The Making of Fritz Menzer - A Secret Life

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Abstract

A technical museum and a filmmaker join for a thoroughly researched documentary about Fritz Menzer, the widely unknown German inventor of cipher device 41. In seven episodes, they uncover Menzers secret life, and identify his central role for German cryptology.

1 Introduction

For some stories, an exhibition showcase is simply too small. In 2013, the Deutsches Museum in Munich, Germany, first came across a relic of a so-called cipher device 41 ("Schlüsselgerät 41", often abbreviated as SG-41). This German cipher machine from World War II was largely unknown. Only few documents were available - and although released by the NSA since 2009, many documents were still censored line by line so that only parts could be read. Even less was known about the inventor, Fritz Menzer. From 2018 to 2022, the Deutsches Museum and filmmaker Robert Jahn therefore carried out a study, resulting in a thoroughly researched documentary series consisting of seven short episodes in which both the life of cryptologist Fritz Menzer and the background story of the cipher device 41 are presented. Since November 2022, the films are worldwide available via the app of the Deutsches Museum. The publication on the internet is planned for autumn 2023.

2 Hunting a Phantom of Cryptology

The Deutsches Museum owns two relics of the cipher device 41 in its collection. One of them was bought at an auction in 2013, the other one was bought from amateur treasure hunters in 2017.

For an exhibition on cryptology that was under construction during the years 2015-2022, extensive research was started by the Deutsches Museum to find out more about the functioning of the

Figure 1: The Schlüsselgerät 41 of the Deutsches Museum found by treasure hunters in 2017

devices, the background to their construction, and their influence on the course of World War II.

Since the start of these studies on the rare cipher device 41, many findings have already been published, see Dahlke (2018) and the films on Conservation studies of the Leibniz Association (2018). In addition, Kopacz and Reuvers (2021) published the mechanical implementation and algorithm of the device, Lasry (2021) published a study on cryptanalysis in 2021. The fact that the cipher device 41 was technically far ahead of its time is fascinating. The SG-41 has a very sophisticated encryption mechanism that, in terms of security, goes far beyond the well-known German machines of World War II (Lasry, 2021).

But what continued to pose great mysteries, however, was the person of the German inventor Fritz Menzer. For a long time, his name referred primarily to a phantom. For decades, almost nothing was publicly known about his - in fact numerous - inventions and his life. Strangely enough, Fritz Menzer had disappeared from all public documents from 1950 onwards (see e.g. Mowry (1983) and Boghardt (2022)), although he lived until 2005. However, as we know today, he was one of the most central figures in German cryptology during the Second World War. He in-

Figure 2: Fritz Menzer, around 1950, by courtesy of Gudrun Jackson

vented new encryption methods, machines and devices, he developed machines to break the Allies' encryptions, and he evaluated the security of existing systems on personel commission of Admiral Canaris.[1]

Furthermore, his inventions continued to have an influence on the development of technology for a long time after the war, not only in Germany. Traces of his inventions can be found in cipher machines used worldwide in the 1950s and 1960s (Kopacz and Reuvers, 2021).

2.1 Traces all over Europe and the USA

The research for this project resembled a criminal investigation to a large extent. When Carola Dahlke, curator of computer science and cryptology at Deutsches Museum and Robert Jahn, filmmaker from Berlin, decided in 2018 to embark on a joint search for Fritz Menzer, not one publicly known photo of Menzer existed.

And to this day, especially in American and Russian archives, many files on Fritz Menzer and his inventions are blocked or partially blacked out. Menzer's traces led to Germany, Austria and Switzerland, to Italy, England, Sweden, Russia, and the USA. First, the documents of the Target Intelligence Committee (TICOM)[2], the internal publications of the NSA[3], and documents from the British codebreakers[4] played a central role. But also the documents of the Wanderer Werke in the Saxon State Archives in Chemnitz[5], the Wehrmacht documents in the Military Archives in Freiburg[6], and the documents of the Bundesarchives Berlin[7] as well as in Koblenz[8] gave important insights. Another valuable source was the archive of the BND[9]. Many documents were only made accessible or released through this study. The researchers received support from many international colleagues. During the years of study, the information from the archives fitted together almost like a jigsaw puzzle, to give a comprehensive picture.

