valley Crematorium in Calgary, Canada,[17] Leuchter erroneously arrived at a figure of 156 bodies per day as the total cremation capacity of the crematoria of Auschwitz and Birkenau. This figure is actually far below the actual capacity.

Pressac and Leuchter arrived at conclusions which, though diametrically opposed, are equally unfounded because no serious, fundamental studies have been conducted of the crematoria ovens at Auschwitz and Birkenau, whether by the orthodox historians or by the Revisionists. We intend to close this debilitating gap.

3. Modern-Day Cremation

3.1. The Technology of Crematoria Ovens Up To World War One

The cremation of dead bodies was practiced in Europe for more than a thousand years before Homer's time.[18] This custom was carried on until 785 AD, when Charlemagne forbade it, on pain of death, in his Decree of Paderborn.[19] In the following centuries cremation disappeared entirely from Christian Europe.

The idea of cremation regained some popularity during the French Revolution, but it was during the second half of the 19th century before it gradually found general acceptance.[20] The trend favoring cremation began to gain momentum in 1849, when the philologist Jakob Grimm gave a memorable lecture "*on the cremation of corpses*"[21] at the Berlin Academy of Sciences. The idea was quickly taken up by eager pioneers, and enthusiastically promoted.[22] The first cremation in a crematorium oven in Europe took place on October 9, 1874 in Dresden, in a makeshift oven designed by Friedrich Siemens. After a few cremations this experimental procedure was banned by the Saxon government.[23]

In those years, Italy was leading this modern movement for cremation, both legally and technologically. The first European crematorium was built in Milan in 1875, one year after cremation was recognized as a legal method for the disposal of the dead.[24] The first German crematorium was put into operation in Gotha on December 10, 1878. This period saw a great fervor of studies and experiments that led to the construction of several types of furnaces. Modern cremation had to satisfy certain ethical, aesthetic, and economic requirements, which were defined during a general conference on cremation technology held June 7, 1876 in Dresden.

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17 Barbara Kulaszka (ed.), *Did Six Million Really Die? Report on the Evidence in the Canadian "False News" Trial of Ernst Zündel – 1988*, Samisdat Publishers Ltd., Toronto 1992, p. 267 (online: www.zundelsite.org/english/dsmrd/dsmrdtoc.html).

18 Carl Schuchhardt, "*Die Anfänge der Leichenverbrennung*", in *Sitzungsberichte der Preußischen Akademie der Wissenschaften. Philosophisch-Historische Klasse*, 1920, p. 502.

19 *Capitulare Paderbrunnense*; see Max Pauly, *Die Feuerbestattung*, Verlagsbuchhandlung J. J. Weber, Leipzig 1904, p. 8.

20 B. Reber, "*Un crématoire du temps de la révolution française*", in *Société de crémation de Genève*, Bulletin VIII, Imprimerie Centrale, Geneva 1908, pp. 26-29.

21 The lecture titled "*Über das Verbrennen von Leichen*" (On the Cremation of Corpses) was published that same year.

22 *E.g.*, by military physicians like J.P. Trusen, Prof. Moleschott, Prof. Richter, Prof. Reclam und Prof. Küchenmeister. For the beginnings of modern cremation, the reader is referred to the two works already cited, as well as to F. Küchenmeister, *Über Leichenverbrennung*, lecture given on April 8, 1874 for the Neustädter Gymnasial-Stipendienfond, Verlag von Ferdinand Enke, Erlangen 1874; P. de Pietra Santa, *La crémation des morts en France et à l'étranger*, Librairie J.-B. Baillière et Fils, Paris 1874; P. de Pietra Santa, *Modern Cremation*, Publication de la Société Française d'Hygiéne; au bureau de la Société, Paris 1889; Rudolph Müller, "*Über Leichenverbrennung*", offprint from: *Medizinische Jahrbücher*, v. 199, issue 1, Vienna 1883; Henry Tompson, *Die moderne Leichenverbrennung*, Fischers Medizinische Buchhandlung, Berlin 1899; K. Weigt, *Almanach der Feuerbestattung*, self-pub. by author, Hannover 1909.

23 M. Pauly, *op. cit.* (note 19), p. 18.

24 G. Pini, *La crémation en Italie et à l'étranger de 1774 jusqu'à nos jours*, Ulrich Hoepli Editeur Libraire, Milan 1885, pp. 16, 30, 130f. An extremely precise description of the facility is provided by Wegmann-Ercolani in their small publication *Über Leichenverbrennung als rationellste Bestattungsart*, Cäsar Schmidt, Zürich 1874, pp. 30-33.

Many cremation facilities of the 1870s were as yet very unreliable and costly to operate – some had cremation times of up to 5-6 hours per corpse –, so that some were torn down again after just a few cremations. But much better capacities and fuel efficiencies were quickly reached: The Gorini oven at Riolo, for instance, which started operation on September 6, 1877, needed only 100-150 kg (220-330 lbs) and 1.5-2h per corpse. The oven by Toisoul and Fradet needed ca. 100 kg and just one hour per corpse.[25] In these ovens, the body was directly exposed to the flames, which were produced either by the incineration of the fuel or by combustion of the fuel gases from the gas generator.

A principle devised by Friedrich Siemens introduced the process of wholly indirect cremation using heated air, allowing only hot air but no flame gases to reach the body. This method predominated unchallenged in Germany until 1924. In this new procedure, cremation was performed by means of air heated to 1000°C (1830°F) in a regenerator or recuperator.[26] The experimental prototype of such an oven was installed in 1878 in Gotha and was used for the cremation of animal carcasses only. A cremation took 135 minutes on average; the first cremation required 1,500 kg (3,300 lbs) of brown coal, subsequent ones took from 250 to 300 kg (550 to 660 lbs) or less, with the requirements decreasing step by step.[27]

The Swedish Klingenstierna oven was a distinct improvement over the Siemens oven. Besides a main firing, it had a secondary firing that served mostly to burn off the remaining gases and smoke particles; the combustion air was heated in a recuperator consisting of metal baffles (heat exchanger between the furnace gas and the combustion air); the body was introduced into the incineration chamber on a small cart that remained there for the entire duration of the cremation cycle. In Germany this system was perfected by E. Dorovius and built by the firm of Gebrüder Beck in Offenbach. The first models, which were installed in the crematoria of Heidelberg (1891) and Jena (1898), still retained a cart for introduction of the body, but the 1899 model (Offenbach crematorium) worked without a cart, and the incineration chamber was replaced by a grating of refractory grilles beneath which two sloping surfaces angled like a funnel channeled the ash into the ash pit.[28] The metal type of recuperator was gradually replaced by one with refractory brick, and the oven took on the typical structure of the German crematoria ovens with coke-fired gas generator.

A prototype of the Schneider furnace was installed in the crematorium of Hamburg in 1892. Its structure was similar to that of the Klingenstierna-Beck oven with some improvements to the gas generator. It took approximately three hours to get this oven to an operational temperature. The duration of a single cremation was between 45 and 90 minutes, with a coke consumption of 250-300 kg (550-660 lbs) for the first and 50-100 kg (110-220 lbs) for subsequent cremations. The Rupp-

[25] G. Pini, *op. cit.* (note 24), p. 132. Unless otherwise noted, the following information is taken from this work (pp. 128-171). Cf. also Malachia de Cristoforis, *Etude pratique sur la crémation*, Imprimerie Treves Frères, Milan 1890, pp. 56-135; P. de Pietra Santa, M. de Nansouty, "*La crémation*", in *Le génie civil*, nos. 8-12, 1881; Luigi Maccone, *Storia documentata sulla cremazione presso i popoli antichi e moderni con speciale riferimento alla igiene*, Istituto Italiano d'Arti grafiche, Bergamo 1932, pp. 102-124; Fritz Schumacher, *Die Feuerbestattung*, J. M. Gebhardt's Verlag, Leipzig 1939, pp. 18-32.

[26] F. Küchenmeister, *Die Feuerbestattung. Unter allen zur Zeit ausführbaren Bestattungsarten die beste Sanitätspolizei des Bodens und der sicherste Cordon gegen Epidemien*, Verlag von Ferdinand Enke, Stuttgart 1875, pp. 70f.

[27] Wilhelm Heepke, *Die Leichenverbrennungsanstalten (die Krematorien)*, Verlag von Carl Marhold, Halle a.S. 1905, p. 20. This work contains a very detailed description of the Siemens, Klingenstierna and Schneider ovens, with extraordinarily precise diagrams (pp. 41-58). For these ovens, cf. the publications cited in this work, as well as E. Beutinger, *Handbuch der Feuerbestattung*. Carl Scholze Verlag, Leipzig 1911; Karl von Engerth, *Fortschritte der Feuerbestattung in Deutschland. Vortrag gehalten in der Hauptversammlung des Vereins der Freunde der Feuerbestattung "Die Flamme" in Wien am 19. Februar 1892*, Verlag von Moritz Perles, Vienna 1892; Karl von Engerth, *Die Feuerbestattung*, self-pub. by author, Vienna 1897; Hermann Ortloff, *Gleichberechtigung der Feuer- und Erdbestattung*, Felix Dietrich, Leipzig 1907. In the appendix: the cremation system of Richard Schneider, formerly Dresden, now Berlin, pp. 60-73.

[28] W. Heepke, *op. cit.* (note 27), p. 45-55.

mann furnace had already the typical structure of a modern coke-fired crematorium oven.[29] According to experimental data taken at the crematorium of Stoccarda during 48 cremations between July 20 and September 15, 1909, a cremation lasted in average 1h 33min, with a minimum of 1h 10min and a maximum of 2h 30min.[30]

The oven designed by the Swedish firm Knös introduced some more improvements to the Klingenstierna-Beck system. Its coke consumption for the heating and the first incineration was 300 kg and 50-90 kg for each subsequent cremation. In Germany, the company Gebrüder Beck of Offenbach produced this oven under a license contract.

3.2. Technological Progress and Developments in the Inter-War Years

After the First World War, the peace dictate of Versailles forced Germany to give up coal-rich regions as well as to supply coal to the victorious powers. Hence, Germany saw herself forced to use the coal reserves left to her as efficiently as possible. For these reasons, German industry endeavored to redesign, in terms of heat engineering, all facilities consuming coal and coal products so as to maximize the return achieved per unit of fuel consumption.

Crematoria ovens and their operation were by no means exempt from this need for the thrifty use of coal. Consequently, a Prussian law dating from September 14, 1911 was amended in 1924; this law had permitted only the wholly indirect cremation of bodies, for aesthetic reasons, but this process required more time and fuel than its alternative.[31] The debate about this amendment was accompanied by at times heated arguments among the cremation experts, disputing which of the two methods was the more economic one.[32] This question could be resolved only by means of scientific cremation experiments. The most significant experiments of this period were carried out in 1926 and 1927 in the crematorium of Dessau by the engineer Richard Kessler, who also wrote a detailed scientific report on the subject.[33] In the following we shall examine the results of these experiments.

The construction method of the new ovens took into account the decisive factors involved in the optimum use of combustion heat that engineer Kessler had discovered in his experiments. As a result the efficiency of the oven increased considerably. The most important technological innovations of that time include the reduction of the horizontal cross-section of the gas generator; more efficient recu-

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[29] Hans Keller, *Mitteilungen über Versuche am Ofen des Krematoriums in Biel*. Bieler Feuerbestattungs-Genossenschaft in Biel. Jahresbericht pro 1927/28, Biel 1928.

[30] R. Nagel, *Wege und Ziele der modernen Feuerbestattung*. Verlag Wilhelm Ruppmann, Stuttgart 1922, p. 36.

[31] Engineer H. Kori, "*Bau und Betrieb von Krematorien. 1. Neue Wege und Ziele*", *Die Wärmewirtschaft*, no. 8, 1924, pp. 115-119; H. Kori, "*Bau und Betrieb von Krematorien. 2. Gutachten der Arbeitsgemeinschaft für Brennstoffersparnis*", *Die Wärmewirtschaft*, no. 8, 1924, pp. 119f.

[32] Corporate pub., "*Bau und Betrieb der Krematorien*", *Die Wärmewirtschaft*, no. 7, 1925, pp. 107f.; "*Bau und Betrieb der Krematorien. Erwiderung auf den Einspruch des Verbandes der Preußischen Feuerbestattungsvereine vom 9. Oktober 1925 gegen den Erlaß des Herrn Ministers des Innern – II T 2015 – vom 24. Oktober 1924*", *Die Wärmewirtschaft*, no. 1, 1926, pp. 9-12; Corporate pub., "*Betr. Ofenanlage in Krematorien*", *Die Wärmewirtschaft*, no. 3, 1927, p. 51; Chief Engineer H. Tilly, "*Über die Wirtschaftlichkeit von Anlagen zur Einäscherung menschlicher Leichen*", *Die Wärmewirtschaft*, no. 9, 1926, pp. 143ff.; Chief Engineer A. Peters, "*Die Wirtschaftlichkeit von Anlagen zur Einäscherung menschlicher Leichen*", *Die Wärmewirtschaft*, no. 11, 1926, pp. 176ff.

[33] Richard Kessler, "*Rationelle Wärmewirtschaft in den Krematorien nach Maßgabe der Versuche im Dessauer Krematorium*", *Die Wärmewirtschaft*, nos. 8-11, 1927. Abbrev. version: "*Rationelle Wärme-Wirtschaft in Krematorien unter besonderer Berücksichtigung der Leuchtgasfeuerung*", *V. Jahrbuch des Verbandes der Feuerbestattungs-Vereine Deutscher Sprache 1930*, Königsberg 1930. It is also worth mentioning the experiments which engineer Hans Keller performed in 1927 in the crematorium of Biel, Switzerland, with an oven with coke-fired gas generator: Hans Keller, "*Mitteilungen über Versuche am Ofen des Krematoriums in Biel*", in Bieler Feuerbestattungs-Genossenschaft in Biel (Schweiz) (ed.), *Jahres-Bericht pro 1927-28*, Biel 1929. Cf. also Hans Keller, "*Versuche an einem Feuerbestattungsofen*", offprint from *Archiv für Wärmewirtschaft und Dampfkesselwesen*, yr. 10, issue 6, 1929.

perators; the installation of an afterburning grate; an air intake system to allow for more efficient afterburning; and the installation of appropriate measuring instruments.[34]

In the early 1930s the coke-fired ovens with gas generator had reached the pinnacle of technological perfection, yet at the same time their inexorable decline began as they were being increasingly supplanted by significantly more economic heating systems, particularly ones using gas and electricity. From this point on, the existing coke-fired ovens were either torn down[35] or restructured to accommodate gas heating.[36] The new heating systems necessitated additional studies on the structure of the ovens as well as on the phenomenon of cremation *per se*, and these studies were presented in significant technical publications.[37]

Even though the first German crematorium had already been built in 1878, cremation was not legally permitted until 1911 and it took until the 1930s before formal legislation on this matter actually appeared. The first real and complete Cremation Act was passed on March 15, 1934. Specific guidelines pertaining to the cremation ovens and the cremation process followed soon thereafter.[38]

As the following table shows, the number of cremations in Germany rose astronomically between the time when the first crematorium was opened, and the beginning of the Second World War:[39]

PERIOD	# OF CREMATORIA	# OF CREMATIONS	ANNUAL AVERAGE # OF CREMATIONS
1878-1887	1	496	50
1888-1897	2	2,192	219
1898-1907	15	12,382	1,238
1908-1917	51	88,687	8,869
1918-1927	81	283,976	28,398
1928-1937	118	628,600	62,860

In 1938, 84,634 cremations were performed in 120 crematoria;[40] in 1939 there were 102,112 cremations; in 1940, 108,130; in 1941, 107,103; and in 1942, 114,184.[41]

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[34] Friedrich Hellwig, "*Vom Bau und Betrieb der Krematorien*", *Gesundheits-Ingenieur*, yr. 54, issue 24, 1931, p. 372; Chief Engineer Peters, "*Winke für den Betrieb von Einäscherungsanlagen*", *Zentralblatt für Feuerbestattung*, yr. 2, 1930, no. 4, pp. 56f.

[35] For example, the old coke oven of the crematorium at Dortmund was dismantled in 1937/38 and replaced with two new ovens of the Volckmann-Ludwig system: Hermann Kämper, "*Der Umbau der Leichenverbrennungsöfen und die Einrichtung von Leichenkühlräumen auf dem Hauptfriedhof der Stadt Dortmund*", *Gesundheits-Ingenieur*, yr. 64, issue 12, 1941, pp. 171-176.

[36] Engineer Dr. Repky, "*Der Umbau koksgefeuerter Krematoriumsöfen auf Leuchtgasbeheizung*", *Gesundheits-Ingenieur*, yr. 55, no. 42, 1932, pp. 506-509.

[37] Of the most important technical articles, we would cite: Friedrich Hellwig, *op. cit.* (note 34), in abbreviated form: "*Vom Bau und Betrieb der Krematorien*", *Zentralblatt für Feuerbestattung*, yr. 4, no. 1, 1932, pp. 8-14; Paul Schläpfer, "*Über den Bau und den Betrieb von Krematoriumsöfen*", separate reprint from *Jahresbericht des Verbandes Schweizerischer Feuerbestattungsvereine*, Zürich 1937; P. Schläpfer, "*Betrachtungen über den Betrieb von Einäscherungsöfen*", *Schweizerischer Verein von Gas- und Wasserfachmännern*, *Monatsbulletin*, yr. XVIII, no. 7, Zürich, July 1938; Richard Kessler, "*Entwicklung und Zukunftswege der Einäscherungstechnik*", *Zentralblatt für Feuerbestattung*, yr. 3, no. 6, 1931, pp. 83-89; R. Kessler, "*Die wärmewirtschaftliche Ausnutzung der Abgase bei Einäscherungsöfen*", *Zentralblatt für Feuerbestattung*, yr. 5, no. 2, 1935, pp. 21-26; Viktor Quehl, "*Feuerbestattung und Einäscherungsöfen*", *Gesundheits-Ingenieur*, yr. 59, no. 38, 1936, pp. 559ff.

[38] "*Betriebsordnung für Feuerbestattungsanlagen*" of Nov. 5, 1935, as well as the "*Verordnung zur Durchführung des Feuerbestattungsgesetzes*" of August 10, 1938, reprinted in Fritz Schumacher, *op. cit.* (note 25), pp. 116-121; *Veröffentlichungen des Großdeutschen Verbandes der Feuerbestattungsvereine*, no. 5, self-pub. by the organization, Königsberg/Prussia 1932. These guidelines were also published in *Zentralblatt für Feuerbestattung*, yr. 5, no. 6, 1933, pp. 87-92; *Richtlinien für den Bau und Betrieb von Öfen zur Einäscherung menschlicher Leichen, aufgestellt vom Großdeutschen Verbande der Feuerbestattungsvereine e.V.*, Verlag der Verlagsabteilung des Großdeutschen Verbandes der Feuerbestattungsvereine e.V., Berlin 1937.

