

**Elektro,
Electro,
Electric,
Electronics ...**

Klaus G. Krämer

**Rechenschieber-Sammler-Treffen RST 18
Erfurt, 22. März 2009**

Die Anfänge der Elektrotechnik

- 1866 Entdeckung des **dynamoelektrischen Prinzips** durch *Werner von Siemens*



Die Anfänge der Elektrotechnik

- 20.12.1879 Gründung des **Elektrotechnischen Vereins** durch *Werner von Siemens* und *Heinrich von Stephan* ; Begriff: „Elektrotechnik“



Die Anfänge der Elektrotechnik

- 08.05.1884 Erste **öffentliche Stromversorgung** Europas in Berlin durch *T. A. Edison* und *E. Rathenau*



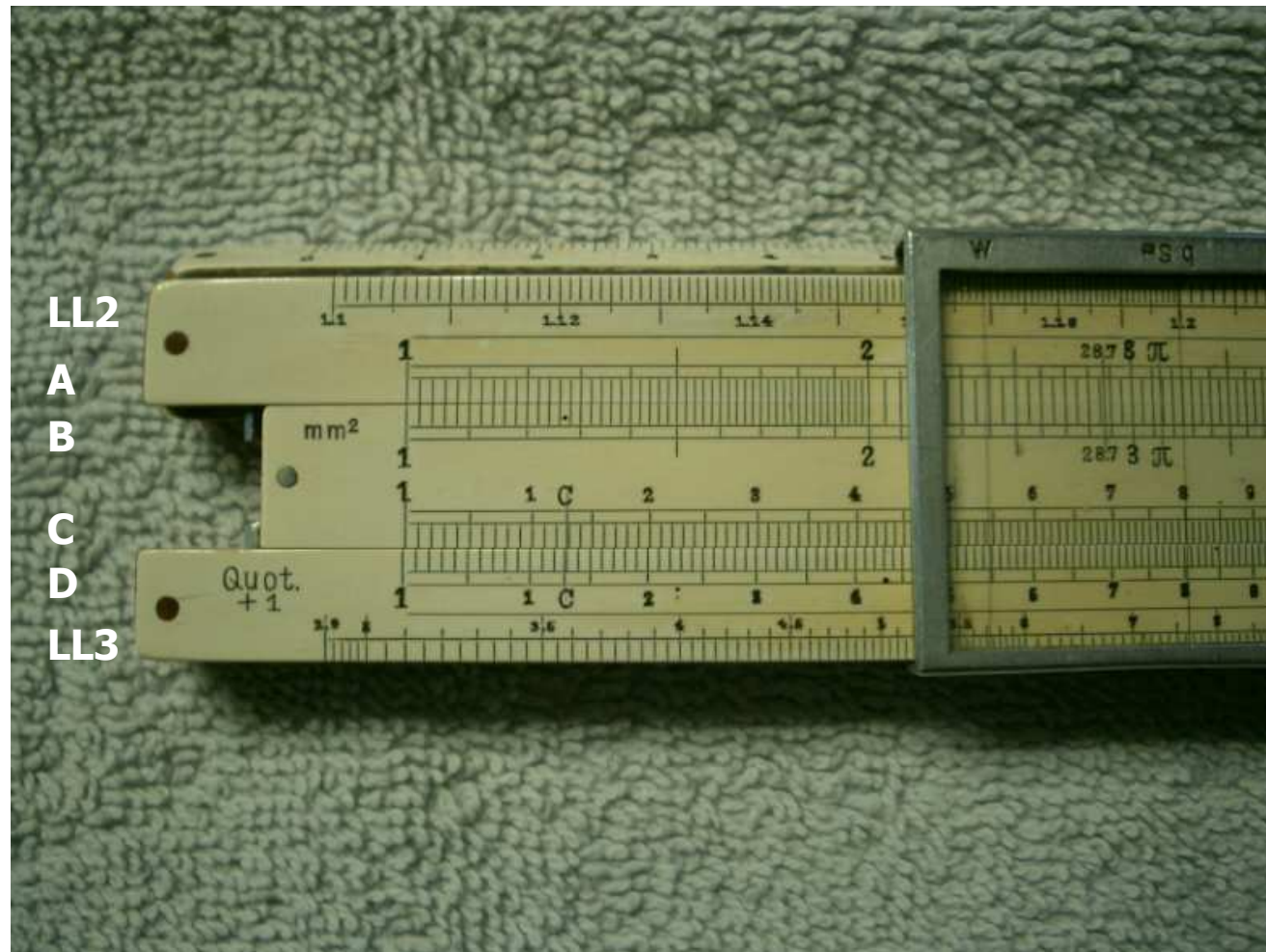
Anfängliche Probleme der Netzplanung

- **Netzberechnung**: Ohm'sches Gesetz, Kirchhoff'sche Regeln, Bleistift und Rechenschieber
- Wenige empirische Informationen über die Belastbarkeit der Komponenten und **Ausgleichsvorgänge**
- Stark unterschiedliche Qualität der **elektrischen Maschinen**
- Rasanter Verbrauchszuwachs
- Ständige Weiterentwicklung der Konstruktionen und Materialien
- Fehlende Normung

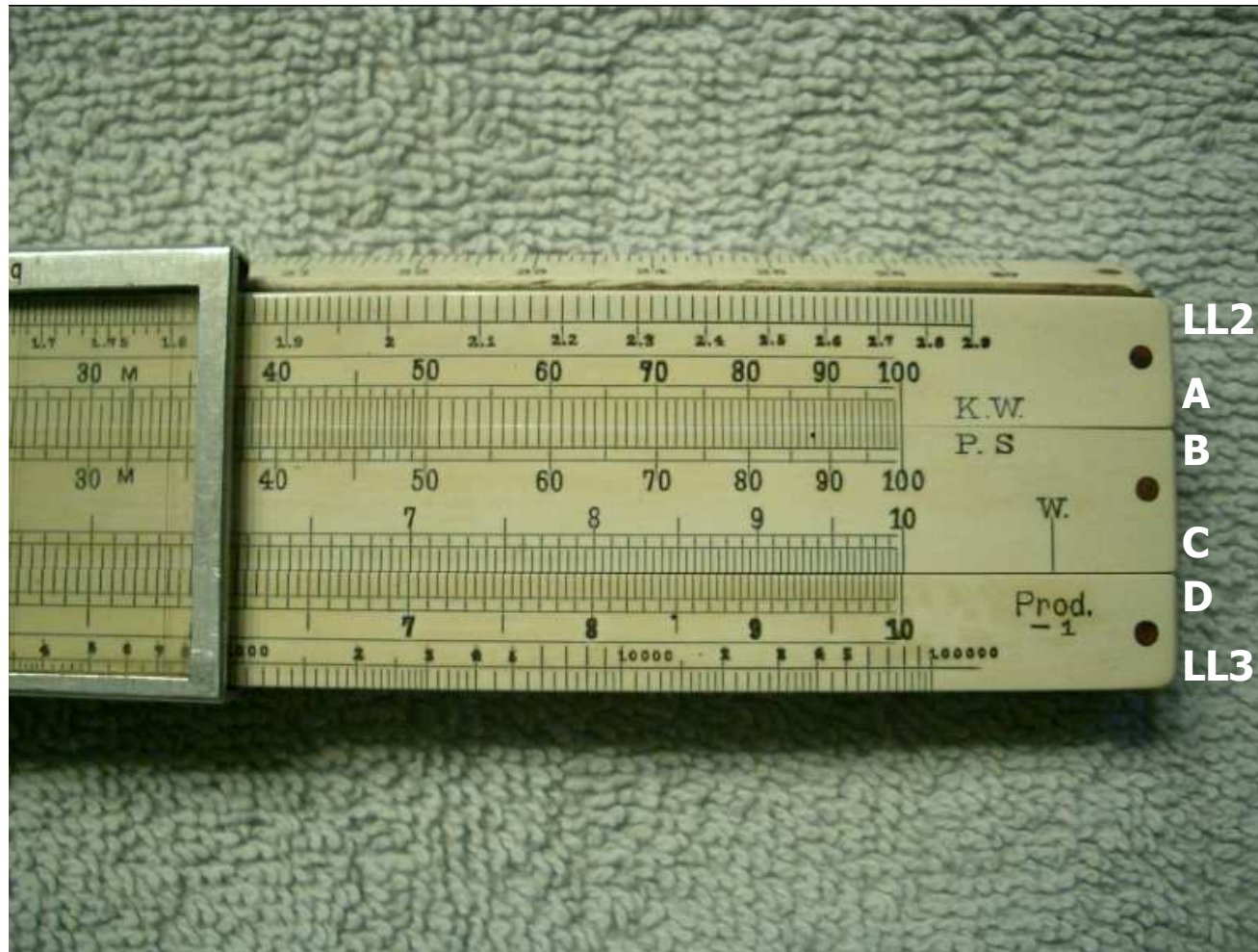
Gesucht: Ein „Elektro“-Rechenstab für

- Netzberechnung
 - **Spannungsfall** auf Kabeln und Leitungen
 - Kurzschlussstrom
 - Wirkleistungsverlust
- **Ausgleichsvorgänge**
 - Erwärmung und Abkühlung
 - Laden und Entladen von Speichern
- Elektrische Maschinen
 - **Wirkungsgrad** von Generatoren und Motoren

„Elektro“ [Faber Castell 378]



„Elektro“ [Faber Castell 378]



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Elektro ...

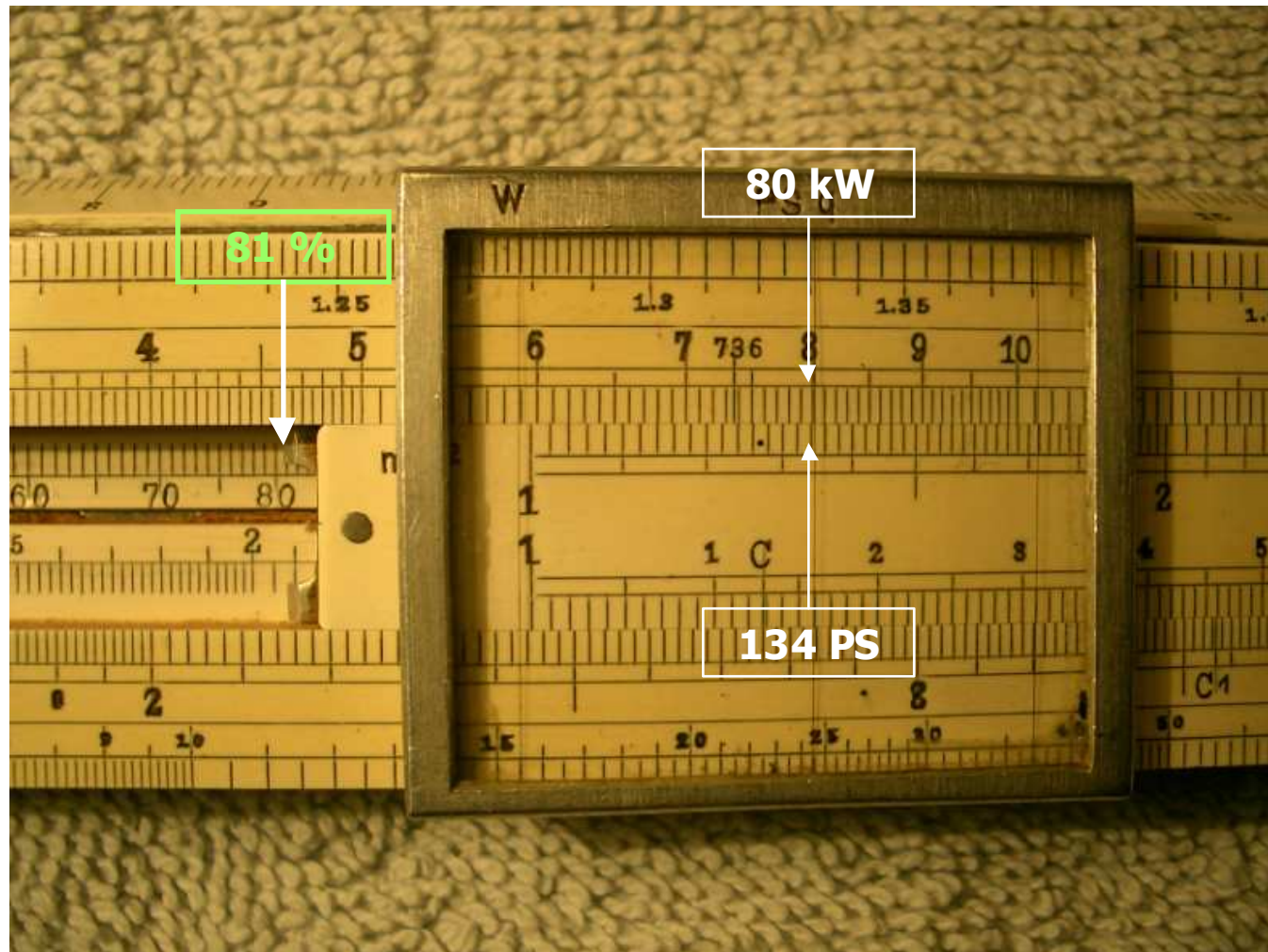
„Elektro“ [Faber Castell 378]



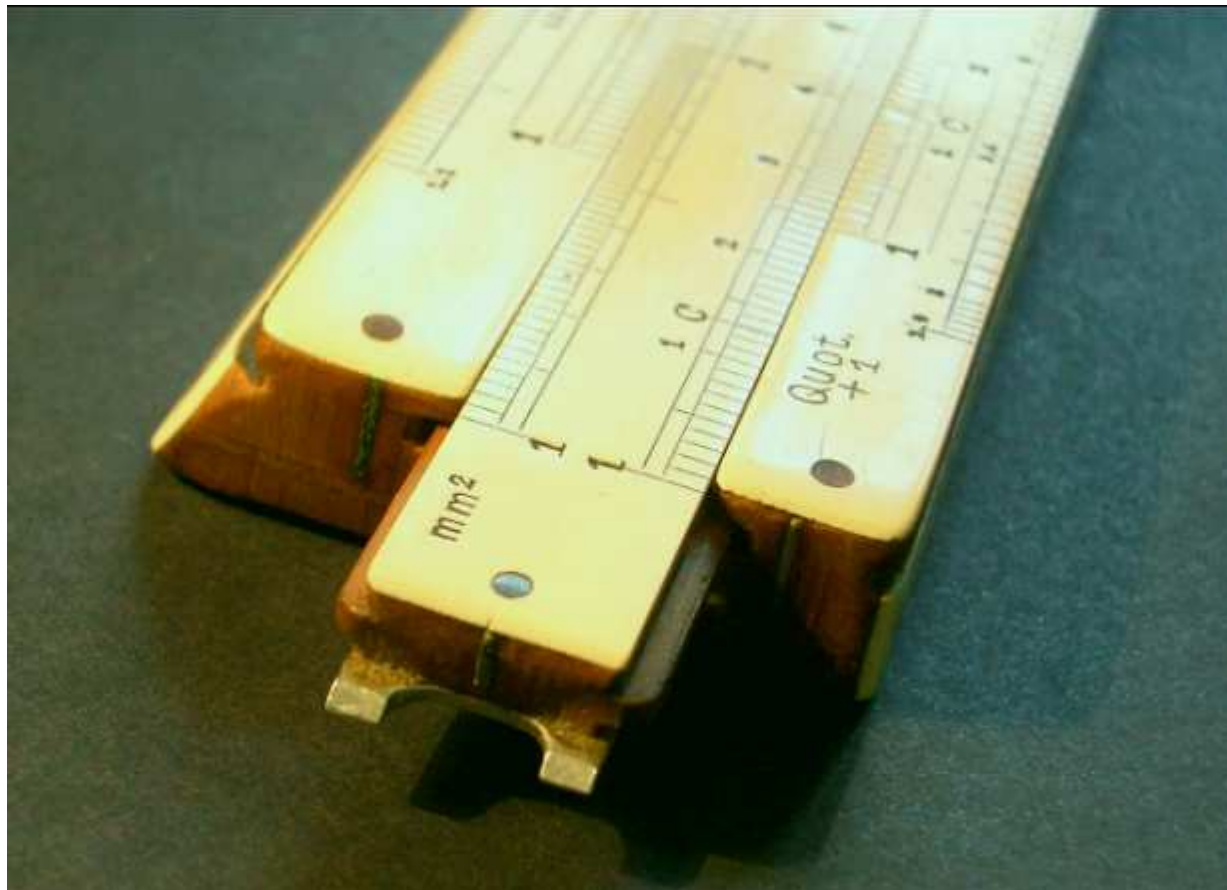
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Elektro ...

