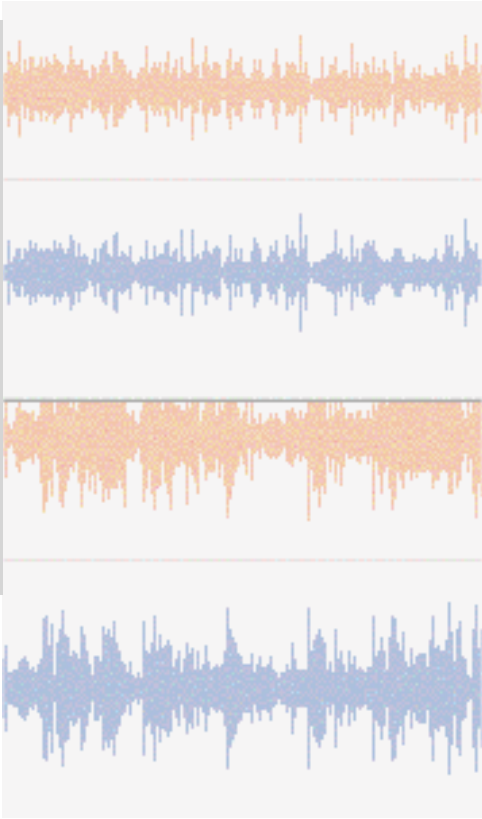
Digitisation of the Collection Armando Leça: A contribution to the history of magnetic recording in the field between 1939-40



Nadja Wallaszkovits
with contributions by Friedrich Engel, Gerhard Kuper

135th AES Convention New York, 2013

Nadja Wallaszkovits

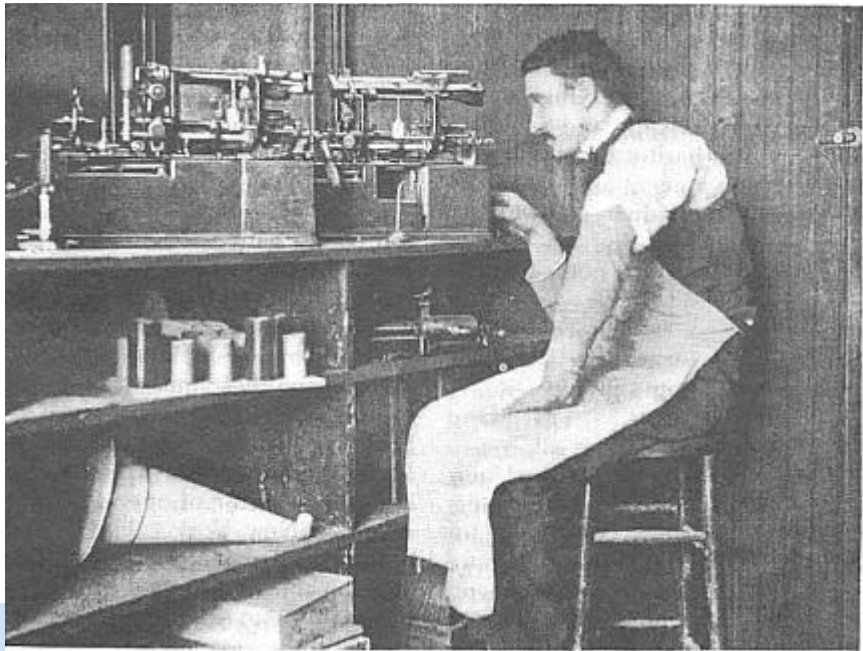
History of Field Recording Technology: A (very) short summary

Jesse Walter Fewkes: Passamaquoddy Cylinder Collection, March 1890

Frances Densmore recording Mountain Chief, 1916

Cylinder Recordings

- Disadvantages: every replay – loss of signal quality
- In the very early days: no possibility of copying without dramatic loss of quality of the original as well as of the copy (mechanical coupling of the replay and recording styli by use of a pantograph)



Gianni Bettini

Acoustical Recordings on Discs

- Disadvantages: heavy weight
- Recording pickups for Berliner grammophone were not available at the market
- Both systems: had to be positioned absolutely even, otherwise cutting errors, speed errors, etc.

Wiener Archivphonograph type V,
original, metal negative and copy

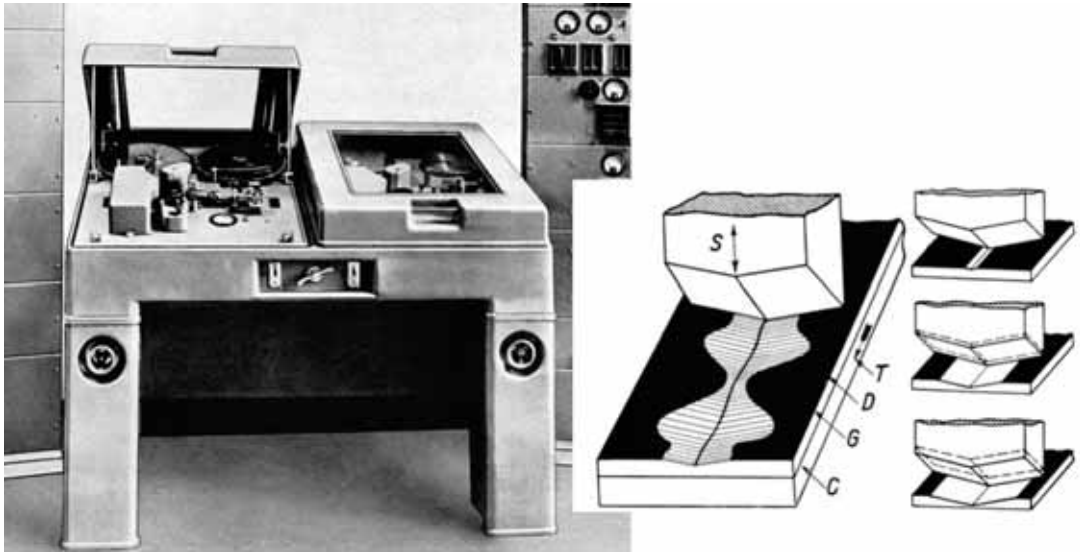
Rudolf Pöch, Baifa men,
Kalahari 1906
Archivphonograph type III

Electrical Recordings on Discs

Neumann disc cutting machine

portable version for instantaneous discs

Alternative Systems…



Philips-Miller recording system, mix of mechanical recording and optical reading

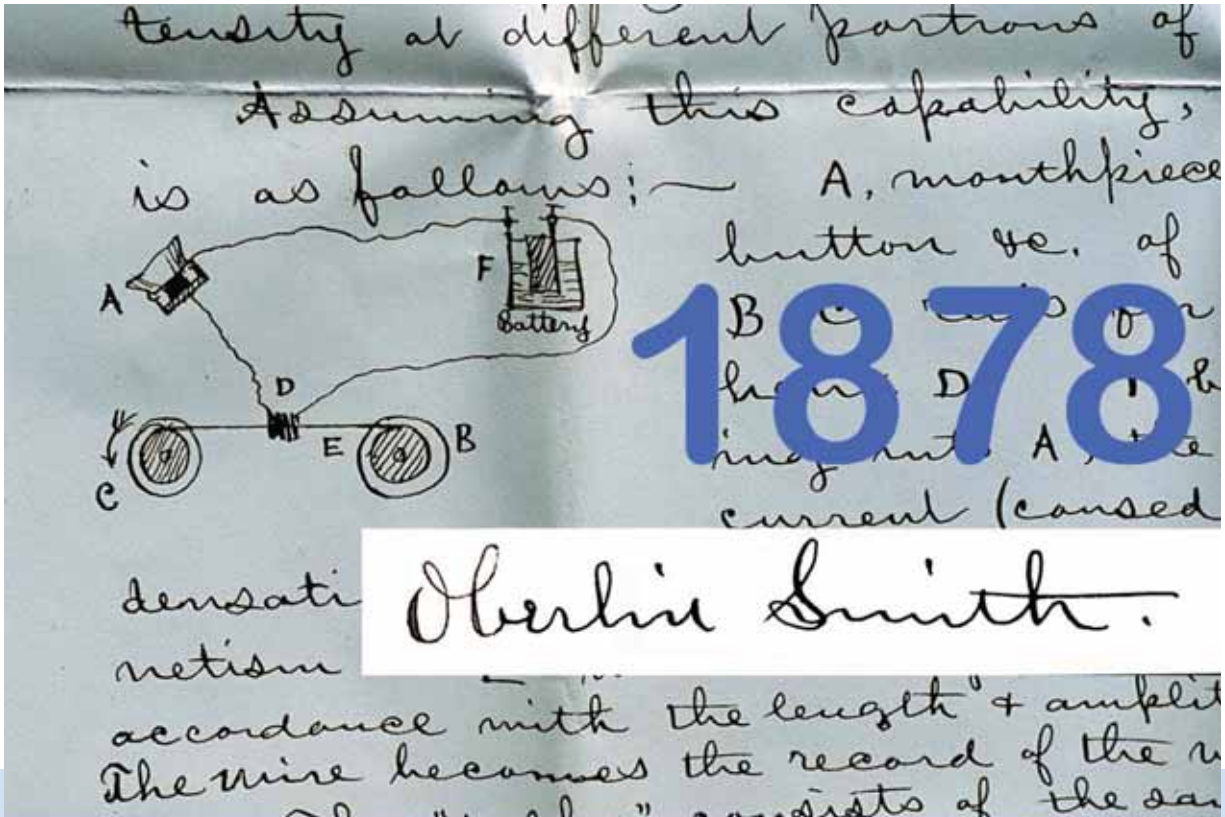
Expensive, not usable in the field

Disadvantages:

- Short recording time (up to ~ 4min)
- Both systems: had to be positioned absolutely even and vibration-free, otherwise cutting errors, speed errors, etc…
- Wax media could only be replayed very few times, otherwise loss of signal quality

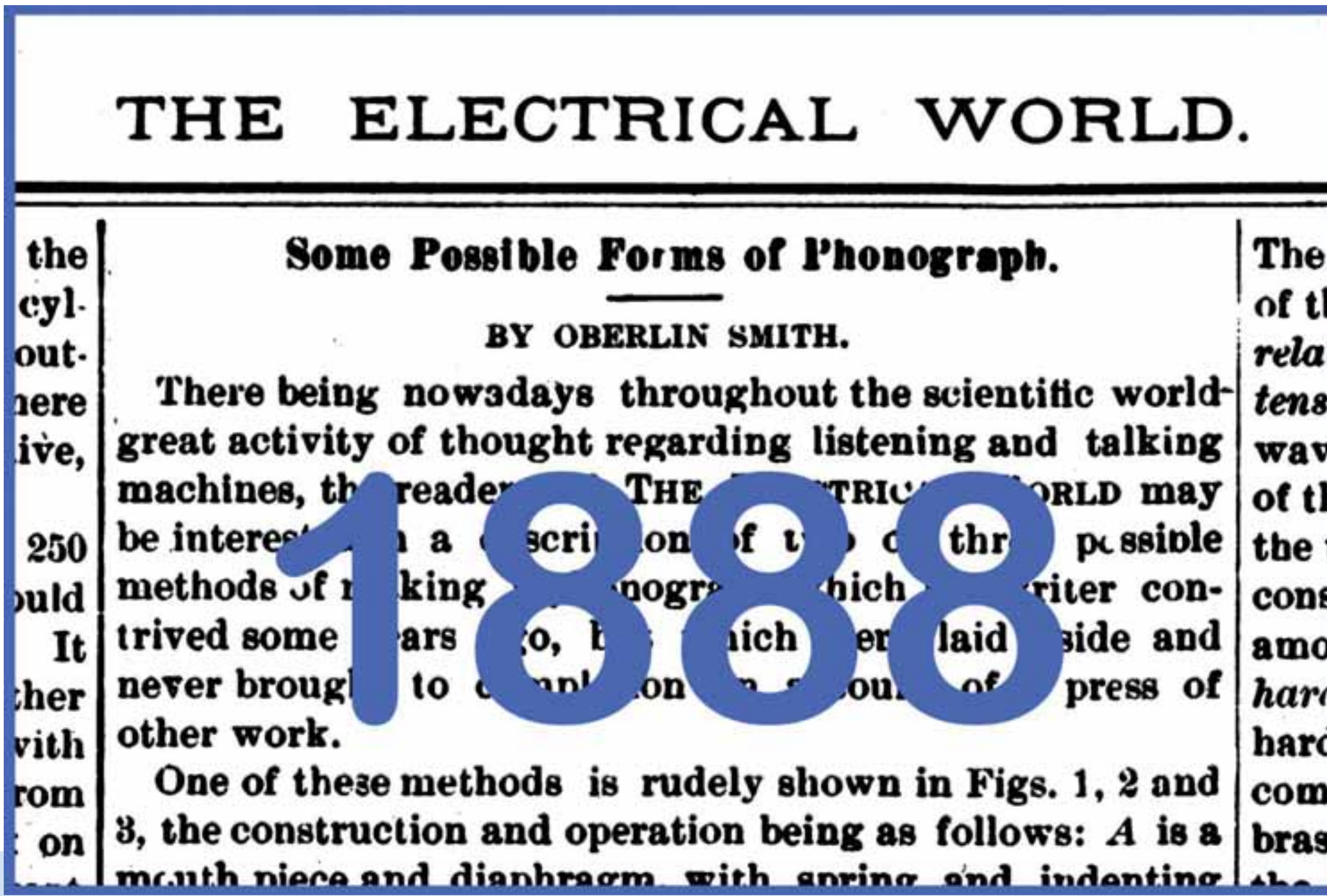
- Mechanical recording was the dominating recording technology in the field between 1890 and the middle of the1930‘s

- Alternative system of **magnetic recording** needed nearly 50 years to be established…



- 10 years later published in a well known journal

…without reflection…



THE ELECTRICAL WORLD.

Some Possible Forms of Phonograph.

BY OBERLIN SMITH.

There being nowadays throughout the scientific world great activity of thought regarding listening and talking machines, th[illegible] reade[illegible] THE [illegible] may be interes[illegible] a [illegible]scri[illegible]on [illegible] thr[illegible] possible methods of [illegible]king [illegible]nogr[illegible] [illegible]hich [illegible]riter con-trived some [illegible]ars [illegible]o, [illegible] [illegible]ich [illegible] laid [illegible]side and never broug[illegible] to [illegible]on [illegible] press of other work.