[39] *Die Feuerbestattung*, yr. XI, 1939, pp. 8f.

[40] *Ibid.*, yr. XII, 1940, p. 14.

[41] *Ibid.*, yr. XVI, 1944, p. 17.

3.3. J. A. Topf & Söhne, Erfurt

Where crematoria ovens are concerned, the firm of J. A. Topf & Sons of Erfurt began manufacturing operations at the start of the First World War and was most notably successful in the early 1920s.[42] Their early models pioneered several innovations, particularly a system of exterior muffle heating, based on a patent by Max J. Kergel.[43] This prevented the cremation products from entering the muffle, thus allowing for an entirely indirect cremation process.

This cremation oven consisted of a coke generator; a self-contained cremation chamber (muffle); a system of baffles underneath (recuperator), which served to preheat the air required for the cremation; and the diversion of the carbon monoxide gases around the muffle.[44] The ovens built during the 1920s needed 60 to 75 minutes and consumed some 160 to 260 kg (350 to 570 lbs) of coke per cremation.[45]

During the 1920s, the firm of J. A. Topf & Sons became Germany's foremost commercial oven manufacturer. Between 1922 and 1927, no less than 18 of the 24 ovens installed in the German crematoria were built by Topf.[46] In the early 1930s Topf's commercial supremacy was consolidated.[47] By now Topf & Sons had achieved a very advanced technological level. They deserve the credit for designing Germany's first fully functional gas-heated cremation oven (1927, in Dresden), as well as the country's first electric cremation oven, which came into service in Erfurt in 1933. The firm also pioneered improvements in cremation technology such as the afterburning grate and the rotating grate.

Even though the electric Topf ovens had no competition in Germany, the company's supremacy in the oven manufacturing field was seriously threatened in those years by the newly developed gas oven of the Volckmann-Ludwig type.[48] In technological respects, the Topf firm responded to the competition posed by the new oven by designing a Model 1934 gas oven.[49] In propagandistic terms they re-

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[42] *Phoenix. Blätter für fakultative Feuerbestattung und verwandte Gebiete*, Vienna, no. 10, 1915, p. 296; *ibid.*, no. 4, 1916, pp. 97ff.

[43] Reichspatentamt (Imperial Patent Office), Patent No. 218581. Class 24d. Issued on February 8, 1910. Max J. Kergel in Beuthen, O.-S. *Leichenverbrennungsofen mit Rekuperator.* Patented in the German Reich as of October 4, 1908.

[44] Balduin Reichenwallner, *Tod und Bestattung*, Katakomben-Verlag / Balduin Reichenwallner, Munich 1926, pp. 28f.

[45] *Öfen für Krematorien System Topf. J. A. Topf & Söhne Erfurt. Maschinenfabrik und feuerungstechnisches Baugeschäft*, publicity leaflet pub. 1926.

[46] *IV. Jahrbuch des Verbandes der Feuerungsbestattungs-Vereine Deutscher Sprache 1928.* Pub. on the occasion of the 22nd Association Conference on July 4-8 in Bremen, by the Association Board, Königsberg/Prussia 1928, p. 84.

[47] F. Hellwig, *op. cit.* (note 34), p. 370.

[48] Regarding the electric Topf oven, see Konrad Weiss, "*Der erste deutsche elektrisch beheizte Einäscherungsofen im Krematorium Erfurt*", *Gesundheits-Ingenieur*, yr. 57, no. 37, Sept. 15, 1934, pp. 453-457; "*Elektrisch betriebener Topf-Einäscherungsofen D.R.P. angem.*", *Zentralblatt für Feuerbestattung*, yr. 7, no. 6, 1935, pp. 88ff.; Konrad Weiss, "*Die Entwicklung des elektrisch beheizten Einäscherungsofens im Krematorium Erfurt*", *Gesundheits-Ingenieur*, yr. 60, no. 11, 1937, pp. 159-162; Fritz Schumacher, *op. cit.* (note 25), pp. 28ff.; Rudolf Jakobskötter, "*Die Entwicklung der elektrischen Einäscherung bis zu dem neuen elektrisch beheizten Heißlufteinäscherungsofen in Erfurt*", *Gesundheits-Ingenieur*, yr. 64, no. 43, 1941, pp. 579-587. First European cremation oven with electric heating came into service in Biel, Switzerland, on Aug. 31, 1933; cf. Hans Keller, "*Der elektrische Einäscherungsofen im Krematorium Biel*", in Bieler Feuerbestattungs-Genossenschaft in Biel (ed.), *Jahresbericht pro 1933*, Biel 1934; Hans Keller, *Der elektrische Ofen im Krematorium Biel*, Graphische Anstalt Schühler A.G., Biel 1935. This experimental oven was gradually perfected by the firm of BBC Brown Boveri, which did not have a large market in Germany; cf. G. Keller, *Die Elektrizität im Dienste der Feuerbestattung*, Aktiengesellschaft Brown, Boveri & Cie, special offprint from the Brown Boveri "*Mitteilungen*", no. 6/7, Baden (Switzerland) 1942. Regarding the Volckmann-Ludwig oven, cf. accredited engineer Hans Volckmann, "*Ein neues Einäscherungsverfahren*", *Zentralblatt für Feuerbestattung*, yr. 3, no. 4, 1931; H. Volckmann, "*Der neue Einäscherungsofen System Volckmann-Ludwig*", *Zentralblatt für Feuerbestattung*, yr. 3, no. 4, 1931; H. Volckmann, "*Das Volckmann-Ludwig-Verfahren und die Kesslerschen Richtlinien*", *Zentralblatt für Feuerbestattung*, yr. 6, no. 8, 1934; H. Wolfer, "*Der neue 'Volckmann-Ludwig'-Einäscherungsofen im Stuttgarter Krematorium*", *Gesundheits-Ingenieur*, yr. 55, no. 13, 1932.

[49] Hugo Etzbach, *Der technische Vorgang bei einer Feuerbestattung*, Druck Johannes Friese, Cologne 1935, pp. 3ff. Regarding the gas-fired Topf oven cf. also F. Schumacher, *op. cit.* (note 25), pp. 25ff.

sponded with rather harsh polemics in the form of a most aggressive article by engineer Kurt Prüfer,[50] the man who would design the three- and eight-muffle ovens of Birkenau; the criticism advanced in that article, however, was refuted by Richard Kessler.[51]

3.4. Structure and Operation of coke-fired cremation ovens of the 1930s

This type of furnace consisted of a gas generator, an incineration room or muffle, a post-combustion chamber below it, and a recuperator thereafter. The gas generator, lined with refractory material, had the usual grill for the coke and openings to regulate air intake and to remove ashes and cinders. A vertical or oblique channel conducted the combustion gases into the muffle. As a result of lack of oxygen, the coke burnt only partly in the gas generator, producing carbon monoxide rich gases which were led into the muffle, where it burnt with additional pre-heated air coming in from the recuperator.

The muffle was a horizontal combustion chamber lined with refractory material. The German "*Norms for the construction and operation of furnaces for the cremation of human corpse*" enacted in 1937 prescribed the following minimal measures for such a muffle: width: 900 millimeter; height: 900 millimeter; length: 2500 millimeter.[52]

At the front, the muffle was closed with a guillotine-like shutter made of fireclay. In front of this shutter was an outer metal door. The bottom of the muffle consisted of a grill made of fireclay, on which the coffin was placed. The remains of the body fell through the refractory grilles into the post-combustion chamber with slanted walls narrowing down to a small cavity in which the container for the ashes was placed.

Openings in the post-combustion chamber led the combustion gases into the recuperator, which is a heat exchanger consisting of intertwined, counter-current fresh-air intake and exhaust gas exit channels. As a result of this heat exchange, the recuperator had temperatures between 400 and 600°C. The oven was a two-level structure: the gas generator and recuperator were at a lower level, while the incineration chamber was at an upper level.

The operation of this system was as follows: First, the shutter of the smoke flue was opened. Then, the coke fire in the generator was lit with the help of some wood. As soon as the combustion gases burning in the muffle had increased the temperature to an operational level, the introduction shutter was opened and the coffin was introduced in the muffle. Because of the high temperature of the muffle, the coffin caught fire already during the introduction. It burned quickly, leaving the corpse on the grill. First, the corpse dehydrated, then the combustible parts incinerated. The solid incineration products of the corpse fell into the post-combustion chamber and ultimately into the ash container, while the gaseous products moved into the side flues of the recuperator and down through them into the waste-gas flue, whence they rose up the stack. When the flame development had stopped, the incandescent ashes were scrapped into the ash container. The oven was operated with the help of various controls (fuel supply, recuperator and generator air intake, exhaust shutter).[53]

3.5. The Coke Consumption of a Cremation Oven with Coke-Fired Generator

A cremation oven's fuel consumption depends in the main on the manner of the oven's construction, the cremation process, the frequency of cremations, the state of the bodies, and the operation of the oven. For this reason it is pointless to speak of an oven's fuel consumption without considering at

[50] Kurt Prüfer, "*'Ein neues Einäscherungsverfahren.' Eine Entgegnung*", *Die Flamme*, yr. 40, 1931, pp. 5f.; for the polemics in company correspondence, cf. also Weimar State Archives, 2/555a.

[51] R. Kessler, "*Der neue Einäscherungsofen System Volckmann-Ludwig*", *Zentralblatt für Feuerbestattung*, 3(3) (1931).

[52] *Richtlinien für den Bau von Öfen zur Einäscherung menschlicher Leichen* aufgestellt vom Großdeutschen Verbande der Feuerbestattungsvereine, in: *Zentralblatt für Feuerbestattung*, 5. Yr., No. 6, 1933, p. 4.

[53] See in particular E. Beutinger, *op. cit.* (note 27), pp. 94-127.

least the following three factors: the oven's construction system, the manner of cremation (direct or indirect), and the frequency with which cremations are carried out.

The procedure involved in indirect cremation is much more fuel-intensive than that of direct cremation, since the former requires that the entire fireproof mass of the recuperator be heated to 1000°C (about 1830°F). The frequency of cremations has a very significant effect on fuel consumption, since the oven's firebrick absorbs most of the heat generated during the first cremations. For this reason fuel consumption is lowest when the oven is operating at thermal equilibrium.

The heat balance of a cremation oven with coke-fired generator is a problem, very difficult to resolve in theory, since in practice the performance is affected by variable factors which cannot be predicted by theory and which affect the operation of the oven from case to case.

In the 1920s this problem was discussed by scientists like Fichtl[54] and Tilly,[55] but the most important contribution to its resolution was Wilhelm Heepke's 1933 article on this subject.[56]

Heepke's calculations showed that the per-cremation coke consumption of a medium-sized oven at thermal equilibrium amounts to 30 kg (66 lbs) of coke (plus the wooden coffin weighing 40 kg, or 88 lbs). However, Heepke's findings are marred by errors both in approach and in arithmetic, and his conclusions are thus questionable. If one takes his errors into account, one arrives at a coke requirement of 20.5 kg (45.1 lbs). This result is consistent with those of experimental origin. The experiment conducted by R. Kessler with coke fuel on January 5, 1927, indicated the following fuel consumption:

- total consumption: 436.0 kg (960 lbs) coke
- preheating of the oven: 200.0 kg (440 lbs) coke
- 8 successive cremations: 236.0 kg (520 lbs) coke
- consumption for 1 cremation, including preheating: 54.5 kg (120 lbs) coke
- consumption for 1 cremation without preheating of the oven: 29.5 kg (65 lbs) coke

The fuel consumption relating to the eight cremations exclusive of the preheating of the oven still includes the consumption producing the heat that is absorbed by the oven's firebrick up to the point where thermal equilibrium is reached. A calculation to take into account the heat loss caused by radiation and conduction shows that the coke consumption for a cremation in an oven at thermal equilibrium is about 20 kg (44 lbs).

This confirms the correctness of this method of calculation, which can thus also be used to determine the thermal balance of the cremation ovens of Auschwitz and Birkenau.

3.6. The Duration of the Cremation Process with a Coke-Fired Generator

Cremation is a physical and chemical process requiring a certain minimum time that cannot be decreased further.[57] This minimum time depends in the main on the chemical composition of the body to be cremated. As special experiments conducted in England in the 1970s showed, the body's protein structure is of great importance. Due to its relatively high nitrogen content, its high ignition temperature and the chemical transformations which the proteins undergo at high temperatures, there is a considerable degree of resistance to combustion, which is amplified further by the fact that the protein substance is submerged, as it were, in body fluid and cannot ignite before this fluid has evaporated. In

[54] Engineer Fichtl, "*Rationelle Wärmewirtschaft in den Krematorien*", *Die Wärme, Zeitschrift für Dampfkessel und Maschinenbetrieb*, 17(34) (1924), pp. 394-397.

[55] H. Tilly, "*Luftüberschuß und Brennstoffverbrauch bei der Einäscherung menschlicher Leichen*", *Die Wärmewirtschaft*, 3(2) (1926), pp. 190f.; H. Tilly, "*Versuch einer rechnungsmäßigen Erfassung der Vorgänge der Einäscherung menschlicher Leichen*", *Die Wärmewirtschaft*, 3(8) (1926), pp. 134ff.; H. Tilly, *op. cit.* (note 32); H. Tilly, "*Über die Einäscherung menschlicher Leichen*", *Die Wärmewirtschaft*, 4(2) (1927), pp. 19-25.

[56] "*Die neuzeitlichen Leicheneinäscherungsöfen mit Koksfeuerung, deren Wärmebilanz und Brennstoffverbrauch*", *Feuerungstechnik*, yr. XXXI, 1933: issue 8, pp. 109ff., and issue 9, pp. 123-128. This is a consolidated version of the study on thermal equilibrium which engineer Heepke had presented in his aforementioned book, *op. cit.* (note 28), pp. 60-63.

[57] Cf. Hans Kraupner, Franz Puls, *Die chemischen Vorgänge bei einer Einäscherung*, special offprint from *Städtehygiene*, Ülzen 8/1970.

other words: A cremation carried out under optimum conditions cannot take less time than the time perforce required for this process to take place.

Conversely, the duration of the cremation cycle increases, of course, the more that actual conditions are removed from the optimum, regardless of whether this discrepancy is due to careless operation of the oven or to a less-than-ideal oven construction system.

Before raising the question of the length of the cremation process or the cremation cycle, we must clarify just exactly what we mean by that. In very general terms, we can say that a cremation is completely finished once the ashes remaining of the body have been removed from the oven. For an oven not equipped with an afterburning grate, the cremation time may be defined as the time between the introduction of the coffin into the muffle and the transfer of the glowing ashes from the ash slope into the ash container, in which they gradually collapse altogether. In an oven equipped with an afterburning grate, such as the generator ovens of Beck and Topf and the Volckmann-Ludwig gas ovens of the 1930s, the end of the cremation process is set as the time at which the glowing ashes are removed from the ash slope or transferred from the bottom of the muffle to the afterburning grate.

Even though it violated the ethical norms set by R. Kessler in 1932, it was common practice in some crematoria to introduce the next body into the muffle while the remnants of the previous still burned on the ash slope, so that one oven actually contained two bodies at the same time, albeit at different stages of the cremation cycle. This process was used in ovens such as the Volckmann-Ludwig type in Stuttgart, which were equipped with a damper in the ash settling chamber.

As we have already mentioned, scientific experiments were carried out in England in the 1970s to determine which factors influence the cremation process. The results were announced in July 1975 at the annual conference of the Cremation Society of Great Britain. The experiments were grouped into two series: an introductory series in Ruislip's Breakspear Crematorium and the main series in Hull's Chanterlands Crematorium. The first group of project leaders selected the factors that, in their opinion, would affect the length of the cremation process. The influence of technical factors was equalized by using the same gas-fired oven (Dowson & Mason Twin Reflux Cremator) and the same heater for all experiments.[58]

On the basis of these experiments it was found that the truly decisive factors, where the time required for a cremation is concerned, are the maximum temperature of the oven and the sex of the deceased. Statisticians graphically summarized the results of the experiments. One of the analysts, Dr. E. W. Jones, commented as follows:[58]

> "*From his graph he was able to tell us (we thought this rather interesting) that there is a maximum point, or rather a minimum point, of incineration time below which it is impossible to go, and our statistician defined this as a thermal barrier that, because of the make, the nature of human tissues, you cannot incinerate them at a rate which is below round about 63 minutes. Now some people will come up with readings of 60, 59, 58, they are the lower ends of this scatter of readings, and that this thermal barrier's optimum temperature is round about 800-900°C.*"

The graph shows that the time that most closely approximates the thermal barrier is 60 minutes, given a temperature of 800°C (1470°F). If the temperature is increased to 1000°C (1830°F), the time required for cremation increases to 67 minutes, and at 1100°C (2010°F) it drops again, to 65 minutes. At higher temperatures, which were not investigated, the time would presumably decrease further, and at extremely high temperatures it probably drops below the thermal barrier. Dr. Jones stated that if one wanted to decrease the cremation time in this way to 20 or even to 15 minutes, one would have to construct an oven capable of working at 2000°C (3630°F).[58]

In reality, the cremation process must take place between fairly precise thermal boundaries. At temperatures of over 1100 to 1200°C (2010 to 2190°F) one encounters the phenomenon of sintering, where the bones of the corpse and the oven refractory begin to soften and to melt together (fuse), and

[58] "*Factors which affect the process of cremation*", Third Session, by Dr. E. W. Jones, assisted by Mr. R. G. Williamson, from: *Annual Cremation Conference Report*, Cremation Society of Great Britain, 1975, p. 81.

at temperatures under 700 to 600°C (1290 to 1110°F) the body merely chars.[59] Dr. E. W. Jones then reports an observation of particular interest to us:[58]

> "*Our statistician colleague did some work, he looked into the records of crematoria in Germany during the last war, and it would appear that the authorities there were presented with a similar problem – that they came up against a thermal barrier. They could not design a furnace that reduced the mean incineration time to a very practical effective level. So we started to look at why there is this thermal barrier with human tissues.*"

It was found that the cause of this factor was that the proteins in the human body – when they are heated to 800 to 900°C (1470 to 1650°F) – undergo a chemical transformation. They dissociate and form compounds "*that can only be described as a hard crust.*"[58]

Naturally the cremation process took longer in ovens operating with a coke-fired gas generator. Regarding the time required for the cremation cycle, the data to be found in contemporaneous literature is almost never entirely reliable, first and foremost because what is meant by 'the time required' is very rarely clearly defined, and secondly because one must expect that the data have been distorted for reasons of competition or propaganda.