As the researched material turned out to become very extensive, several publications are planned. For a start, this paper focuses on the making of a documentary film for museum purposes. The pub-

[1] See Mowry (1983), p.23-24, Menzer's own memoirs in TICOM DF-174 (1949), p.18-21 and archivales of Bletchley Park, HW 73/4: Personnel of OKW/CHI, pp.3-12 (https://discovery.nationalarchives.gov.uk/details/r/C11204798) and of the BND, AZ 60331, Fragmente der Kriegstagebücher des OKW/Chi 1940-1944, pp.246-259, 272-291, 302-310 and Kothe (1998a), Kothe (1998b)

[2] TICOM Collection: see e.g. the overview volumes of WDGAS-14, the TICOM I-series at archive.org/details/ticom/: I-20, I-21, I-31, I-46, I-57, I-58, I-84, I-92, I-111, I-118, I-123, I-181, I-194, I-200, I-201, I-202, I-206, and the National Archives and Records Administration, College Park, Maryland: 5776 Fritz Menzer Contacts with American and Soviet Authorities (TICOM DF-174) and 5776A: DF-174a,b,c and 5784 List of Germans formerly connected with German Signal Intelligence activities (TICOM DF-185 Part I and Part II); RG 457: Entry P4: Records of the National Security Agency

[3] For NSA-internal publications see e.g. Mowry (1983) and the National Security Agency FOIA Historical Releases, Friedman-Documents: Folder 117 – Document ID A2436243 Report of Visit to Crypto A.G. (Hagelin) by William Friedman, 1955 and Folder 516 – Document ID A4146536 Theoretical Security of the Schlusselkasten, 1949

[4] Bletchley Park intelligence, see the National Archives, Kew, UK: The German Central Cryptographic Organisation (account based on Abwehr and SD sources, HW 73/5, 1939 Sep 01 - 1945 May 08)

[5] See the Sächsisches Staatsarchiv Chemnitz (StAC), Bestand 31030, Wanderer-Werke

[6] See the Bundesarchiv Freiburg, RW 4/777 Organisationsangelegenheiten Chi, innerer Dienstbetrieb, 1944-45 and RW 4/920 WNV/Gruppe Chiffrierstelle OKW - "Der Stand des Chiffrierwesens in der Wehrmacht", 1945

[7] See the Bundesarchiv in Berlin Personenrecherche Menzer, Fritz (Oswin), B563/22074 p 6,66,104,169,199 B563 VI/AS-BRL-1942/495 lfd. Nr. 571 and BArch MfS, Allg/P 7056/61, Aufklärung 37

[8] Bundesarchiv, Koblenz, Vorschlagsliste Nr. 164 des Bundesministers der Finanzen, Archiv Nr. 38879, lfd. Nr. 460

[9] Archiv des Bundesnachrichtendienstes, AZ 60331, Fragmente der Kriegstagebücher des OKW/Chi 1940-1944, pp. 151-323

lication of all findings and knowledge about Fritz Menzer, and about his numerous inventions in the field of cryptology is planned in follow-up studies in the near future.

2.2 Supported by Menzer's Family

One of the most decisive moments in this study was the fact that the researchers were able to make direct contact with Fritz Menzer's only living daughter in the spring of 2020, and with other family members in 2020 and 2021. This offered access not only to Fritz Menzer's life from the Second World War until his death in 2005, but also to personal belongings, photo albums, letters, sound recordings and stories about him. In the course of the study, the name Fritz Menzer to which nothing was known became a real person who held great technical talent. His adventurous life was shaped by the Nazi era, the time of liberation and the emerging cold war. But his life was also marked by a lifelong silence. It was only through the Deutsches Museum's first publications about the Schlüsselgerät 41 that Fritz Menzer's family learned about his inventions and his activities for the Wehrmacht during World War II.