One of these methods is rudely shown in Figs. 1, 2 and 3, the construction and operation being as follows: *A* is a mouth piece and diaphragm with spring and indenting

…needed another 10 years (1898/1902) to be realized by Valdemar Poulsen and his employees:

- Magnetic recording was described on media as wire, steel tape, and even….

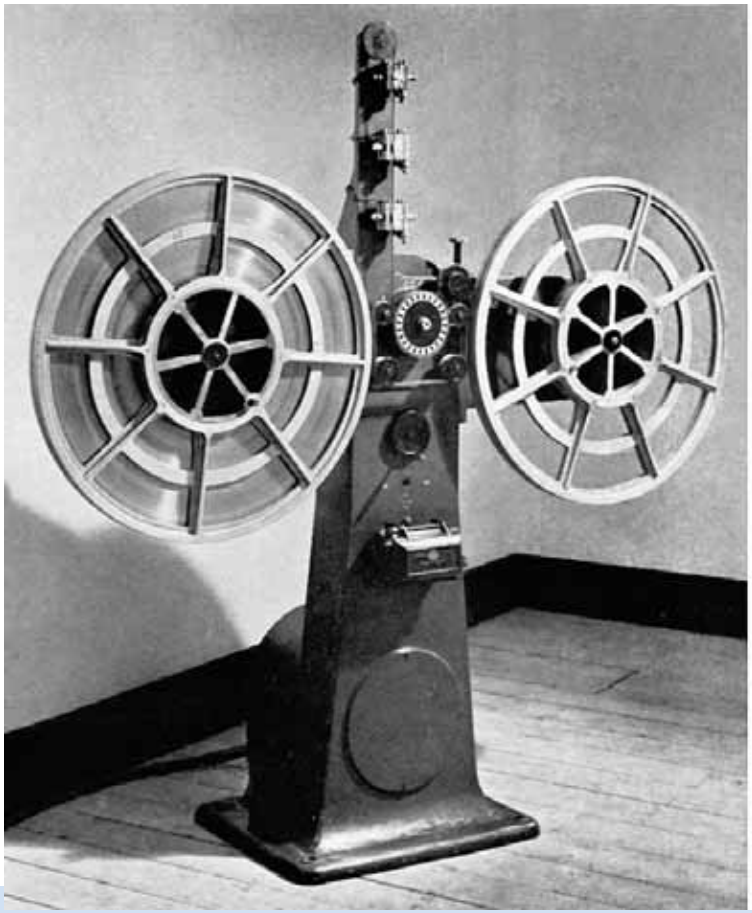
… for discs!

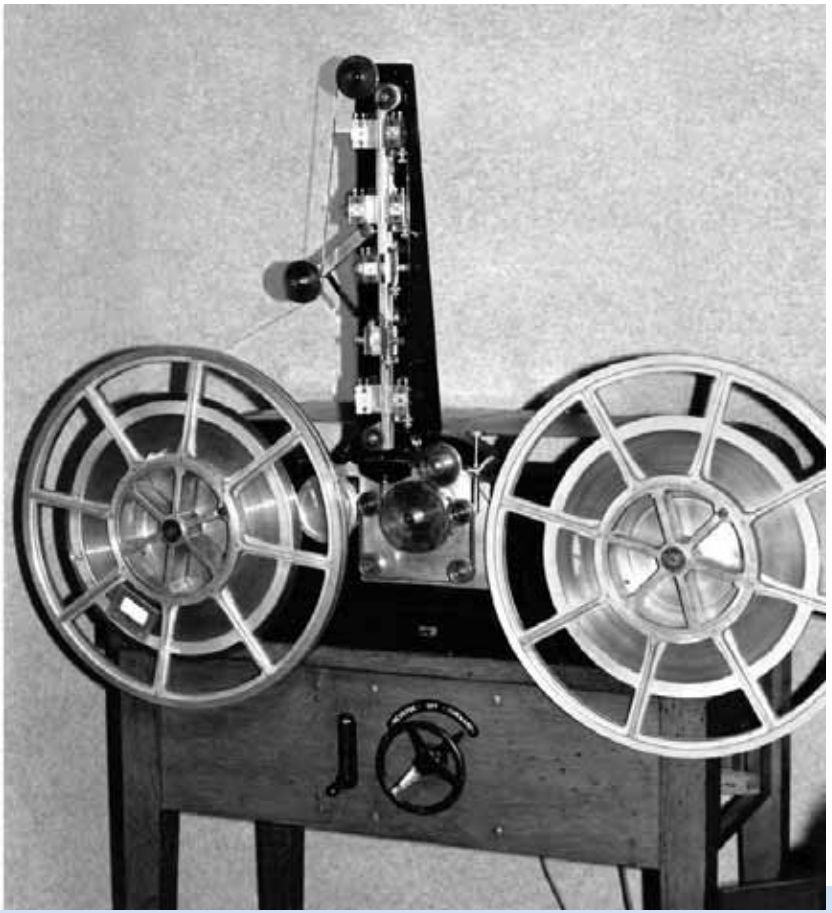
Magnetic hard disc, preferred storage medium until now, is a invention of the year 1903!

Disadvantage of the early magnetic recording systems:

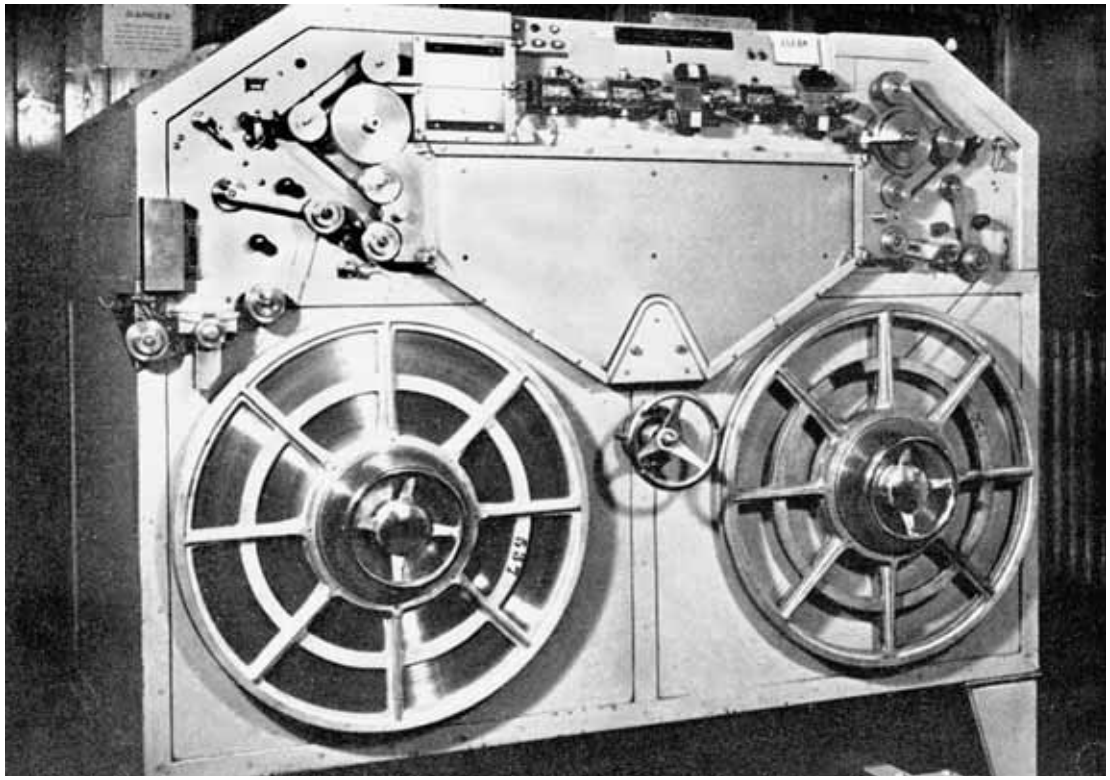
- Very low playback level due to lack of (affordable) amplifiers
- This situation changed substantially with the extension of radio broadcasting

- 1929 Curt Stille: steel tape recorder
- Financed by his partner Ludwig Blattner, who handed over the property rights to British Marconi Wireless Telegraph Co.Ltd





- 1932 steel tape recording was first introduced by BBC, later by radio stations in Europe, Canada and Australia
- In use until 1950‘s



Marconi MSR 3
weight: 450 kg

DEUTSCHES REICH

AUSGEGEBEN AM
26. JUNI 1930

REICHSPATENTAMT

PATENTSCHRIFT

№ 500900

KLASSE 42g GRUPPE ~~17~~ 10

P 57028 IX/42g

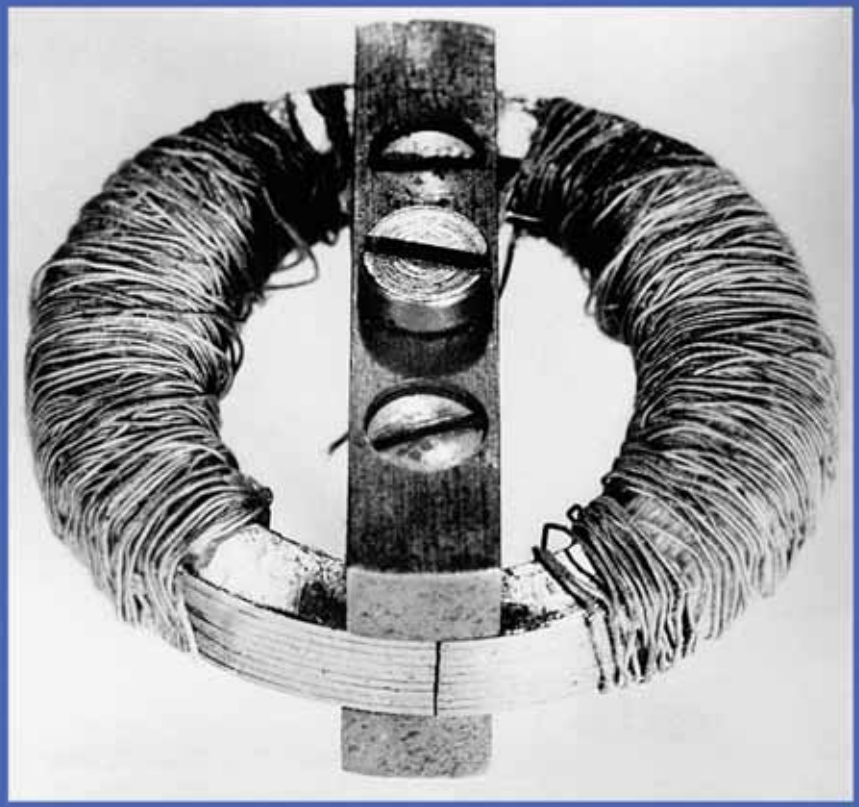
Tag der Bekanntmachung über die Erteilung des Patents: 5. Juni 1930

Fritz Pfleumer in Dresden

Lautschriftträger

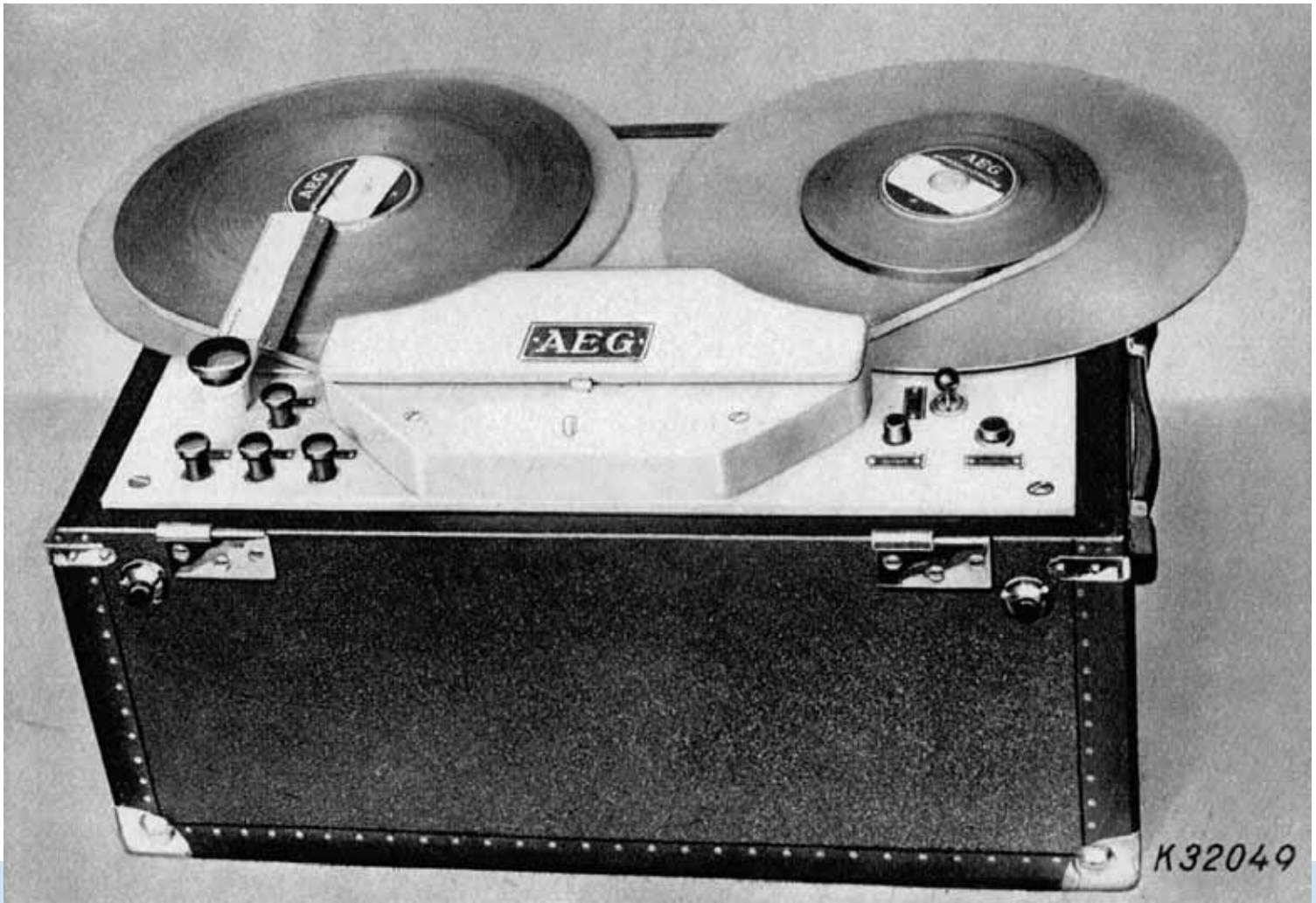
Patentiert im Deutschen Reiche vom 31. Januar 1928 ab