This is why we shall take data supplied by the technical measuring instruments in the ovens themselves as our objective and incontrovertible starting point. From this perspective, the diagram summarizing the cremations performed by R. Kessler with coke fuel on January 5, 1927, is especially significant. This was a case where one is completely justified in saying that the cremations were carried out under the optimum conditions for an oven with a gas generator, because:

- the construction system of the oven was excellent;
- Kessler had taken every measure necessary to prepare the oven in terms of heat engineering;
- the appropriate technical instruments were used to observe the cremation cycle in every phase;
- under the knowledgeable supervision of an expert engineer the operation of the oven went off especially smoothly.

During these experiments the average cremation time was 1 hour and 26 minutes, while the shortest cremation took 1 hour. The average temperature in the muffle was about 870°C (1600°F). We shall return to this point later. In this context it is important to stress that engineer Kessler was using the method of direct cremation. For comparison we refer to a different series of eight cremations that Kessler performed in the same oven, using briquettes instead of coke fuel. That time the average cremation took 1 hour and 22 minutes. Two weeks later the same experiment, using gas heating for the oven, returned an average cremation time of 1 hour and 12 minutes for each of the eight cremations.[60]

4. The Topf Cremation Facilities for Concentration Camps

As of the late 1930s, Topf & Söhne as well as other manufacturers, especially the firm of H. Kori in Berlin and the Didier-Werke (also in Berlin),[61] began to design cremation ovens for the concentration camps. These ovens were constructed more simply than those for civilian use. The Topf firm developed six projects for cremation ovens of this type:

1. Coke-fired single muffle oven, never built.[62]

2. Mobile, petrol-fired two-muffle oven, later converted into a stationary coke-fired oven. This type of oven was installed in Gusen (a subcamp of Mauthausen) and Dachau. The first one was ordered by the *SS-Neubauleitung* of the Mauthausen camp on March 21, 1940, as a mobile, petrol-fired oven ("*fahrbarer Ofen mit Ölbeheizung*"), but on October 9, 1940, it was decided to convert it

[59] R. Kessler, *op. cit.* (note 33), issue 8, p. 140; P. Schläpfer, "*Betrachtungen…*", *op. cit.* (note 37), p. 151.
[60] R. Kessler, *op. cit.* (note 33), issue 9, pp. 150f. and 156f.
[61] See chapter 4.4.
[62] Drawing of J.A. Topf & Söhne D 58173 of Jan. 6, 1941: "*Einmuffel-Einäscherungsofen*" coke-fired for the *SS-Neubauleitung* of KL Mauthausen. Source: *BAK* (Koblenz Federal Archives), NS 4/Ma 54; *Kosten-Anschlag* of Topf firm from Jan. 6, 1941, for *SS-Neubauleitung* of KL Mauthausen reg. a coke-fired crematorium oven with one or two muffles. *BAK*, NS 4/Ma 54.

into a coke-fired oven.[63] Topf shipped the oven by railroad on December 12, 1940, and it arrived at its destination on December 19.[64] This same day, the *SS-Neubauleitung* of the Mauthausen camp sent a telegram to Topf with an urgent request for an engineer.[64] The Topf firm sent its engineer August Willing to Gusen on December 27,[65] who immediately began his work and finished it on January 22, 1941. The two coke-fired gas generators had been installed during the construction of the oven, which went into operation at the end of January 1941.[66]

According to a Topf letter to the *SS-Neubauleitung* of Dachau of July 25, 1940,[67] the oven of the Dachau camp had been delivered even earlier. The SS authority of the Dachau camp decided also to convert this oven's heating system by replacing the two petrol burners with coke gas generators. Both converted ovens do still exist today in these former concentration camps. Initially, the decision of local authorities to convert the heating system of certain crematorium ovens was prompted by the sheer lack of liquid fuel, but on December 17, 1943, the Chief of *Amt CIII* (*Technische Fachgebiete*) of the SS-WVHA sent an executive order stating:[68]

> *"In the crematoria, the use of liquid fuel can no longer be permitted. The modification to solid fuel has to be done everywhere."*

3. Coke-fired two muffle oven, installed at Buchenwald camp. On June 18, 1938, the Construction Office of the SS administration of Buchenwald-Sachsenhausen camp sent a request to *SS-Gruppenführer* Eicke, head of the *Totenkopfverbände* and of the concentration camps, to authorize the construction of a crematorium at the Buchenwald camp. Eicke forwarded this request to the Head of the SS administration in Munich with a note in which he endorsed the request since, as a result of an increased number of inmates of this camp, Buchenwald was confronted with deceased inmates almost on a daily base, whose bodies had to be cremated in the municipal crematorium of Weimar.[69] The request was welcomed and the authorization was released by the *Hauptamt Haushalt und Bauten* (HHB) at the beginning of December 1939. For the construction of an "*emergency crematorium*" (*Notkrematorium*), as it is referred to in German administrative documents, a request was sent to the firm Topf. On December 21, 1939, Topf sent an estimate to the appropriate authorities for "*1 petrol- or coke-fired Topf incineration oven with double muffle and compressed-air-blowers, as well as forced-draft blowers*" for 7,753 RM, plus 1,250 RM for the installation.[70]

The "*Description of the structure of the new construction of an emergency crematorium in the detention camp Buchenwald*" specifies:[71]

> *"Due to the high mortality rates in the Buchenwald camp, the construction of an emergency crematorium with petrol-fired cremation oven (double muffle oven) has become necessary. For this, a location of 6 x 9 m and 4 m height is required."*

In its estimate of December 21, 1939, the Topf firm also included a drawing of the oven, edited the same day,[72] and a plan for a small crematorium of just 6 m × 9 m × 4 m.[73] The document just quoted refers to this small crematorium and contains a "*cost calculation*", a "*recapitulation of the costs"* and finally a "*calculation of the masses*" of the emergency crematorium for the Buchenwald

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63 Letter Topf, Feb. 26, 1941, to *SS-Neubauleitung* of KL Mauthausen. *BAK*, NS 4 Ma/54.
64 Telegram *SS-Neubauleitung* of KL Mauthausen to Topf, Dec. 19, 1940. *BAK*, NS 4 Ma/54.
65 Letter Topf to *SS-Neubauleitung* of KL Mauthausen, Dec. 23, 1940. *BAK*, NS 4 Ma/54.
66 Letter *SS-Neubauleitung* of KL Mauthausen to Topf, Feb. 14, 1941. *BAK*, NS 4 Ma/54.
67 Letter Topf to *SS-Neubauleitung* of KL Mauthausen, July 25, 1940. *BAK*, NS 4 Ma/54.
68 *AGK* (Archiwum Głównej Komisji Zbrodni Przeciwko Narodowi Polskiemu Instytutu Pamieci Narodowej, Warszawa), NTN, 94, p. 177.
69 NO-4353.
70 *Kosten-Anschlag* J.A. Topf & Söhne, Dec. 21, 1939, for *SS-Neubauleitung* of KL Buchenwald reg. a petrol- or coke-fired crematorium oven with two muffles. NO-4448.
71 NO-4401.
72 Drawing of J.A. Topf & Söhne D 56570, Dec. 21, 1939, "*Doppelmuffel-Einäscherungsofen mit Ölbrenner* " for KL Buchenwald. NO-4444.
73 Plan of crematorium in KL Buchenwald (Dec. 1939). NO-4444.

camp, whose cost was estimated to 14,200 RM.[74] No documents regarding the realization of this project are known to me. A later, undated project, probably from 1940, shows a more sophisticated crematorium with outer dimensions of 14 m × 12 m, consisting of five rooms. The furnace room (6.50 m × 4.99 m), however, contains only one single muffle oven.[75] According to Kurt Prüfer, a Topf two-muffle oven was installed at Buchenwald in 1940-1941,[76] which evidently was the subject of the estimate mentioned above.

4. Coke-fired two muffle oven type Auschwitz. Three ovens of this type were built in the crematorium of Auschwitz I between 1940 and 1942; one was built in 1945 in the crematorium of Mauthausen.

5. Coke-fired three muffle oven. Two ovens of this model (one also equipped for petrol-firing) were installed in the crematorium of Buchenwald in 1942, two in the crematorium of Groß-Rosen in 1942,[77] and ten in the crematoria II and III of Birkenau in 1942-1943.

6. Coke-fired eight muffle oven. Two ovens of this type were built in the crematoria IV and V of Birkenau in 1942-1943, and one half of such an oven (4 muffles) was installed at Mogilew in 1942. The ovens of Auschwitz will be described in the following paragraphs.

4.1. The Coke-Fired Topf Double-Muffle Cremation Ovens

As far as we know, Topf built four ovens of this type, of which three were installed in crematorium I, the old crematorium of Main Camp Auschwitz, while the fourth was located in the crematorium of Mauthausen.

Work on building the first oven for Auschwitz began in early July 1940. A September 16, 1940 letter from the Auschwitz Administration reveals that the oven had been "*in service for weeks already*".[78] One can thus assume that the oven was first put into service around the end of July 1940. It was built between July 5 and 25, 1940, and the first cremation took place on August 15.[79]

The cost estimate for the second oven is dated November 13, 1940. The Topf firm delivered the various components of the oven to Auschwitz on December 20 and 21, 1940 and January 17 and 21, 1941.[80] It was constructed between January 26 and February 22, 1941.[81]

Topf revised its cost estimate for the third oven on September 25, 1941,[82] and sent the required material to Auschwitz on October 21, a total of 3,548.5 kg.[83] Construction of the foundation for the third oven began on November 19, 1941, and was completed on December 3;[84] work was then discontinued due to a lack of fireproof material. The pertinent invoice issued by Topf is dated December 16, 1941.[85] Due to a *Waggonsperre* (railroad car prohibition[86]), however, construction of the ovens

[74] *SS-Neubauleitung* Buchenwald, *Kostenberechnung*, Jan. 10, 1940. NO-4401.
[75] Drawing of the Buchenwald crematorium (Jan. 1940). NO-4445.
[76] Interrogation of K. Prüfer, Feb. 11, 1948, by Lieutenant Colonel of *Smersh* Doperchuk. Federativnaya Slushba Besopasnosti Rossiskoi Federatsii (*FSBRF*), Fond N-19262, p. 124. German translation in : J. Graf, "*Anatomie der sowjetischen Befragung der Topf-Ingenieure*." in: *VffG*, 6(4) (2002), p. 404.
[77] So far, no documents were discovered about these furnaces, but in 1948, the Soviet counter-espionage service (*Smersh*) had a plan of the crematorium of Groß-Rosen drawn by the Topf company that showed two triple-muffle ovens. Kurt Prüfer confirmed that they had been constructed in 1942. *FSBRF*, Fond N-19262, p. 183 ; cf. J. Graf, *ibid.*, p. 412.
[78] Danuta Czech, *Auschwitz Chronicle, 1939-1945*, Henry Holt, New York 1989, p. 16; cf. *RGVA* (Rossiski Gosudarstvenni Vojenni Archiv, Moscow), 502-1-327, p. 216.
[79] *RGVA*, 502-1-214, pp. 95, 97; 502-1-327, p. 215.
[80] *RGVA*, 502-1-327, pp. 168-172.
[81] *RGVA*, 502-1-214, p. 68, 72.
[82] *RGVA*, 502-2-23, pp. 264-266.
[83] *RGVA*, 502-1-312, pp. 104f.
[84] D. Czech, *op. cit.* (note 78), pp. 108, 112.
[85] *APMO*, D-Z/Bau, no. inw. 1967, pp. 130f.

could not start because the Collmener Schamottewerke, supplying Topf with refractory material, had not been able to deliver the required material. The railroad freight car with the refractory material, sent from the Plützsch firm, arrived at the camp on January 3, 1942,[87] but this oven was built in March 1942.[88]

The oven for Mauthausen (near Linz, Austria) was ordered from the Topf firm on October 16, 1941, but the SS Office for Construction Management hesitated for a long time before having it built. The components of the oven were shipped to Mauthausen between February 6, 1942 and January 12, 1943,[89] but the decision to assemble it was not made until late 1944.[90] The oven was finally built in January-February 1945, which explains the fact that it is relatively well preserved.

The two Topf double-muffle cremation ovens presently on display in the crematorium of Auschwitz Main Camp were reconstructed after the war, but in a rather awkward manner, using original parts that had been removed from the ovens by the SS. It is thus entirely pointless to examine these reconstructions in the hopes of gaining an understanding of this type of oven. For this reason our investigation is based wholly on the examination of the oven from Mauthausen, and on the documents available to us relating to the ovens of Auschwitz and that of Mauthausen – all of which were the same model.[91]

The components of the oven of Mauthausen are also included on Topf's shipment list of January 12, 1943.[92] The construction of the double-muffle cremation oven is shown on diagram "*Topf D57253*", which dates from June 10, 1940 and refers to the first oven built in Auschwitz. The oven is solid brick and sealed with a row of wrought-iron anchors. The dimensions of the Mauthausen oven are virtually identical to those shown on diagram D57253, which correspond to the measurements of the anchor irons itemized on Topf's shipment list of January 17, 1941 with respect to the second oven of Auschwitz. The oven is equipped with two cremation chambers, or muffles.[93] The oven's operation is explained in the "*Operation Manual for the Coke-Fired Topf Double-Muffle Cremation Oven.*"[94]

The crematorium of Auschwitz was originally constructed in accordance with diagram "*Topf D50042*" of September 25, 1941, which had been drawn up for the construction of the third oven.[95] Each oven was equipped with its own forced-air installation; this consisted of an air blower, which was operated with a 1.5 hp three-phase AC motor coupled directly to the blower shaft, and an appropriate duct. The square stack originally had an area of 500 × 500 mm^2 (19.7" × 19.7"). The exhaust installation, with a capacity of about 4,000 m^3/h (141,200 cu.ft./h) of stack gas, consisted of an exhaust fan powered with a 3 hp three-phase AC motor coupled directly to the blower shaft; an air shutter

[86] *RGVA*, 502-1-312, p. 98. During the war, companies needed special permission to receive transportation space in railroad cars due to restricted capacity. At times, no cars were assigned for civil purposes because all transportation was required for military purposes.

[87] *RGVA*, 502-1-312, p. 83.

[88] *RGVA*, 502-1-22, p. 11ff.

[89] Letter from the SS Construction Office of the concentration camp Gusen to the Topf firm, Oct. 24, 1942. Letter from the Topf firm to the SS Construction Office of the concentration camp Gusen, Jan. 16, 1943. *BAK*, NS 4 Ma/54.

[90] Letter from the Topf firm to the SS Construction Office of the concentration camp Mauthausen, Dec. 20, 1944. *BAK*, NS 4 Ma/54.

[91] Letters from the Topf firm to the SS Construction Office of the concentration camp Mauthausen, Nov. 23, 1940 and Oct. 16, 1941. *BAK*, NS 4 Ma/54. The letter of Oct. 16, 1941 expressly mentions the delivery of a "*Doppelmuffeleinäscherungsofen – Modell Auschwitz*" (double-muffle cremation oven – Auschwitz model).

[92] Delivery notice from the Topf firm, Jan. 12, 1943. *BAK*, NS Ma/54.

[93] Regarding details on construction, cf. our main work, *op. cit.* (note 2), as well as J. A. Topf & Söhne Erfurt. Coke-fired cremation oven and foundation blueprint. D57253. Jan. 10, 1940. Regarding SS New Construction Office of the concentration camp Auschwitz. *BAK*, NS 4 Ma/54; listing of the materials for a Topf Double-Muffle Cremation Oven, Jan. 23, 1943. *BAK*, NS 4 Ma/54; bill no. D 41/107, Feb. 5, 1941, *BAK*, NS 4 Ma/54.

[94] *Betriebsvorschrift des koksbeheizten Topf-Doppelmuffel-Einäscherungsofens* (Operation Manual for the Coke-Fired Topf Double-Muffle Cremation Oven). Sept. 26, 1941. *APMO*, BW 11/1, p. 3.

[95] *APMO*, neg. no. 20818/1.

separated the high and low pressure chambers. The function of this installation is described in the relevant operation manual from the Topf firm.[96]

The oven loading system was made up of a carriage via which the body was introduced into the muffle. This conveyance consisted of a carriage, which moved on special rails and on which the coffin was introduced, and of a shunting carriage running above it.

On July 19, 1943 the crematorium was taken out of service,[97] and the ovens were then dismantled.

After the end of the war the Poles reconstructed ovens 1 and 2, for which purpose they used the original parts which had been removed by the SS and of which many were still in the former coke fuel storage room. The reconstruction was done in a remarkably slipshod manner, and the ovens would not be functional in their present state.

4.2. The Coke-Fired Topf Three-Muffle Cremation Ovens

Just like the eight-muffle oven, this oven was designed by engineer Prüfer during the last months of 1941. On October 22, 1941 the Central Construction Office of Auschwitz ordered from the Topf firm, five Topf three-muffle ovens with forced-air blower, for the new crematorium, which the Office intended to construct in the Main Camp. These ovens were later installed in crematorium II of Birkenau. The final bill for this was dated January 27, 1943, and the cost per oven was RM 6,378.[98] The five three-muffle cremation ovens for crematorium III were first ordered by the Central Construction Office on September 25, 1942, by telephone, and on September 30 by registered letter.[99] On October 28 the Topf firm sent the Central Construction Office diagram D59394 for the construction of the ovens in crematoria II and III. This diagram has been lost.[100] The final bill for the five three-muffle cremation ovens for crematorium III of Birkenau is dated May 27, 1943. The cost per oven was RM 7,830.[101]

The first two three-muffle ovens supplied by Topf went into service in the concentration camp Buchenwald, on August 23 and October 3, 1942.[102]

The following description of the Topf three-muffle cremation oven is based on direct examinations of the ovens of Buchenwald and on the documents available. Three photographs from SS sources[103] confirm that the three-muffle ovens installed in crematoria II and III of Birkenau were the same model as those in Buchenwald; one of these, however, could also be fired with fuel oil.