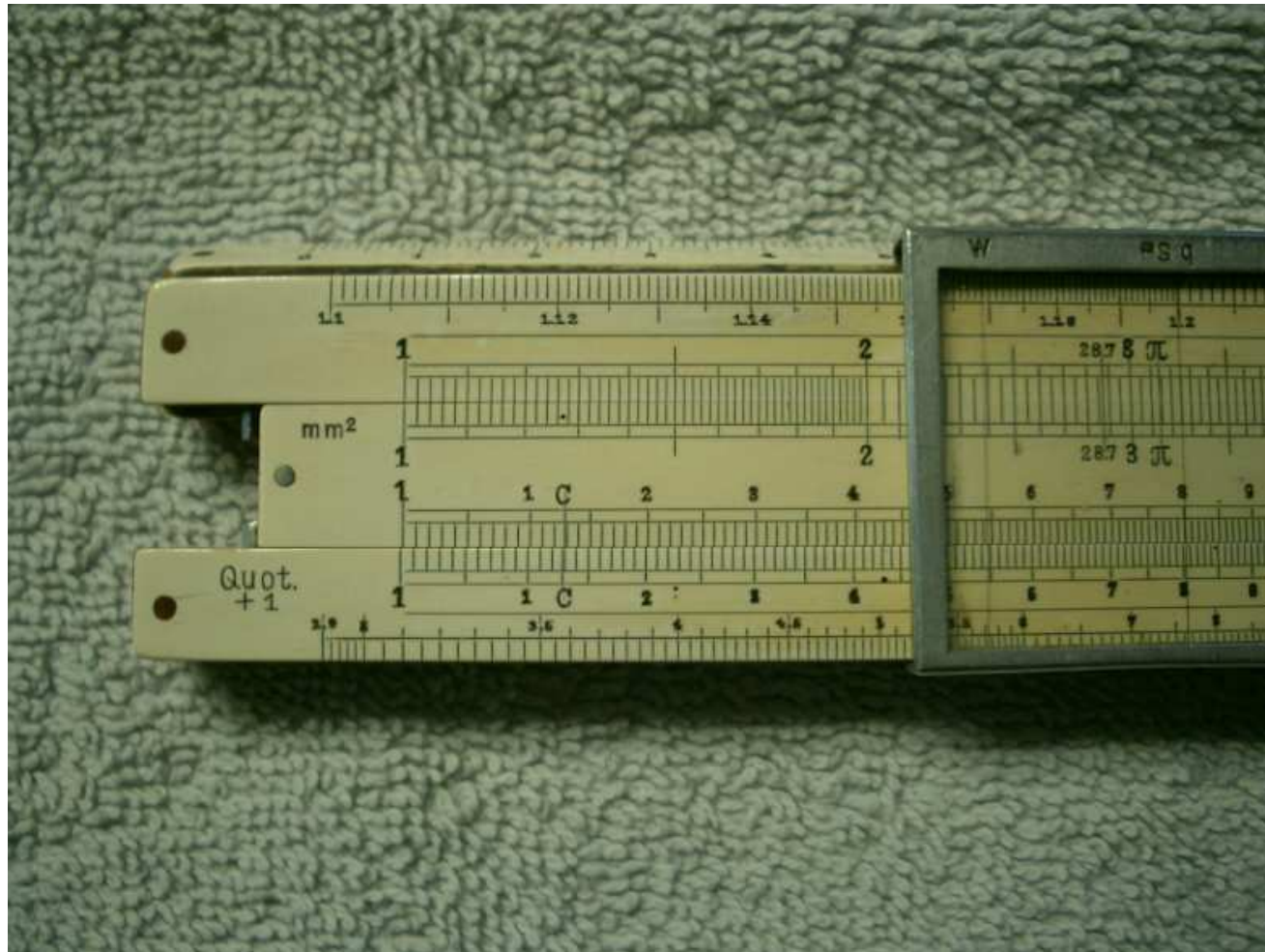
Wirkungsgrad Generator



Ableseschneiden an der Zunge



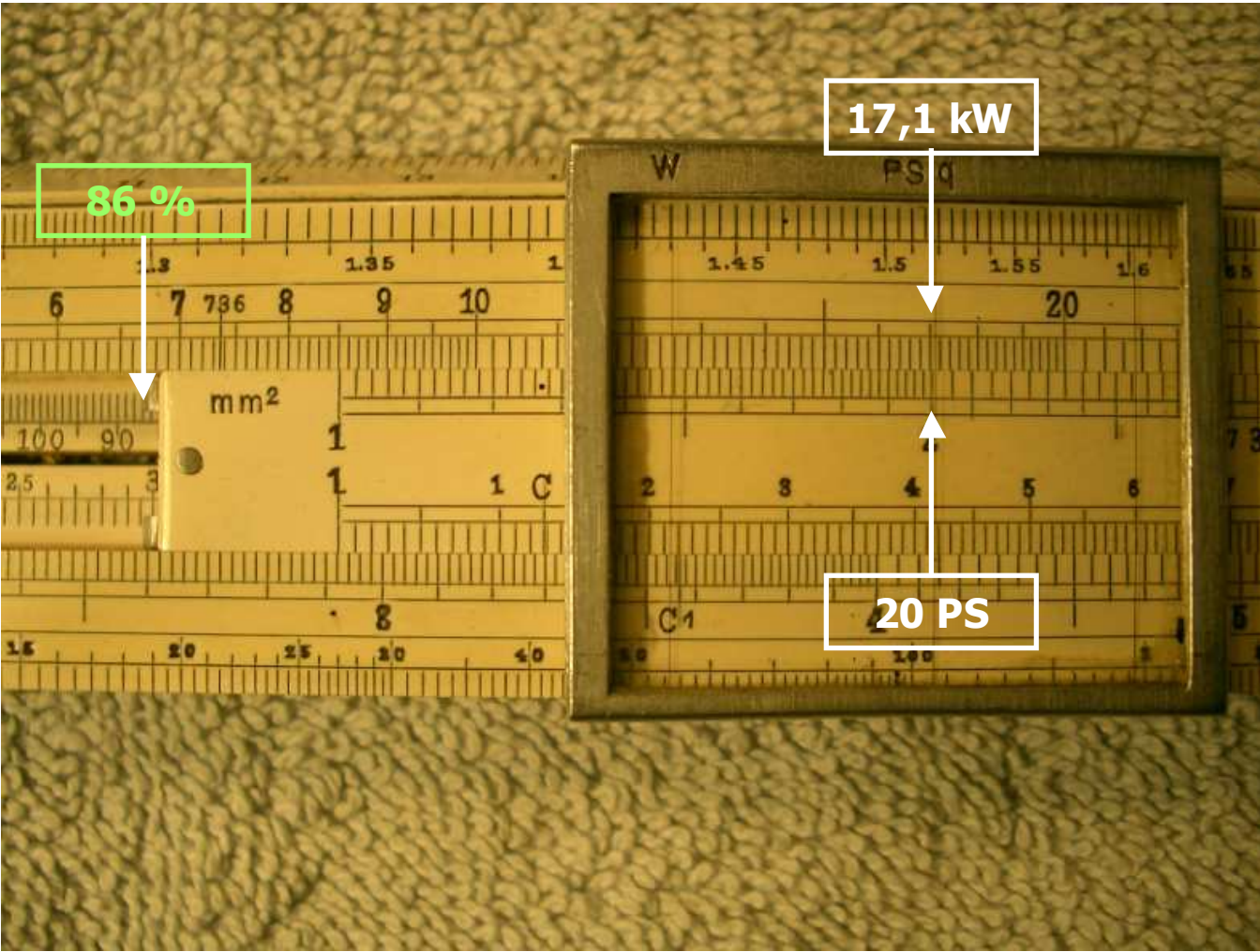
„Elektro“ [Faber Castell 378]



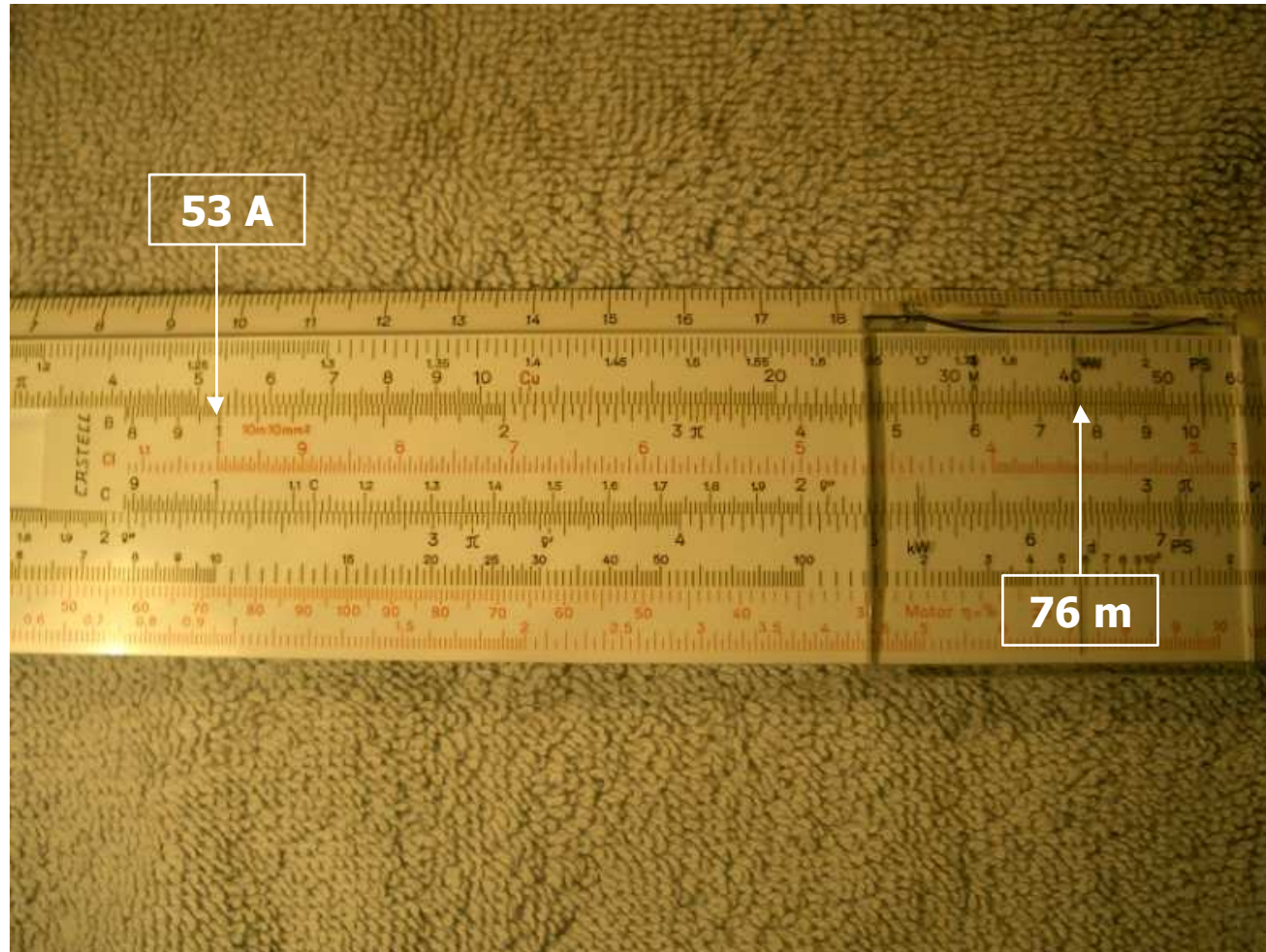
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Elektro ...

Wirkungsgrad Motor



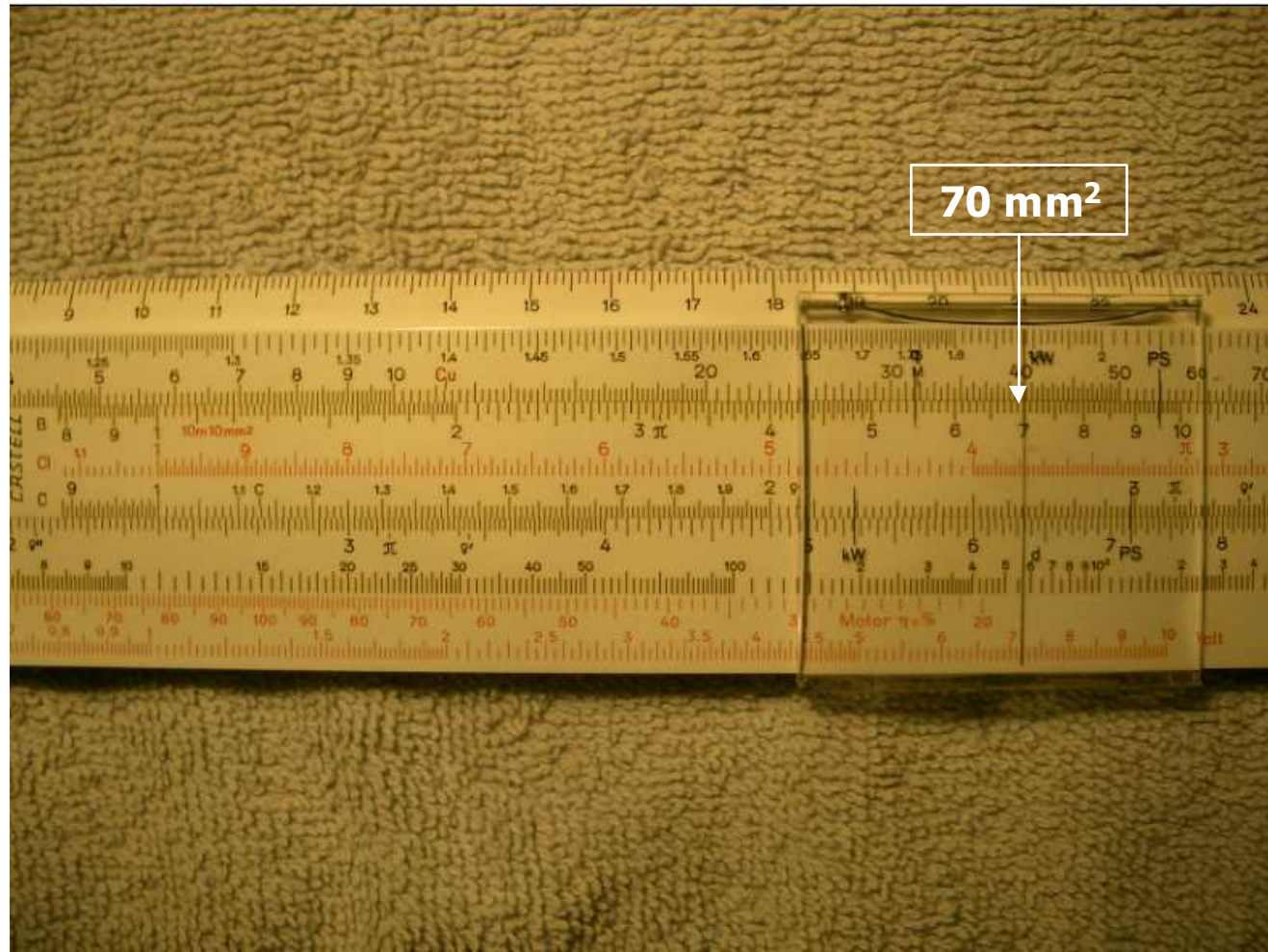
Spannungsfall



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Elektro ...