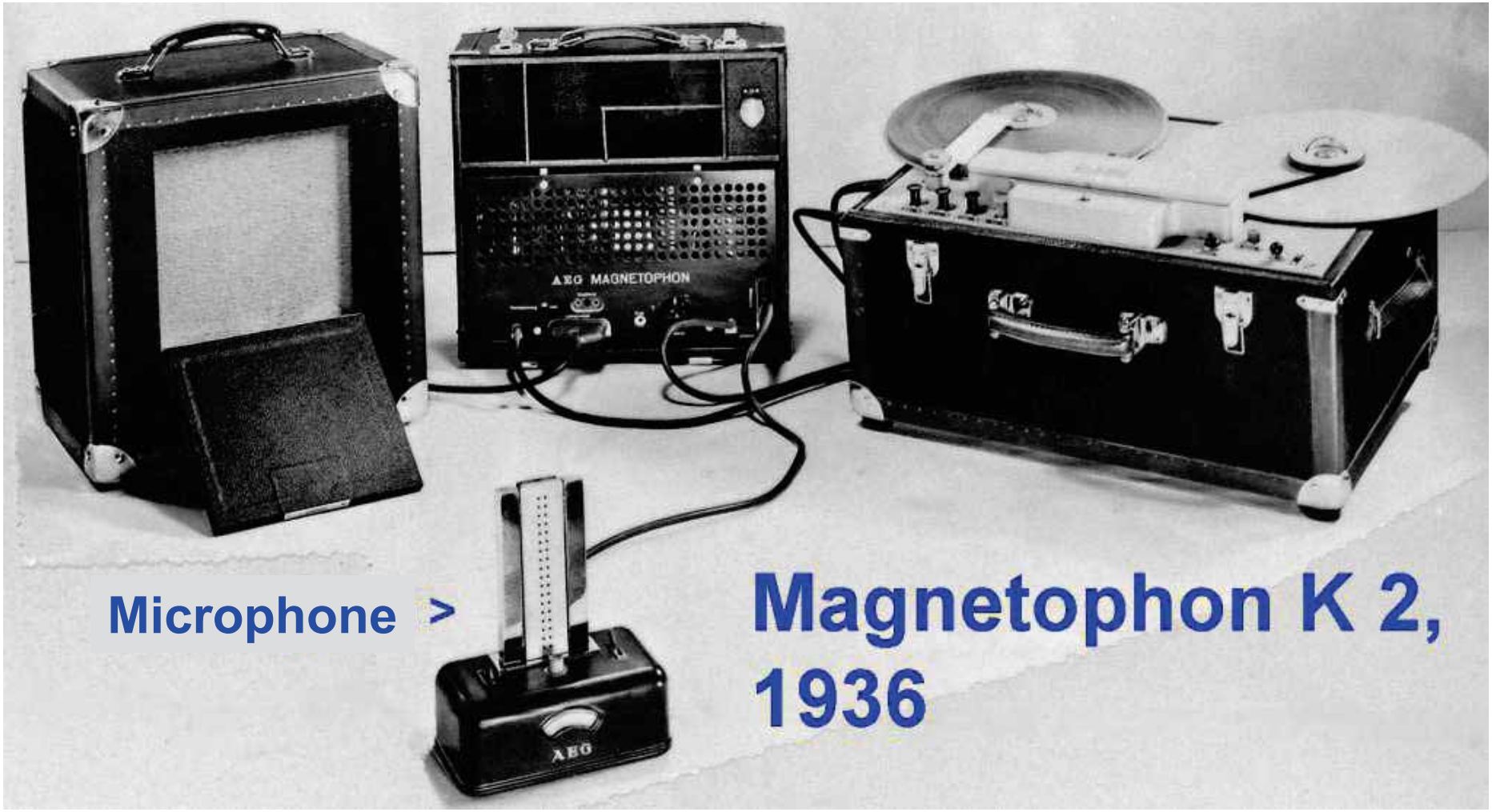
Tönendes Papier. Der Dresdener Ingenieur Pfleumer hat ein billiges Verfahren gefunden, Töne auf Papier zu fixieren. — Auf 2 Drehscheiben bewegt sich ein Streifen Papier, ähnlich wie das Farbband der Schreibmaschine. Der Streifen besitzt einen Ueberzug von Stahlstaub und gleitet an einem Magneten vorüber. Die in Magnetismus transformierten Töne magnetisieren bei der Aufnahme den Stahlstaub. Bei der Wiedergabe wirken die magnetisierten Stäubchen, die jahrelang das Lautbild festhalten, auf den Elektromagneten ein; die Schwankungen des Magnetismus werden alsdann durch Geräte, die dem Instrumentarium des Rundfunks entnommen sind, in Töne zurückgebildet. — Eine 300 m lange Rolle des von Pfleumer erfundenen Lautschriftträgers, der eine 20-Minuten-Tonaufnahme erlaubt, läßt sich für etwa M 1.50 herstellen. Streifen, die schon 500mal gelaufen sind, zeigen keinerlei Abnutzung. Instrumentalmusik, Gesang, Orgelspiel usw. kommen klar wieder. Das Papier (Pergamyn) hat nur eine Stärke von einem vierzigstel Millimeter. — Durch Ueberstreichen mit einem Magneten kann das Tonbild gelöscht werden, und das Papierband ist dann zu einer Neuaufnahme bereit. Im Apparat erfolgt die Löschung zugleich mit der Neuaufnahme. Phot. Ströhla



1933

1935



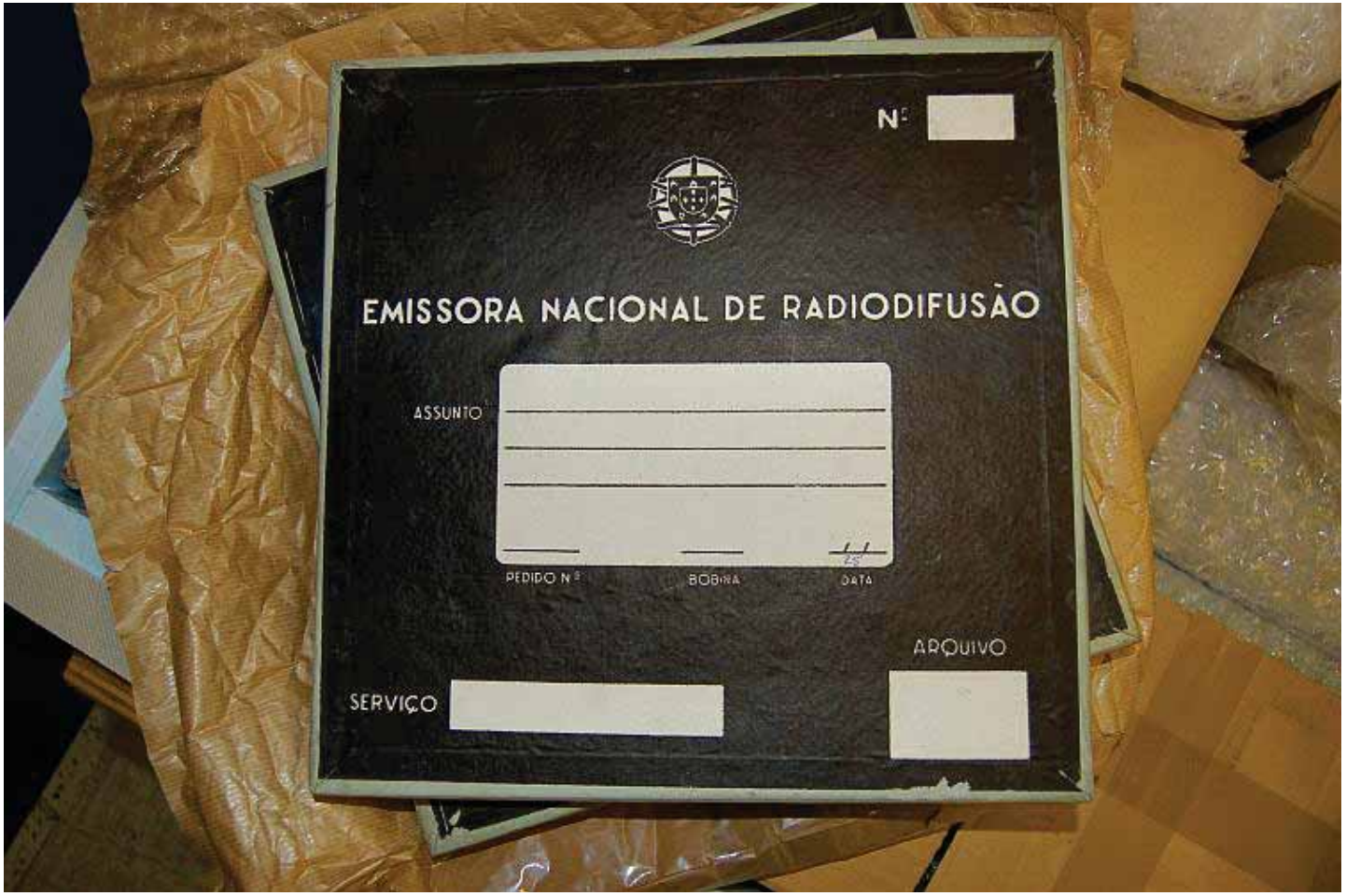

AEG MAGNETOPHON
AEG
Microphone >
Magnetophon K 2,
1936

The Collection Armando Leça, recorded Nov. 1939- April 1940, AEG Magnetophon K4 Serial nr. 1260