Regarding its construction, the three-muffle oven consisted of an oven with two muffles, each with one coke gas generator, and an additional third, central muffle and other technical modifications, which we have already set out elsewhere.[2]

The oven is contained within a solid brick structure with fittings of wrought and cast iron. Considering that the fireproof brickwork of the double-muffle cremation oven of the type installed at Auschwitz weighed about 10,000 kg (22,000 lbs),[104] it is clear that the three-muffle oven was a more economical facility, as one can also deduce from the considerably lower price. The third double-muffle oven of Auschwitz cost RM 7,332 and included a forced-air blower and a conveyance, with the appropriate rails, to introduce the body into the muffle. The ovens of crematorium II of Birkenau cost

[96] Operation Manual for the 'Topf' Exhaust Installation, Sept. 26, 1941. *APMO*, BW 11/1, p. 2.
[97] D. Czech, *op. cit.* (note 78), p. 442.
[98] Letter from Kurt Prüfer to Ludwig and Ernst Topf, Dec. 6, 1941. *APMO*, BW 30/46, p. 6; bill no. 69, Jan. 27, 1943. *RGVA*, 502-1-327, pp. 10-10a.
[99] Letter from the Topf firm to the Central Construction Office of the concentration camp Auschwitz, Sept. 30, 1942. *APMO*, BW 30/34, p. 114, and BW30/27, p. 30.
[100] Letter from the Topf firm to the Central Construction Office of the concentration camp Auschwitz, Oct. 28, 1942. *APMO*, BW 30/34, p. 96.
[101] Bill no. 728 of May 27, 1943. *RGVA*, 502-1-327, pp. 19-19a.!!!
[102] Letter K. Prüfer to head of Topf firm, Nov. 15, 1942. *APMO*, BW 30/46, p. 18.
[103] *APMO*, microfilm nos. 287, 290 and 291.
[104] "*Aufstellung der Materialen zu einem Topf-Doppel-Einäscherungsofen*" (list of materials for a Topf double-muffle cremation oven) *BAK*, NS4/Ma 54.

RM 6,378 each and included a forced-air installation. Considering that two body conveyances and the rails for five ovens cost RM 1,780, the three-muffle oven with the same equipment actually cost less than a double-muffle oven. The unit price for the ovens for crematorium III, on the other hand, was a little higher (RM 7,380, without the body conveyance), but still much more reasonable.

Crematoria II and III of Birkenau had a large oven room measuring 30 m × 11.24 m (98.4' × 36.9'). The five three-muffle cremation ovens were located along the longitudinal axis. Adjoining the oven room was a crematorium wing 10 m × 12 m (33' × 39') in size and split into two sections by a dividing wall. The smaller section directly adjoining the oven room was in turn subdivided into three rooms: two engine rooms and a room for one of the three exhaust installations with which the crematorium was equipped. The other section contained the stack, the other two exhaust installations and a trash incinerator, which is why this room was labeled "*trash incinerator*" on the corresponding blueprints.[105] The flue gases from the ovens were sucked up by an exhaust installation housed in an adjoining room, and blown into the stack at high velocity.[106] In March 1943 the three exhaust blowers of crematorium II were seriously damaged and had to be dismantled. As a result, the facilities intended for crematorium III were not installed.

Unlike crematorium II, crematorium III was not equipped with the rails via which ovens were loaded; rather, these body conveyances were replaced with litters.[107] Such a litter – they were also used in the Topf double-muffle ovens of Mauthausen and in the Kori ovens in other concentration camps – consisted of two parallel metal pipes 3 cm (approx. 1") in diameter and some 350 cm (11.5') in length. A slightly concave metal sheet 190 cm (6.2') long and 38 cm (15") wide was soldered onto their front, where they were to enter the muffle. The two pipes of the litter were soldered onto the oven door at the same distance apart as the guiding rollers, so that they could glide on them easily. In March 1943 it was decided that this system would also be introduced in crematorium II.[108]

The operation of the coke-fired three-muffle oven is explained in the corresponding Operation Manual for the Coke-Fired Topf Three-Muffle Cremation Oven,[109] which was based on the manual for the double-muffle cremation oven. The only significant difference relates to the heat tolerance of the muffles, which were not to be heated to more than 1000°C (1830°F), whereas the double-muffle oven could be heated to 1100°C (2010°F). This lower heat tolerance is due to the lesser quantity of fireproof brickwork per muffle of this oven type (approximately 2,100 kg, or 4,630 lbs) as compared to that of the double-muffle oven (approximately 3,000 kg, or 6,600 lbs), and probably also to the lesser quality of the materials used.

In Germany, cremation in concentration camps had been regulated at the beginning of World War Two by the "*decree regarding cremations in the crematorium of concentration camp Sachsenhausen*", which Himmler had issued on February 28, 1940.[110] This decree was entirely in accordance with the legal stipulations in effect for civilian crematoria.[111] Whether these legal regulations were later modified or rescinded, and/or whether other regulations applied to the concentration camps located in the occupied eastern territories than applied to those in the Reich proper, is not known, but it

[105] Plan of the new crematorium of Auschwitz (and future crematorium II/III of Birkenau). Diagram by the Construction Office of Auschwitz, no. 933, of Jan. 19, 1942. *APMO*, neg. nos. 20957 and 20818/4.

[106] *APMO*, neg. nos. 518 and 520; cf. advance bill from the Topf firm, Dec. 18, 1941. Each exhaust (induced-draft) installation cost RM 3,016. *APMO*, D-Z/Bau, no. inw. 1967, p. 97.

[107] Letter from the Topf firm to the Central Construction Office of the concentration camp Auschwitz, Sept. 30, 1942. *APMO*, BW 30/34 p. 114.

[108] Memo of March 25, 1943. *APMO*, BW 30/33, p. 8.

[109] *Betriebsvorschrift des koksbeheizten Topf-Dreimuffel-Einäscherungsofens* (Operation Manual for the Coke-Fired Topf Three-Muffle Cremation Oven). This document was published for the first time in Dr. Miklos Nyiszli's *Médecin à Auschwitz. Souvenirs d'un médecin déporté, traduit et adapté du hongrois par Tibère Kremer*, Juillard, Paris 1961 (extratextual document); cf. *APMO*, BW 30/34, p. 56.

[110] *Erlaß über die Durchführung von Einäscherungen im Krematorium des Konzentrationslagers Sachsenhausen*. *BAK*, NS 3/425.

[111] Text from F.Schumacher, *op. cit.* (note 25), pp. 116-120.

is certain that the Topf double- and three-muffle cremation ovens were designed along the same norms as the civilian ovens. The Topf cost estimates for these ovens also list carriages or devices for the introduction of coffins into the muffle, which proves that cremation was intended to include the coffin. This is further established by the operating guidelines, which recommended starting the forced-air blower immediately after the introduction of the body, and to leave it on for about 20 minutes. This recommendation is tailor-made for the circumstance that the bodies enter the oven in coffins, since the rapid and intensive combustion of the coffin requires a large quantity of air. In a cremation without a coffin, on the other hand, this stipulation would be completely pointless, because adding a large quantity of cold air during the beginning stage of cremation, where moisture evaporates from the body – a process which robs the oven of a large amount of heat – would only have slowed the cremation process.

The operating instructions also indicate that the ovens were designed for the cremation of one body at a time per muffle, since they specify that the bodies had to be introduced successively. On July 3, 1940, in order to "put the crematorium into operation", the firm Topf also offered "*500 ash urns*" and "*500 fireclay markers*" to the SS-Neubauleitung of Auschwitz.[112] The latter were numbered plates of fireclay, which were placed on the coffin or directly on the corpse to identify the ashes. In 1946, some of these plates were found near the crematorium II. They were handed over to investigating judge Jan Sehn,[113] who, as far as I know, never mentioned them in his findings about his investigations on Auschwitz. This confirms that not even in Birkenau corpses were cremated anonymously in masses, but one at a time.

4.3. The Coke-Fired Topf Eight-Muffle Cremation Oven

This oven, whose construction was probably shown on the missing diagrams D59555, D60129 and D60132 from the Topf firm,[114] was designed by engineer Prüfer, presumably in late 1941. In any case it was designed along the lines of the three-muffle oven, whose design diagram bears a lower number, namely D59394.

On December 4, 1941 the Main Office for Budget and Buildings in Berlin ordered from the Topf firm, "*4 double-Topf-4 muffle cremation ovens*" for Mogilew in Russia, where POW transit camp 185 was located.[115] The order was confirmed on December 9, but only half the oven (four muffles) was shipped to Mogilew on December 30, while the rest remained in Topf's storehouse for the time being. On August 26, in accordance with the suggestion engineer Prüfer had made on the occasion of his visit to Auschwitz on August 19, 1942, the SS Economic-Administrative Main Office ordered that two of the ovens for Mogilew should instead be sent to Auschwitz. However, the Central Construction Office waited two-and-a-half months before requesting a cost estimate for this model of oven. Topf sent the estimate on November 16. The total price of RM 55,200 – RM 13,800 for each oven – included a 6% surcharge because the company had had to revise the drafts and design new models for the ovens' fittings so often.[115]

The blueprints of crematorium IV (and crematorium V, in mirror image) of Birkenau which show the foundations and the vertical cross-section of the "*eight-muffle cremation oven*", the photos taken by the Poles in 1945 of the ruins of crematorium V, and the direct examination of these ruins, enable us to reconstruct this model of oven with sufficient accuracy.[116]

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[112] *RGVA*, 502-1-327, p. 226.
[113] Testimony of A. Żłobnicki, Nov. 18, 1981. *APMO*, *Oświadczenia* (explanations), vol. 96, p. 63a and 70.
[114] *RGVA*, 502-1-313, pp. 139f.
[115] *RGVA*, 502-1-327, pp. 47f.
[116] Cf. bill no. 380 of April 5, 1943. *RGVA*, 502-1-314, pp. 29-29a; plan of crematorium IV (and V) of Birkenau. Construction Office Diagram no. 1678 of Aug. 14, 1942. *APMO*, neg. no. 20946/6; plan of crematorium IV (and V) by the Construction Office, no. 2036 of Jan. 11, 1943. *APMO*, neg. no. 6234; *APMO*, neg.fot. nos. 620, 14283, 21334/81, 21334/82, 21334/83, 21334/141; J. A. Topf & Söhne Erfurt Diagram D58173 of Jan. 6, 1941. Single-muffle cremation oven. SS New Construction Office of the concentration camp Mauthausen. *BAK*, NS 4 Ma/54.

The coke-fired Topf eight-muffle cremation oven consisted of eight ovens with one muffle each, as shown on Topf's diagram 58173. Four ovens together make up each of two groups. Each group consists of two pairs of ovens, set up in mirror image so that the back and two central walls of the muffle are shared. The two oven groups are connected by four generators and set up in pairs along the same lines, so that they ultimately form one single oven with eight muffles which is referred to in the corresponding invoice as the "*large-area cremation oven*", due to its size (its base covered an area of about 32 m^2, or 344 sq.ft.).

The oven was encased in a solid brick structure containing a series of anchor irons. These are clearly visible on the Polish photographs of 1945 and are still present today in the ruins of this crematorium.

The heating grates were also designed to burn wood, as one can see from Topf's invoice of April 5, 1943, where "*wood heating*" is mentioned. The system for introducing the bodies into the muffles used a litter like that in crematoria II and III; it was affixed on two simplified rollers bolted to the anchor irons underneath the muffle damper.

The oven was probably not equipped with forced-air blowers, since none are mentioned on the bill of April 5, 1943. The stacks were designed without exhaust systems. The base unit of the Topf eight-muffle cremation oven consisted of two muffles and one generator, and the flue system for the stack gases corresponded to that of the "*single-muffle cremation oven*" shown on Topf design D58173.

4.4. The Cremation Ovens of the Firm of H. Kori, Berlin, and Ignis Hüttenbau, Teplitz

Where the supply of cremation ovens to German concentration camps is concerned, the Berlin manufacturer H. Kori was Topf's major competitor. Kori's coke- or oil-fired ovens were installed at Dachau, Mauthausen, Majdanek, Stutthof near Danzig (not to be confused with the Alsatian camp Struthof near Natzweiler), Ravensbrück, Groß-Rosen and Neuengamme, among other places.

Strictly speaking, these ovens have no immediate significance to a study of the crematoria at Auschwitz and Birkenau. However, since we shall eventually use some data from Kori ovens to draw certain conclusions about characteristics also present in the Birkenau ovens, we have also analyzed these Kori ovens in detail. Since these analyses would go beyond the scope of the present study, we refer the reader to the relevant sources.[117]

In the course of 1942, a crematorium was built for the ghetto of Terezín, which was called Theresienstadt at that time. A detailed cost estimate exists for this installation dated April 2, 1942, from the firm Ignis Hüttenbau A.G. of Teplitz-Schönau in the then Protectorate of Boemia and Moravia (today's Teplice in Czechia).[118] Because of the rapid increase of the mortality in the ghetto of Theresienstadt – from 256 deaths in April 1942 over 2,327 in May to 3,941 in June[119] –, the crematorium was equipped with four petrol-fired ovens by Ignis-Hüttenbau.[120]

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[117] Cf. the following documents: letter from the Didier-Werke, Aug. 25, 1943, to Herrn Boriwoje Palitsch, Belgrade, regarding SS cremation facility in Belgrade. USSR-64; letter from the firm of H. Kori, May 18, 1943, to accredited engineer Waller of Department CIII of the SS Economic-Administrative Main Office, regarding the delivery of one or two Kori cremation ovens. *KfSD* (Archives of the Curatorship for the Atonement Memorial of the Concentration Camp Dachau), 5732; cremation facility for the POW camp Lublin. Design by the firm of H. Kori J. no. 9122, *KfSD*, 659/41; letter from the firm of H. Kori, Oct. 23, 1941, to SS-*Sturmbannführer* Lenzer, Lublin. *APMM* (Archivum Panstwowego Muzeum na Majdanku), sygn. VI-9a, v. 1; letter from the firm of H. Kori to the Headquarters of the Waffen-SS and Police POW camp Lublin. *APMM*, sygn. VI-9a, v. 1; *APMO*, ZO, sygn. Dpr-20/61a, p. 76.

[118] Letter and cost estimate of the company Ignis Hüttenbau A.G. of Teplitz- Schönau, Apr. 2, 1942, "*An die Zentralstelle für jüdische Auswanderer, z.H. des Kommandos der Waffen-SS in Theresienstadt*" con oggetto "*Errichtung eines Krematoriums in Theresienstadt*". Památník Terezín, A 7-856.

[119] *Terezínská Pametní Kniha*, Terezínská Iniciativa Melantrich, 1995, vol. I, p.33.

[120] See chapter 6.5.

5. Coke Consumption of Topf Cremation Ovens of Auschwitz & Birkenau

5.1. Heat Balance of Topf Double-Muffle Cremation Ovens at Gusen

The decisive factor influencing the consumption of fuel of a crematorium oven is the frequency of cremation: the higher the frequency, the less fuel is required for each individual cremation. For example, the diagram "*Subsequent cremations*" published by Prof. P. Schläpfer in 1936 based on practical experiences shows a consumption of over 400 kg of coke for the first cremation, starting with a cold oven, of about 200 kg for the second, and little more than 100 kg for the fourth cremation.[121] After the eighth cremation, the graph becomes more or less horizontal, reaching a value of 37.5 kg of coke at the twentieth and last cremation.[122] This means that 20 discontinuous cremations separated from each other by a day or more would have required more than (400 × 20 =) 8,000 kg of coke, while 20 consecutive cremations in a warm oven would have required only (37.5 × 20 =) 740 kg. From the tenth consecutive cremation onward the fuel consumption was steady because by then, the refractory material was warmed up and absorbed only as much heat as was necessary to compensate for heat losses due to radiation and convection, *i.e.*, the oven was in a thermal equilibrium. Therefore, in order to find out the minimal fuel consumption of any crematorium oven, it is necessary to establish the conditions when the oven is in a thermal equilibrium, *i.e.*, when the ovens gives off as much heat to the environment as it gets back from the burning fuel.

Between the few relevant surviving documents on the crematorium of Gusen exists a list edited by *SS-Unterscharführer* Wassner, head of the crematorium of Gusen, which documented the number of inmates cremated and the coke consumption per corpse for the period from September 26 to November 12, 1941. According to this document, 677 corpses were cremated in this crematorium between October 31 and November 12, 1941.[123] This amounts to an average of 52 corpses per day, or 26 corpses per day and muffle, with a total consumption of 20,700 kg of coke, or 30.6 kg of coke per corpse.

Since these consumption figures are based on practical data, they are a precious point of departure for the calculation of the heat balance of the Topf ovens of Auschwitz-Birkenau. Mathematically, the heat balance of an oven is expressed by an equation consisting of all losses of heat, split up into various factors (heat sinks, for instance loss by radiation, conduction, hot exhaust gases), and all contributions of heat (heat sources, *e.g.*, burning fuel, coffin, corpse).[124] Except for the volume of air going through the oven, which depends on the management of the oven, all factors can be calculated. But because in the specific case of Gusen the fuel consumption is known by practical data, all factors can be determined.[125]

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[121] Diagram entitled "*Einäscherungen hintereinander*", in P. Schläpfer, "*Über den Bau und den Betrieb von Krematoriumsöfen*", *op. cit.* (note 37), p. 36.

[122] Naturally it is necessary to always add the heat produced from the coffin.

[123] *ÖDMM* (*Öffentliches Denkmal und Museum Mauthausen*, Public Memorial and Museum of Mauthausen), Archiv, B 12/31.

[124] The calculation of the heat balance was conducted according to the method developed by W. Heepke in his article "*Die neuzeitlichen Leicheneinäscherungsöfen mit Koksfeuerung, deren Wärmebilanz und Brennstoffverbrauch*," in: *Feuerungstechnik*, yr. XXI, issue 8/9, 1933.

[125] Based on W. Heepke's model, *ibid.*, the fundamental equation of the oven of Gusen that expresses the average consumption of a cremation is: $\frac{L + W2 + W2a + W3 + Vls - W7}{\eta Hu} = 30.6$, with L = heat difference of combustion gases between entry and exit + small losses; W2 = vaporization heat of water of the corpse; W2a = heat required to bring water steam up to the temperature of the exiting combustion gases; W3 = heat of the ashes at the extraction from the oven; Vls = loss of heat of the oven by radiation and conduction; W7 = calorific value of the body (and coffin, if applicable); ηHu = efficiency of coke.