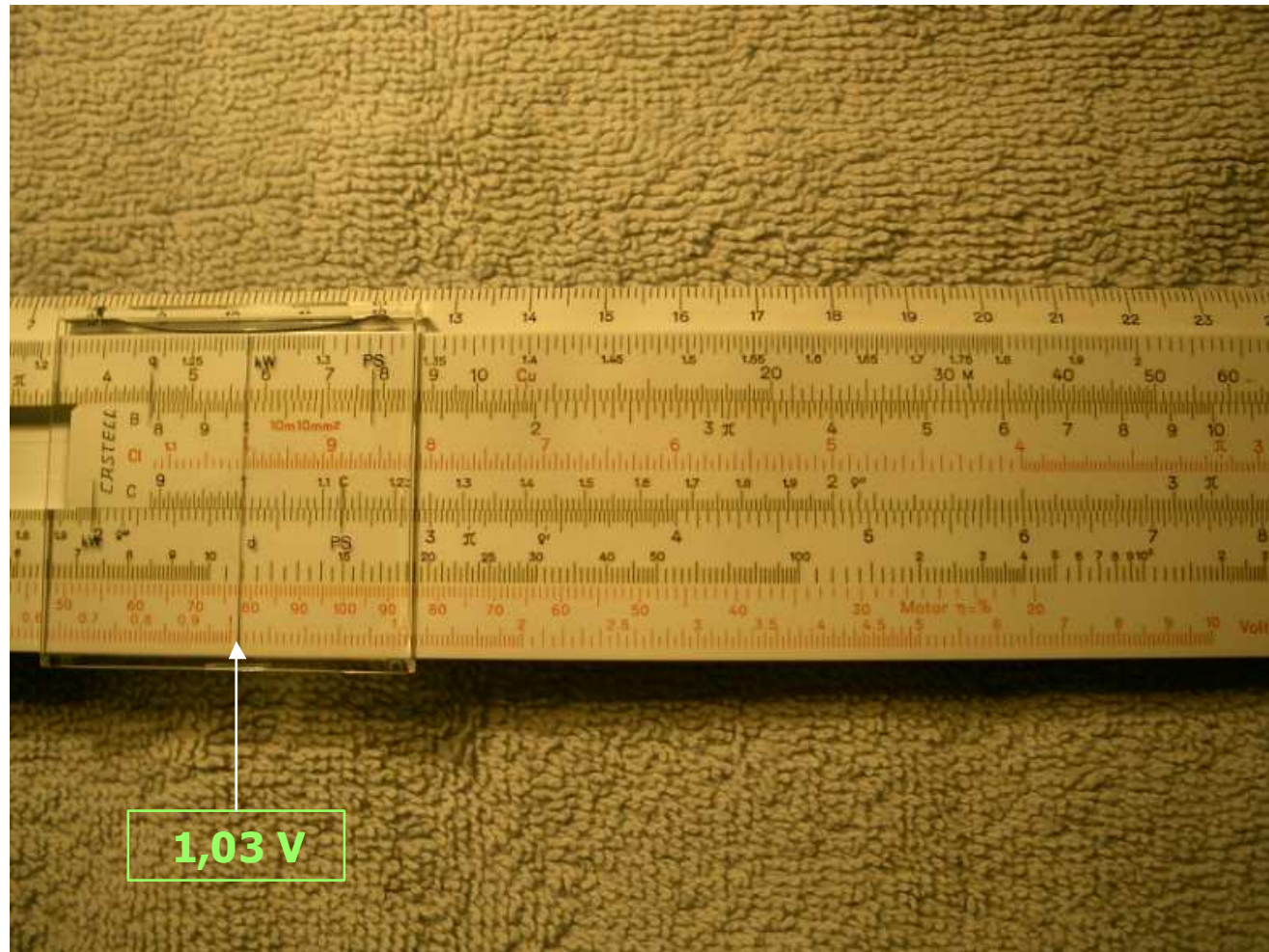
Spannungsfall



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Elektro ...

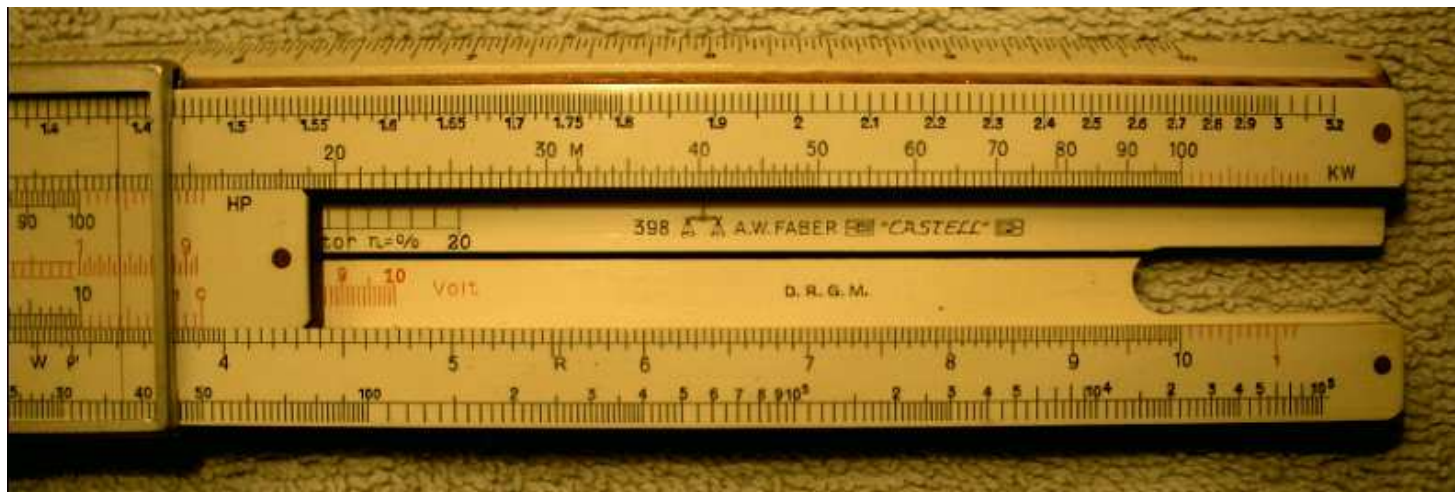
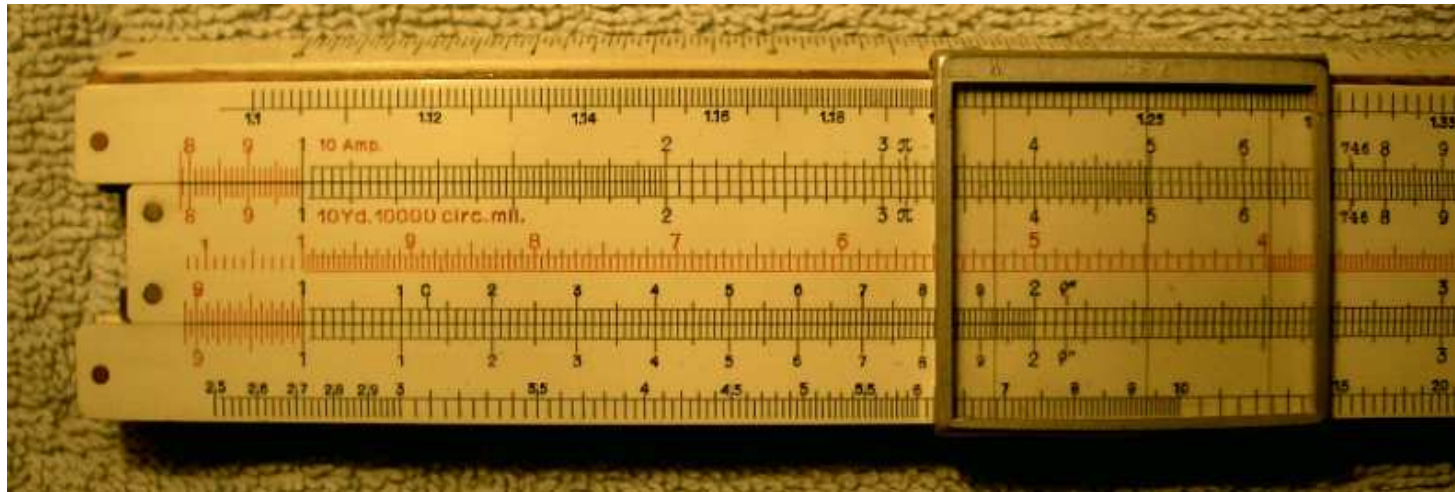
Spannungsfall



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Elektro ...

Faber Castell 398



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Elektro ...

Faber Castell 398

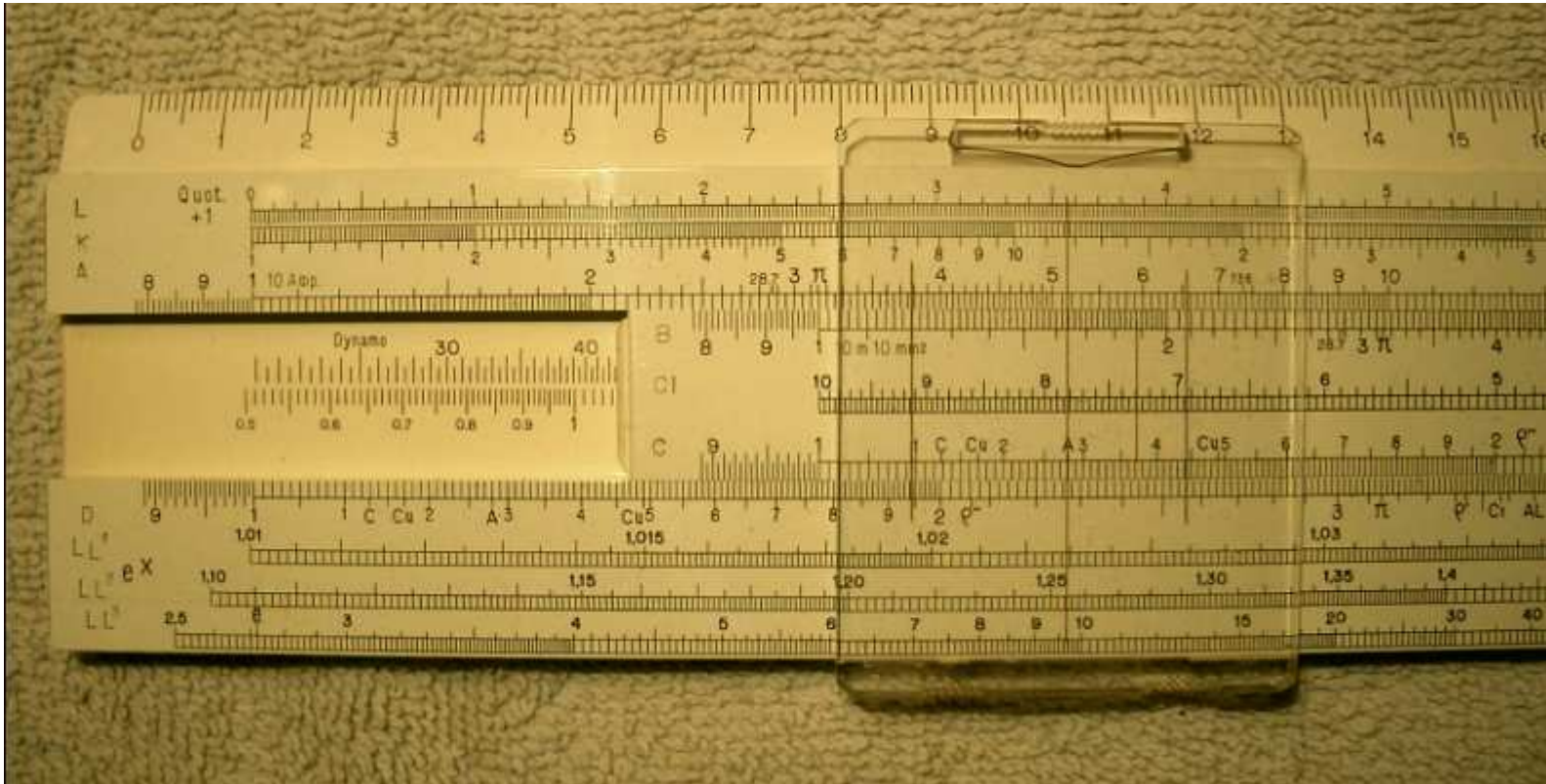




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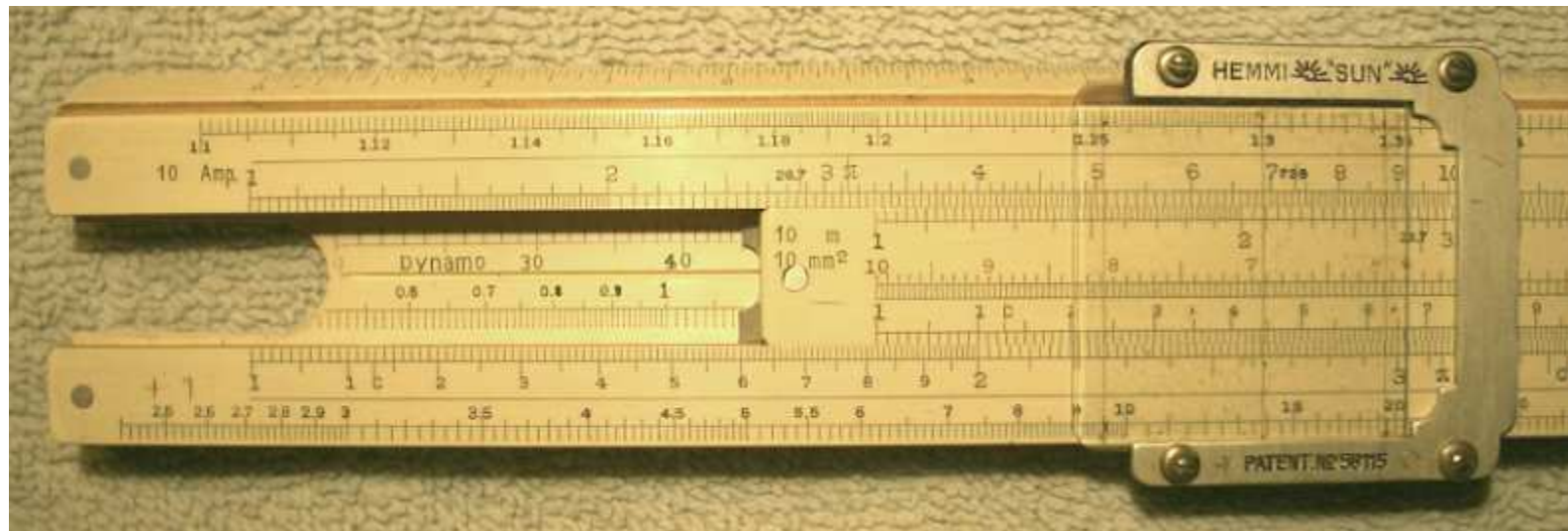
Unbekannter Hersteller, Frankreich



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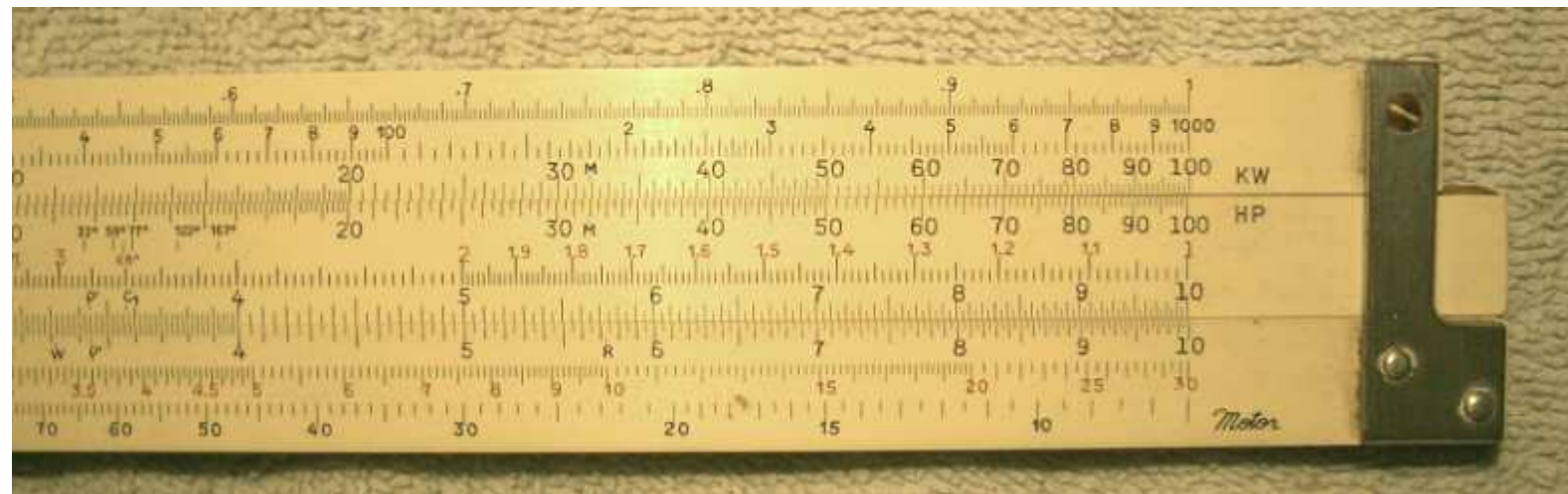
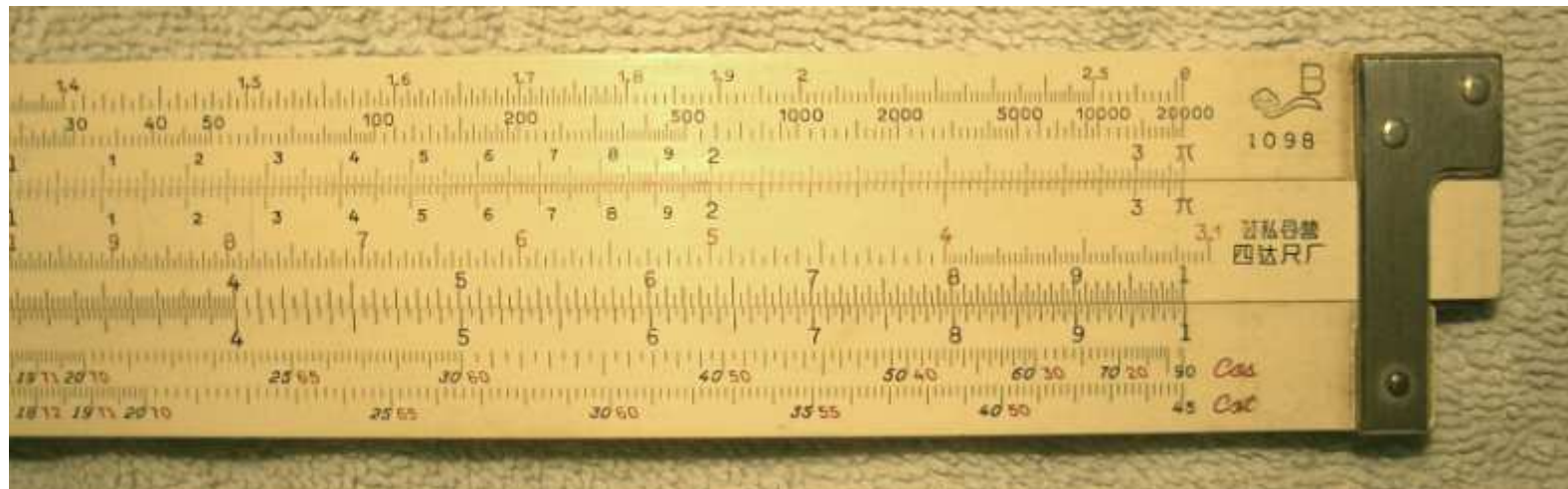
Sun Hemmi



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Elektro ...