3 Challenges of Museums

Modern exhibition concepts require that visitors approach the objects and contents with all their senses. Precisely because today's generations of visitors are accustomed to receiving topics comprehensively prepared on web-platforms, especially museums focused on history of science are challenged to offer a holistic experience. At the core, of course, is the physical collection, which can only be viewed in a museum. Here, however, the difficult question quickly arises of how to bring the context of objects to the visitor in an interesting, captivating, possibly even fun way. Hands-on stations, audio stories, pictures, dioramas, texts and guided tours play the main role here. But none of these media can comprehensively narrate the history and background of an object. However, research museums in particular have accumulated a profound knowledge about their collection that find little space to be told. To share this knowledge, and to walk the path of research with visitors or maybe take a small journey through time, the cinematic medium offers a wonderful opportunity. At the same time, museums should focus on exhibiting objects, not screens. Therefore, modern exhibition concepts envisage putting available additional material on objects and further facts into an app. Every visitor who has a smart-phone can download the app free of charge and dive deeper into interesting topics if desired, or discover more of the work and processes behind the museum exhibitions (e.g. the depots, workshops, the conservation and research departments).

4 Making of a Documentary

The documentaries created in this study were planned to be accessible in the museum's app. This should enable visitors to access the content directly in the exhibition or anywhere in the world at any time. The complete study, as well as the filmic realisation, was financed by the so-called Future Initiative (the modernisation project), and by the research department of the Deutsches Museum.

In the course of research, Fritz Menzer's life turned out to be very fragmentary. As well, the general knowledge about his life stayed still fragmentary, despite the intensive research. This laid the base for the filmic concept, namely to show important parts of Fritz Menzer's life and work in seven episodes. Every historic fact, event and circumstance shown in the films has been elaborately researched and substantiated by at least two independent sources.

To adopt the filmic approach to the fragmented life of Fritz Menzer the documentary was divided in seven episodes and accompanied by additional audiovisual and text-based material.

To create a complex and precise storytelling that is likewise engaging and emotional, the documentary is based on four narrative layers:

- Interviews with experts and contemporary witnesses
- Filming in sites of historical events
- Historic documents and photographs from public archives and private collections
- Animated moving images designed by the Italian artist Cosimo Miorelli

The aim was to shed light on Fritz Menzers life as well as on the development of cipher machines in the first part of the 20th century, with a very special focus on Menzer's cipher device SG-41. As the development of cipher machines

and Menzer's life itself were very much connected to political conditions, it was crucial to include the main political events and figures in the documentary. Namely, the rearmament efforts of Nazi Germany in the 1930s, World War II in its various phases, German military resistance, the importance of concentration camps and forced labour for core German industries, the defeat of Nazi Germany, the emerging Cold War, and finally the reconstruction of military and intelligence capabilities in the two German states.

Each of the seven episodes focuses on a specific event in Menzers life and connects this to a historic key-event. The only exception is episode two, as this episode purely focuses on the aims to investigate the SG-41 as part of the 3D-Cipher project[10].

Menzer's life and work, as shown in the seven main episodes, illustrates the dilemma of German cryptology in the time in and around World War II. What to do with a leading-edge innovation, if it is meant to serve an evil cause? As a scientific piece of work, the documentary does not offer answers to this moral question. But it offers a wide range of newly discovered facts and additional information to the audience.

The following subsections give an overview of the seven episodes of Fritz Menzer - A Secret Life. For each episode, a brief description serves like a teaser as an introduction for the app users to generate interest.

From the Erzgebirge to the world of cryptology

Teaser: "Berlin 1935: The Wehrmacht cryptologist Fritz Menzer negotiates with Boris Hagelin. How can Hagelin's machines be improved? A concept for the future cipher device 41 matures in Menzer's head. But how does a young man from the provinces end up in such a decisive position?"

Filming Locations: Herrndorf, Zug, Brand-Erbisdorf (Saxony), Buildings of former German High Command in Berlin.

Animated content: Menzer's work on the C-35/36 Hagelin machines, the meeting of Boris Hagelin with Menzer and other Wehrmacht officials at OKW/Chi[11], the use of Enigma in the German Wehrmacht, the outbreak of World War II.