5.2. Heat Balance of Topf Double-Muffle Cremation Ovens at Auschwitz

The heat balance of the Topf double-muffle ovens at Auschwitz can be calculated following this approach by taking into consideration the slightly different operating temperature, cremation time, and surface area of the oven.[126] Our calculations for the coke required for a single cremation in this type of oven in thermal equilibrium resulted in the following:[127]

- normal corpse: 23.5 kg (51.5 lbs) coke;
- moderately thin corpse: 28.0 kg (61.3 lbs) coke;
- emaciated corpse ("*Muselmann*"): 32.5 kg (71.1 lbs) coke.

5.3. Heat Balance of the Topf Three- and Eight-Muffle Cremation Ovens

The three-muffle oven was derived from a double-muffle oven by inserting a third muffle in between. The two outside muffles behaved like those of a double-muffle oven, but gave off high-temperature stack gases to the center muffle. In order to allow the cremation of a body in the center muffle, an excess of combustion air went through the outside muffles, so that their exhaust gases would contain oxygen in sufficient quantities to cremate a body in the center muffle. For this reason, the amount of combustion air was not proportional to the air of the double-muffle oven, which prevents us from making an exact calculation of this oven's heat balance. All we can say for certain is that the coke consumption of the three-muffle oven must have been slightly higher than that of a double-muffle oven due to increased heat losses resulting from a slightly higher air flow, and that there were additional radiation and conduction losses of the center muffle, which can be calculated. Therefore, the equation for calculating the theoretical minimal value of coke consumption for a triple-muffle oven type Auschwitz is:

$$\frac{C2 + Vls3 - Vls2}{2 \times \eta Hu} \times {}^{2}/_{3} = C3$$

C2 = coke consumption per corpse of a double-muffle oven;
Vls3 – Vls2 = difference of heat losses by radiation and conduction between a double-muffle and a triple-muffle oven;
C3 = coke consumption per corpse of a triple-muffle oven;
ηHu = coke efficiency.

Thus, the minimal theoretical coke consumption per corpse in a triple-muffle oven was 2/3 the value of a double-muffle oven plus the amount of coke to compensate for the additional heat losses of the third muffle by radiation and conduction. Our results are:

- normal body: 16 kg (35.0 lbs) coke;
- moderately skinny body: 19 kg (41.6 lbs) coke;
- emaciated body ("*Muselmann*"): 22 kg (48.1 lbs) coke.

The eight-muffle ovens consisted of two pairs of connected double-muffle ovens. Since the combustion gasses of the first muffle passed across to the second muffle, similar consideration apply to this type of oven: the smoke gasses of the first muffle needed to contain a minimum quantity of oxygen sufficient for the combustion of the corpse of the second muffle. As a theoretical minimum of coke consumption per corpse for this type of oven, we assume half of that of the double-muffle oven:

- normal body: $23.5 \div 2 \cong 12$ kg (26.3 lbs) coke;
- moderately skinny body: $28.0 \div 2 = 14$ kg (30.6 lbs) coke;
- emaciated body ("*Muselmann*"): $32.5 \div 2 \cong 16$ kg (35.0 lbs) coke.

[126] In our calculation (note 2), we also made some adjustments to W. Heepke's equation for losses he did not take into consideration, see there.

[127] It is assumed: for normal corpses a weight of 70 kg; for moderately thin corpses a weight of 55 kg, with loss of 25% of protein and 30% of body fat; for the emaciated corpse 40 kg, with loss of 50% of protein and 60% of body fat.

The combustion of the body provided the center muffle with enough hot air to balance this muffle's heat losses, so that the coke consumption of the three-muffle oven in fact approximated that of the double-muffle oven while permitting the cremation of three instead of only two bodies. For this reason its efficiency was actually one-third greater than that of the double-muffle oven.

Therefore, the coke requirements of the three-muffle oven were as follows:

- normal body: 25.0 kg × $^2/_3$ = 16.7 kg (36.8 lbs) coke;
- moderately skinny body: 28.0 kg × $^2/_3$ = 18.7 kg (41.2 lbs) coke;
- emaciated body ("*Muselmann*"): 30.5 kg × $^2/_3$ = 20.3 kg (44.7 lbs) coke.

5.4. Observations on the coke consumption of the triple- and eight-muffle ovens

In a memo (*Aktenvermerk*) of March 17, 1943, edited by civil employee Jährling "*on behalf of the firm Topf & Söhne*",[128] estimates for the coke consumption of the four crematoria of Birkenau are given. This document deserves a closer analysis. Regarding the coke consumption, it refers to "*10 Feuerungen = 350 kg/stdl.*" (10 fireplaces = 350 kg/h), which means that each fireplace of the five triple-muffle ovens of both crematorium II and III was expected to consume 35 kg/h of coke;[129] the same figure of 35 kg/h per fireplace is given for the two eight-muffle ovens located in the crematoria IV and V. This document also states that the amount of coke required during continuous operation ("*bei Dauerbetrieb*") is only $^2/_3$ as compared to a discontinuous operation, which is explained by the fact that the oven is in thermal equilibrium, as explained above.

The reduction of coke consumption during 12 hours of activity by $^1/_3$ from 4,200 to 2,800 kg means that during discontinuous cremations, (4,200 – 2,800 =) 1,400 kg of coke were necessary to reheat the five ovens,[130] whereas the remaining 2,800 kg were used for the actual cremations. This results in the following figures:

	availability of coke per oven	availability of coke per muffle	coke consumption per muffle during continuous operation
triple-muffle oven	70 kg/h	23.3 kg/h	15.5 kg/h
eight-muffle oven	140 kg/h	17.5 kg/h	11.7 kg/h

These data are almost identical to those calculated above for normal corpses[131] and confirm the accuracy of our heat balance calculations for both the triple- and the eight-muffle ovens.

6. Time Required for Cremation in the Topf Ovens of Auschwitz & Birkenau

6.1. The Documents

The highly controversial issue of the time required for a single cremation in the Topf cremation ovens is addressed in three documents that, however, give quite contradictory data.

A letter sent by Topf to the SS New Construction Office of the concentration camp Mauthausen on November 1, 1940 contained the cost estimate for a "*coke-fired Topf double-muffle cremation oven with forced-air installation*" and for a "*Topf draft-enhancing installation*".[132] The letter states:[133]

[128] *APMO*, BW 30/7/34, p. 54.
[129] Each crematorium had five ovens with altogether ten fireplaces, two in each oven.
[130] All the refractory material to the point of thermal equilibrium.
[131] Since the relative consumptions of double-muffle ovens – and the two outside muffles of the triple-muffles ovens – are known, the consumption of 15.5 kg per hour and muffle can only refer to a normal corpse; if it referred to a medium corpse, the center muffle of the triple-muffle oven would not only consume no energy, but it would actually save energy worth almost 11 kg of coke; if it referred to an emaciated corpse, the energy saving would amount to almost 20 kg of coke. Thus, both hypotheses would be false.
[132] Topf cost estimate for concentration camp Mauthausen, Nov. 1, 1940. *BAK*, NS 4 Ma/54.

"*Our Herr Prüfer has already informed you that in the previously offered oven, two bodies can be cremated per hour.*"

Since the oven at issue is a double-muffle oven of the Auschwitz type, this information of Prüfer's means that one body could be cremated per hour and muffle. The oven's theoretical capacity was therefore 48 bodies per 24 hours.

The second document is a letter dated July 14, 1941, in which Topf replied to a specific inquiry of the SS New Construction Office of the concentration camp Mauthausen:[134]

"*30 to 36 bodies may be cremated in about 10 hours in the coke-fired Topf Double-Muffle Cremation Oven.*"

Based on this claim, one cremation in one muffle took 33-40 minutes, and the oven's theoretical capacity was 72-86 bodies per 24 hours.

The third document is a letter sent on June 28, 1943 by SS-*Sturmbannführer* Bischoff, the Chief of the Auschwitz Central Construction Office, to SS-*Brigadeführer* Kammler, the Chief of the Economic-Administrative Main Office *Amtsgruppe* C. In this letter he mentions the following 24-hour capacities of the crematoria of Auschwitz and Birkenau:[135]

• old crematorium I:	340 persons	• crematorium IV:	768 persons
• crematorium II:	1,440 persons	• crematorium V:	768 persons
• crematorium III:	1,440 persons	**Total:**	**4,756 persons**

Based on this document, the time required for a cremation in the double-muffle oven was about 25 minutes, and 15 minutes in the three- and eight-muffle ovens.

In order to determine to what extent the data provided by these three documents are technologically founded, and in order to estimate the minimum time required for the cremation process in the Topf ovens at Auschwitz, we shall apply three objective test criteria plus three additional criteria, all of which are based on practical experience:

1) The results of cremation experiments with coke performed by the engineer R. Kessler on January 5, 1927.

2) An excerpt from the cremation lists of the crematorium at Gusen camp.

3) Numerous excerpts of such lists relating to the crematorium of Westerbork.

4) Another important experimental criterion derives from practical results of animal carcass incineration ovens produced by Kori.

5) The technical data reported by Soviet and Polish sources about the Kori ovens at the concentration camps of Majdanek (August 1944), Sachsenhausen (June 1945), and Stutthof (May 1945) will supply further useful information.

6) Finally, the cremation lists of the crematorium at the Terezín ghetto, containing four petrol-fired ovens made by Ignis-Hüttenbau, which were without any doubt the most efficient ovens built during the Second World War, will allow us to obtain a minimal limit for time required for the cremation process in the cremation ovens built during the 1940's in German concentration camps and ghettos.

6.2. The Cremation Experiments by R. Kessler

As indicated in chapter 3.6., the time required for the cremation process depends mainly on the structure and chemical composition of the human body, but to a significant extent also on the construction and operation of the cremation oven.

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[133] Letter from the Topf firm to the SS New Construction Office of the concentration camp Mauthausen, Nov. 1, 1940. *BAK*, NS 4 Ma/54.

[134] Letter from the Topf firm to the SS New Construction Office of the concentration camp Mauthausen, July 14, 1941. Weimar State Archives, LK 4651.

[135] *RGVA*, 502-1-314, p. 14a.

Since the cremation ovens of Auschwitz and Birkenau were coke-fired, it is appropriate to compare, for a better understanding of the cremation process, the experiment with coke-fired cremation which engineer Richard Kessler performed on January 5, 1927 in the crematorium of Dessau.[136]

Of course, in order to arrive at a realistic assessment, it is necessary to keep in mind that the oven Gebrüder Beck used by Kessler was technically superior to the Topf ovens of Auschwitz-Birkenau, both due to the higher weight of refractory material and the presence of a recuperator, and because Kessler's oven was equipped with many monitoring devices permitting effective control during every phase of the cremation. Finally, Kessler's cremations were performed with special caution under the surveillance of an expert engineer, so that the entire process was optimized.

The influence of a coffin – present during Kessler's experiments, but absent in Auschwitz – is considered to have had no influence on the duration of the cremation, because the disadvantage of a slightly delayed beginning of the corpse's cremation was compensated by the advantage of additional heat provided by the burning coffin.

Now to Kessler's experimental results. On average, the initial temperature of the cremation was 800°C (1472°F); the highest temperature during the combustion of the coffin of about 1000°C (1832°F) was reached after 12 min. The highest temperature of combustion of the bodies of about 900°C (1652°F) was reached after 28 min. The average duration of evaporation of body fluids was 27 minutes, while the main combustion process within the muffle lasted some 55 minutes. After that, the intensity of combustion decreased gradually until it stopped after another 31 minutes. Thus, the average duration of the entire cremation was 86 minutes.

It is important to realize that Kessler's cremation process was different from the process applied in Auschwitz-Birkenau: For legal reasons, Kessler had to wait until the glowing ash from the cremated body no longer gave off any flames before he transferred it into the ash container. By contrast, in the Topf cremation ovens of Auschwitz and Birkenau the next body was introduced into the muffle as soon as the remains of the first had dropped through the muffle grating into the ash chamber, where the cremation process then concluded. Thus the main part of the cremation in the Topf ovens was finished at the point where the remains of the first body dropped through the grating and into the afterburn chamber, where they then continued to burn for another 20 minutes. This follows from Topf's guidelines.

In Kessler's case, the average time between introducing the body and attaining maximum temperature was 55 minutes. At the point where the maximum heat was attained, the body was still in the muffle, as the increase of the muffle temperature to almost 900°C (1652°F) shows. Therefore the duration of the cremation process up to the point where the remains of the body dropped through the grating into the ash chamber was necessarily longer than 55 minutes. As a point of reference, we conclude that the average duration of the main process of a single cremation in a coke-fired muffle was not shorter than 55 minutes.

6.3. The Cremation List of the Crematorium at Westerbork

The crematorium at Westerbork camp (Holland) was equipped with a coke-fired Kori oven, which went into operation on March 15, 1943, at a moment when the mortality was increasing strongly.[137] Several documents on the activity of this crematorium have been preserved. Those of interest here are:

[136] R. Kessler, "*Rationelle Wärmewirtschaft in den Krematorien nach Maßgabe der Versuche im Dessauer Krematorium*", *op. cit.*, (note 33).

[137] Second half-year of 1942: 108; 1943: 593; 1944: 50; 1945: 4; *Rapport over de sterfte in het Kamp Westerbork in het tijdvak van 15 Juli 1942 tot 12 April 1945*. *ROD* (Rijksinstituut voor Oorlogsdocumentatie, Amsterdam), C[64] 514, p. 1

– the "*Crematorium Operation Book*" (*Crematorium Betriebsbuch*) containing the names of the deceased between June 23, 1943, and March 31, 1944, (numbered from 277 to 510)[138] with date of birth, date of death;[139]
– various cremation lists giving the number of corpses cremated, the time each cremation took, and the amount of coke used;[140]
– also, a "*List of names of Jewish persons deceased in the Westerbork and Buchenwald camps and buried in Dutch cemeteries*" exists, edited by the Dutch Red Cross in which all of the names of the dead Jews to Westerbork are recorded in alphabetical order, giving, *i.a.*, the date of birth, date of death and cremation, as well as the urn number.[141]

According to this, cremations did not take place every day, but only after a sufficient number of corpses had accumulated in the mortuary of the crematorium in order to save fuel.

In the Westerbork camp, a high percentage of the deceased were newborn babies, with 25% in May and June 1943 and 40% in August.[142] Most of these babies were only a few months old and sometimes only a few days. Usually, two of these corpses were cremated together or one baby corpse together with an adult. Two little corpses were usually cremated in between the cremation of two adult corpses, so their cremation coincided with the final phase of proceeding and the initial phase of the succeeding cremation. The average duration for cremating an adult corpse individually was 50 min, whereas the cremation of a baby (average age: one year) together with an adult corpse (average age: 70 years) lasted 57 min. Here, as for the Topf ovens at Auschwitz-Birkenau, the end of the cremation is defined by the moment when the residues of the corpse(s) fell into the post-combustion chamber, enabling the introduction of a new corpse into the muffle.

6.4. The Cremation Lists of the Crematorium at Gusen

This list is subdivided in four columns.[123] The first one ("*Uhr*") gives the time and the number of wheelbarrows of coke; the second column ("*Datum*") indicates the date of cremation, the third one ("*Leichen*") the number of corpses cremated, the fourth ("*Karren Koks 1 K. = 60 kg*") the total number of wheelbarrows of coke (1 cart = 60 kg), which means that the first column lists the numbers of carts progressively, so the last figure of the first column corresponds to the figure in the fourth column. However, the first column (time) does not give the time of beginning and end of the cremation, but the times when coke was taken from the coke storage or the time when the relevant numbers of coke carts were unloaded near the oven. The only objective criterion that allows establishing the duration of the cremation with some approximation is the combustion capacity of the fireplaces, namely the amount of coke burned in one fireplace in an hour. With natural draft, this capacity was 90-120 kg of coal per hour. According to the above quoted memo of March 17, 1943,[128] the combustion capacity of the fireplaces of the triple- and eight-muffle Topf ovens of Auschwitz were 35 kg of coke per hour. Since the surface of the fireplaces was 0.3 m², the combustion capacity per m² was (35 ÷ 0.3 =) 116.7 kg/h ≅ 120 kg/h. The combustion capacity is increased – within certain limits – by the chimney's draft, pulling oxygen through the grill. For coke-fired ovens, the highest acceptable draft with forced-draft blowers (*Saugzug-Anlage*) was 30 mm of water column,[143] corresponding to the combustion of about 180 kg of coke per hour and square meter of grill.[144] Since each fireplace grill of the oven of Gusen had a surface of (0.5 × 0.5 =) 0.25 m², the maximum capacity, with a draft of 30 mm of water column, was (180 × 0.25 =) 45 kg of coke per hour, or 90 kg for two fireplaces.

[138] Corresponding to the numbers on the urns used; *ROD*, C[64] 292.
[139] *ROD*, C[64] 292.
[140] *ROD*, C[64] 392.
[141] *ROD*, C[64] 314.
[142] *Rapport over de sterfte… op. cit.* (note 137), p. 2.
[143] W. Heepke, *Die Leichenverbrennungs-Anstalten (die Krematorien)*, *op. cit.* (note 27), p. 71.
[144] G. Colombo, *Manuale dell'ingegnere civile e industriale*. Ulrico Hoepli, Milano 1916, p. 366.

Also, the three forced-draft blowers initially installed in crematorium II of Birkenau worked with a pressure of 30 mm of water column, with a gas volume of 40,000 m³/h, each driven by a 380 Volt/15 HP engine. The standard forced-draft blowers installed at the oven of Gusen camp were also installed in the crematorium at Auschwitz with a gas volume of 4,000 m³/h and an engine of 3 HP. The pressure difference it produced is not known, but it sure was not higher than 30 mm water column.

We return at the problem of the duration of the cremation. We assume that cremation began at 7 am on October 31, 1941, and ended at 23 pm on November 12, 1941, which would have been 304 hours or 18,240 minutes.[145] The duration of the combustion of 20,700 kg of coke actually consumed (see chapter 5.1.) depends of course on the combustion capacity of the fireplaces. As shown above, the maximum combustion capacity of the two Gusen fireplaces with forced-draft blowers at a pressure of 30 mm water column was about 90 kg/h of coke. This results in a total combustion time of the coke of (20,700 ÷ 90 =) 230 hours or 13,800 min., an average time of activity of the oven of (230 hours ÷ 12.67 days ≅) 18 hours per day, and an average incineration time per corpse of (30.6 ÷ 45 × 60 ≅) 41 minutes. This is the lowest theoretical value. According to operation instruction of the Topf firm for the double- and triple-muffle oven, the post-combustion of the corpse residues lasted about 20 minutes; adding this time to the main combustion – 40 minutes – results in a total cremation time of 60 minutes, which represents the limit Dr. Jones called "*thermal barrier*", that is to say the lower time limit which cannot be underpassed. This duration, as will be explained subsequently, is valid for the oven of Gusen, but cannot be attributed directly to the double-muffle oven of the Auschwitz type, to which the Topf letter of July 14, 1941, referred to explicitly.