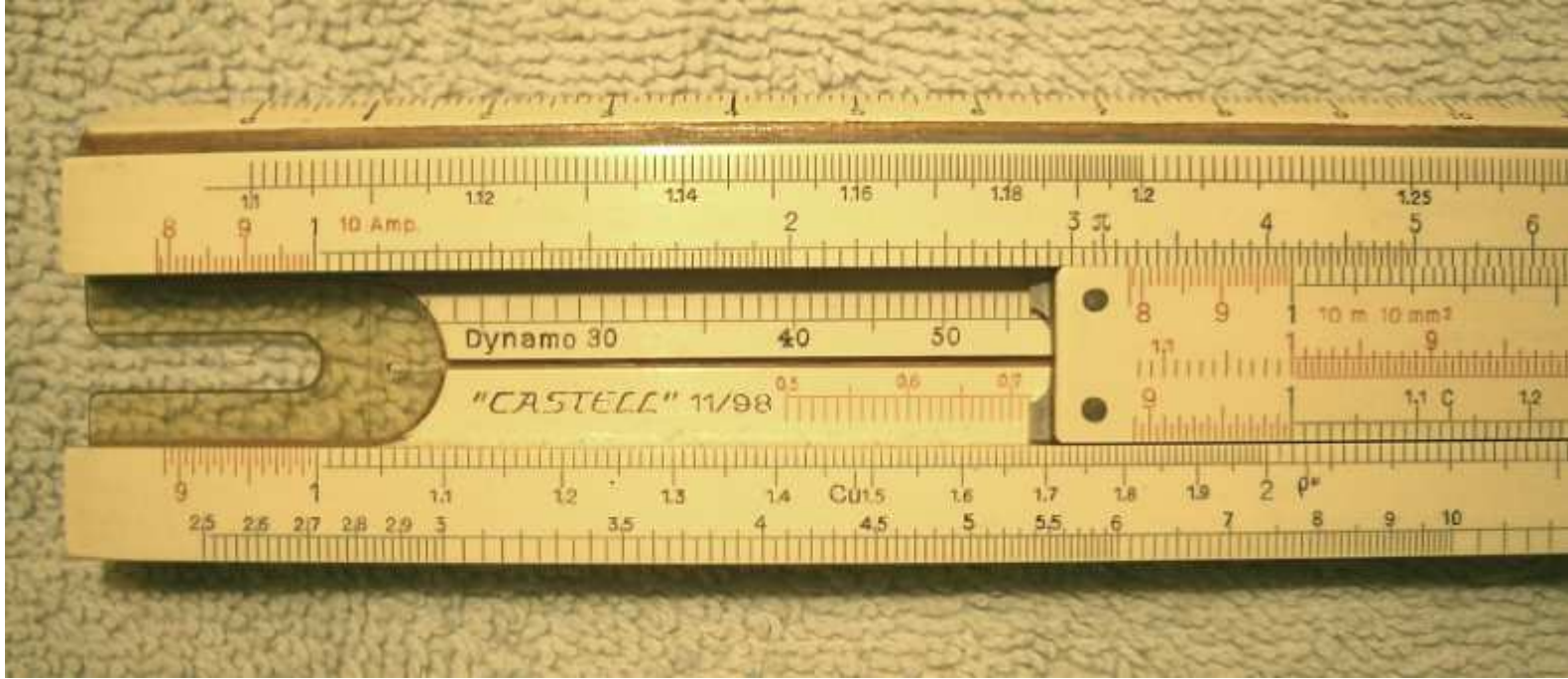
Sida (Flying Fish) 1098



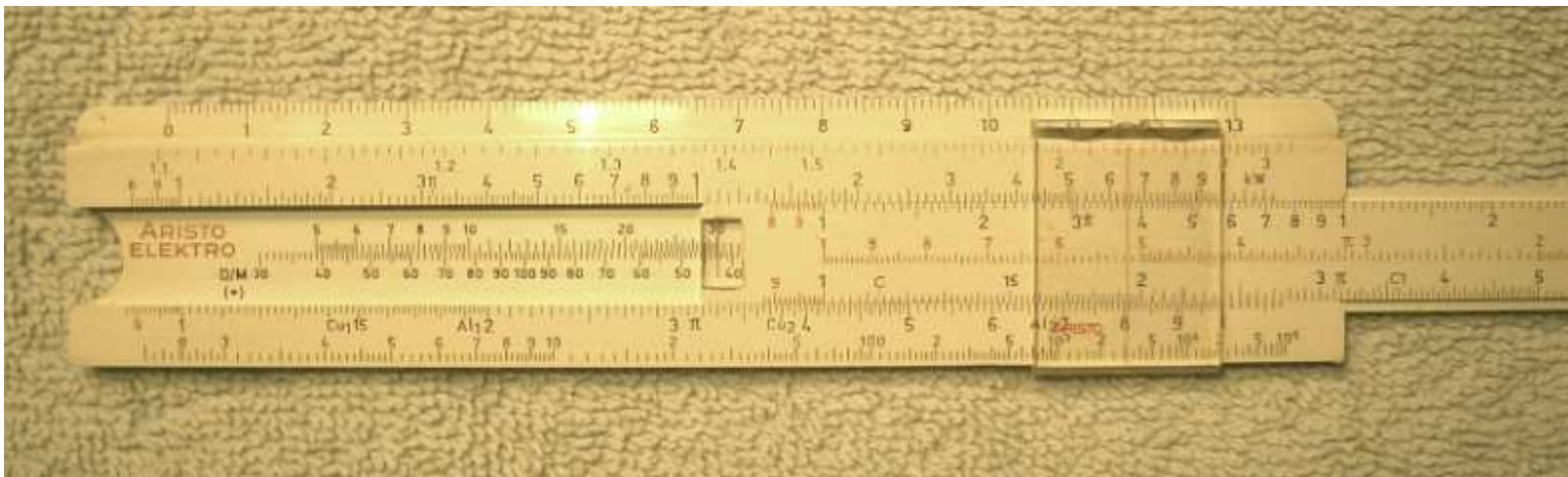
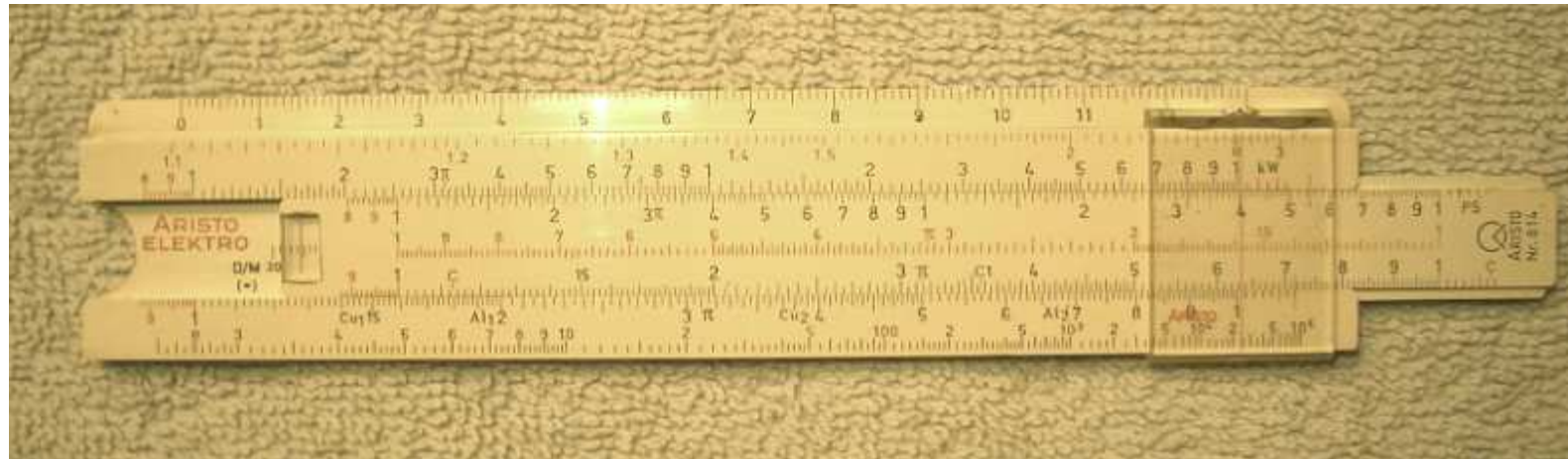
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Elektro ...

Faber-Castell 11/98



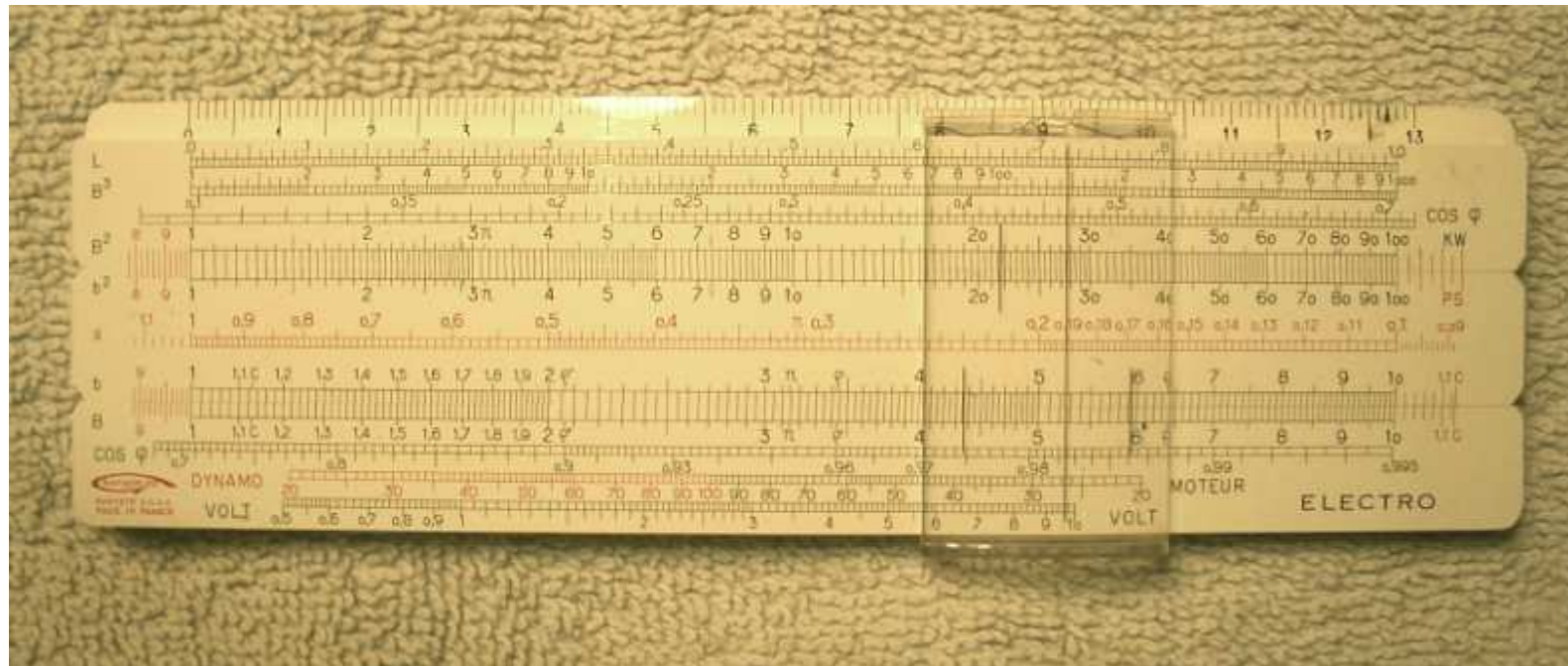
Aristo 814



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Elektro ...

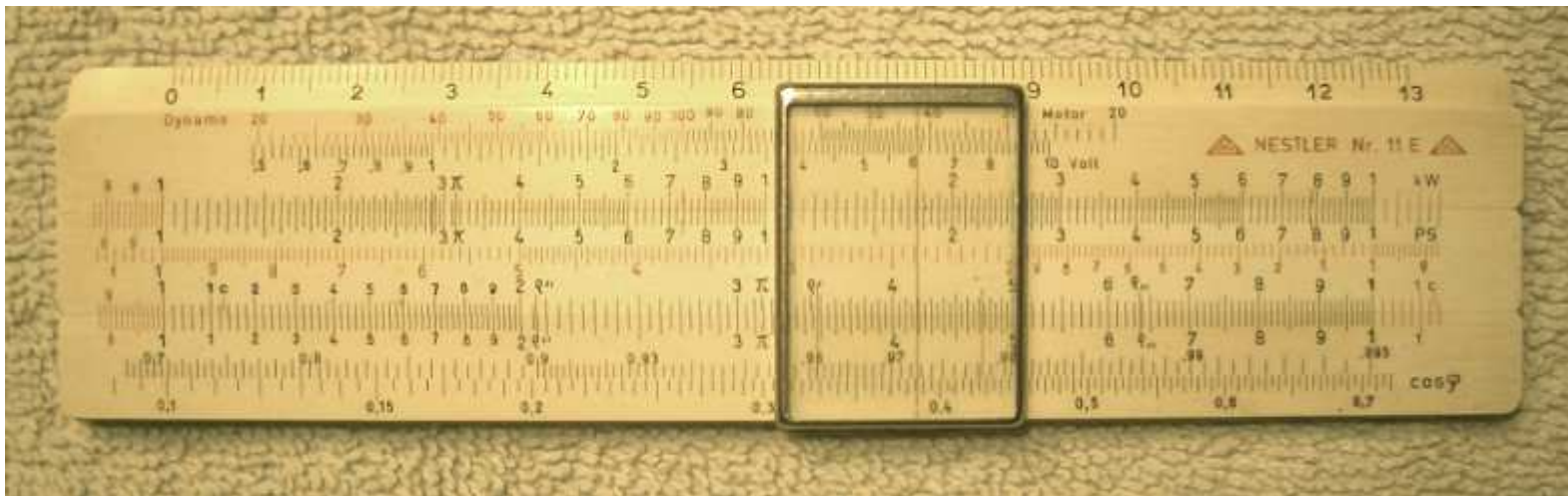
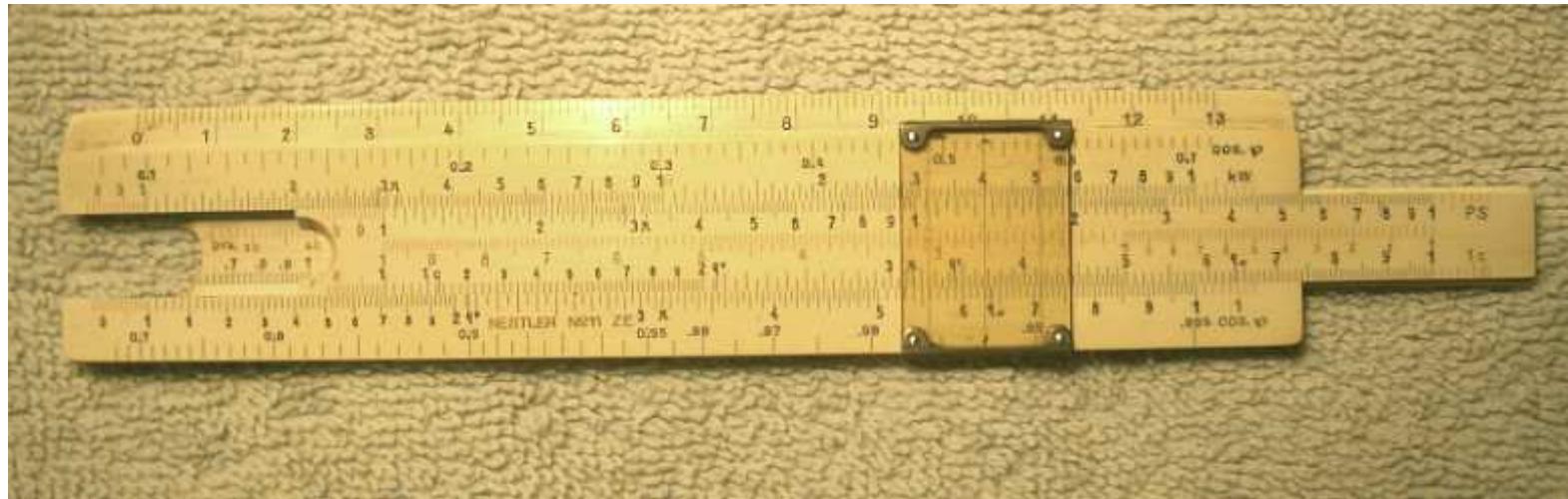
Graphoplex 650



