

**Friedrich Engel, Gerhard Kuper, Frank Bell**

**Zeitschichten: Magnetbandtechnik als Kulturträger. Erfinder-Biographien und Erfindungen.**

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There is not a misprint in the title: it is not (hi)stories (German: Zeitgeschichten) but time layers (German: Zeitschichten); the book makes use of the term 'time' meaning chronology but not history as a cultural-philosophical analysis.

The authors: Friedrich Engel worked for the BASF Corporation for many years. Fascinated by the magnetic tape technology and its history he has written many articles on magnetic tape and its application in a variety of publications. The focus of his contribution is the historical development of magnetic storage technology and magnetic tape in particular. Gerhard Kuper was head of the basic development division at AEG (Allgemeine Elektrizitätsgesellschaft) in Wedel near Hamburg where the so-called AEG magnetophones (tape recorders) were produced for a long time. His contribution concentrates on the technical problem solutions of the recording and replay equipment. Frank Bell, collector of sound studio and movie devices, is author of TV documentations. His contribution describes the introduction of magnetic tape in radio and TV at the NWDR broadcasting corporation (Nordwestdeutscher Rundfunk).

It is obvious that Friedrich Engel and Gerhard Kuper especially supplement each other ideally in their respective areas of knowledge. With BASF and AEG as background companies where magnetic tape recording started economically, it is understandable that both authors restrict themselves to the development in Germany - without losing sight of the international competitors.

The book is divided into nine chapters plus an introduction and a comprehensive credits chapter with explanations in tabular form, photo credits, register and a list of footnotes.

The first chapter "Vordenker und Pioniere" (Forerunners and factual pioneers) deals with the more than 50 years between 1878 and 1932 where we meet inventors and discoverers such as Oberlin Smith, Valdemar Poulsen, Curt Stille and Fritz Pfleumer, all of them engaged in magnetism and its possible applications but not yet able to formulate a conclusive scientific explanation of the phenomena of magnetism.

The collaboration of the two large-scale enterprises AEG (for the electro-mechanical part) and BASF (for the chemical part) in order to gain acceptance and market the findings they had obtained so far, leads over to chapter two "Die Ausformung der Magnettontechnik" (The shaping of the magnetic tape technology) about 1933 – 1945. This chapter describes the cumbersome way in which the technical difficulties had to be subdued (e.g. homogeneous tape against coated tape, or one-motor-drive against three-motor-drive principle) until the method of magnetic tape recording had been completely developed to a marketable product. The final break-through against the superior record succeeded from one moment to the next with the discovery of the high-frequency bias. At AEG, it was most of all Eduard Schueller

who, unlike any other person, full of imagination and unerringly pushed the development of the magnetic tape recording, whilst at BASF the components of the magnetic tape such as the base film, the magnetic particles and the binder were continuously improved.

The period from the end of WWII until 1960 is covered by the comprehensive third chapter “Die Jahrzehnte der Reife” (The decades of maturity). It begins with the transfer of the magnetophone as one of the spoils of war to the UK and especially the USA, where it was recognized as a high-grade sound recording system. First of all in the USA a rapid continuation of the improvement of the magnetic tape recorder took place; this was possible due to the international decontrol of the German patents and meant an immense advantage for US companies, affecting AEG and BASF adversely. As a consequence, AEG and BASF were increasingly confronted with an international competition in Europe and also from overseas. From about 1950 onward magnetic tape recording won through, at first in the USA, then worldwide and most of all in Europe, not only on the professional but also on the newly arising amateur market. As a supportive effect, a European standard for magnetic tapes was introduced in order to guarantee compatibility between tape and recorder, independent of the manufacturer.