6.5. The Cremation List of Ignis-Hüttenbau Petrol-Fired Oven in Terezín

The Ignis-Hüttenbau ovens in Terezín were by far the most modern and efficient of all those ever installed in German concentration camps. Their design had been inspired by the gas-fired Volckmann-Ludwig ovens. Additionally, they were equipped with a powerful forced-draft blower and an adjustable oil burner. We will later return to these special installations.

The examination of 717 cremations performed in these ovens between October 3 and November 15, 1943 (41 days), results in the following:

- The minimal average cremation time on a single day was about 32 min. in oven no. III (November 9, 1943, with 23 cremations) and about 31 min. in oven no. IV (October 10.)
- The average duration of all cremations was about 36 min. in both ovens.
- 491 of the 682 cremations, for which the duration is indicated, lasted 35 minutes or less (72%,); 22% lasted between 40 and 45 min., 42 lasted between 50 and 60 min., 1 lasted more than 60 min.
- In average, it took some 35 min. to cremate a female corpse, and around 36 min. to cremate a male corpse.

In order to save fuel, cremations were performed only in one oven at a time, so that it would be kept in thermal equilibrium. After a certain number of cremations, operation was passed on to the other oven, which was continued in a cyclic manner.

6.6. Conclusions

1) The shortest time required for a cremation resulting from experimental data referred to in this chapter is that of the Ignis-Hüttenbau oven in Terezín: 35-36 min. However, it is necessary to keep in mind to what this duration refers to and what made it possible. The Ignis-Hüttenbau ovens were much larger and bulkier than the Topf ovens. In particularly, their muffles were 100 cm high, 90 cm wide, and 260 cm long, while the respective dimensions of the Topf triple-muffle ovens were 80,

[145] 12 days plus 16 hours, or 12.67 days.

70, and 200 cm. The Terezín ovens allowed a procedure which was impossible with the Topf ovens: the body was introduced into the front of the muffle in a light coffin of unfinished boards, which was exposed to the combustion air injected from eight nozzles and the flame of the oil burner, thus quickly burning up. Generally after 30-35 minutes, when the body was basically dehydrated and disintegrated, it was pushed into the back part of the muffle. There, the main combustion took place and the remains fell into the post-combustion chamber. This way, another corpse could already be introduced after the last one had barely dehydrated.

2) Such a procedure was impossible with the Topf ovens, both because they were coke-fired and because the dimensions of its muffles rendered it impossible. In the Topf double-muffle oven of Gusen, the theoretical minimal duration of 40 min. depended first of all on the special structure of the refractory grill of the muffle (consisting of transversal and longitudinal beams forming eight rectangular openings of 30 cm × 25 cm),[146] which allowed huge body parts to fall into the post-combustion chamber pretty early, completing the main combustion in there and freeing the muffle for the next corpse. Secondly, the forced-draft blowers in Gusen were much more efficient than those installed in the crematorium at Auschwitz, where the same type of installation served six muffles instead of just two like in Gusen. Thus, the cremation capacity alleged in the Topf letter of July 14, 1941, was based on experiences with the oven at Gusen, but not with those of Auschwitz: the claimed capacity of 30 corpses in ca. 10 hours (= 40 min. for each cremation) assumed the highest obtainable forced-draft pressure. In the light of results obtained with the Ignis-Hüttenbau ovens, a capacity of 36 corpses in ca. 10 hours (= 33 min. for each cremation) was impossible to achieve as an *average cremation time*, a value that could be attained only in exceptional cases. The duration of 40 min. represents a minimum limit, which could not be achieved with the Topf ovens of Auschwitz-Birkenau.

3) The average duration of cremations performed at Westerbork was 50 min., which was confirmed by experiments performed by engineer Kessler. We must consider, however, that the Kori oven of Westerbork could provide more heat than the Topf ovens at Auschwitz due to a bigger fireplace area (0.8 m × 0.6 m, capacity of ca. 58 kg/h of coke),[147] as well as the Topf letter of November 1, 1940, cited above, speaking of an average duration of a cremation in the Auschwitz type oven of 60 min.[133]

4) The 60 min. duration of cremating a single body in the ovens at Birkenau was confirmed by the Topf engineers Kurt Prüfer and Karl Schultze during their interrogation by the Soviet counter-espionage service *Smersh*. During the interrogation on March 4, 1946, K. Schultz stated:[148]

> *"Five ovens were in two crematoria, and three corpses were introduced in each oven* [one in each muffle]*, i.e., there were three openings (muffles) in each oven. In one crematorium with five ovens* [and fifteen muffles]*, one could incinerate fifteen corpses in one hour."*

During the interrogation on March 5, 1946, K. Prüfer explained why the cremation lasted so long in the Birkenau crematoria:[149]

> *"In civil crematoria, pre-heated air is blown in with the help of special bellows, due to which the corpse burns faster and without smoke. The construction of the crematoria for the concentration camps is different; it was not possible to pre-heat the air, as a result of which the corpse burned slower and with developing smoke. In order to reduce the smoke and the smell of a burning corpse, a fan is used.*
>
> *Question: How many corpses would be cremated per hour in a crematorium in Auschwitz?*
>
> *Answer: In a crematorium that had five ovens and fifteen muffles, one cremated fifteen corpses in an hour."*

[146] The muffles of the Topf ovens of Auschwitz-had only transversal beams in a distance of ca. 20 cm.
[147] Drawing H. Kori J.No. 9239.
[148] *FSBRF*, Fond N-19262J, p. 52; cf. J. Graf, *op. cit.* (note 76), pp. 413f.
[149] *FSBRF*, Fond N-19262J, p. 33a; cf. Graf, *op. cit.* (note 76), p. 404.

It is therefore established that the average duration of a cremation in Auschwitz was about one hour. It remains to be seen whether or not the simultaneous cremation of several corpses in one muffle was economically advantageous. This problem will be dealt with in the following chapter.

7. The Cremation Capacity of the Crematorium Ovens of Auschwitz-Birkenau

7.1. Uninterrupted Operation of the Oven

Even though the duration of the cremation process is an important factor contributing to the capacity of a cremation oven, it is not the only factor, because it is also influenced by two other factors: the duration of consecutive operations and the oven maintenance. In this paragraph, we will consider these technical problems. Like any oven fired with solid fuel, the functionality of a coke-fired oven depends on the working conditions of the grill of the fireplace, which decreases inevitably as a result of the formation of cinders. For this reason, Topf's operation manual for the double- and triple-muffle ovens stated:[109]

"*Every evening the generator grate must be cleaned of coke cinders and the ash must be removed.*"

7.1.1. Formation and Removal of Cinders

The formation of cinders in the fireplaces of the coke gas generators is an inevitable phenomenon because every solid fuel contains incombustible ingredients that become liquid at high temperatures, which drain down through the layer of fuel and solidify on the grill due to the cooling provoked by fresh air.[150] The melting point of coke cinders fluctuates between 1,000 and 1,500°C, but is usually around 1,100-1,200°C,[151] whereas the temperature of coke fireplaces is ca. 1,500°C.[152] To give an idea about the quantity of cinders produced on the grill of a fireplace, we refer to the cremation experiments by R. Kessler of January 5, 1927, during which 436 kg of coke resulted in 21 kg (4.8%) of cinders.[153]

The removal of cinders from the surface of the grill, to which it was sintered firmly, required special tools and was an arduous work. It required, or course, that the grill was free of coke, which means that the oven was shut down. Thus, the time required for the entire procedure included the time to shut down the oven and reheat it after completion:

7.1.2. Duration of Consecutive Operations

In a letter of Hans Kori to *SS-Sturmbannführer* Lenzer of the POW camp Lublin (Majdanek) of October 23, 1941, the warm water production for 50 showers by using the excess heat of the Kori five-muffle oven was considered for "*täglich bei einem 20 Stundenbetrieb*" (with a daily operation of 20 hours).[154] Since in this project engineer Kori aimed to obtain the highest efficiency possible, it is clear that he expected an interruption of the oven's activity for 4 hours each day, which was probably the time required to clean the fireplaces. We can therefore assume that these ovens normally operated uninterruptedly for 20 hours a day. This does obviously not mean that the ovens were unable to operate for more of 20 hours continuously, but only that they worked more efficiently when subject to a 20/4 hours operating/cleaning rhythm. In his testimony during the trial

[150] Hans Schulze-Manitius, "*Moderne Feuerungsroste*", *Feuerungstechnik*, yr. XXIII, issue 8, 1935, p. 89.
[151] A.J. ter Linden, "*Feuerräume und Feuerraumwände*", *Feuerungstechnik*, yr. XXIII, issue 2, 1935, p. 14.
[152] H. Keller, *Mitteilungen über Versuche am Ofen des Krematoriums in Biel*, *op. cit.* (note 29), p. 3.
[153] R. Kessler, *op. cit.* (note 33), issue 9, p. 154.
[154] *APMM*, sygn. VI-9a, vol. 1.

against Rudolf Höß, engineer Roman Dawidowski assumed a period of "*3 hours of interruption per day for extracting the cinders from the gas generator and for various smaller activities.*"[155]

7.2. Simultaneous Cremation of More Than One Corpse in One Muffle

To complete the study of the cremation capacity of the Topf ovens, it remains to be examined if it was possible to increase the capacity of the oven be increasing the load, that is to say, by introducing two or more adult corpses in a single muffle. Such a practice was forbidden by law for civil crematoria. As described above, in the Westerbork crematorium this practice was applied only for the simultaneous cremation of adult corpses with the corpses of babies. In the crematorium of Terezín with its four huge petrol-fired ovens, the simultaneous cremation of two corpses in one muffle was common practice, but the corpses were introduced consecutively, one in front of the other. This procedure required a completely different oven design than that of the Topf ovens for the concentration camp, so the experiences with this crematorium cannot serve as a point of reference for the controversial problem analyzed in this chapter.

7.2.1. Experiences with Incineration Ovens of Animal Carcasses

From a practical point of view, the technical approach to simultaneous cremation of several corpses is the operation of incineration ovens for animal carcasses. The following table summarizes the results of the operation of eight oven models for the incineration of animal carcasses by the Kori firm,[156] with:

1: type of oven
2: maximum load of the oven
3: relative consumption of fossil carbon[157]
4: duration of combustion process
5: quantity of fossil carbon required to incinerate 1 kg of organic substance
6: time required to incinerate 1 kg of organic substance
7: quantity of organic substance incinerated in 1 min. (in kg)

1	2	3	4	5	6	7
1a	250 kg	110 kg	5.0 h	0.440 kg	72 sec	0.83 kg
1b	310 kg	130 kg	6.0 h	0.419 kg	70 sec	0.86 kg
2a	370 kg	150 kg	7.0 h	0.405 kg	68 sec	0.88 kg
2b	450 kg	170 kg	8.0 h	0.377 kg	64 sec	0.94 kg
3a	540 kg	200 kg	9.5 h	0.370 kg	63 sec	0.95 kg
3b	650 kg	225 kg	10.5 h	0.346 kg	58 sec	1.03 kg
4a	750 kg	265 kg	12.0 h	0.353 kg	58 sec	1.04 kg
4b	900 kg	300 kg	13.5 h	0.333 kg	54 sec	1.11 kg

These data are valid points of reference for the subject of this chapter, because these ovens really performed simultaneous cremations of several animal carcasses, or parts of them, in the same muffle. In the oven with the highest capacity, model 4b, the simultaneous incineration of 900 kg of organic substance required 54 seconds and consumed 0.333 kg of fossil carbon per kg of organic substance. For 70 kg of organic substance (an average adult human), this corresponds to 63 minutes and 23.3 kg of fossil carbon. The oven model 2b had a muffle with a surface area (1.38 m²), which was quite comparable to that of the Topf triple-muffle oven (1.4 m²). In this oven model, the cremation of several corpses of a total weight equal to the greatest load (450 kg) would have resulted in a

[155] *AGK*, NTN, 93, p. 47.
[156] W. Heepke, *Die Kadaver-Vernichtungsanlage*, Verlag von Carl Marhold, Halle a. S. 1905, p. 43.
[157] This is a theoretical figure assuming carbon that has no other components in it, neither combustible nor incombustible. This way, the influence of coal and coke of various caloric values is eliminated.

cremation time of 75 minutes and a fuel consumption of coke equal to 28.2 for each corpse of 70 kg. However, since the Kori oven had been specially designed for the mass incineration of animals carcasses, these data cannot be transferred directly to the Topf ovens, which means that with the same load, the Topf ovens would have required more time and fuel. In other words: It is feasible to state that simultaneous cremations of multiple corpses, instead of their subsequent cremation, would not have resulted in any savings in the ovens of Auschwitz-Birkenau, neither in time nor in fuel.

7.2.2. The Experiences of the Westerbork Crematorium

The experiences from the consecutive cremations in Westerbork confirm this conclusion. As indicated in chapter 6.3., the corpses of two adults were never cremated together in this crematorium. The only kind of simultaneous cremation was that of an adult corpse together with the corpse of a baby. As shown, this prolonged the average cremation time by 14% (from 50 to 57 minutes), which is at least equal to, if nor considerably more than, the percentage as the baby's weight compared to that of the adult (5-10 kg ÷ 70 kg = 7-14%). This indicates that the simultaneous cremation of two adults would have at least doubled the duration of the cremation.

7.3. Technical Features of the Kori Ovens at Lublin-Majdanek, Sachsenhausen, and Stutthof, according to Soviet Claims

After the liberation of the eastern concentration camps, the Soviets established various 'Investigative Commissions' that investigated, *i.a.*, the technical features of the crematorium ovens at Stutthof camp (May 1945),[158] Sachsenhausen camp (June 1945)[159] and Majdanek camp (August 1944).[160] The Soviet experts established the duration of a cremation on the base of a "*Guiding diagram for the determination of the time of combustion of corpses in various crematorium ovens as a function of the temperature*," claiming the following relation between temperature and the duration of cremation:

1. Klingenstierna oven:	800°C:	120 min		1,200°C:	60 min
	900°C:	105 min	3. Schneider oven:	1,300°C:	45 min
2. Siemens oven:	1,000°C:	90 min		1,400°C:	30 min
	1,100°C:	75 min		1,500°C:	15 min

The source of the data used to edit the diagram is unknown, but is must be assumed that all data with temperatures over 1000°, which were not reached by any crematorium at that time, must have been extrapolated linearly, which is utterly inadmissible because at a theoretical temperature of 1,600°C, this would lead to a cremation time of zero minutes – and even of negative times beyond that![161] As described in chapter 3.1, all three ovens listed here were extremely old models. They all operated with the indirect firing method, where only heated air of up to 1000°C was employed for the cremation, which took between 45 and 90 minutes. The Soviet experts performed another inadmissible extrapolation regarding the load of the ovens. Since simultaneous cremation were outlawed in civil crematoria, as a result of which there were no experimental data in this regard, the Soviet experts simply took the data relating to individual cremations, but attributed the cremation times to a muffle loaded with 2 to 12 bodies. But as was shown in the previous chapter, increasing the loaded of a muffle designed for a single corpse unavoidably leads to a progressive increase of the incineration time. Therefore, this diagram of the Soviet experts is lacking scientific foundation. The

[158] "*Protocol about technical features of the SS concentration camp of Stutthof*", May 14, 1945. *GARF* (Gosudarstvenni Archiv Rossiskoi Federatsii, Moscow), 7021-106-216, pp. 5f.
[159] *GARF*, 7021-104-3, pp. 26-31.
[160] *GARF*, 7021-107-9, pp. 245-249. The original text of this report was translated in the book by J. Graf, C. Mattogno, *KL Majdanek. Eine historische und technische Studie*. Castle Hill Publisher, Hastings 1998, p. 286 (Engl.: *Concentration Camp Majdanek*, Theses & Dissertations Press, Chicago, IL, 2003).
[161] Cf. also Richard Kessler, *Rationelle Wärme-Wirtschaft… op. cit.* (note 33), p. 136.

coke-fired Kori ovens at Sachsenhausen, Majdanek, and Stutthof with an average operating temperature of 800°C and an average duration of a single cremation of 50 minutes (like the Kori oven at Westerbork) could incinerate 144, 115, and 58 bodies in 24 hours, respectively. This means that the Soviet expert calculated capacities, which were 5 times higher than the actual capacity of the Majdanek crematorium and 10 times higher than that of the Stutthof crematorium! What needs to be pointed out, however, is the fact that not even the Soviet experts dared to attribute cremation times lower than 60 minutes to crematorium ovens operating at maximum temperatures of 1,100°C, which could be reached only for a short moment during the combustion of a coffin.

7.4. The Oven Capacity for Normal Cremations at Auschwitz-Birkenau

Therefore, given the capacity of one body per hour and 20 hours' operation per day, the actual maximum capacity of the Topf cremation ovens of Auschwitz and Birkenau per 24 hours was as follows:

CREMATORIUM	# MUFFLES	OPERATION	CAPACITY
Crematorium I	6	× 20 h/day =	120 normal bodies/day
Crematorium II	15	× 20 h/day =	300 normal bodies/day
Crematorium III	15	× 20 h/day =	300 normal bodies/day
Crematorium IV	8	× 20 h/day =	160 normal bodies/day
Crematorium V	8	× 20 h/day =	160 normal bodies/day
TOTAL	52	× 20 h/day =	1,040 normal bodies/day

This cremation capacity is, however, purely theoretical, because it ignores an important fact: according to the memo of March 17, 1943,[128] the normal activity of the crematoria was only 12 hours per day, thus taking into consideration the inevitable occurring breakdowns of machinery. Hence, the actual capacity was only 60% of the values given above:

CREMATORIUM	# MUFFLES	OPERATION	CAPACITY
Crematorium I	6	× 12 h/day =	72 normal bodies/day
Crematorium II	15	× 12 h/day =	180 normal bodies/day
Crematorium III	15	× 12 h/day =	180 normal bodies/day
Crematorium IV	8	× 12 h/day =	96 normal bodies/day
Crematorium V	8	× 12 h/day =	96 normal bodies/day
TOTAL	52	× 12 h/day =	624 normal bodies/day

7.5. The Reason for Extending the Cremation Facilities in Birkenau

Originally, only one new crematorium with 15 muffles was planned to be erected in Birkenau (crematorium II), but this plan was extended in 1942 to four crematoria with altogether 46 muffles. There were two related reasons for extending the cremation facilities in Birkenau. The first reason was an order given by Himmler during his visit to Auschwitz on July 17 and 18, 1942, to enlarge the camp so that it could hold 200,000 inmates.[162] The second factor was the inmates' mortality, caused by a terrible typhus epidemic that broke out in July 1942.