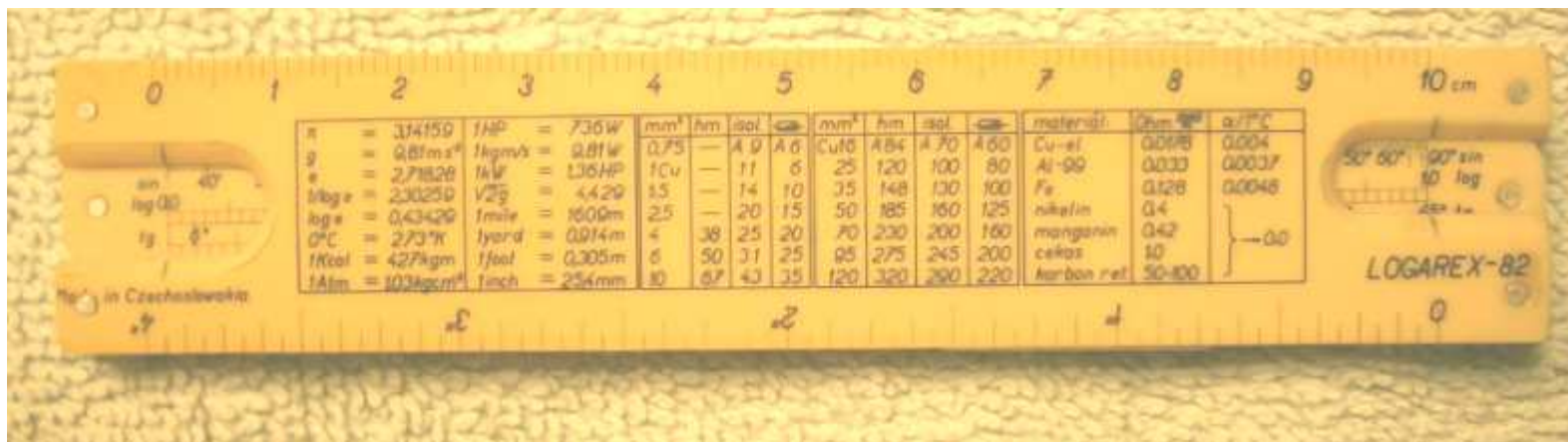
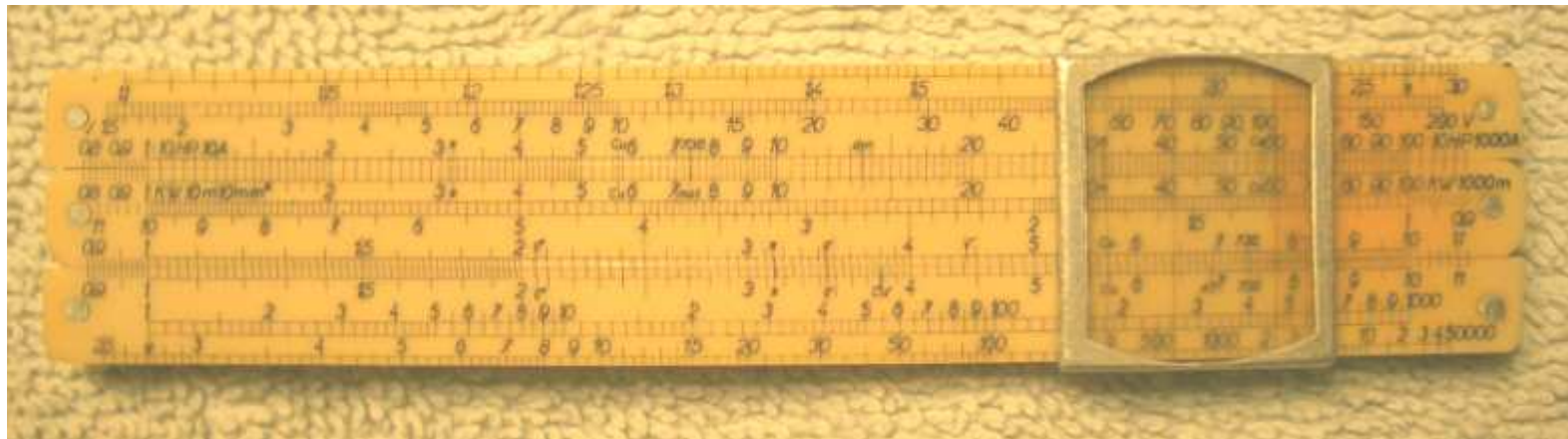
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Elektro ...