[10]The 3D-Cipher project focuses on the investigation of cipher devices with computer tomography. More information can be taken from e.g. Göggerle (2022)

[11]See Svensson (2016), p. 27ff and TICOM I-31, p.6

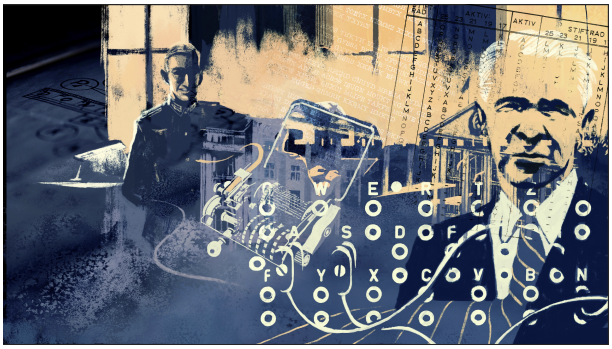


Figure 3: OKW/Chi negotiating with Boris Hagelin in 1935; designed by Cosimo Miorelli

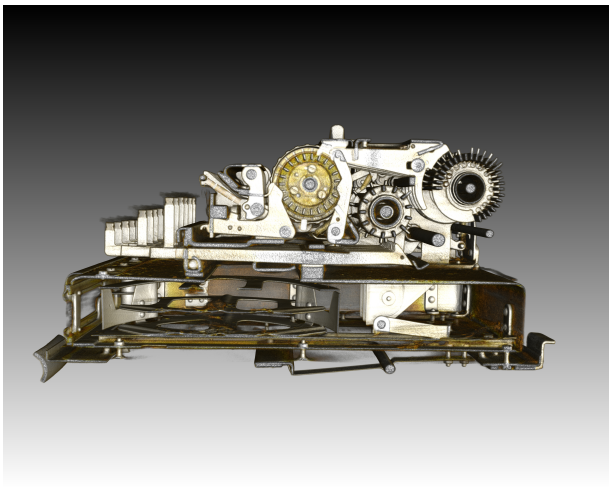


Figure 4: CT-scan of SG-41; scanned and processed at the EZRT, Fraunhofer IIS Fürth

With high-tech to the secrets of SG-41

Teaser: "For almost 80 years, the encryption mechanism of the cipher device 41 has not been fully revealed. And it was only detailed scan data from the 3D-Cipher project that unlocked SG-41's last secrets."

Filming location: Development Center X-Ray Technology EZRT, Fraunhofer IIS (Fürth, Germany)

Animated content: 3-D model of the SG-41.

Now Enigma must die

Teaser: "By the beginning of World War II, the Enigma was already obsolete technology. Fritz Menzer designs a new, secure machine to replace the Enigma. But how can this succeed?"

Filming locations: Buildings of former German High Command (Berlin), Wanderer Werke (Chemnitz), former Bunker of Wehrmacht High Command (Wünsdorf)

Animated content: Forced Labour of prisoners

Figure 5: Fritz Menzer at his desk at OKW/Chi; designed by Cosimo Miorelli

Figure 6: The train-ride of German cipher specialists to Austria in 1945; designed by Cosimo Miorelli

of war and prisoners of concentration camps at Wanderer Werke, the US-Air raid on Wanderer-Werke.

British codebreakers on Menzer's traces

Teaser: "Towards the end of World War II, the Bletchley Park codebreakers become aware of the new German cipher device. However, the British secret service had already been keeping a close eye on the inventor Fritz Menzer long before."

Filming location: Bletchley Park (UK)

Animated content: Menzer travelling to locations of the Abwehr in Europe. Menzer's connection to Admiral Canaris. The failed attempt to kill Hitler in 1944 and the assassination of Canaris. Menzer working on the SG-41.

On the run from the Allies

Teaser: "In 1945, British and American special forces search for German crypto experts before they fall into the hands of the Soviets. Target Intelligence Committee - TICOM for short - is the name of the secret project."

Filming locations: Former Bunker of Wehrmacht High Command (Wünsdorf), Werfen (Austria), Bad Aibling (Bavaria)

Animated content: the train-ride of German cipher specialists to Werfen (Austria), arrest of cipher-specialists and transport to POW camp in Bad Aibling (Bavaria). TICOM search for cipher equipment and documents, Menzer's release from POW camp.

A double agent and the secret prison

Teaser: "In 1947, the struggle between the victorious powers of the Second World War for the leading German cryptologists is in full swing. Fritz Menzer finds himself caught between the fronts of the emerging Cold War."