The August of 1942 was the month with the highest mortality in the entire history of the Auschwitz camp.[163] Some 8,600 inmates died during that month alone, almost double as many as during the previous month (about 4,400 deaths). The first known evidence for the decision to erect three more crematoria is dated August 14, 1942 (which is the date given on the construction drawings no.

[162] Letter Bischoff to Amt CV of SS-WVHA, Aug. 3 and Aug. 27, 1942. *GARF*, 7021-108-32, p. 37 and 41.
[163] The following figures are based on statistical analysis of the Auschwitz *Sterbebücher*; cf. Staatliches Museum Auschwitz-Birkenau (ed.), *Die Sterbebücher von Auschwitz*, Saur, Munich 1995.

1678 for the crematoria IV/V[164]). By August 13, more than 2,500 inmates had already died during that month, with an average mortality of more than 190 deaths per day. During the six days of August 14 to 19 – the day which is referred to in the discussions summarized in a memo of August 21[165] –, the mortality was even higher: ca. 2,400 deaths, in average ca. 400 per day. The maximum was reached on August 19 with more than 500 deaths. On August 1, 1942, 21,421 inmates were incarcerated in the men's camp. Until August 19, 4,113 of them had died, in average 216 per day, 1,675 of them between August 14 and 19 (279/day). Between August 1 and 19, 1942, the average strength of the men's camp was 22,900. If already such a small population could result in a mortality of 500 corpses per day, what would have happened if a similar epidemic had erupted with a camp holding 200,000 inmates?

8. Operation of the Crematoria of Birkenau

The following table shows from when and until when the crematoria of Birkenau existed:

	TIME IN EXISTENCE	DAYS
Crematorium II	March 15, 1943 – November 27, 1944	624
Crematorium III	June 25, 1943 – November 27, 1944	522
Crematorium IV	March 22, 1943 – October 7, 1944	566
Crematorium V	April 4, 1943 – January 18, 1945	656
Crematoria II and III together		1,145
Crematoria IV and V together		1,222

However, the Topf cremation ovens of Birkenau suffered constantly from defects, which interrupted their activity frequently and sometimes for long periods of time.

Crematorium II was subjected to the first serious repairs a little more than a week after it started operating. On March 24 and 25, 1943, the Topf engineers Prüfer and Schultze came to Auschwitz to verify the extent of the damages.[166] At the beginning of April, it was discovered that the damage was not restricted to the three forced-draft blowers, which had burned out, but that parts of the refractory material of flue and chimney had collapsed,[167] so that the Auschwitz Central Construction Office asked Prüfer during his visit (between April 4 and 9) for a "*new suggestion regarding the chimney lining*".[168] From a drawing of the Central Construction Office, it turns out that the damage had affected parts of the walls delimiting the chimney's center smoke channel.[169] Thus, this crematorium remained inactive from May 17[170] to September 1, 1943,[171] and was doubtlessly operated only at reduced load between the beginning of April and May 16.

Crematorium III was in service from June 25 to December 31, and crematorium IV from March 22 to May 10.[172] As for crematorium V, it was most likely in service at least until crematorium III was put into operation, in other words for less than three months, from April 4 to June 24.[173]

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[164] *APMO*, negative n. 20946/6

[165] *RGVA*, 502-1-313, pp. 159f.

[166] *APMO*, BW 30/25, p. 8.

[167] *APMO*, BW 30/34, p. 17.

[168] Memo of Kirschnek from Sept. 14, 1943. *RGVA*, 502-1-26, p. 144.

[169] The chimney of crematoria II & III was subdivided into three smoke channels with a cross-section of 80 × 120 cm.

[170] Between May 17 and 19, Topf engineer Messing disassembled the three forced-draft blowers of crematorium II (*RGVA*, 502-1-306, pp. 91-91a). A few days later, the Koehler company began the repair job (*RGVA*, 502-1-313, p. 37).

[171] The work was probably finished toward the end of August, because on August 30, the Central Construction Office requested various painting products from the Supplies Administration for crematorium II (*RGVA*, 502-1-314, p. 23).

[172] This date is also only approximate. Cracks already appeared in the eight-muffle oven of crematorium IV as early as April 3 (a); the SS Construction Office's telegram to the Topf firm, dated May 14, 1943, requests "*calculations re. heat engineering for stacks of Crematoria II and IV*" (b). This means that the stack of crematorium IV had also been seriously damaged before this date.
a) *APMO*, BW 30/34, p. 42.

Thus the following picture emerges of the service and downtime periods of the four crematoria of Birkenau in 1943:

	TIME PERIOD	EXISTENCE	IN SERVICE	OUT OF SERVICE
Crematorium II	March 15 – Dec. 31	292 days	166 days	126 days
Crematorium III	June 25 – Dec. 31	190 days	190 days	–
Crematorium IV	March 22 – Dec. 31	285 days	50 days	235 days
Crematorium V	April 4 – Dec. 31	272 days	82 days	190 days
TOTAL:		1,039 days	488 days	551 days

Furthermore, from October 21, 1943 to January 27, 1944, in other words for 98 days, several ovens of crematoria II and III were probably out of service due to repairs on 20 oven doors.[174]

The data available for 1944 are less complete.

On February 2, 1944, the Central Construction Office asked to the camp commander again for permission to allow the engineers Prüfer and Holick access to the camp:[175]

> *"in order to inspect and repair the damages to the large disinfestation facility in the POW camp and in the crematoria."*

On February 22, 1944, the camp administration (*Standortverwaltung*) ordered the Central Construction Office to supply 400 refractory bricks "for urgent repairs of the crematoria."[176]

On April 3, 1944, an order was issued for the "*repair of 20 oven doors*" for the ovens of crematoria II and III. These repairs were completed on October 17, *i.e.*, 196 days later.[177]

At the beginning of May 1944, the masonry of the smoke flue and chimney was again damaged, because on May 9, the head of the Central Construction Office of the Birkenau camp asked the camp commandant for a "*permission to enter the crematoria I-IV*" for the Koehler firm,[178] because it had been "*commissioned to make urgent maintenance works at the crematoria.*"[179]

Between June 20 and July 20 a further "*two large and five small oven doors*" were repaired.[180] In 1943, crematorium IV sustained irreparable damage, and crematorium V was also seriously damaged. In early June 1944, there was an attempt to repair them, as the order of June 1 to "*repair 30 oven doors*" in these crematoria shows.[177]

The repairs were completed on June 6, 1944, and that very same day another order was issued for "*repairs*" to crematoria II through V. These repairs were completed on September 6.[177] However, if we take Pressac's word, crematorium IV was used as dormitory from late May 1944 on, for the prisoners making up the *Sonderkommando*.[181] One can thus assume that crematorium IV was not in service at all in 1944, whereas crematorium V was functional from early June 1944 until January 18, 1945, *i.e.*, for 230 days.

We summarize. In 1943 the crematorium II worked at least from April 9 to May 16 at reduced load, *i.e.*, for at least 38 days. The damage to the chimney of crematorium I, which subsequently had to be torn down and rebuilt, should have made the Central Construction Office somewhat care-

b) *APMO*, BW 30/34, p. 41.

173 Pressac claims that crematorium IV was no longer used after September 1943 (a), but does not document his claim. According to R. Höß the crematorium had to be "*repeatedly shut down, since the stacks were burnt out after a short period of cremations of about four or six weeks*" (b).
a) J.-C. Pressac, *Les crématoires…*, *op. cit.* (note 8), p. 81.
b) M. Broszat (ed.), *Kommandant in Auschwitz. Autobiographische Aufzeichnungen des Rudolf Höß*, dtv, Munich 1981, p. 165.

174 *APMO*, Dpr.-Hd/11a, p. 95 (Höß Trial).

175 *RGVA*, 502-1-345, p. 50.

176 *RGVA*, 502-1-313, p. 13.

177 *APMO*, Dpr.-Hd/11a, p. 96 (Höß Trial).

178 The Koehler firm had constructed the smoke flues and chimneys of the crematoria II & III.

179 *RGVA*, 502-1-83, p. 377.

180 D. Czech, *op. cit.* (note 78), p. 637.

181 J.-C. Pressac, *Auschwitz…*, *op. cit.* (note 8), p. 389.

ful, so that it is reasonable to assume a 50% operation time for crematorium II for this period of time (= 10 h per day), which is equivalent to 19 days of 100% operation. From May 17 to August 31, crematorium II remained closed for 107 days. In addition to this, some individual ovens were out of service as a result of repairing individual oven doors (20 doors for 294 days and 7 doors for 30 days, which is equivalent to 10 oven doors for ca. 600 days). If taking into account that each triple-muffle oven had ten oven doors and that crematoria II and III had ten such ovens altogether, this amounts to additional 60 days of inactivity for these crematoria. On February 2, 1944, damages to the refractory material of crematoria II and III were discovered, which was repaired by February 22. These damages affected at least two ovens (one in each crematorium), leaving them inactive for at least 25 days, which is equivalent to (25÷5=) 5 days of activity for each crematorium. At the beginning of May 1994, damages to the refractory material were discovered in the flues and /or chimneys of crematorium II, III, and V. In lack of any sources, we assume that the ensuing intensive repairs took only 3 days to complete for each crematorium. In 1944, therefore, crematoria II and III remained inactive for at least (60+5+5+3+3=) 76 days, or in average 38 days per crematorium, and crematorium V for at least 3 days.

Thus, the service times for the cremation ovens of Birkenau for the year 1944 and for January 1945 may be summarized as follows; however, this does not take into account the downtime of individual ovens as mentioned previously:

	TIME PERIOD	DAYS	IN SERVICE	OUT OF SERVICE
Crematorium II	Jan. 1 – Oct. 30/44	304	266	38
Crematorium III	Jan. 1 – Oct. 30/44	304	266	38
Crematorium IV	–	–	–	–
Crematorium V	Jan. 1 – Oct. 30/44	304	144	160
TOTAL:		912	676	236

Now we can calculate the total number of days on which the crematoria of Birkenau were in service:

DAYS IN SERVICE		DAYS IN SERVICE	
Crematoria II and III together:	888	Crematoria IV and V together:	276

From March 15, 1943, to October 30, 1944, ca. 50,000 registered inmates died a 'natural death' in the camp. Assuming that their corpses were cremated in proportion to the days of activity and the number of muffles of the crematoria (crematoria II & III = 86%, crematoria IV & V = 14%), this means that ca. 43,000 corpses were cremated in crematoria II & III and ca. 7,000 in crematoria IV & V. In case of 20 days of activity of the cremation ovens (see table chapter 7.4.), the cremation of these bodies required thus:

Crematoria II & III: (43,000 corpses ÷ 300 corpses/day =) 143 days of both crematoria together
Crematoria IV & V: (7,000 corpses ÷ 160 corpses/day =) 44 days of both crematoria together

So for further cremations there would have remained:

Crematoria II & III: (888 – 143 =) 745 days of both crematoria together
Crematoria IV & V: (276 – 44 =) 232 days of both crematoria together

The number of the corpses of alleged gassed victims that could have been cremated is therefore:[182]

Crematoria II & III: (745 × 360 corpses/day =) 268,200
Crematoria IV & V: (232 × 192 corpses/day =) 44,500

In Total: 312,700

Even though these figures are based on real data, they are merely theoretical. In the reality, another factor influenced the number of possible cremations in a decisive manner: the duration of the refractory material of the muffles.

[182] I have increased the capacity of the crematoria by $^1/_6$ to take into consideration the cremation of children.

9. Durability of the Firebrick of the Cremation Ovens

As a result of thermal stresses, the fireproof brick of a cremation oven inevitably wears out, and eventually this becomes a serious hazard. In the civilian cremation ovens which had been constructed in the usual manner and with the building materials normally used in the 1930s, the lifespan of the fireproof brick was about 2,000 cremations, but the Topf firm had managed to extend its durability to 3,000 cremations.[183]

In the cremation ovens in the concentration camps, the problem of wear and tear on the fireproof brick was greater, not only because of the lesser mass of this fireproof material and its lower quality, but also because of the greater rate of use of the facility, and also due to its operation by untrained personnel whose hostile attitude to their work may very well have been reflected in the carelessness they showed in performing that work.

The very real impact of these factors is demonstrated by the case of the Topf double-muffle cremation oven at Gusen. This oven went into service on January 29, 1941[184] but was already damaged only eight months later. On September 24 the SS Construction Office of the concentration camp Mauthausen requested the Topf firm to "*immediately dispatch one of your oven specialists to repair the cremation oven in the labor camp Gusen.*"[185] Topf sent the fitter August Willing, who arrived in Gusen on October 11 and went to work the next day. From the relevant "*receipts for special billing re. day-rate jobs*" we know that this work took from October 12 to November 9, 1941. In 68 work hours in the week of October 16 to 22 he replaced the fireproof brick of the oven ("*dismantling the oven, and rebuilding inside*"). In 52 work hours the following week he finished lining the outside brickwork and performed a test cremation. Willing remained at Gusen until November 9 to tune the oven properly and to supervise its operation.[186]

From February to October 1941, in a period of 273 days, 3,179 inmates died in the Gusen camp;[187] this means that about 1,600 cremations took place in each muffle. This would confirm the average lifespan of the firebrick in a muffle as being about 2,000 cremations. But even assuming that the ovens had been used to the absolute limit of their capacity, the firebrick could not have lasted for more than 3,000 cremations.

Thus, the 46 muffles in the cremation ovens of Birkenau could have cremated a maximum of (46 × 3,000 =) 138,000 bodies. After that, they would have had to be dismantled in order to replace the firebrick.

If Pressac were correct in his assumption that these ovens served for the cremation of not only the 100,000 registered inmates who died of natural causes and are proven to have been cremated here, but also for the cremation of an additional 530,000 gassing victims, then the brickwork of the muffles would have had to be replaced (630,000 ÷ 138,000 =) approximately five times. For crematoria II and III alone this would have required 320,000 kg (705,600 lbs) of fireproof material – not to mention the inevitable damage done to the fireproof inner lining of the generators – and if we take the time needed by August Willing in Gusen as guideline, the work would have taken about 9,000 man-hours to complete.

All this would have generated an immense number of documents, yet the extensive correspondence between the Topf firm and the SS Construction Office contains no trace of such paperwork. There are not even any indirect references or other clues that would hint at such a mammoth task – with one single exception: a letter from Topf to the SS Construction Office, dated December 9, 1941, which in-

[183] R. Jakobskötter, "*Die Entwicklung der elektrischen Einäscherung…*", *op. cit.* (note 48), p. 583.
[184] This date follows from the list of coke deliveries to the crematorium of Gusen. *ÖDMM*, B 12/31, p. 352.
[185] Letter from the SS Construction Office of the concentration camp Mauthausen to the Topf firm, Sept. 24, 1941. *BAK*, NS 4 Ma/54.
[186] J. A. Topf & Söhne, receipts for special billing regarding day-rate jobs, Oct. 12 – Nov. 9, 1941. *BAK*, NS 4 Ma/54.
[187] Hans Marsalek, *Die Geschichte des Konzentrationslagers Mauthausen. Dokumentation*, Österreichische Lagergemeinschaft Mauthausen, Vienna 1980, p. 156.

dicates that the Construction Office had ordered "*one wagonload of firebrick*" from Topf. This material, which was enough "*for the new construction of one oven*", was to be used "*as replacement material for repair work.*"[188]

Taking into consideration this restoration of the fireproof brick of two muffles, the six muffles of the Auschwitz I (the Main Camp) were able to cremate a total of 24,000 bodies.

From all this it follows that the ovens of Auschwitz I and Birkenau (Auschwitz II) altogether were able to cremate about (138,000 + 24,000 =) 162,000 bodies during the period of their existence. This figure agrees quite well with the number of known, deceased registered inmates.

Thus, the cremation of the supposed gassing victims was physically impossible in technological respects as well.

10. The Number of Cremations in the Crematoria of Birkenau

10.1. The SS Estimate

As quoted before, civil engineer Jährling calculated the coke requirements of the four crematoria of Birkenau in a memo of March 17, 1943, "*on the basis of data from the firm Topf & Söhne (builder of the ovens) of March 11, 1943*",[128] based on a daily operation time of 12 hours. The Topf letter mentioned by Jährling has not been located. It might have referred to the combustion capacity of the fireplace only, but we are looking for the coke consumption as a function of the number of cremations. Since the coke consumption is also a function of the type of corpse cremated (for emaciated bodies, the quantity of coke estimated by Jährling would have sufficed for 370 bodies),[189] it is preferable to consider the duration of the cremation process, which was in average an hour, plus an additional hour for heating the oven. This means that 506 bodies could have been cremated within 12 hours. From January 1 to March 10, 1943, ca. 14,800 inmates died in Auschwitz, in average 207 per day. In February 1943, the mortality was ca. 7,400 inmates, in average 264 per day.[163] In the same period, according to the *Kalendarium* of Danuta Czech, the number of the alleged gassing victims was ca. 72,700, in average 1,054 per day. Therefore, if there had been any homicidal gassings, calculations for coke consumption and hours of operation would have been based upon 1,250 corpses per day. This figure corresponds to of 17,875 kg of coke[190] compared to the actual estimate of 7,840 kg, and would have required a daily operation of (1,250÷46 =) 27 hours! This shows that Jährling's calculations referred exclusively to corpses of registered inmates who died a 'natural' death. But even this calculation was enormously exaggerated, because between March 15 and October 25, 1943 (224 days), only 628.5 tons of coke were supplied to the crematoria of Auschwitz-Birkenau, in average 2.8 tons per day, which is only slightly more than a third of Jährling's estimate. This will be the topic of the next chapter.

10.2. The Number of Cremations in 1943: Coke Fuel Consumption

The archives of the Auschwitz Museum contain hundreds of receipts documenting deliveries of coke fuel to the crematoria.[191] A member of the museum staff has compiled a per-month list of the quantities specified on each of these receipts. We have in our possession a list of the coke deliveries for the time from February 16, 1942 to October 25, 1943.[192]

[188] *APMO*, BW 11/1, p. 4.
[189] See the calculation on that in the first English version of this article, *op. cit.*, (note 3), p. 406.
[190] See table on page 393 of this article: 15.7 kg/h for crematoria II & III, 11.7 kg/h for crematoria IV & V, average: 14.3 kg/h; 1,250 × 14.3 =17,875.
[191] Receipt. *APMO*, segregator 22a, sygn. D-AuI-4, no. 12025-12031.
[192] *APMO*, D-AuI-4, segregator 22, 22a.