Armando Leça
1893-1977


AEG
MAGNETOPHON

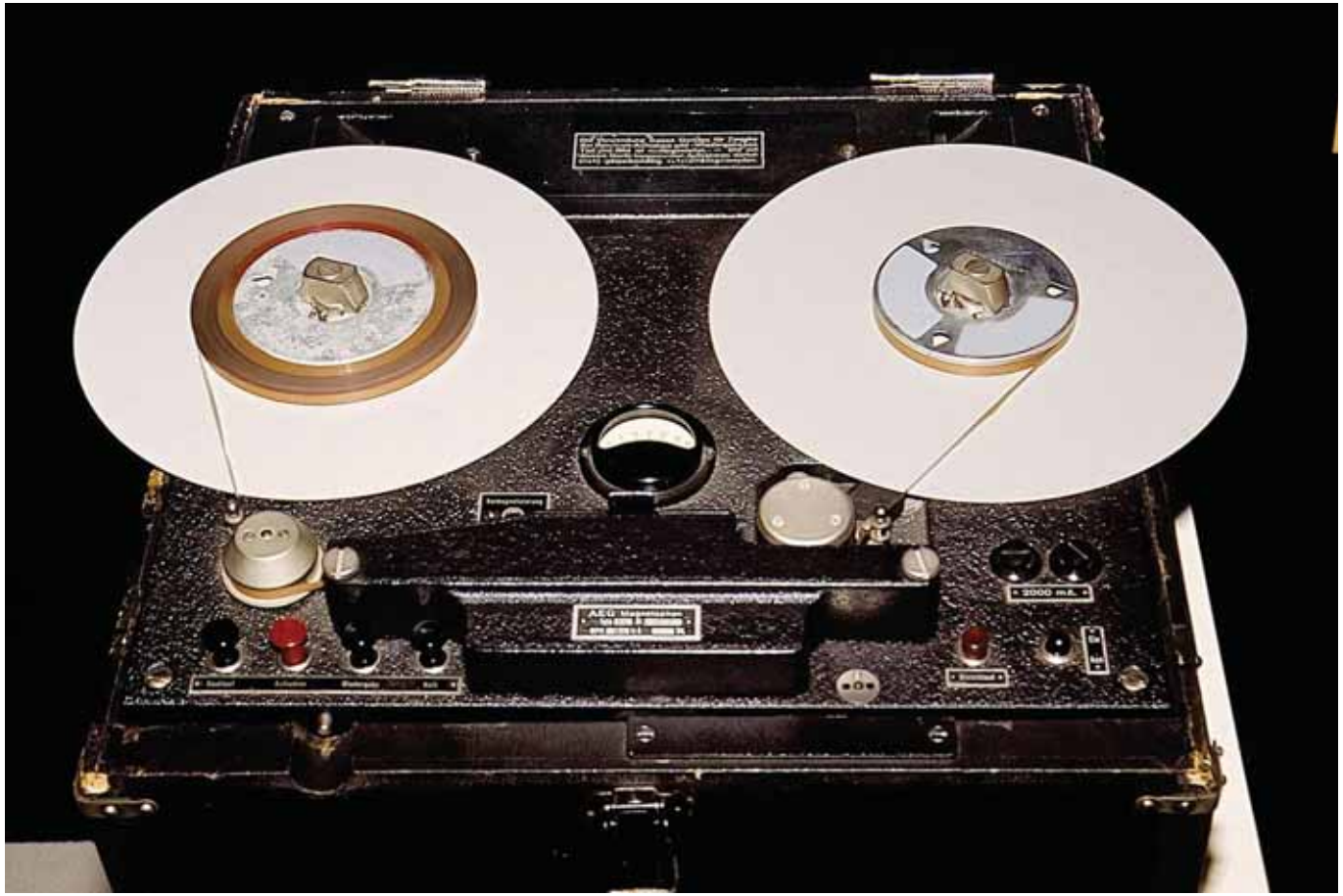

FRAGIL

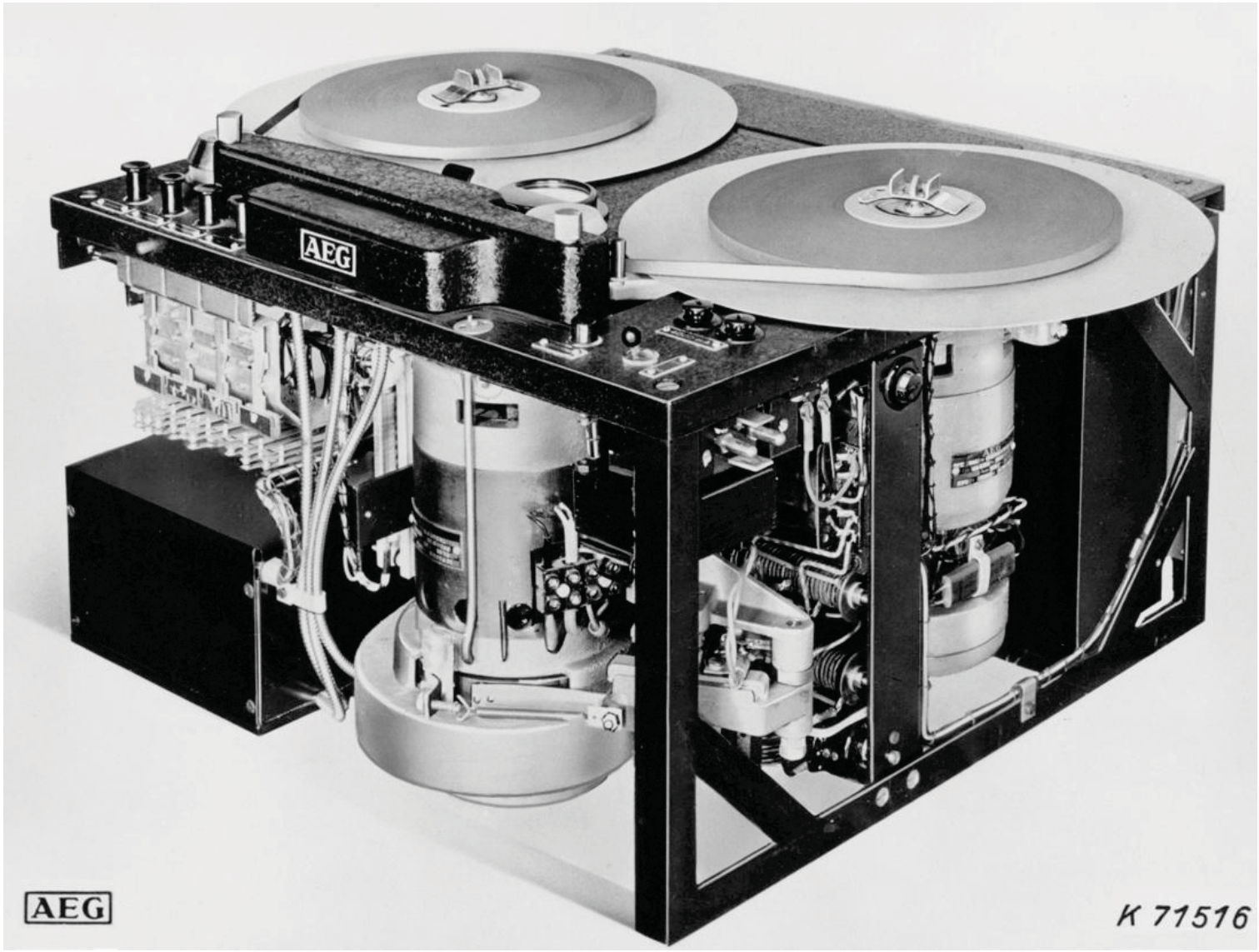

Nº
EMISSORA NACIONAL DE RADIODIFUSÃO
ASSUNTO
PEDIDO Nº
BOBINA
DATA
ARQUIVO
SERVIÇO

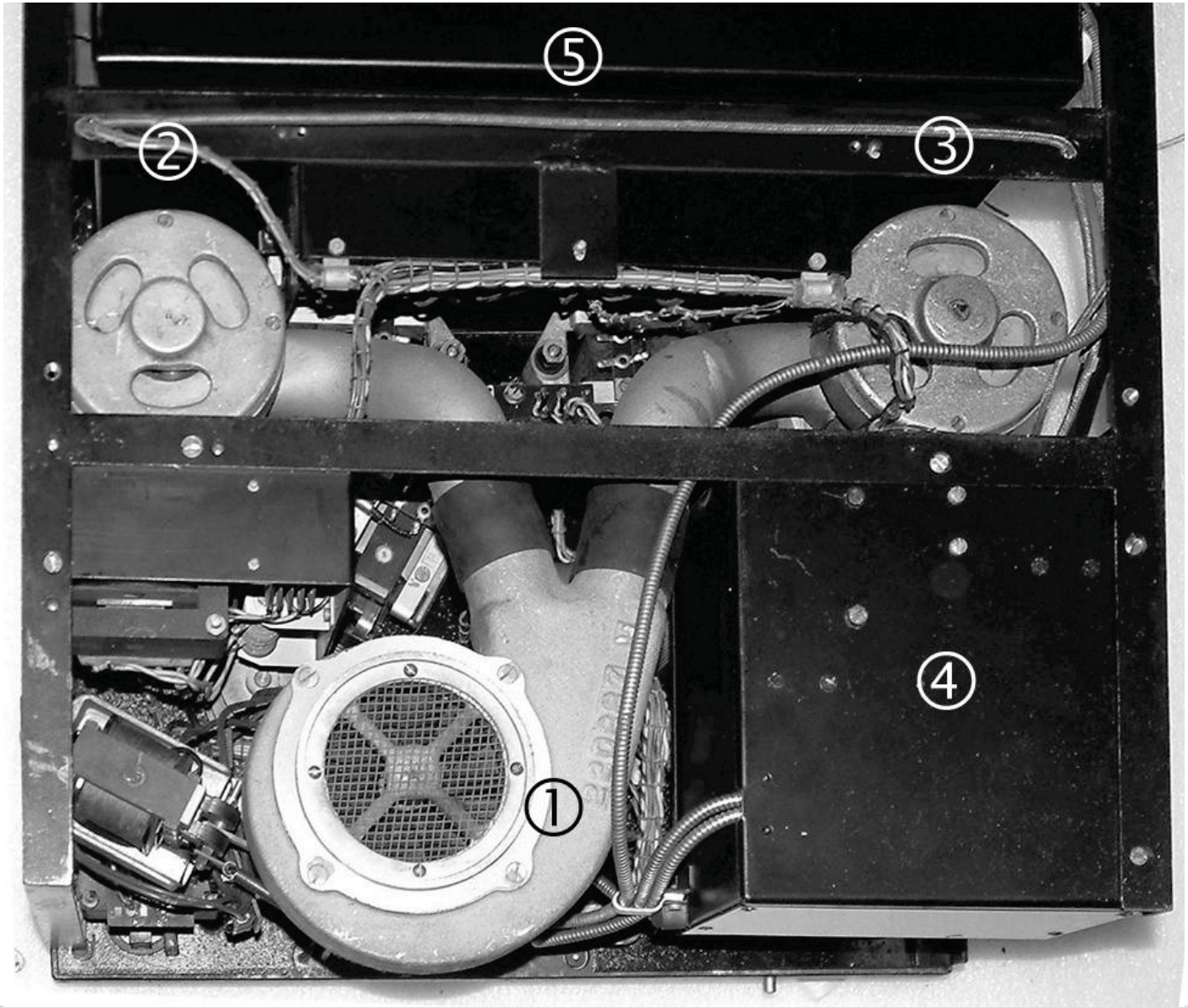
Overview: magnetic tape recording in the field

1936	Wolfgang Sichardt, Switzerland	Magnetophon K2
1939	Leandro Mazzoni, Albania	Magnetophon K6