Figure 7: OKW/Chi dumps cipher equipment into the river Salzach in 1945; designed by Cosimo Miorelli

Filming location: Zschopau (Saxony), former secret prison of the Soviet Union in Dresden, surrounding of Berlin and Tempelhof Airfield (Berlin).

Animated content: Menzer in the secret prison of the Soviet Union in Dresden. Soviet officials searching for the prototype of the Schlüsselkasten in Zschopau. Menzers negotiations with the Soviets and his release. Menzers family escaping to Berlin.

New life, new secrets

"Fritz Menzer's ideas are incorporated into the new cipher machines that dominate the world market in the post-war period. However, he himself seems to have left the world of cryptology forever - or has he?"

Filming locations: Former Camp King in Oberursel (Hessen), Former buildung of Bundesschuldenverwaltung in Bad Homburg (Hessen) and Berlin-Tempelhof. Former NSA Intelligence Center at Tempelhof Airfield, former Intelligence Center at Teufelsberg (Berlin), grave of Fritz Menzer

Figure 8: Menzer being released from the army in June 1945; designed by Robert Jahn and Cosimo Miorelli

Figure 10: Menzer gets caught between the fronts of the two Cold War powers; designed by Cosimo Miorelli

Figure 9: Menzer being Sowjet prisoner of war in 1948; designed by Cosimo Miorelli

Figure 11: Menzer starts a new life; designed by Cosimo Miorelli

(Bad Homburg).

Animated content: former OKW/Chi personal working at Camp King in Oberursel (Hessen), Hagelins CX-52 and its connection to SG-41, Menzer caught in between between job offers of the US-Army, Bundeswehr and Stasi. Menzer as the founder of the punch card office of the Bundesschuldenverwaltung.

4.1 Additional Material

The medium app allows for additional material - sound recordings, interviews, specialist information and documents - with which the viewers can acquire even more knowledge for themselves. How can good storytelling be combined with the complex results of the scientific research on Fritz Menzer, and on German cryptology before, during and after World War II, and the role of cipher device SG-41? This was the challenge within this project.

The additional audiovisual and text-based material that is already included in the app will be supplemented within the next months and years. This means that on the one hand, museum visitors will be more and more able to deepen their knowledge in an interactive manner. On the other hand this process keeps the app-content up to date, as with further research, knowledge of Menzer's life and work and his role within German cryptology will widen. This aspect is crucial as there is still a wide range of German, Russian and American archival documents still classified, or in the process of declassification.

4.2 Time-travel

The aim of the study was to make the elaborate research about Fritz Menzer tangible as history. However, since the museum and the filmmaker are dealing with a largely secret world, there is naturally almost no historical visual material. Together with the Italian artist Cosimo Miorelli, a narrative level was therefore developed that creates moving images from the researched facts, historical documents and image fragments.

These images make it possible to immerse emotionally in the life and work of Fritz Menzer, and to explain better the historical backgrounds that influenced his life and actions. As well, this level

of imagery makes it possible to show war themes such as bombing, imprisonment and escape without neglecting important events, but also without making them seem idealised. The film series thus create an emotional narrative that combines the personal and the political. At the same time, it is completely fact-based. Miorelli's images were combined with on-site filming at original locations and with personal interviews, where the camera was operated by Thomas Keffel.

As well, the museum and the filmmaker owe the fact that Fritz Menzer's story can be told in a personal way to the trust of his relatives. They provided extensive private documents as well as pictures and sound recordings (Jackson, 2021; Langer, 2021; Kothe, 1998a; Kothe, 1998b).

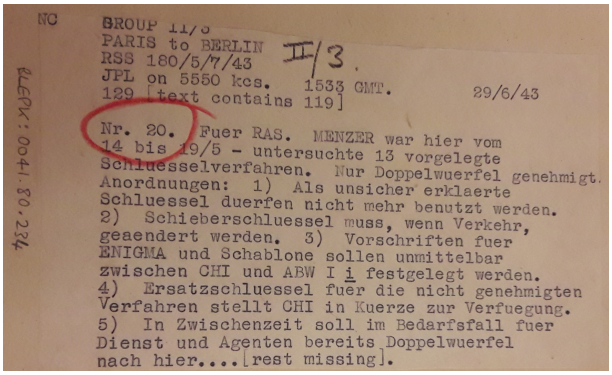
4.3 Coming to terms with a difficult period

The general public still knows very little about German cryptology during World War II. Most museum visitors are familiar with the deciphering (especially the British deciphering) of the Enigma because it has become the focus of attention through famous Hollywood films. However, few have delved deeper into the background, the various machines and the people who worked with these objects. The reason for this is that the German war generation kept silent during the post-war period and took their stories to the grave. As a result, very few eyewitness accounts of the events in cryptology have survived. An invaluable find of information is thus provided by the TICOM protocols and a few photos documenting this period.