By means of a calculation, J.-C. Pressac has shown that these deliveries are complete as listed.[193] For 1943 they were as follows:

MONTH	COKE [METRIC TONS]	MONTH	COKE [METRIC TONS]
March	144.5	July	67.0
April	60.0	August	71.0
May	91.0	September	61.0
June	61.0	October	82.0

Thus, from March 15 to October 25, 1943, a total amount of 607 tons of coke was delivered to the crematoria. Furthermore, a total of 96 m^3 (3,390 cu.ft.) of wood was delivered in the months of September and October.

The 96 m^3 (3,390 cu.ft.) of wood that were delivered in September and October correspond to about 43 metric tons. If we set the calorific value of one kilogram of wood equal to that of half a kilogram of coke, then 43 metric tons of wood correspond to 21.5 metric tons of coke. On the basis of this relationship we can equate the calorific value of the coke and wood supplied with a total of (607 + 21.5 =) 628.5 metric tons of coke.

From March 15 to October 25, 1943, ca. 16,000 registered inmates died,[163] which means that the coke consumption per corpse was (628,500÷16,000=) 39.3 kg. This figure also includes the quantity of coke necessary to preheat the ovens. In chapter 5.4., the importance of this factor on the coke consumption was indicated. It will be emphasized here with an example from the oven at Gusen.

From 26 September to October 15, 1941 (20 days), 193 corpses were cremated in this oven during 10 days of activity. That means that the oven operated in average every second day, each time cremating 19 corpses and consuming 47.5 kg of coke per corpse.

From October 26 to 30 (5 days), 129 corpses were cremated, some of them each day, in average 26 corpses per day with 37.2 kg of coke per corpse.

From October 31 to November 12 (13 days), 677 were cremated, as already mentioned. In a daily cycle, in average 52 corpses were cremated requiring 30.6 kg of coke per body.

This means that changing the operation mode from sporadic (19/day)[194] to continuous (52/day) decreased the coke consumption from 47.5 down to 30.6 kg/body, which is a saving of 35.6%,[195] an amount used to heat up the oven when operated discontinuously. Applying this factor to the coke consumption of the ovens at Auschwitz-Birkenau for emaciated corpses, so that we obtain the coke consumption per corpse for a discontinuous operation (operation only every second day), leads to the following results:

Crematorium I: 32.5 ÷ 0.6442 = 50.4 kg
Crematorium II & III: 22.0 ÷ 0.6442 = 34.1 kg
Crematorium IV & V: 16.0 ÷ 0.6442 = 24.8 kg

From March 15 to August 31, 1943, 3,374 registered inmates died in the Auschwitz main camp alone, as recorded in the *Leichenhallenbuch* (Mortuary Book).[196] Considered the decreasing mortality during July (277) and August (215), the total until October 25 might have amounted to 4,000, which were cremated in crematorium I. From March 15 to October 25, 1943, the crematoria II and III were in service for 222 days, the crematoria IV and V for 132 days. Considering the days of activity and the available muffles, crematoria II & III had 76% of the entire cremation capacity of the camp during that time, whereas crematoria IV & V had 24%. Assuming that cremations took place according to this percentage, this results in:

[193] J.-C. Pressac, *Auschwitz…*, *op. cit.* (note 8), p. 224.
[194] It must be kept in mind that this oven had two muffles, so 19 cremations per day correspond to ca. 10 loadings.
[195] In the intermediate case – numerous, but not many cremations each day, – coke saving would be ca. $^1/_6$.
[196] *AGK*, NTN 92, pp. 141f. (statistic recapitulation by Jan Sehn).

Crematorium I:	16,000 – ≅4,000 ≅	12,000 bodies
Crematoria II & III:	12,000 × 0.76 ≅	9,100 bodies
Crematoria IV & V:	12,000 × 0.24 ≅	2,900 bodies

The consumptions of coke were therefore as follows:

Crematorium I:	4,000 × 32.5 =	130,000 kg
Crematoria II & III:	9,100 × 22 =	200,200 kg
Crematoria IV & V:	2,900 × 16 =	46,400 kg
	Total:	**376,600 kg**

This total corresponds to (376,600 ÷ 628,500 × 100=) 59.9% of the total supplies during this time, a percentage that is very close to that calculated above for the oven at Gusen (64.4%). The quantity of coke delivered to the crematoria was therefore full compatible with a discontinuous cremation of the corpses of the registered inmates who had died a 'natural' death.

We will now examine the assumption of homicidal gassings. According to Czech's *Kalendarium*, 116,794 persons were gassed between March 15 and October 25, 1943, or rounded up 116,800. As F. Piper confirms,[197] no cremations took place in burning pits in the open in 1943 after crematorium II had been put into service. This means that all corpses of alleged gassings had to be cremated in crematorium ovens. As shown above, at least 376,600 kg of the total delivery of 628,500 kg of coke was required to cremate the corpses of the 16,000 registered inmates who died a 'natural' death during this time, which left (628,500 – 376,600 =) 251,900 kg of coke for the cremation of the claimed gassing victims. We assume the most favorable case that these cremations were evenly spread out over time (which is very doubtful from a historical point of view), that all victims had normal bodies, and that the consumption decreased by $^1/_6$ due to the presence of children. This results in the following:

Crematoria II & III:	116,800 × 0.76 ≅	88,800 bodies × (16 × $^5/_6$) =	1,184,000 kg
Crematoria IV & V:	116,800 × 0.24 ≅	28,000 bodies × (12 × $^5/_6$) =	280,000 kg
	Total:	**116,800 bodies**	**1,464,000 kg**

Hence, the cremation of the 116,800 gassing victims would have required at least 1,464,000 kg of coke, but only a maximum of 251,900 kg was available, which would have resulted in (251,900 ÷ 116,800 =) 2.15 kg of coke per corpse, a quantity that would have been absolutely insufficient to carry out any cremation.

All this points to a plain and simple conclusion: the coke deliveries from March to October 1943 prove indisputably that only the bodies of the inmates who had died of natural causes could be cremated in the crematoria.

THEREFORE, NO MASS MURDERS TOOK PLACE IN AUSCHWITZ AND BIRKENAU IN THE TIME FROM MARCH TO OCTOBER 1943!

11. The 'Burning Pits' of Birkenau

11.1. The Chief Witness, Filip Müller

The foremost 'witness' for this manner of body disposal is Filip Müller, who speaks of five pits located in the northern yard of crematorium V. His account is quite long-winded; we shall quote the most important points:[198]

> "*The two pits* [that had been dug] *were 40 to 50 meters long, about 8 meters wide and 2 meters deep. However, this particular place of torment was not yet ready for use by any means. Once the rough work*

[197] F. Piper, "*Gas Chambers and Crematoria*", in: Y. Gutman, M. Berenbaum (eds.), *Anatomy of the Auschwitz Death Camp*. Indiana University Press, Bloomington and Indianapolis 1994, p. 164.

[198] Filip Müller, *Auschwitz Inferno: Testimony of a Sonderkommando*, Routledge & Kegan Paul, London 1979, p. 130.

> *was finished, there followed the realization of the refinements thought up by the arch-exterminator's* [Otto Moll's] *warped ingenuity.*
>
> *Together with his assistant, Eckardt, he climbed down into the pit and marked out a 25 centimeters by 30 centimeters wide strip, running lengthways down the middle from end to end. By digging a channel which sloped slightly to either side from the center point, it would be possible to catch the fat exuding from the corpses as they were burning in the pit, in two collecting pans at either end of the channel.*"

After this work was finished, Moll allegedly climbed into the pit to test the incline of the drain channel with a bucket of water. The incline turns out to be inadequate. It is made steeper, and in the next test the water runs along the channel and flows into a container placed at its end.[199] Müller continues:[200]

> "*As it began to grow light, the fire was lit in two of the pits in which about 2,500 dead bodies lay piled one on top of the other. Two hours later all that could be discerned in the white-hot flames were countless charred and scorched shapes, their blackish-phosphorescent hue a sign that they were in an advanced stage of cremation. At this point the fire had to be kept going from outside because the pyre which at first protruded about half a meter above the edge of pit had, in the meantime, gone below this level. While in the crematorium ovens, once corpses were thoroughly alight, it was possible to maintain a lasting red heat with the help of fans, in the pits the fire would burn only as long as the air could circulate freely in between the bodies. As the heap of bodies settled, no air was able to get in from outside. This meant that we stokers had to constantly pour oil or wood alcohol on the burning corpses, in addition to human fat, large quantities of which had collected and was boiling in the two collecting pans on either side of the pit. The sizzling fat was scooped out with buckets on a long curved rod and poured all over the pit causing flames to leap up amid much crackling and hissing. Dense smoke and fumes rose incessantly. The air reeked of oil, fat, benzene and burnt flesh.* […]
>
> *Some twenty-five bearers were employed in clearing the gas chamber and removing the corpses to the pits.* […] *About fifteen stokers had to place the fuel in the pit and to light and maintain the fire by constantly stoking in between the corpses and pouring oil, wood alcohol and liquid human fat over them. There were approximately thirty-five men in the ash team. Some had to dig the ashes from the pits and remove them to the ash depot. The others were busy pulverizing the ashes.* […]
>
> *In order to prepare the third pit for cremation old railway sleepers, wooden beams, planks, and sawdust were arranged in layers and covered with a layer of dry fir branches. Then the bearers laid about 400 corpses face upwards in four long rows on top of the fuel. The next layer again consisted of fuel covered, as before, with fir branches. Then followed another layer of corpses. This sequence was repeated once more until, in the end, there were some 1,200 dead bodies in three layers. Meanwhile the stokers had soaked pieces of material and rags in oil and wood alcohol and stuffed them in between the fuel in many places.*"

The cremation allegedly took five to six hours:[201]

> "*In the meantime* [the fire] *had gone out* [in the two other pits]. *The process of incineration took five to six hours. What was left barely filled a third of the pit.*"

11.2. The Method of Scooping Human Fat

The flashpoint of animal fats is 184°C (363°F).[202] This means that in the presence of fire or embers, animal fats – and human fat also belongs in this category – ignites at 184°C (363°F). Therefore burning wood would inevitably ignite any fat exuding from the corpses. This effect is familiar to anyone who has ever barbecued and had fat drip from his steak into the charcoal: the entire grill is quickly ablaze.

[199] *Ibid.*, pp. 131-132.
[200] *Ibid.*, pp. 136f.
[201] *Ibid.*, p. 138.
[202] J. H. Perry, *Chemical Engineer's Handbook*, Wilmington, Delaware, 1949, p. 1584.

Thus, the set-up described by Filip Müller is outrageous nonsense and would not allow for any scooping of the fat whatsoever.[203]

11.3. Open-Air Cremations That Actually Did Take Place

John C. Ball demonstrates in the present volume that the air photos taken of Auschwitz by the Allies show no traces of mass incinerations in pits. Aside from the above arguments, we have also explained other reasons that would show the mass incinerations alleged to have taken place in open pits to be impossible.[203]

However, this is by no means to say that no incinerations were carried out in Birkenau in the open air – on pyres or in rudimentary open ovens.

One may reasonably assume that in late 1941, when the mortality rate in Auschwitz rose to frightening proportions, many bodies were taken to Birkenau and buried there in mass graves. According to the Mortuary Book and the Book of the Dead, 1,358 inmates and 3,726 Soviet prisoners-of-war died in November 1941, a total of 5,084 people, 169 per day on average. At that time the crematorium of the Main Camp had only two ovens whose maximum capacity altogether was 84 bodies per day and which, on top of everything else, had sustained some damage.[204] The coke deliveries to the crematorium also prove that only a portion of the deceased inmates could have been cremated. From November 1, 1941 to January 31, 1942, the crematorium received 93.6 metric tons of coke, which would have sufficed for 3,000 bodies at the very most; however, a total of 9,355 inmates died during that period. In the following months the crematorium could just barely handle the cremation of the people who died in the Main Camp. On March 1, 1942, the Soviet prisoners-of-war were taken to Birkenau.[205] On August 6, the inmates of the Women's Camp, which had been opened on March 26, were also transferred there.[206] From March 1, 1942, to February 28, 1943, 14,515 male inmates died in the Main Camp and were registered in the Mortuary Book, and several thousand female inmates also died, but during this same time only 373.5 metric tons of coke were supplied to the crematorium, which would have sufficed for the cremation of at most some 12,200 bodies. All the bodies of inmates who died in Birkenau were buried in mass graves.

In the following months the mortality rate rose sharply due to the dreadful typhus epidemic that had broken out in acute form in July 1942. As a consequence of this epidemic the Head of the camp, Commandant Rudolf Höß, ordered the camp "*completely closed off*" on July 23, 1942.[207]

In other words, bodies buried in mass graves also included many thousands of typhus victims, which made sanitary conditions in Birkenau even more catastrophic, especially if one considers the high water table of Birkenau, which must have swamped the graves quickly. It is easy to believe Pery Broad when he writes – albeit with propagandistic embellishments – that the body toxins of the buried had contaminated the ground water in the entire area,[208] which resulted in the massive death of fish in the lakes surrounding Birkenau, particularly in Harmense.[209] And in fact the pollution by body toxins

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[203] For details see our main work, *op. cit.* (note 2), and note 5. Myroslaw Dragan recently conducted an experiment by incinerating a deer carcass in a pit which turned out to be a slow, but feasible method to reduce an animal to ashes; paper to be published in *Vierteljahreshefte für freie Geschichtsforschung* and *The Revisionist*.

[204] The Dec. 9, 1941, letter from the Topf firm to the SS Construction Office of Auschwitz mentions "*a repair of the two coke-fired double-muffle cremation ovens*" which had already been carried out. *APMO*, BW 11/1, p. 4.

[205] D. Czech, *op. cit.* (note 78), p. 139.

[206] *Ibid.*, pp. 148, 212.

[207] *APMO*, camp order. t.l. camp order no. 19/42, sygn. A-AuI-1, p. 17.

[208] About the ground water table in Birkenau cf. Michael Gärtner, Werner Rademacher, "*Ground Water in the Area of the POW camp Birkenau*", *TR* 1(1)(2003), pp. 3-12 (online: vho.org/tr/2003/1/GaertnerRademacher3-12.html); Carlo Mattogno, "*'Cremation Pits' and Ground Water Levels at Birkenau*", *The Revisionist*, 1(1) (2003), pp. 14-17 (online: vho.org/tr/2003/1/Mattogno14-17.html).

[209] P. Broad, "*Erinnerungen*", in J. Bezwinska, Danuta Czech, *Auschwitz in den Augen der SS*, 3rd ed., Krajowa Agencja Wydawnictwa, Katowice 1981, pp. 165f. Broad makes the anachronistic claim that the mass graves were opened after the discovery of the graves of Katyn (Feb. 1943).

– pollution not only of the ground water but also of the soil and the air[210] – had been one of the main arguments of the proponents of cremation in the late 19th century![211]

The SS in Auschwitz countered this dreadful sanitary problem for the long term by planning the four crematoria of Birkenau (one of which – the one that was to become crematorium II – had already been planned in October 1941, but for the Main Camp) and by the efficient installation of disinfestation and delousing facilities (the Central Sauna), and for the short term by exhuming and burning the bodies.

The decision to construct the crematoria of Birkenau was made in August 1942,[164] at a time when the mortality rate averaged 270 inmates a day due to the typhus epidemic, and this with an average camp population of some 22,000 male and 10,000 female inmates (in August 1942). On the occasion of his inspection of the camp on July 17 and 18, 1942, Himmler had ordered that POW camp Birkenau's initial intended capacity of 125,000 be increased to 200,000. Under these circumstances, it is clear that the 550-per-day capacity of the Birkenau crematoria (for which the memo of March 17, 1943 provides for a daily operation time of 12 hours) was by no means exaggerated in view of potential future epidemics among a three- or four-fold greater camp population.

Little is known about the opening of mass graves and incineration of bodies contained therein. On September 17, 1942, SS-*Untersturmführer* Walter Dejaco, who together with his colleague Hössler had accompanied Camp Commandant Rudolf Höß to Litzmannstadt (Lodz), drew up a "*travel report*" in which he mentioned that the purpose of the trip had been the "*visual inspection of the special facility, and discussions with SS-Standartenführer Blobel about the implementation of such a facility.*" This special facility was almost certainly a means for incinerating bodies in the open air. Dejaco also reported that the construction materials ordered from the *Ostdeutsche Baustoffwerke* in Posen via "*special order by Staf. Blobel*" had to be delivered to Auschwitz immediately; and that the firm of Schriever & Co. in Hannover had to supply a "*ball grinder for substances*".[212] This was most likely a device for grinding up the residue left after incineration.

According to Danuta Czech's *Auschwitz Chronicle, 1939-1945*, incineration of exhumed bodies began on September 21,[213] which seems quite credible, and ended in November. It is not known how these bodies were burned, but most definitely not in burning pits. Mass graves were almost certainly located to the southwest of the "*temporary earth basin*", about 650 ft. west of what was to become Sector BIII of Birkenau, since the air photos from 1944 – specifically those from May 31 – show traces of four huge, parallel trenches in that area. (See the chapter by J. C. Ball, this volume.)

The majority of the inmates who died between September 23, 1942 and the opening of the crematoria were also burnt in the open air.

However, if traces of mass cremations of human beings are in fact found in the vicinity of the former camp Birkenau,[214] this does not in any way mean that the camp was the site of mass murders.

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[210] Ptomaines – discovered by Prof. Selmi in Bologna, Italy – are toxic alkaloids forming in dead bodies during putrefaction.

[211] "*Ground water is even better suited than soil and air to spreading the products of putrefaction; it is all the more dangerous in that the underground watercourses can undergo changes which are not noticeable at the surface.*" – "*The hazards of earth burial increase when the bodies are those of victims of infectious diseases.*" M. Pauly, *op. cit.* (note 19), pp. 24f.

[212] NO-4467.

[213] D. Czech, *op. cit.* (note 78), p. 242.

[214] Udo Walendy, *Historische Tatsachen*, no. 60, Verlag für Volkstum und Zeitgeschichtsforschung, Vlotho 1993, pp. 7-10, discusses an expert report of the Polish firm "*Hydrokop*" which conducted some explorative drillings in Birkenau soil and allegedly found such traces. See also note 30 in J. C. Ball's chapter, this volume.