1939/40	Armando Leça, Portugal	Magnetophon K4 (ser. Nr. 1260)
1940/43	Alfred Quellmalz, Southern Tyrolia	Magnetophon K4 (ser. Nr. 1297)


1939
Magnetophon Koffergerät
Modell K4


2000 mA


AEG
AEG
K 71516


⑤
②
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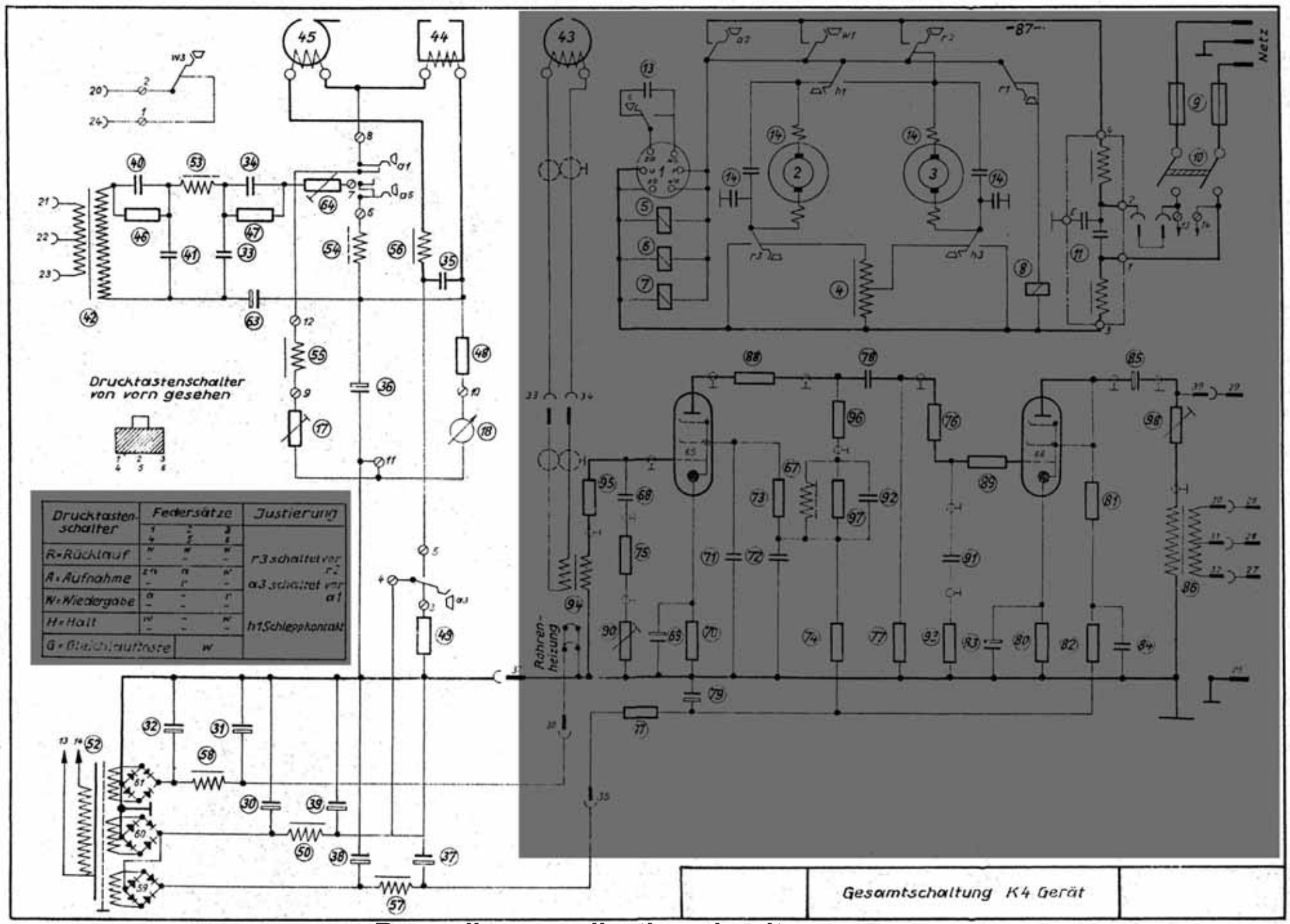
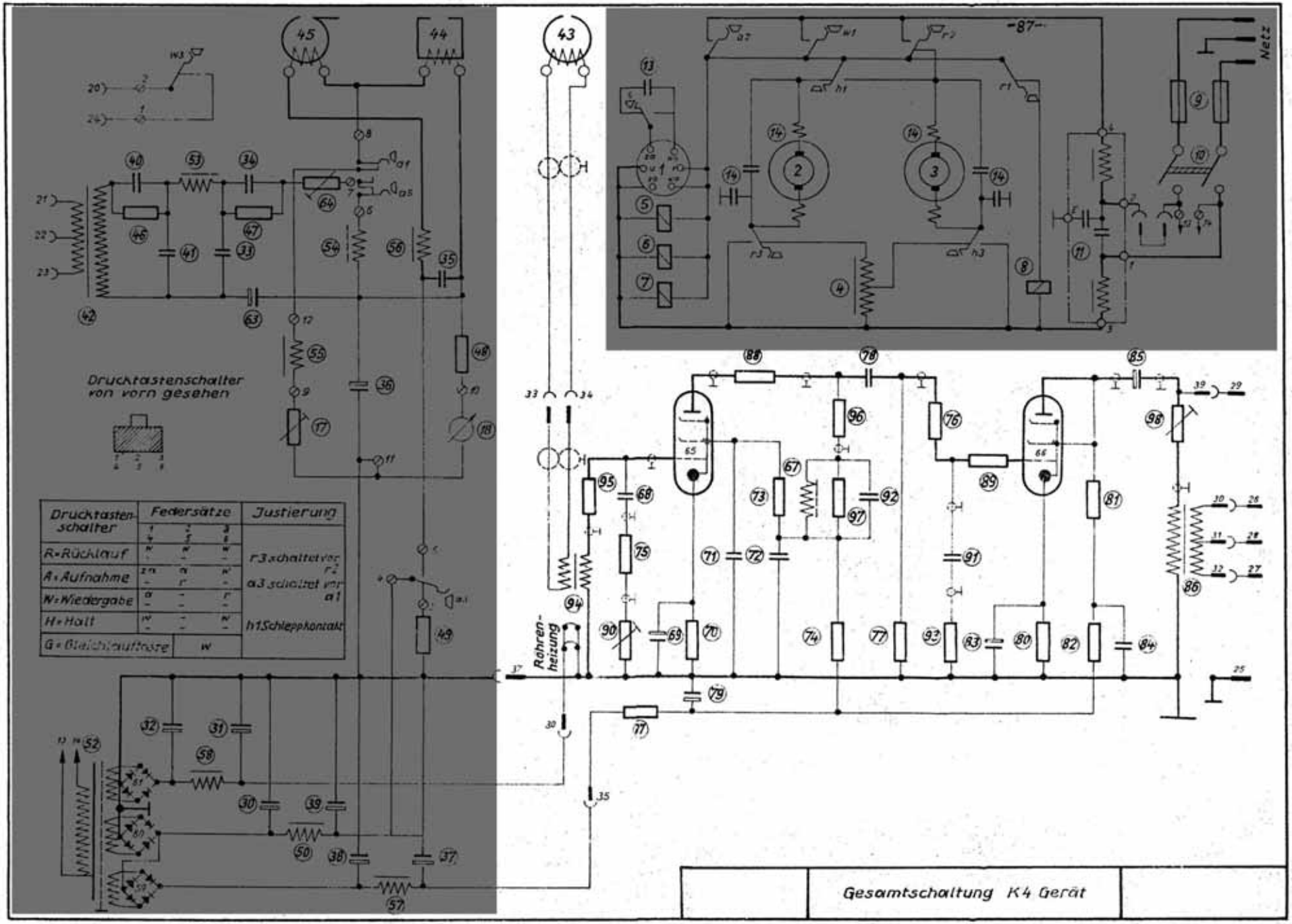
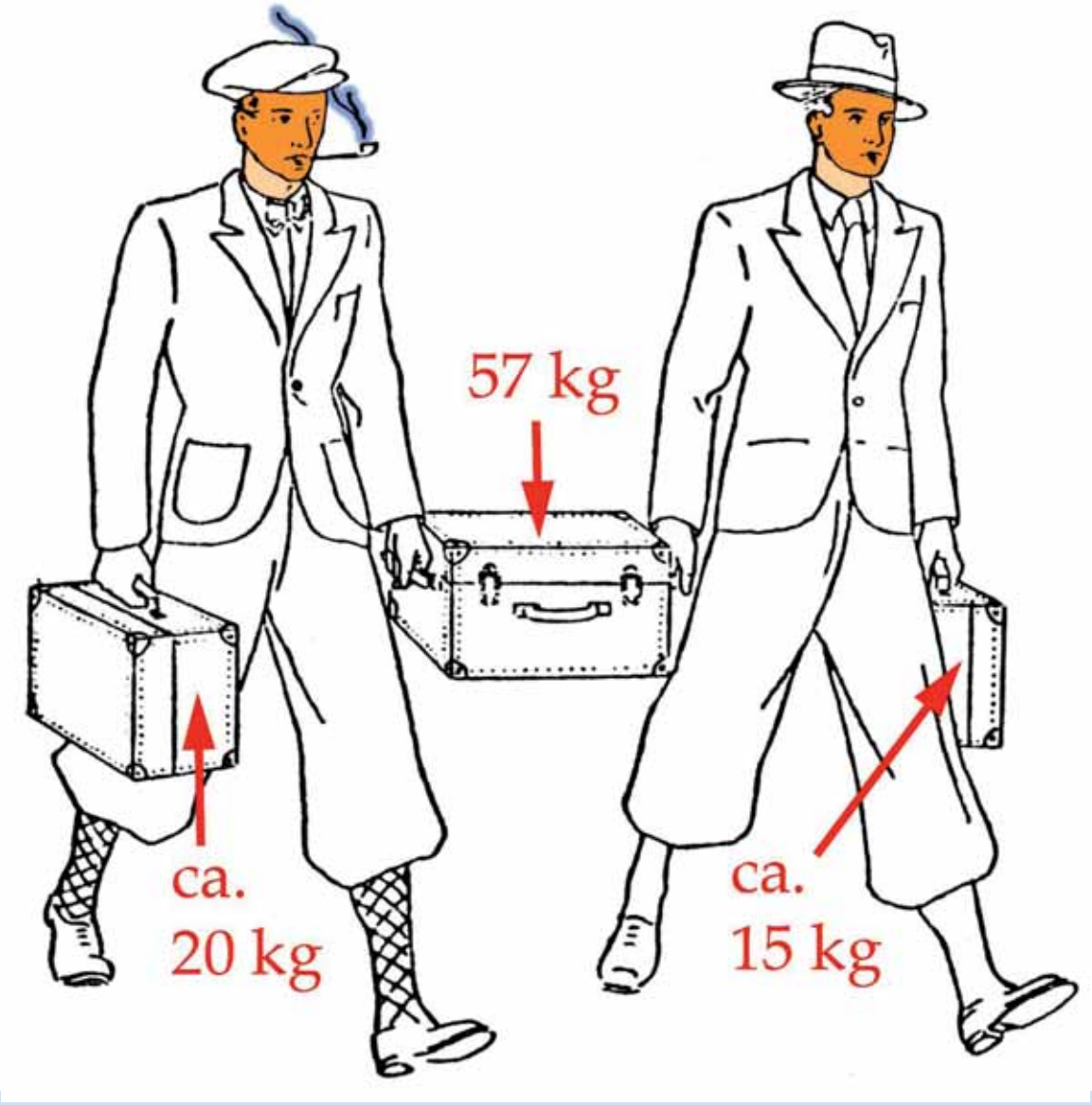