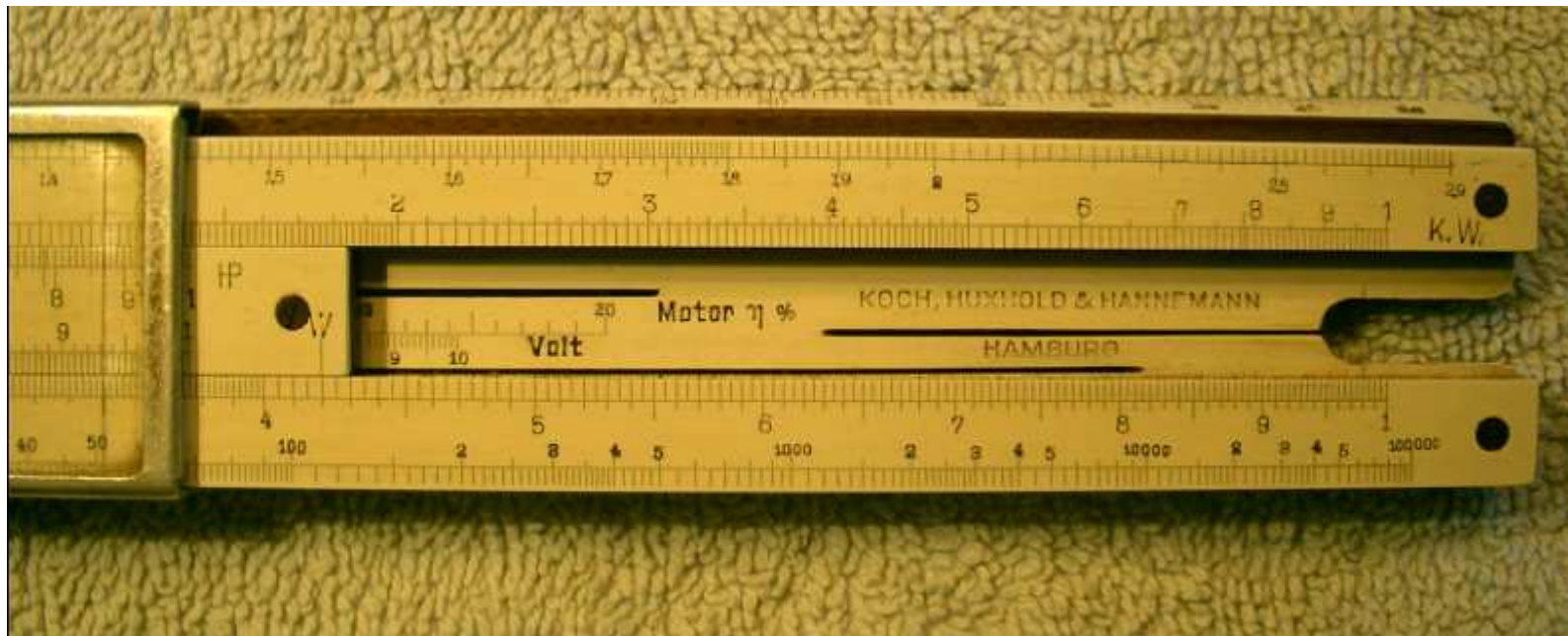
Nestler 11 ZE, 11 E



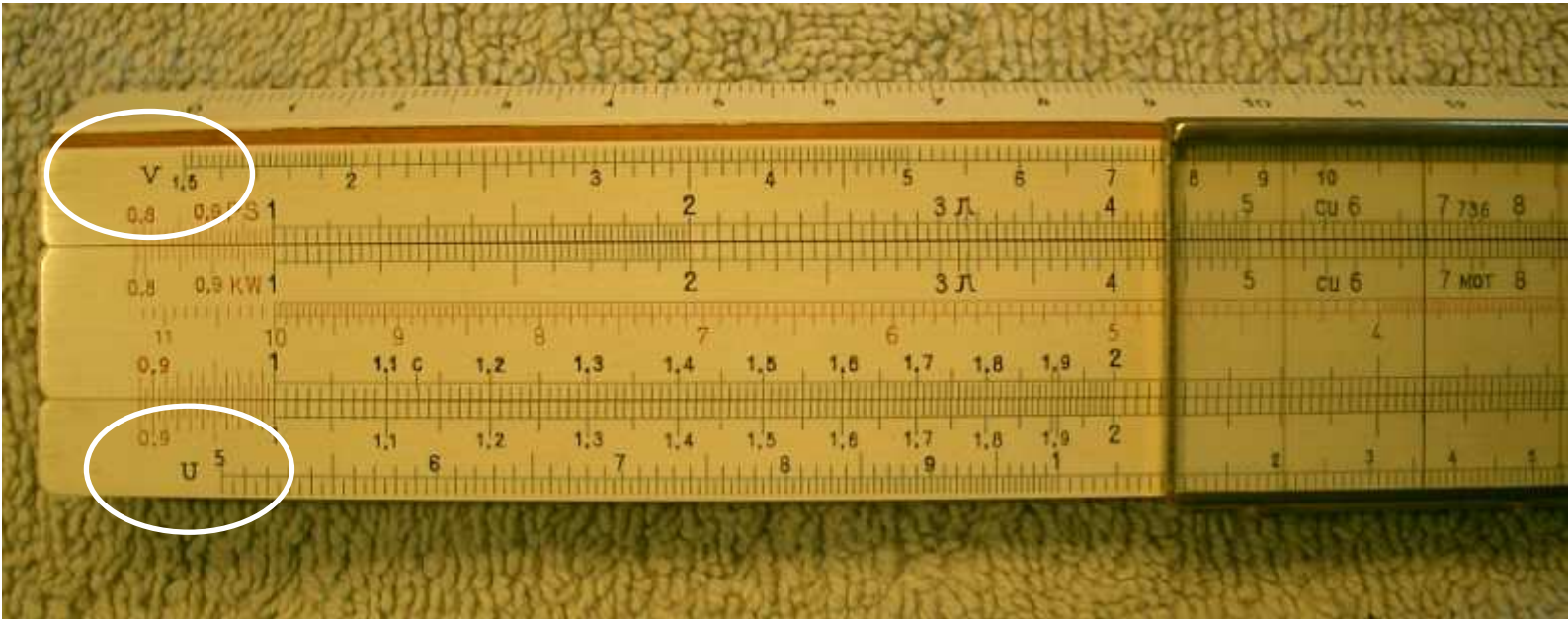
Logarex 82



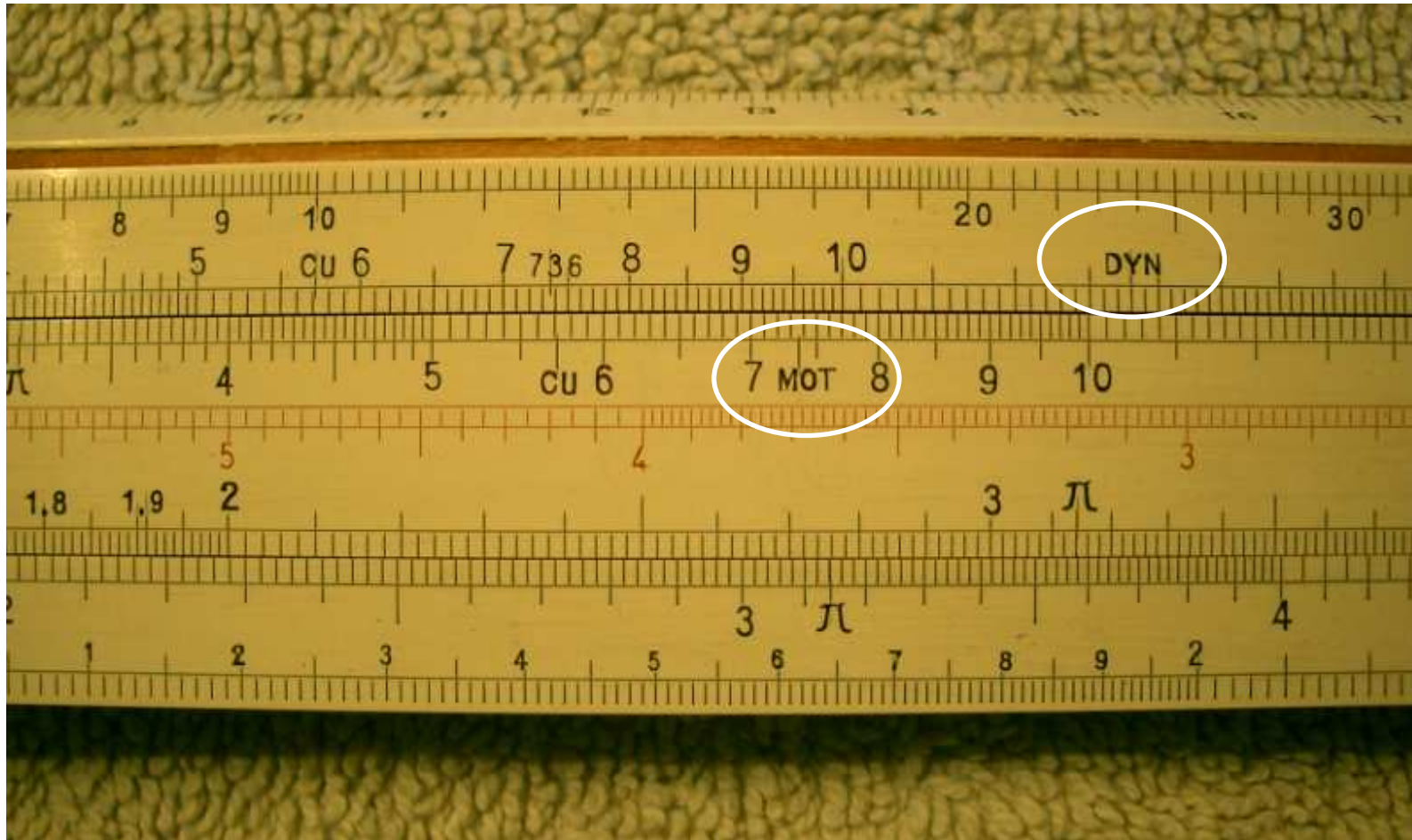
Koch Huxold Hannemann



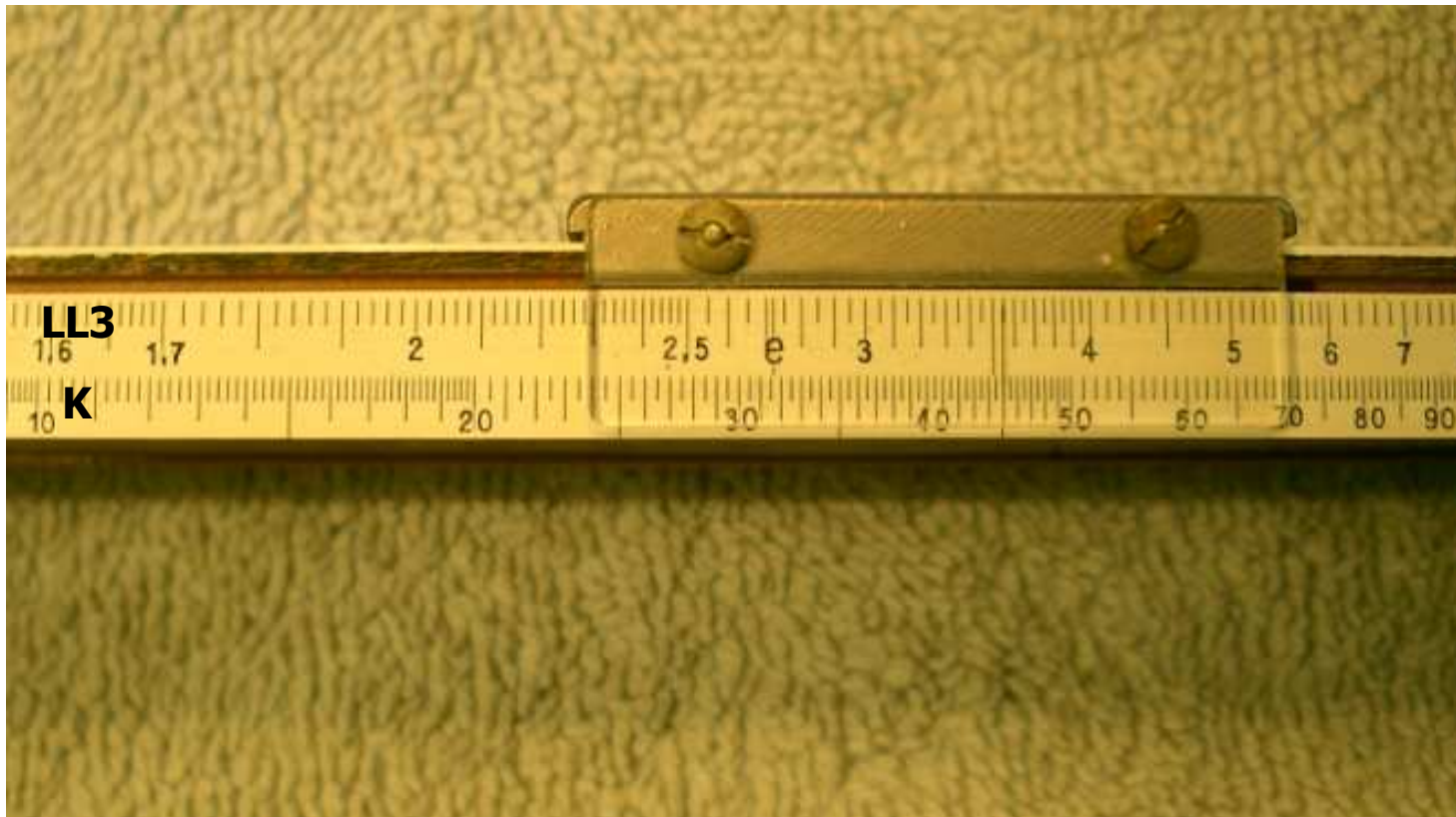
Nestler 37 [0370]



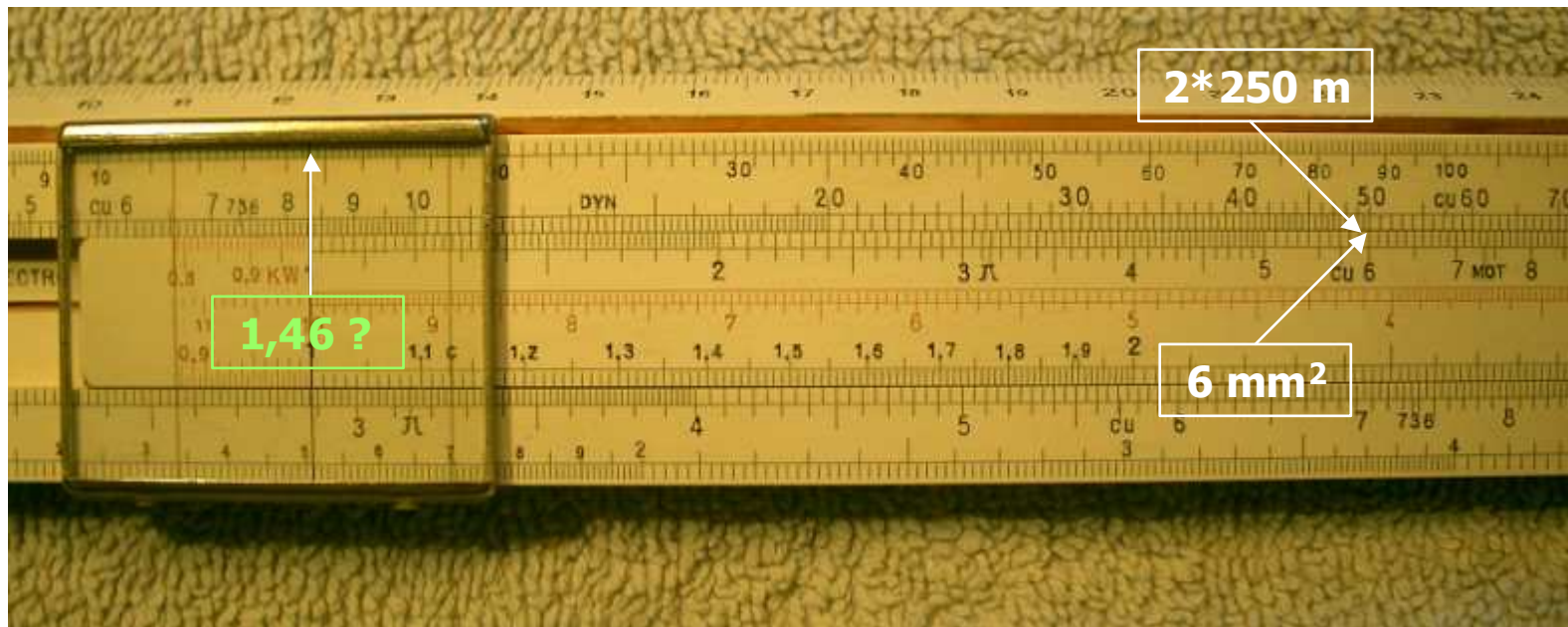
Nestler 37 [0370]



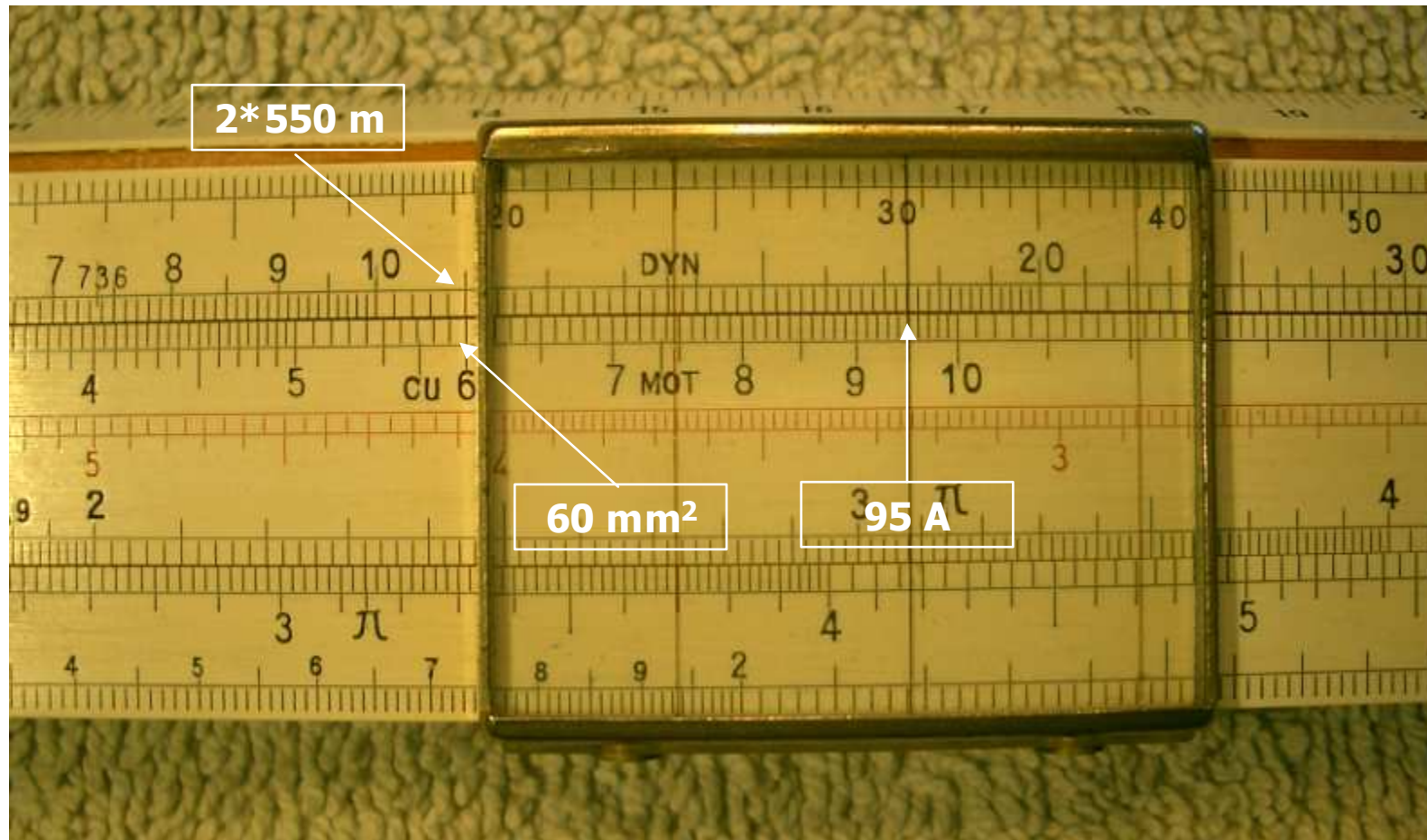
Nestler 37 [0370]