The fourth chapter “Magnetton für Studio und Rundfunk” (Magnetic sound for recording studio and broadcasting) covers the professional sector between 1960 and 1990. The high requirements of the broadcasters with regard to tape speed, frequency response, dynamics, signal-to-noise ratio, print-through effect and such things compelled the manufacturers to continuously improve their products. However, considering the perfection already achieved, great strides were no longer possible. All AEG-Telefunken magnetophones of the post-war time, starting with the K8 type up to M21 type, are described. Also, competing machines up to the so-called ‘small tape decks’ such as the famous Maihak Reportofon are not omitted. At BASF, the PVC film base was replaced with the PE foil and for the first time back-coated tapes turned up. When AEG-Telefunken sold its magnetophone line to Studer, it became clear that the magnetic tape recording technology, at least in the analogue domain, exceeded its summit. Even the multi-track technology with up to 32 tracks was unable to change that tendency. The analogue magnetic tape was exhausted.

Not only broadcasting and record companies used magnetic sound as shown in the fifth chapter “Magnetton für Film und Fernsehen” (Magnetic sound for film and television). Magnetic sound for film advanced just after WWII as far as Hollywood but did not succeed finally in the movie theaters against photographic sound despite clear advantages. In contrast, magnetic sound gained followers quickly within the TV-film area and was eventually internationally standardized in 1972 as Timecode-system.

A special sixth chapter “Musik von Kassetten” (Music from cassettes) is dedicated to the Compact Cassette and its introduction, triumphant advance and universal use. The Compact Cassette was so successful because there was, on the one hand, an attractive offer of pre-recorded cassettes and, on the other hand, broad support from the set-producing industry thanks to the clever licensing policy of Philips, flanked by suitable standards. Also the replacement of iron dioxide by chromium dioxide as magnetic particles took a positive effect on the CC’s success.

The seventh chapter “Videoaufzeichnung” (Video recording) deals with the simultaneous recording of video and audio on magnetic tape. The race for the first fully functioning video recorder took place in the USA and was won by Ampex against strong competition of RCA and Bing Crosby Enterprises. The Ampex VR-1000 used rotating heads writing vertical tracks on a 2"-magnetic tape manufactured by 3M. The first 2" video recorder produced in Europe was launched ten years later by the German company Fernseh GmbH. From then things started happening: aside from the Telefunken TED videodisc (a pure outsider), machines using helical-scan tape processing with  $\alpha$ - and  $\Omega$ -wrapping in professional B- and C- formats were put on the market. Home systems such as VCR, U-matic, Betamax, VHS, Video 2000, Betacam SP, LVR, Video 8, Hi-8 and DV conquered the amateur market. In parallel, the magnetic tape was further developed from chromium dioxide through MP tape (metal particle, pure iron) towards ME tape (metal evaporated).

The eighth chapter “Technische Magnetbandspeicher” (Technical magnetic tape storage) is dedicated to the so-called instrumentation recorder used for the recording of measuring data, e.g. for air traffic control. Before that, magnetic storage devices for data recording such as the drum dump, the ferrite-core memory or disc-shaped stores (diskettes) were in use. Already in this phase there was a clear tendency towards the hard-disc superseding the magnetic tape storage.

The last chapter describes the magnetic tape entering the digital era. Due to the fact that its non-linear characteristic curve, which is extremely critical in the analogue domain, plays no part in the digital domain, things such as signal-to-noise ratio, modulation noise, print-through effect, sensitivity variations, frequency response, level control, crosstalk and the like are no longer measurable and, therefore, meaningless. And most of all: copying without any quality loss for almost as many generations as you like – this is possible in the digital domain only. The digital revolution is irresistible, no matter whether audio-, video- or any other signals have to be recorded.

The book is clearly written and understandable also for the layman; moreover, 3747 (!) footnotes give evidence that the book is, one should almost admiringly certify: meticulously researched, complemented richly by 624 illustrations. A variety of tables for different facts, among them pertinent patents, offers additional useful information (e.g. a table important for archival work “Unrecorded tapes, standard recording tapes, equalization curves”), and a comprehensive index facilitates the location of relevant text. \_

Conclusion: despite its proud price, this book is a must for everyone who is interested in or deals with magnetic recording and storage of sound and images.