Recording equalization circuit



Playback equalization circuit


AEG MAGNETOPHON
Type
Nr.
V ~
Watt
Kopfhörer-Kontrolle
Aus
Lautsprecher
Erde
Lautstärke
Klangfarbe

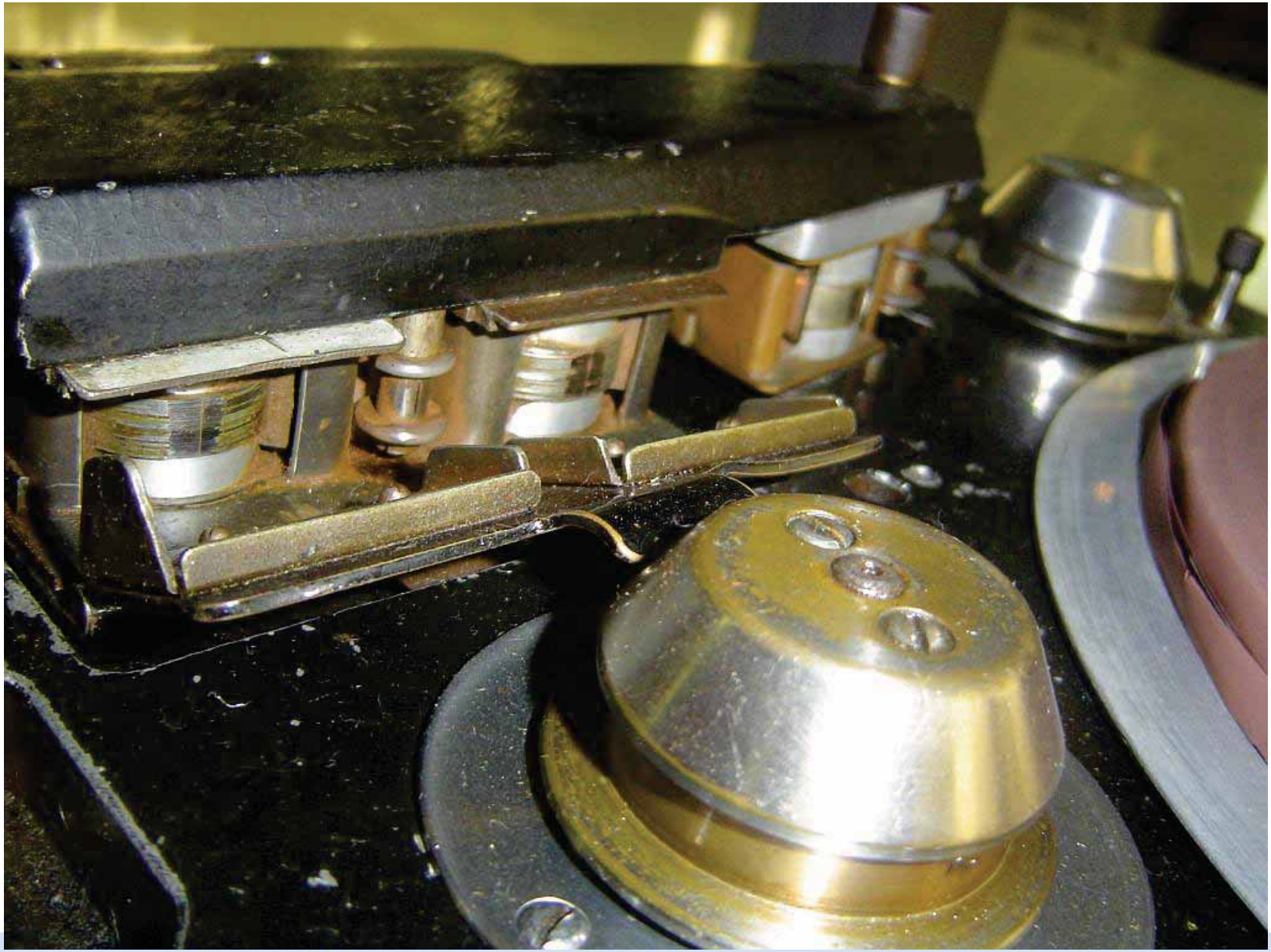

57 kg
ca.
20 kg
ca.
15 kg

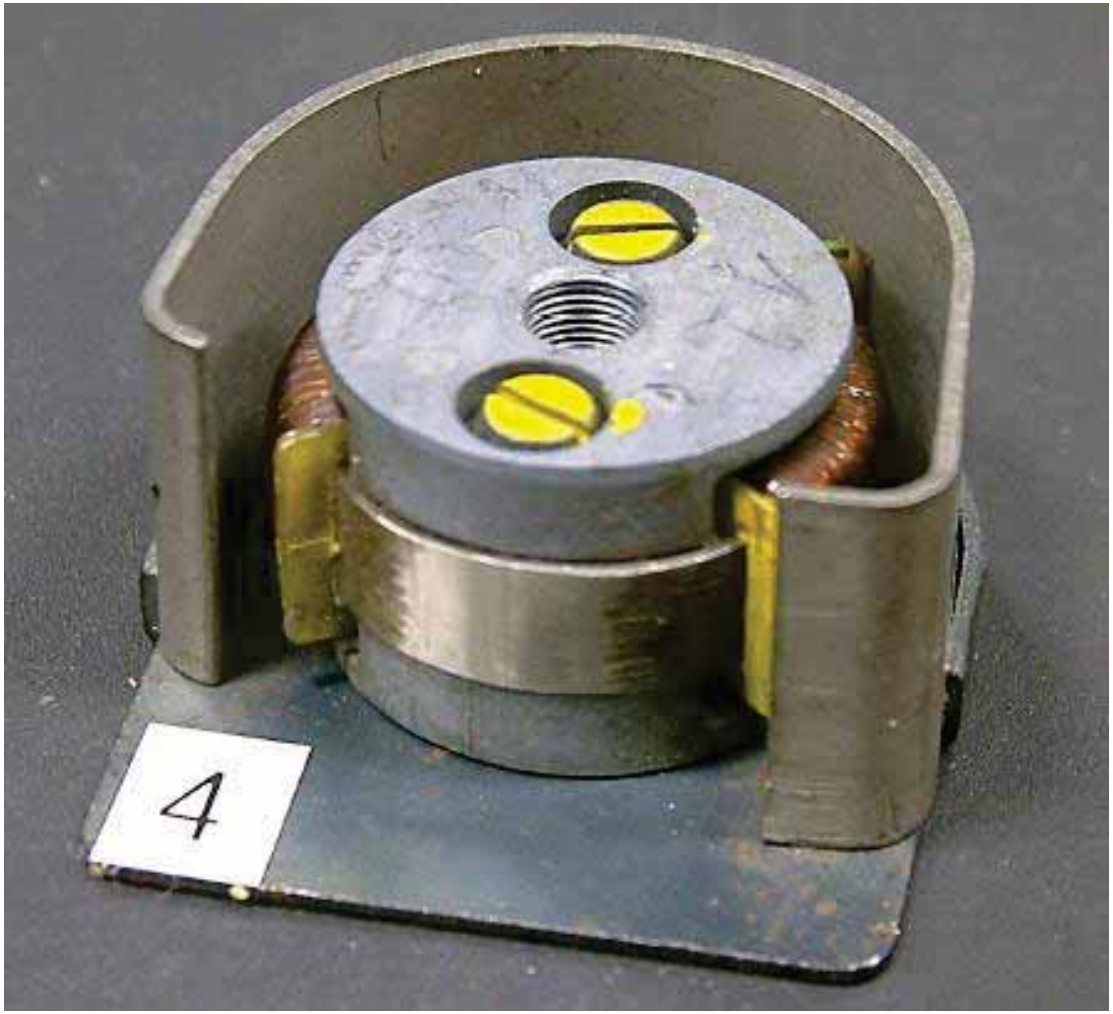
AEG K4 “special”, Ser.Nr. 3020

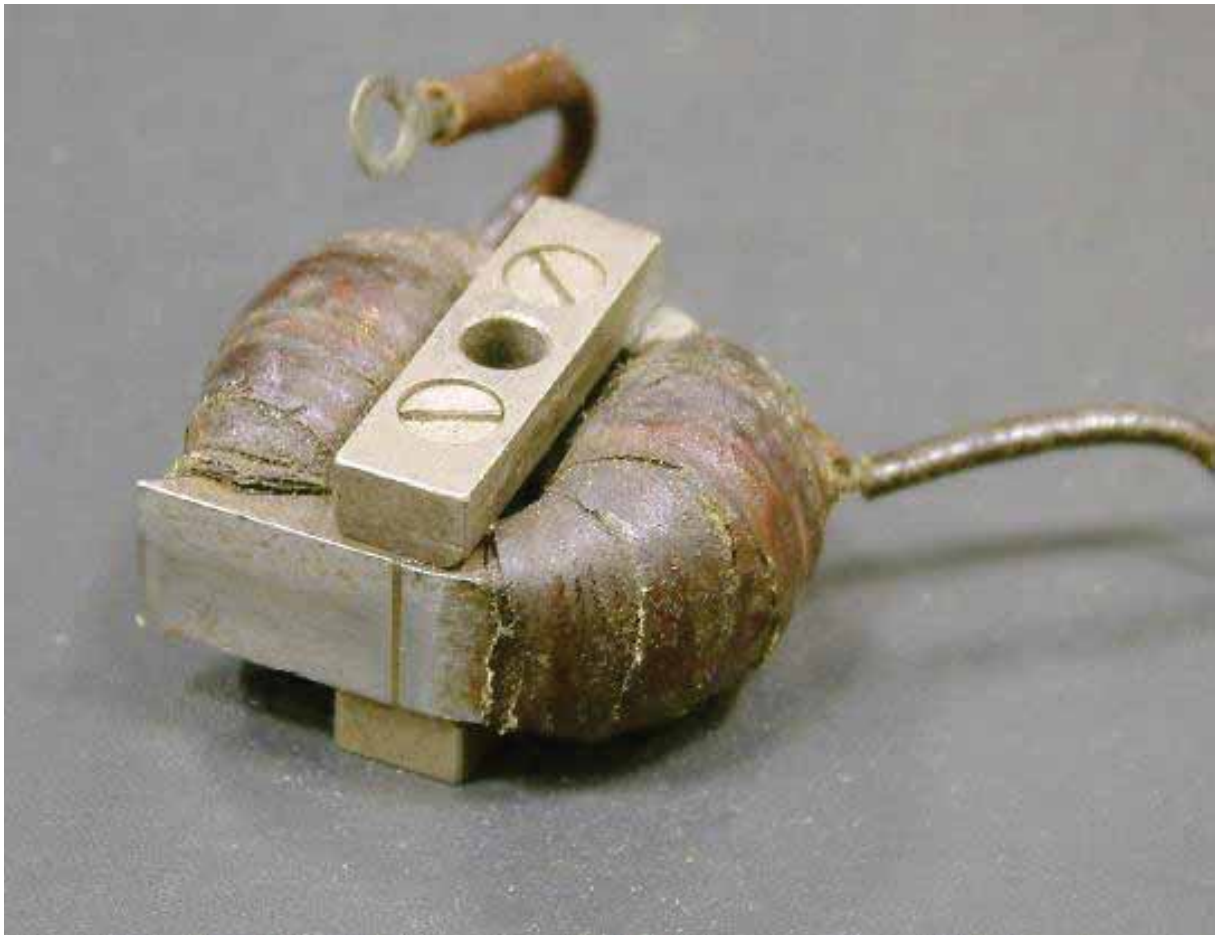
1946 designed for German national postal authority “Deutsche Reichspost”, later brought to San Francisco in 1947/48 by Jack Mullin

Nadja Wallaszkovits

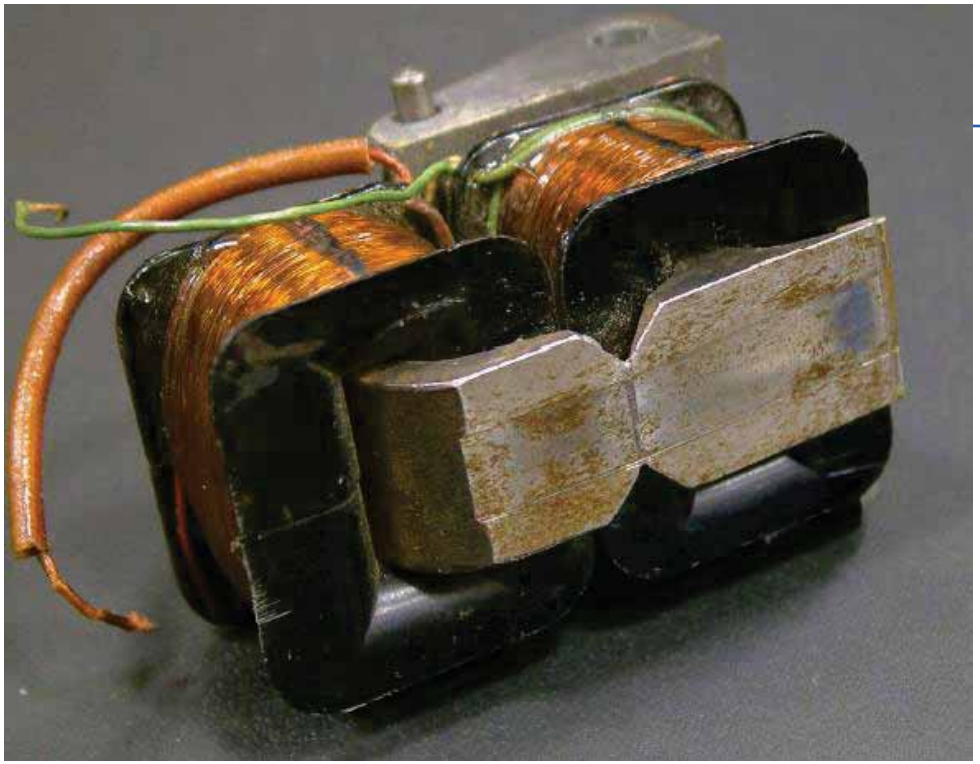
Why does it sound as it sounds?
Armando Leças machine – a prototype




4



Schüller-Müller-Ernesti erase head



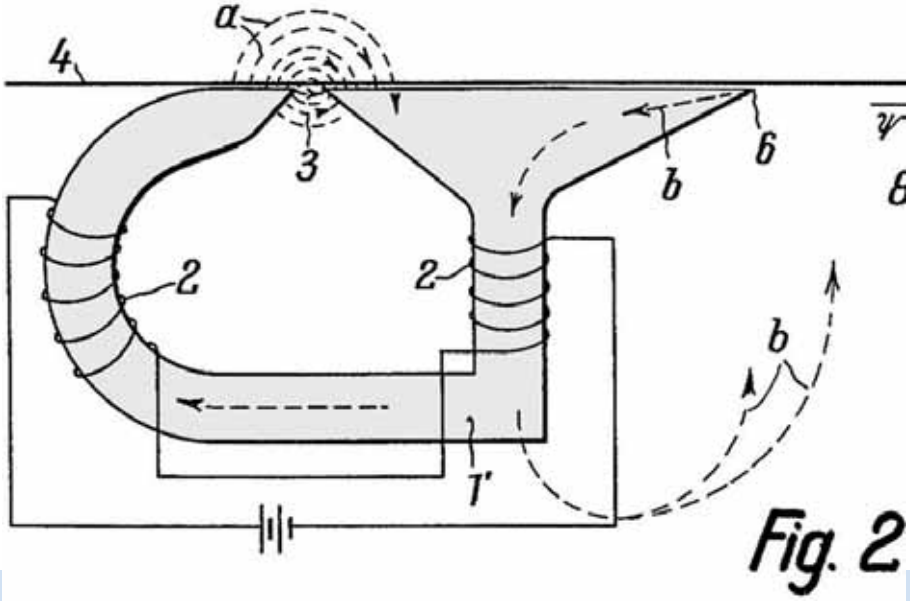


Fig. 2

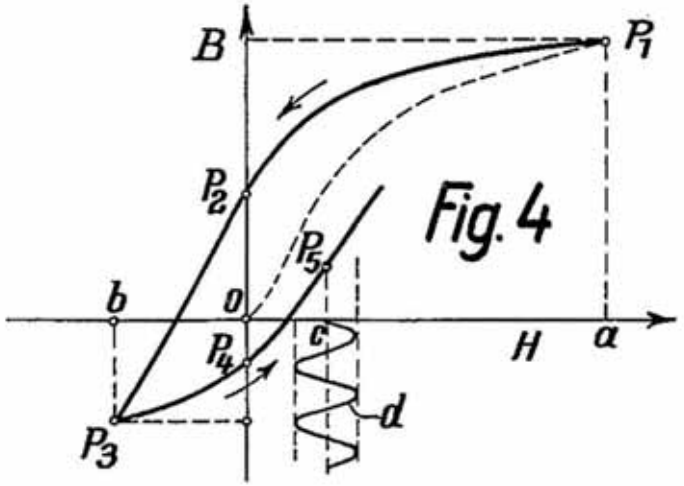
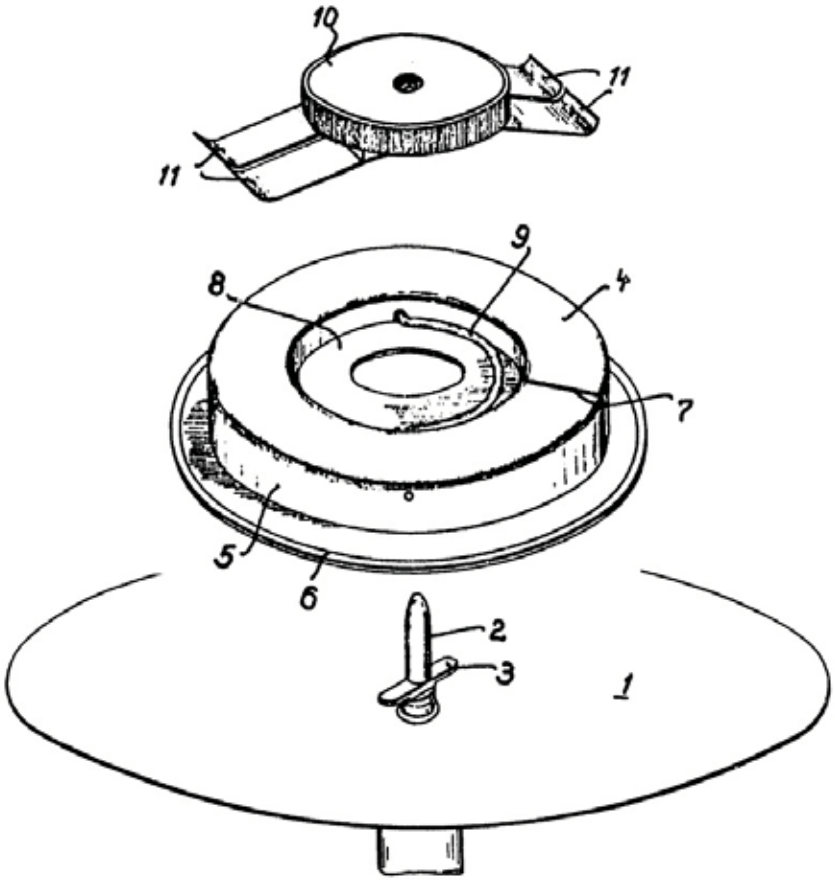
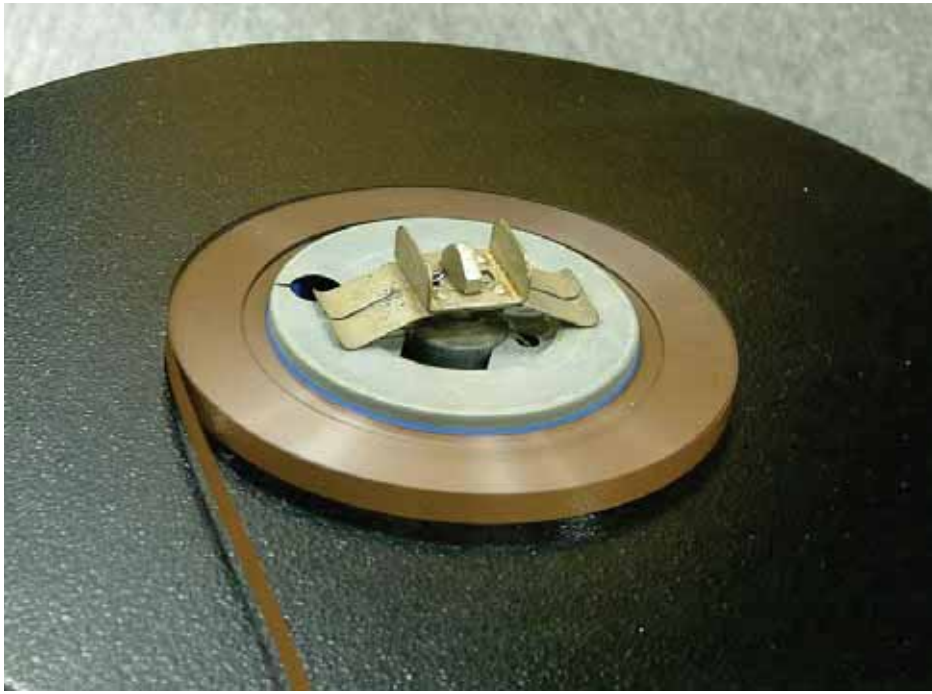