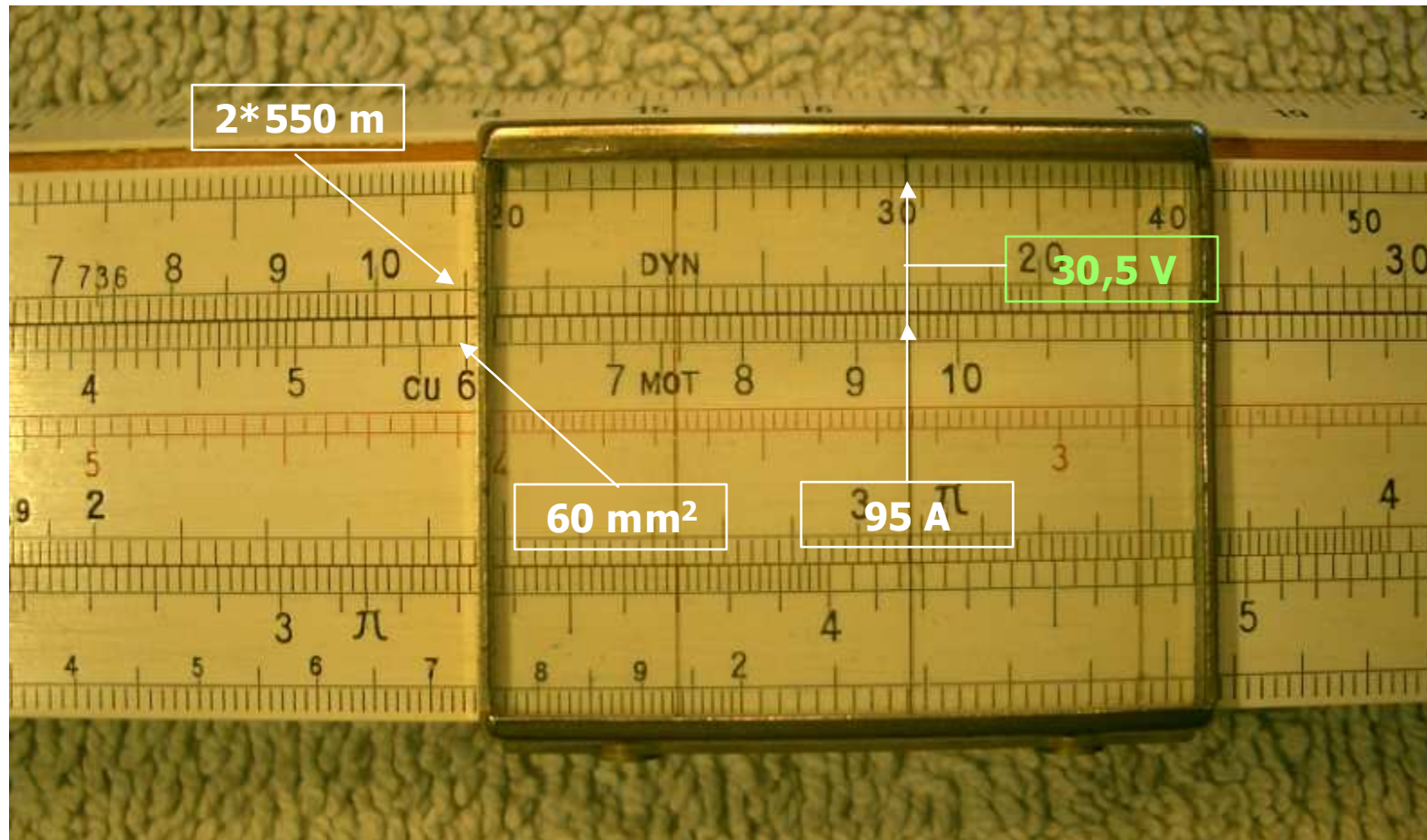
Schleifenwiderstand



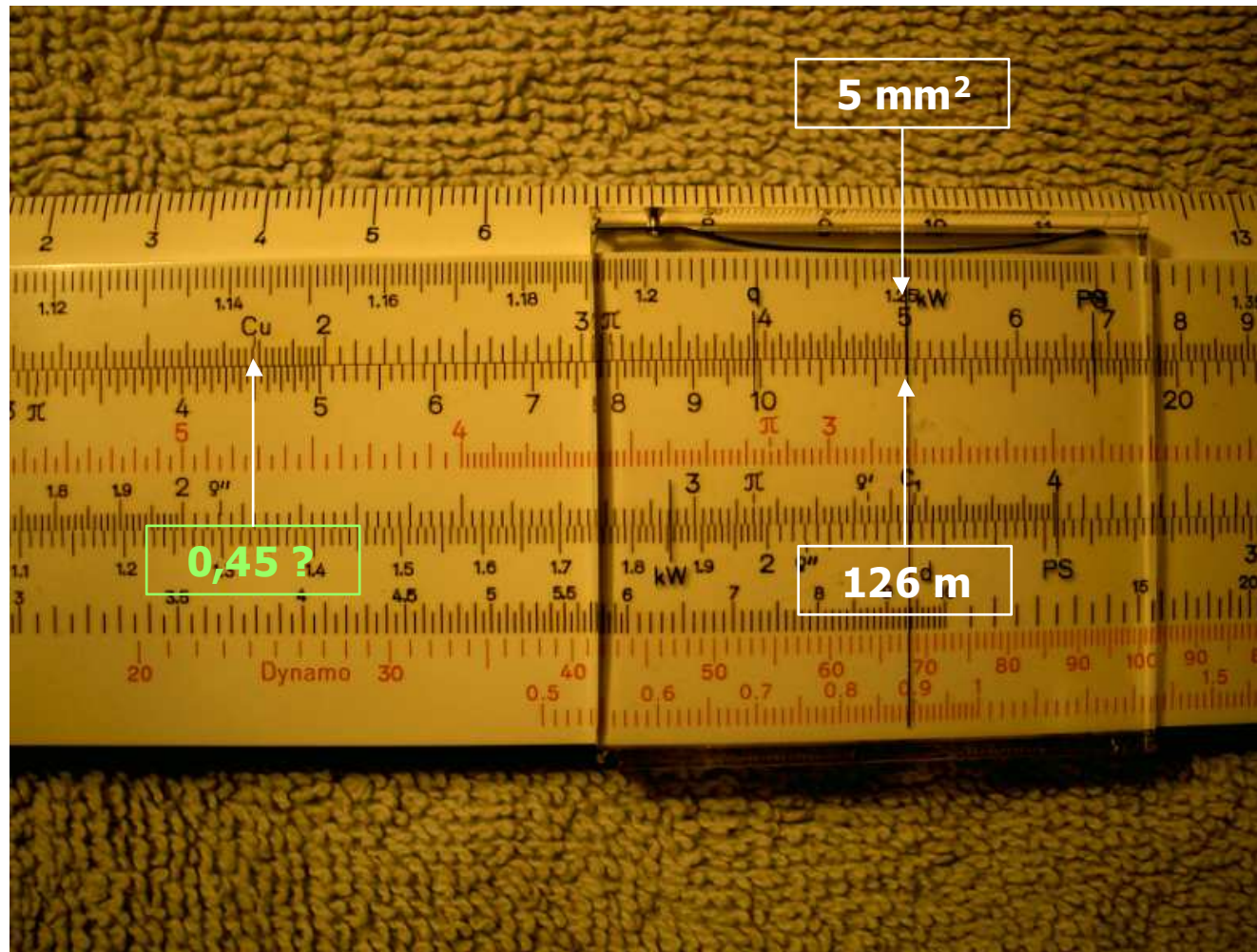
Spannungsfall



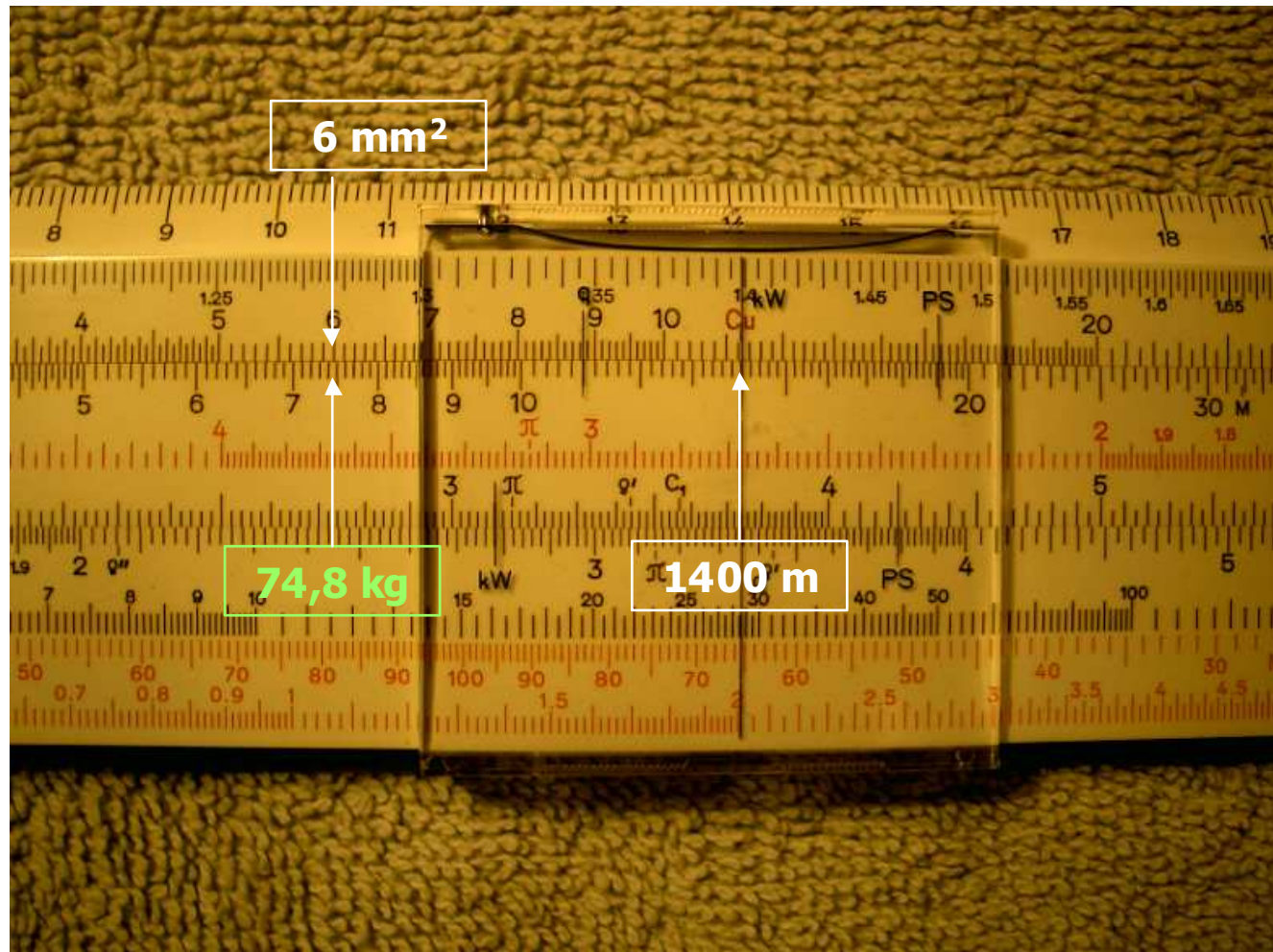
Spannungsfall



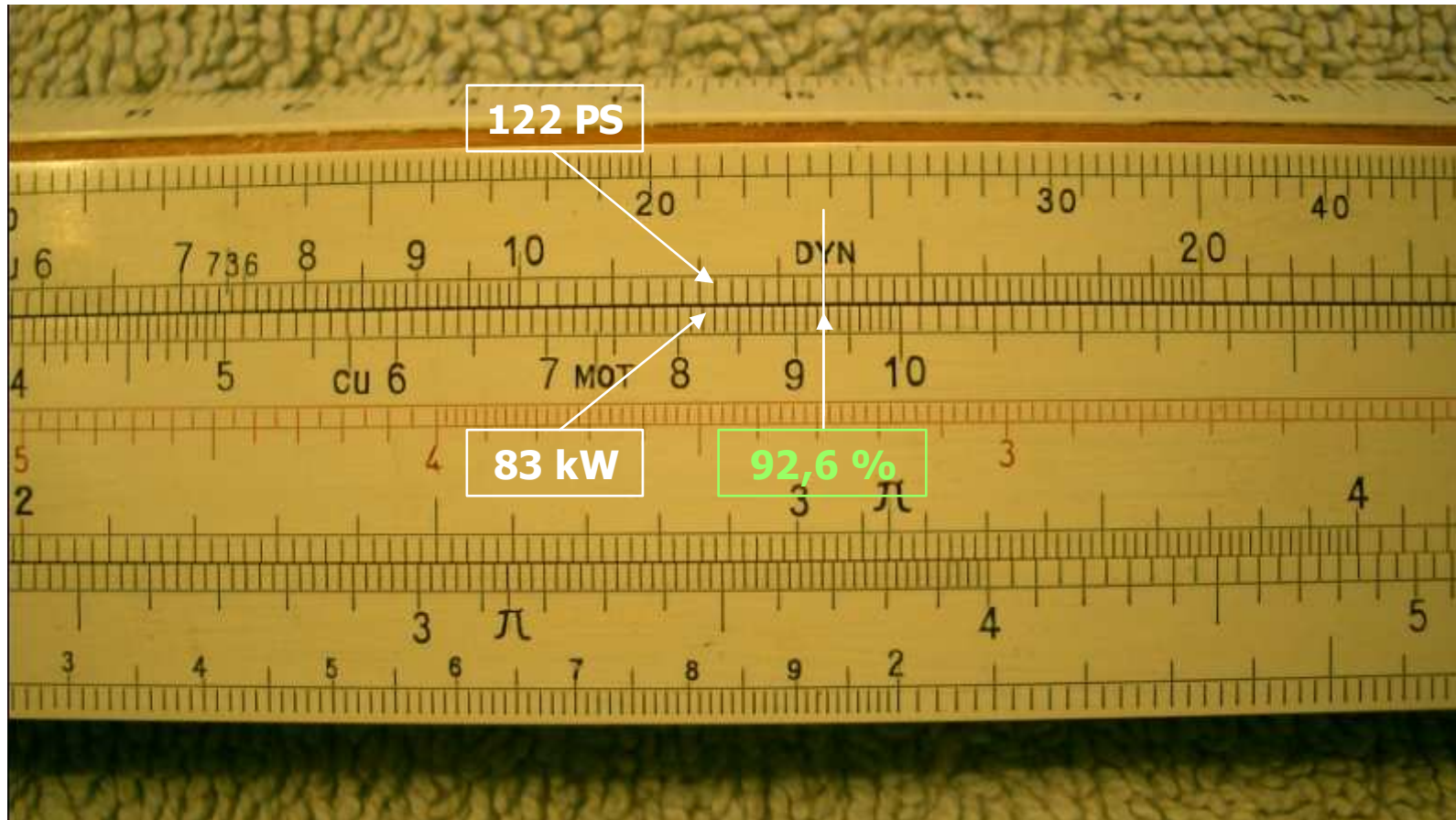
Schwarze Marke Cu : Leitungswiderstand



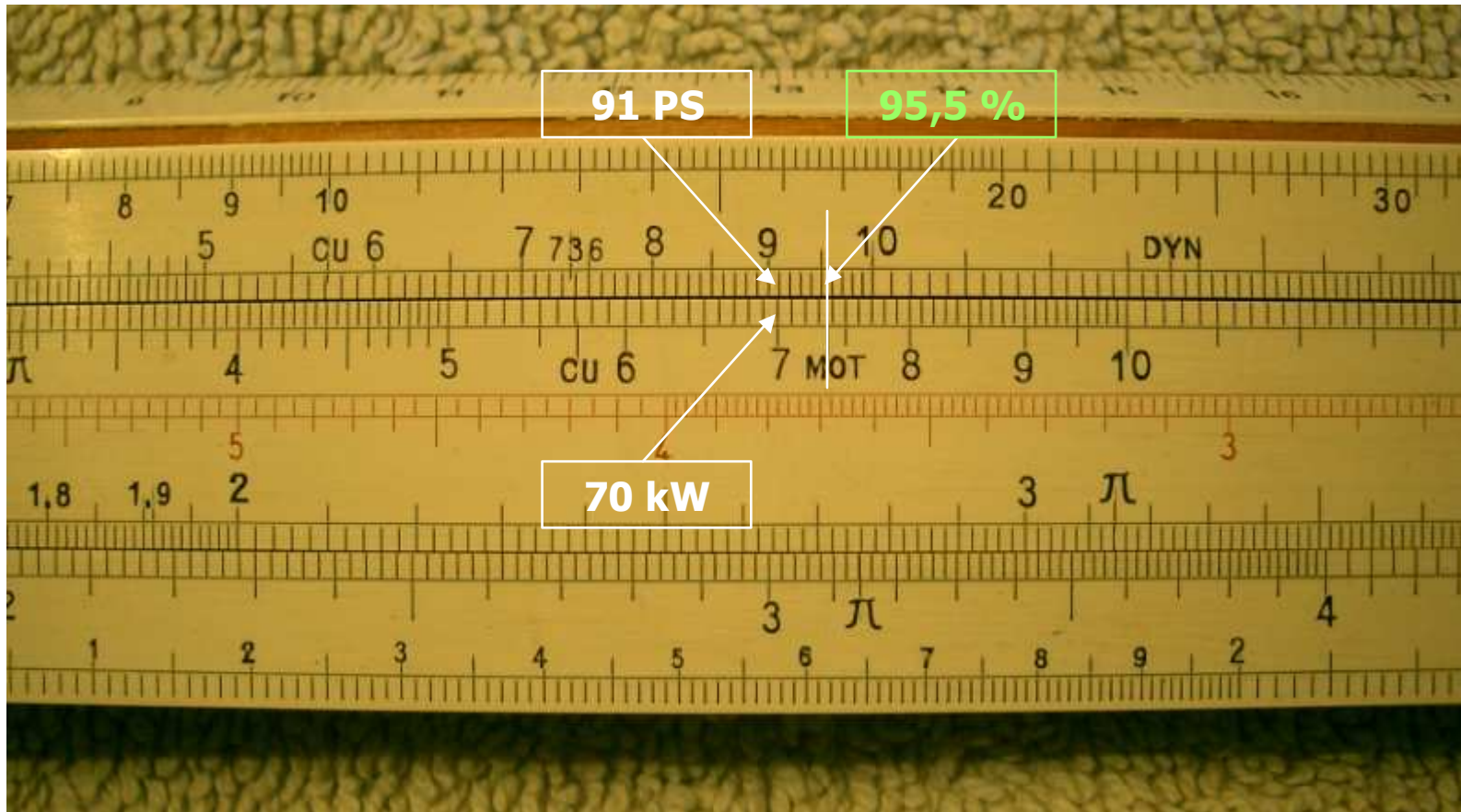
Rote Marke Cu : Drahtgewicht



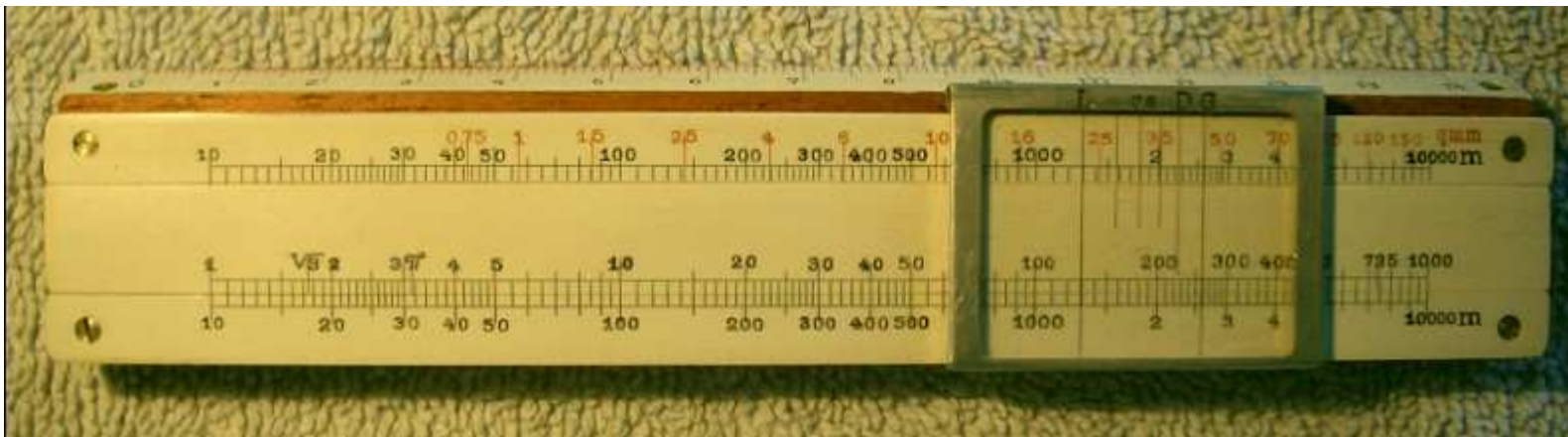
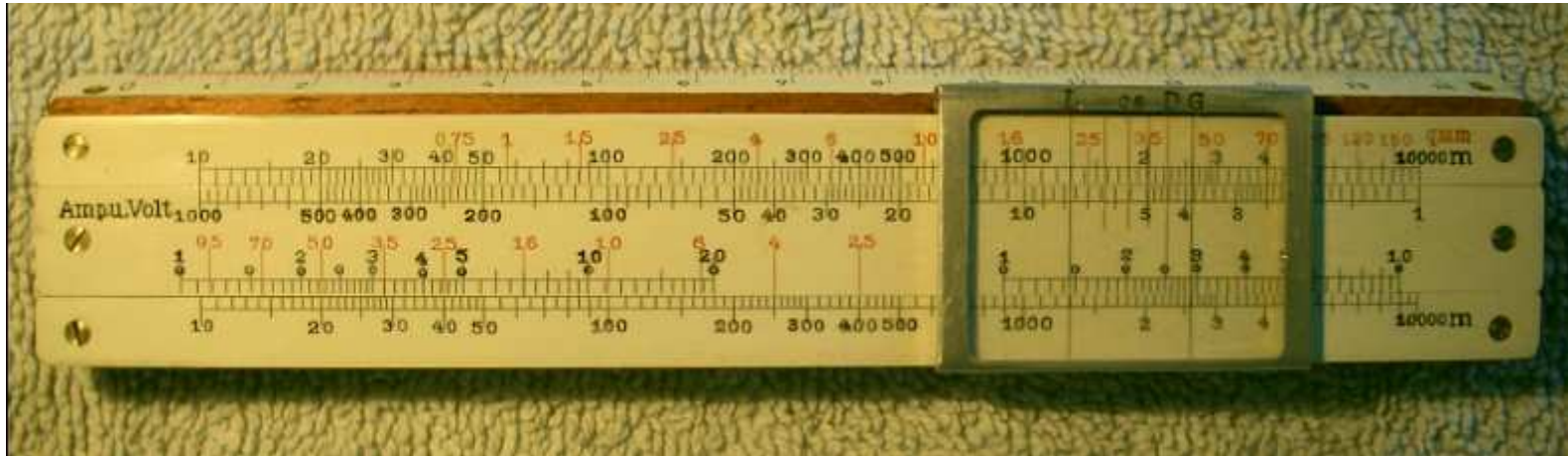
Generatorwirkungsgrad