As well, in 2021, this study came across documents in the Bletchley Park archives[12] showing that the British codebreakers had recognised Fritz Menzer's central role in German cryptology as early as 1943/44, and had reconstructed his travels through Europe - facts that were completely unknown in Germany until a few years ago.

And still, although there is historical research and publication in this field (Weierud and Zabell, 2019; Rezabek, 2020; Dahlke, 2020), there is hardly any well-founded, but rather very sensational reporting on German cryptologists and German cipher machines in the public media. Apparently, the great majority of the German press is not yet in a position to deal with this difficult chapter of history scientifically.

[12] HW 73/4: Personnel of OKW/CHI, https://discovery.nationalarchives.gov.uk/details/r/C11204798


NC
GROUP II/3
PARIS to BERLIN
RSS 180/5/7/43
JPL on 5550 kcs. 1533 GMT. 29/6/43
129 [text contains 119]

Nr. 20. Fuer RAS. MENZER war hier vom 14 bis 19/5 - untersuchte 13 vorgelegte Schluesselverfahren. Nur Doppelwuerfel genehmigt. Anordnungen: 1) Als unsicher erklaerte Schluessel duerfen nicht mehr benutzt werden. 2) Schieberschluessel muss, wenn Verkehr, geaendert werden. 3) Vorschriften fuer ENIGMA und Schablone sollen unmittelbar zwischen CHI und ABW I i festgelegt werden. 4) Ersatzschluessel fuer die nicht genehmigten Verfahren stellt CHI in Kuerze zur Verfuegung. 5) In Zwischenzeit soll im Bedarfsfall fuer Dienst und Agenten bereits Doppelwuerfel nach hier....[rest missing].

BLEPK: 0041.80.234

Figure 12: Archive material from Bletchley Park (UK): BLEPK:0041.80.234

This proves the importance of the work of museums. Neither can curators just put their collection in a display case and brag as if these were technical German masterpieces of World War II, nor should they hide them away in the depot and not talk about them (according to Kranzberg's first law of technology, see Kranzberg (1986)). The only way to exhibit these objects is through the context of the machines, the stories about the people of the time and the reasons why something was constructed. This is the only way German museums can come to terms with history and do justice to the interest and scientific aspirations of the third and fourth generation after the war, their main visitors.

4.4 Receptions

The creation of the cipher device 41 is, along with the biography of its inventor Fritz Menzer, an interesting opportunity to illuminate the German history of the 20th century with all its facets, including all its dark sides. The fact that SG-41 came into being at all was due to the weaknesses of the Enigma. The fact that it could no longer be of decisive use in National Socialist warfare is a great stroke of luck. And the fact that it played a decisive role in the development of post-war machines illustrates the continuity that existed in German politics and business after 1945.

The film series is available worldwide via the Deutsches Museum's new app. The voiceover texts are inserted in German and as well, there are subtitles in German and English. It is a kind of experiment to put the broad context to an exhibition on cryptology into such a medium. With the download numbers of the app, good results can be seen - the app is basically downloaded about 6600

times per month, and the Fritz Menzer story has been viewed 696 times since its release on the 8th November 2022 until 20th April 2023.

4.5 Outlook

Surprisingly, many of Menzer's colleagues from the Third Reich's various cipher bureaus continued to work for and with the victorious powers of World War II shortly after the end of the war. This opens up numerous new interesting stories for further investigations in the future.

For the time being, the films have only been released for the museum's app, as the Deutsches Museum and the filmmaker hope to attract a TV station to finance a proper documentary. As well, they have already received numerous requests to rent the films. The films have also already been accepted at film festivals. In the near future, a complete publication of all episodes on the internet is planned, not only with German voiceover, but also with an English version.

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