Fig. 4


10
11
11
9
8
4
7
5
6
2
3
1



Digitisation:
The tapes

Preexamination of the Collection

Preservation status - physical condition

- 62 tapes
- 30 cm diameter pancakes on flangeless 70 mm hubs


AEG
MAGNETOPHON

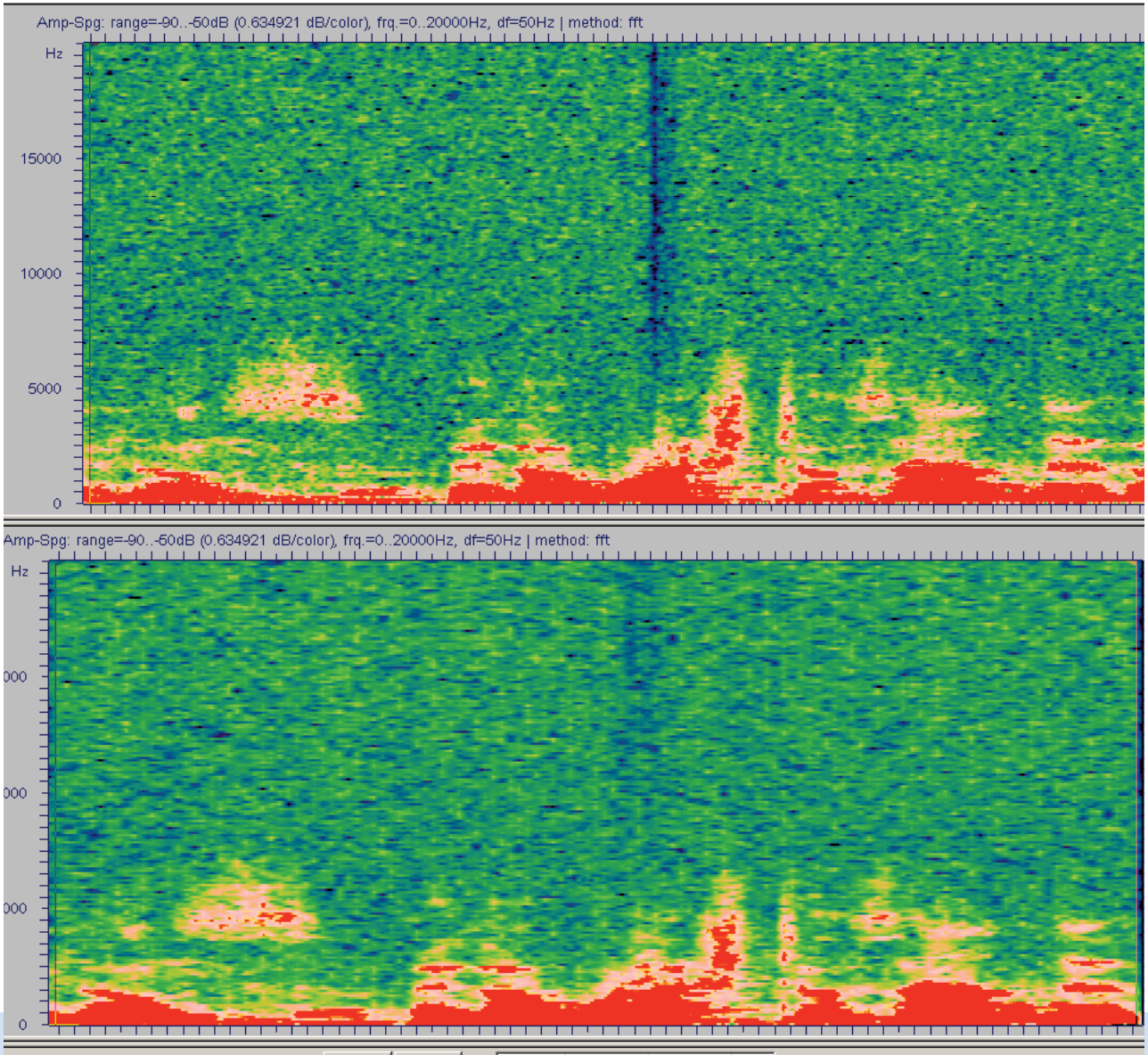
Preexamination of the Collection

Preservation status - physical condition

Several types of splices:

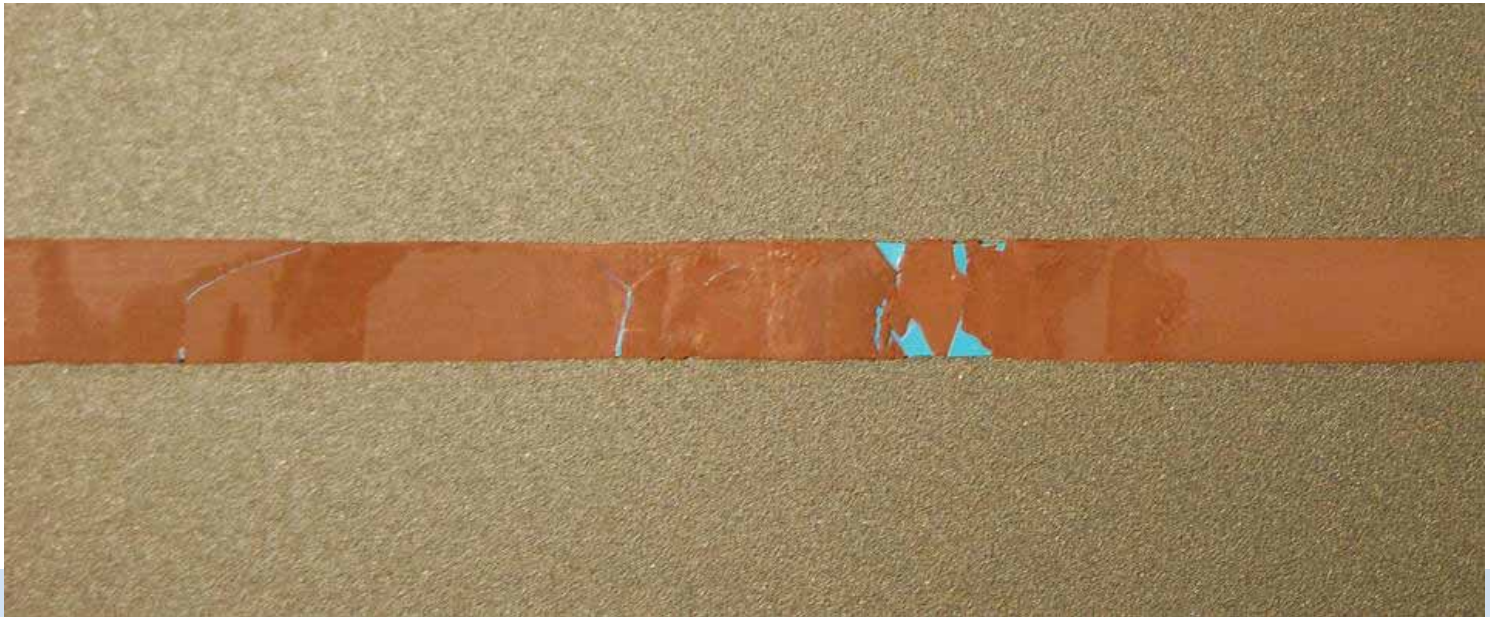
- historical splices using liquid glue, overlapping layers, originating from manufacturing process or from editing process at time of recording
- historical splices using splicing tape
- modern splices using splicing tape, originating from repairing broken tape parts

Splices using liquid glue before and after carrier restoration



Carrier restoration

- Physical carrier restoration
  - Repair bad/ bleeding splices – remove old adhesives, clean tape from splice residues with highly purified light fuel
  - Add leader tape - only if necessary for complete signal retrieval
  - Restore tape pack to flat wind – often very difficult with brittle acetate tape



Preexamination of the Collection

Preservation status - chemical condition

Basically good!

- Deformation (form of eaves gutter)
- Spoking
- Brittleness
- Corrosion due to water influence

Preexamination of the Collection

Preservation status - chemical condition

- **Instability of cellulose acetate**

  Historic tapes with a substrate or binder of acetate (produced until sixties):

  - Different elongation and stretching properties of the components
  - Hygroscopic
  - **Vinegar syndrome** ⇒ brittleness, deformation, cracks, disruption, crimps and ripples

Chemical carrier restoration

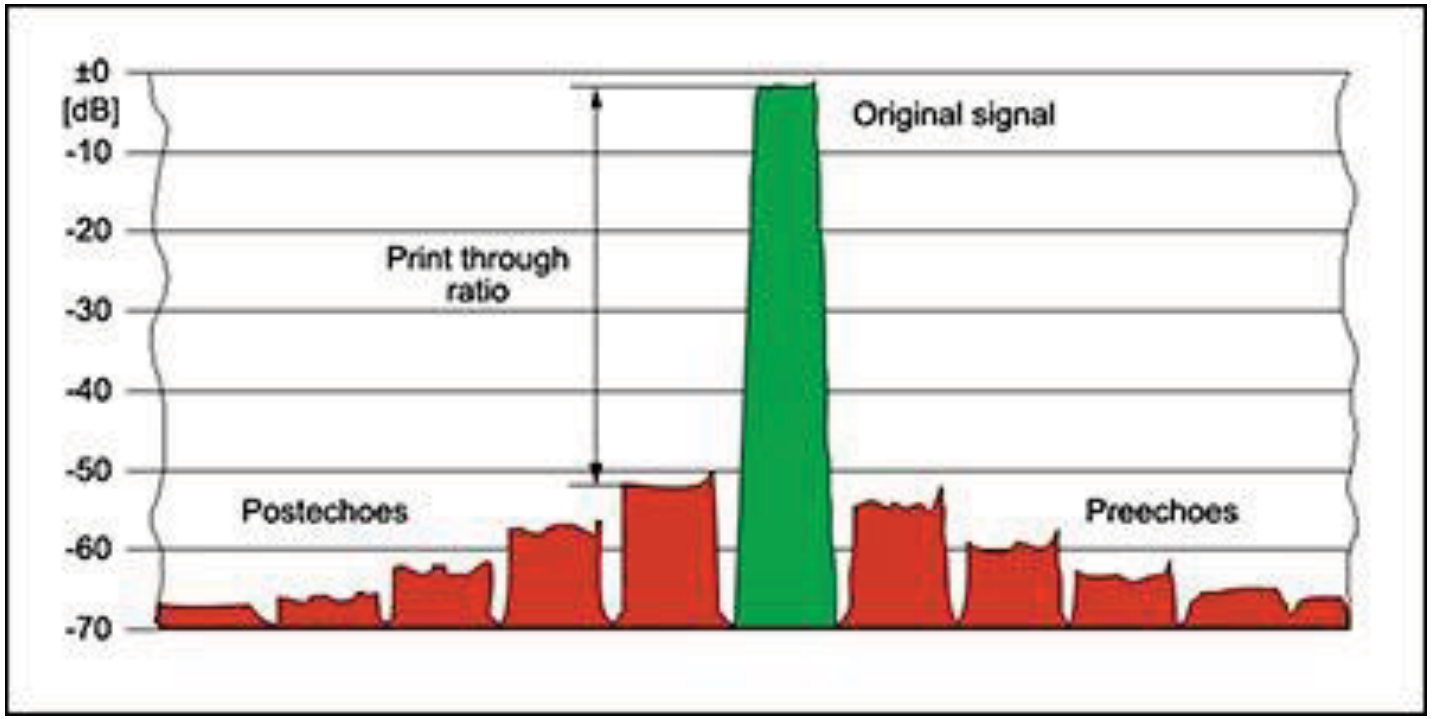
Recently developed by the Phonogrammarchiv::

permanent refreshment of highly deteriorated acetate tapes

Before….

…and after treatment

- Removal of storage related artefacts, e.g. print through



Imperative *before* replay of originals!

Preexamination of the Collection

Replay parameters

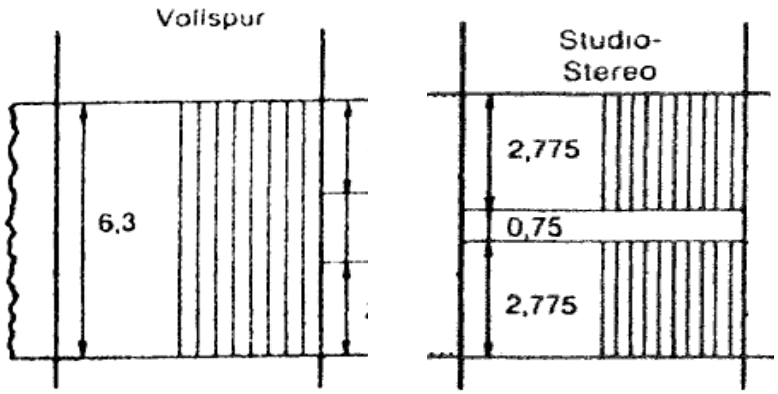
Basically pre-standardisation

- Recording format: mono full track
- Tape widh: 6.5 mm
- Recording speed: 77 cm/s
- Tapes B wind (Schicht aussen)
- Equalisation: can be assumed to correspond with IEC I (35 µs)
- Digitisation resolution: 192 kHz/24 Bit

Preexamination of the Collection

Choice of replay track format

Mono full track or studio stereo „butterfly“ head?



Preexamination of the Collection

Choice of replay track format

Mono full track head:

- Advantage: 100% congruent trackwidth, slightly better S/N ratio

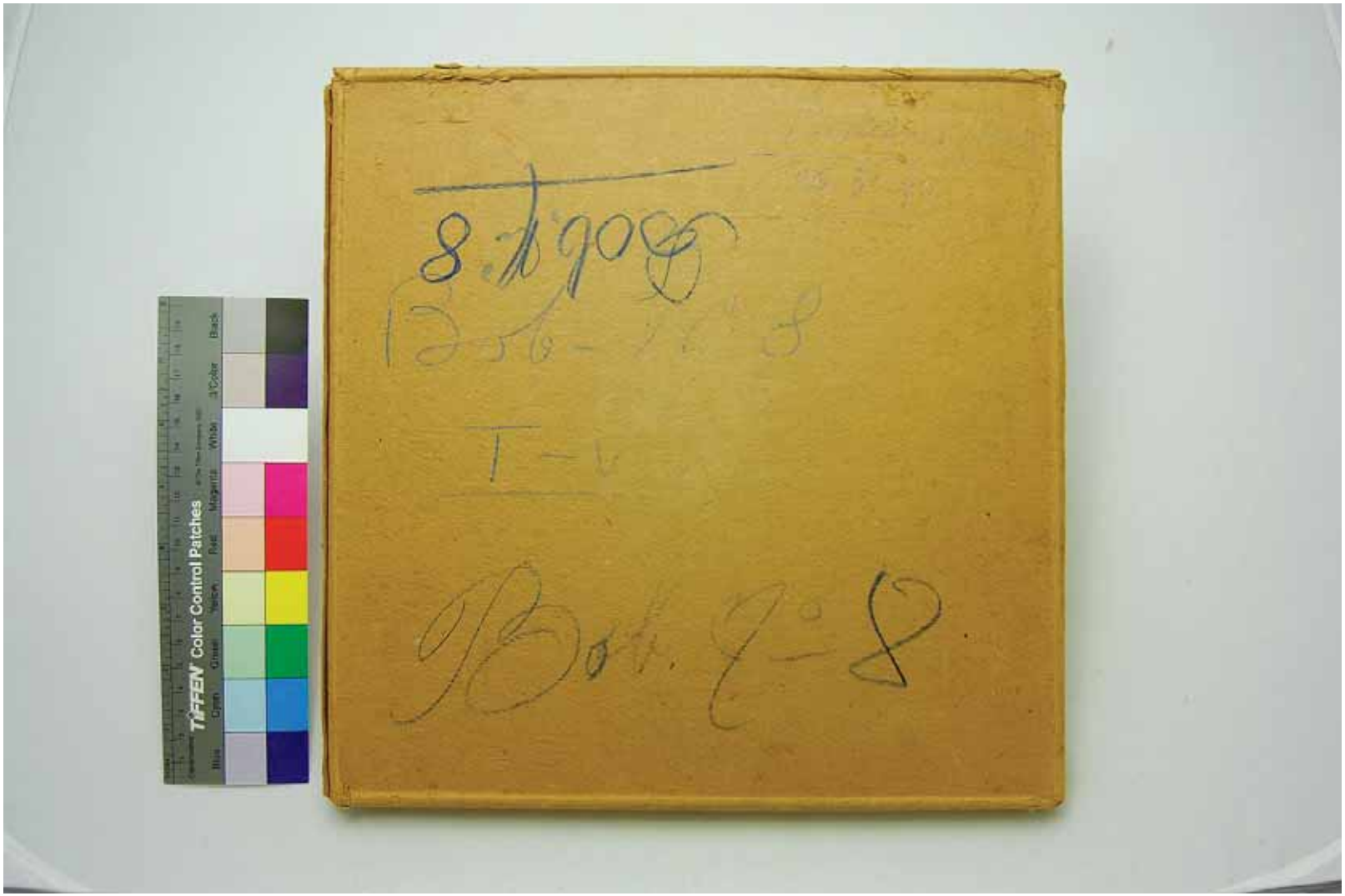
Butterfly head:

- Accurate basis adjustment of azimuth can be reached by using analysis tools (not only the ears…)
- Possible advantages for future digital restoration of dynamic azimuth deviations, that cannot be corrected manually
- Acetate tapes: vertical parts break off the tape, sometimes over a longer part
- Manufacturing tolerances concerning the properties of the magnetic layer can change within the width of the tape – level differences between upper and lower edge of the tape

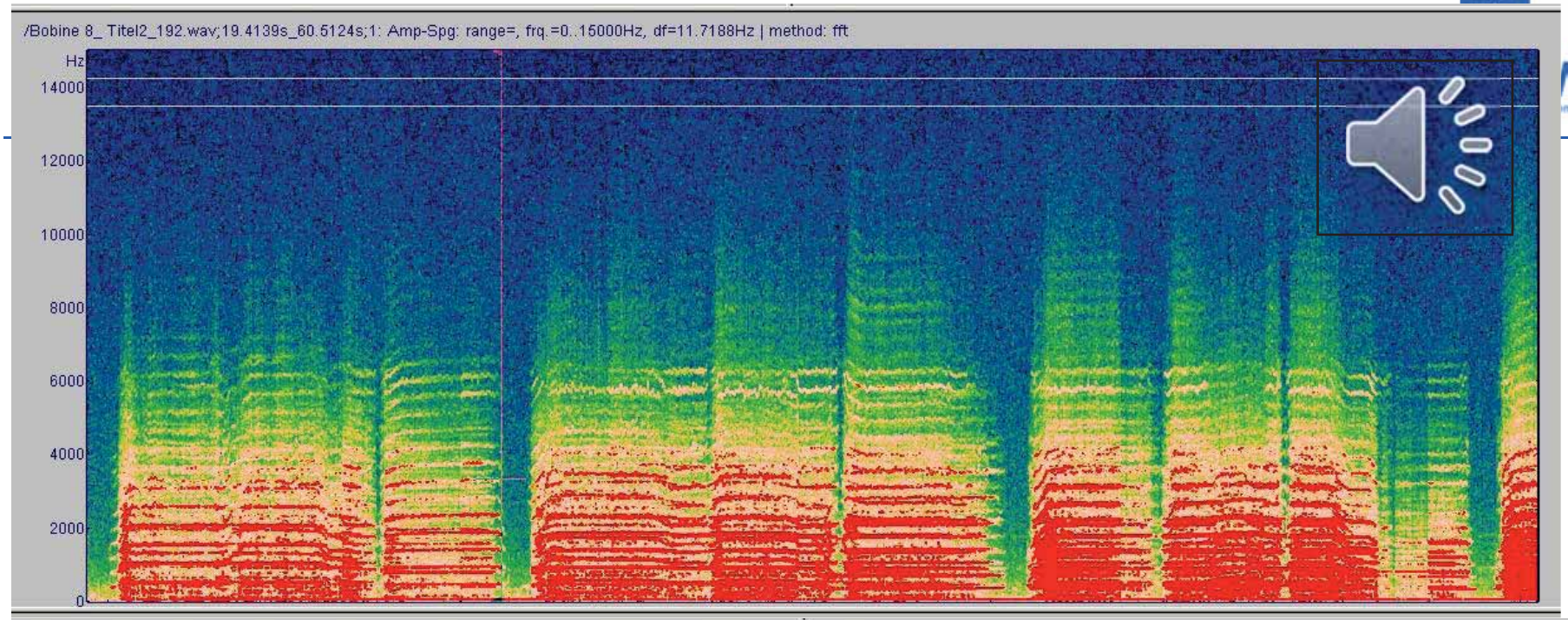
Advantages for further restoration

Playback parameters

- tape speed is very often not easy to determine a priori (e.g. unknown machine, irregularities, etc…)
- helpful analyses:
  - listening to the audio contents, identify signals
  - analysis of the hum of the power supply – sometimes problematic
  - analysis of the high frequency bias signal – not possible (DC biasing)


TIFFEN Color Control Patches


TIFFEN Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
3/Color
Black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Hz
14000
12000
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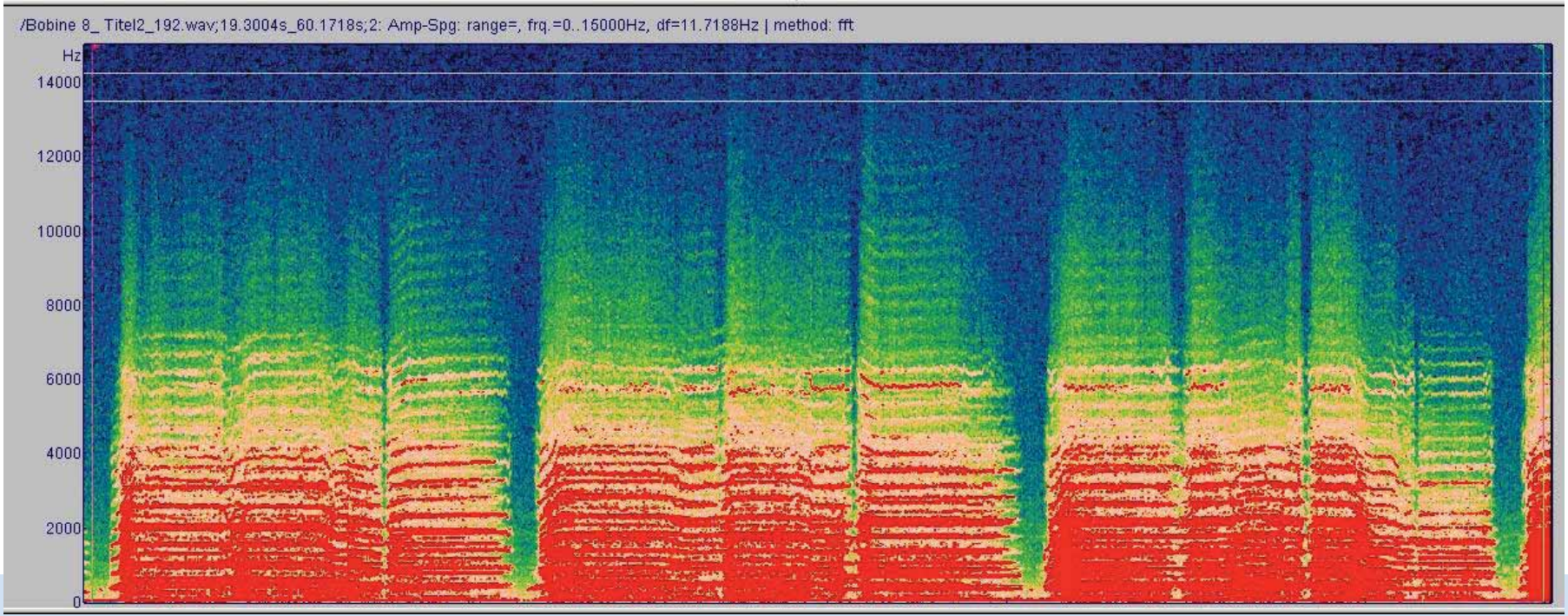
8000
6000
4000
2000
0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Hz
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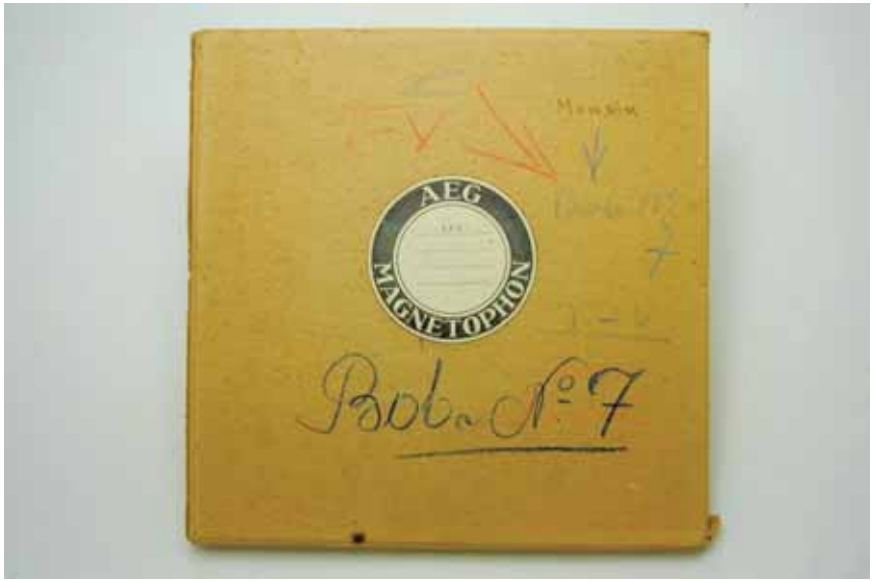
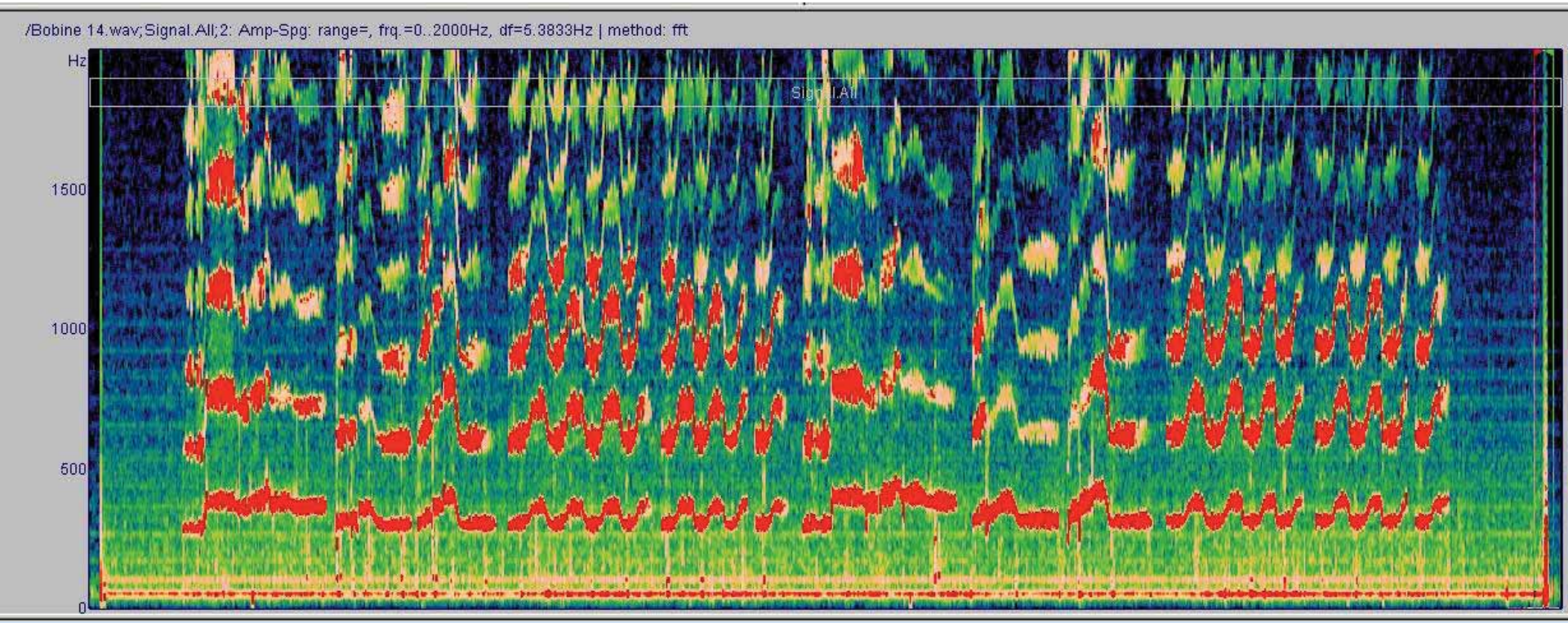
4000
2000
0

- Erasing artefacts
- Distortions
- Wet glues



OAW
Austrian Academy of Sciences



Original photographs,
documenting various recording situations

MANY THANKS TO:

Friedrich K. Engel, Bensheim, Germany,

formerly technical writer/ documentalist for Agfa-Gevaert and BASF, for providing most valuable information about the design details of the machines, and

Dr. Gerhard Kuper, Wedel, Germany,

formerly head of basic engineering for AEG,

for providing several pictures of the machines and the magnetic heads

Their comprehensive and absolutely fabulous encyclopedia of magnetic tape development is also available as e-book from

www.beam-ebooks.de/ebook/40085/1

and

Eduardo Leite, Portuguese Radio *Emissora Nacional Portuguesa,*

for providing photos of Armando Leças tape recorder

THANK YOU FOR YOUR ATTENTION!

Nadja.Wallaszkovits@oeaw.ac.at

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http://www.jazzpoparkisto.net/audio

http://www.iasaweb.org