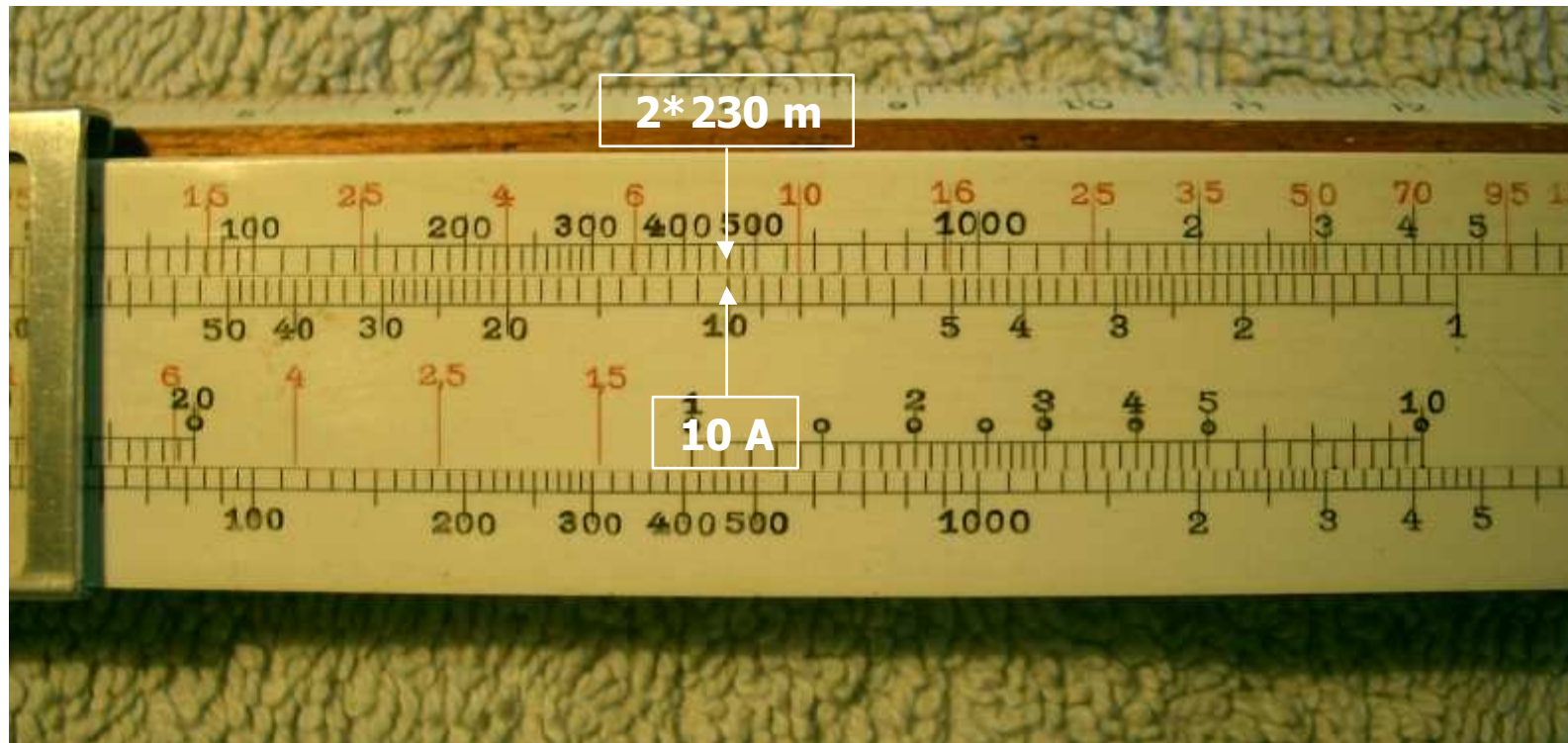
Motorwirkungsgrad



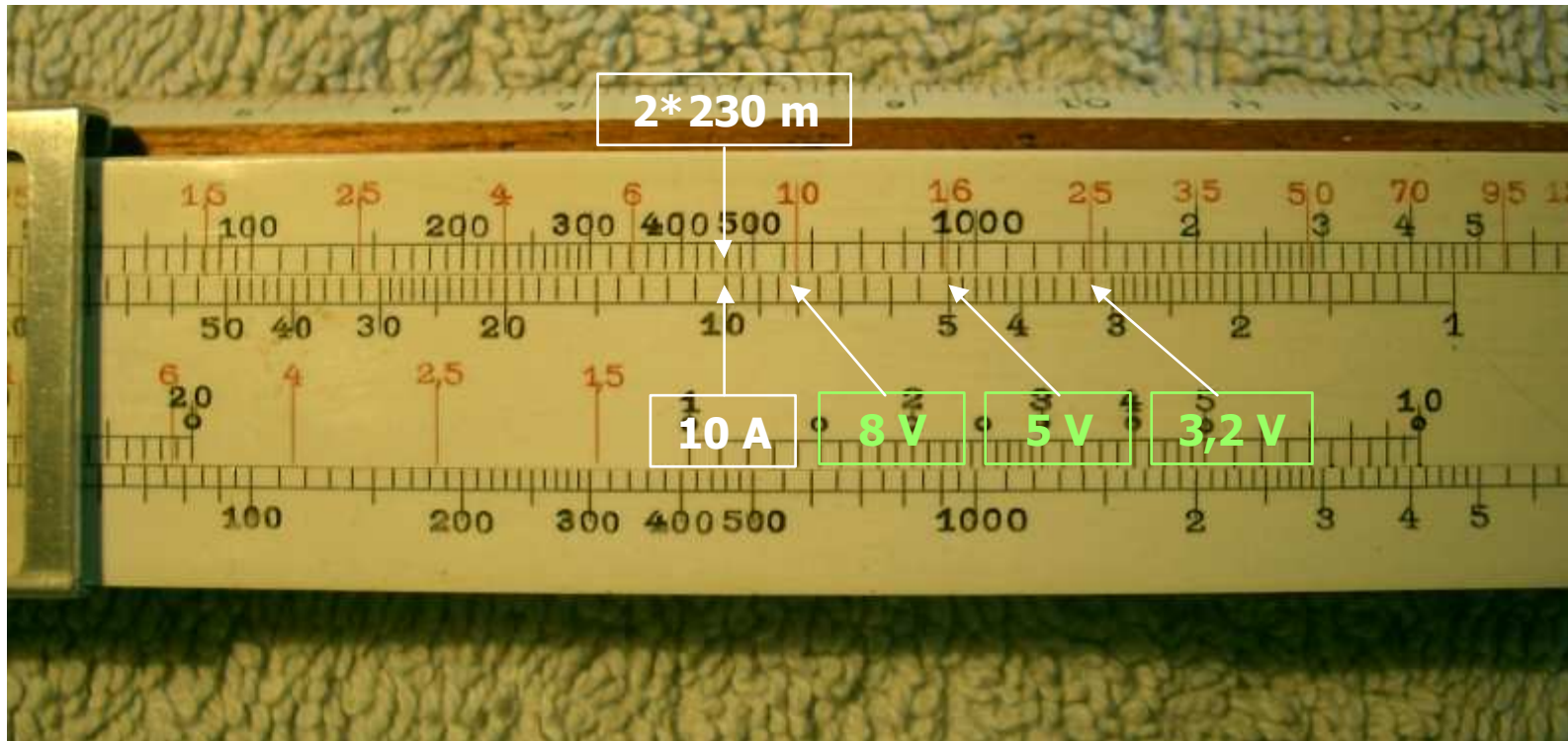
Nestler 39 System Besser



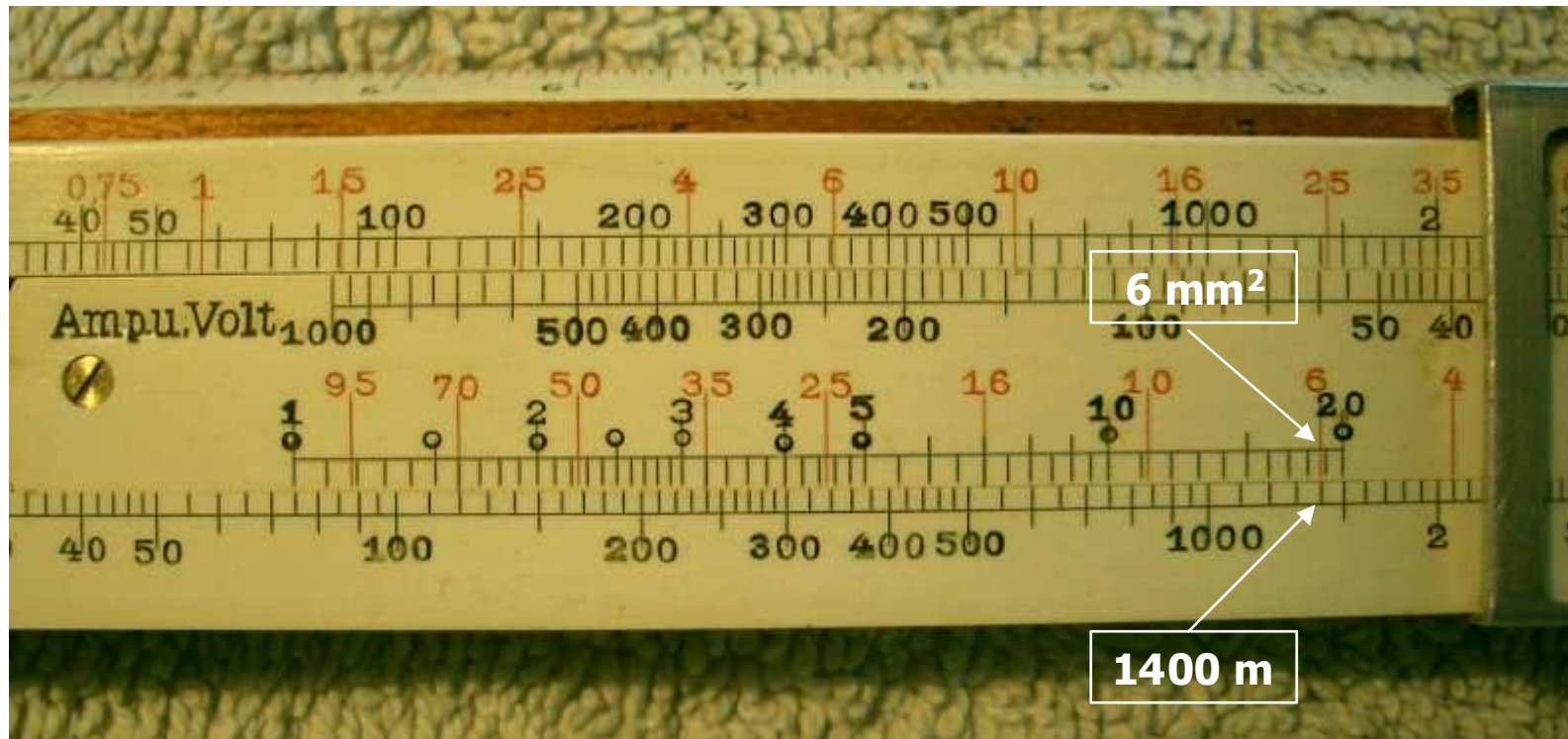
System Besser; Spannungsfall



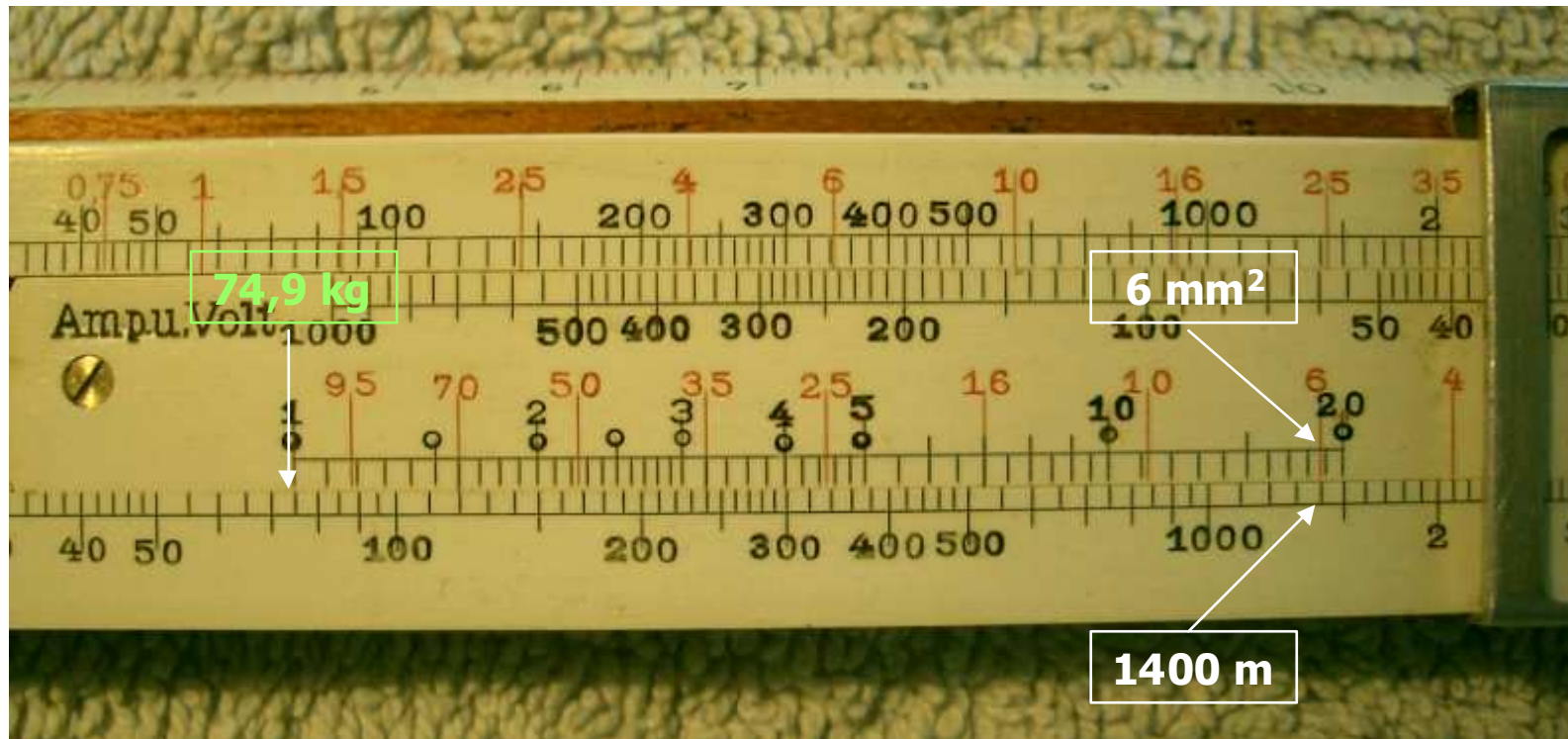
System Besser; Spannungsfall



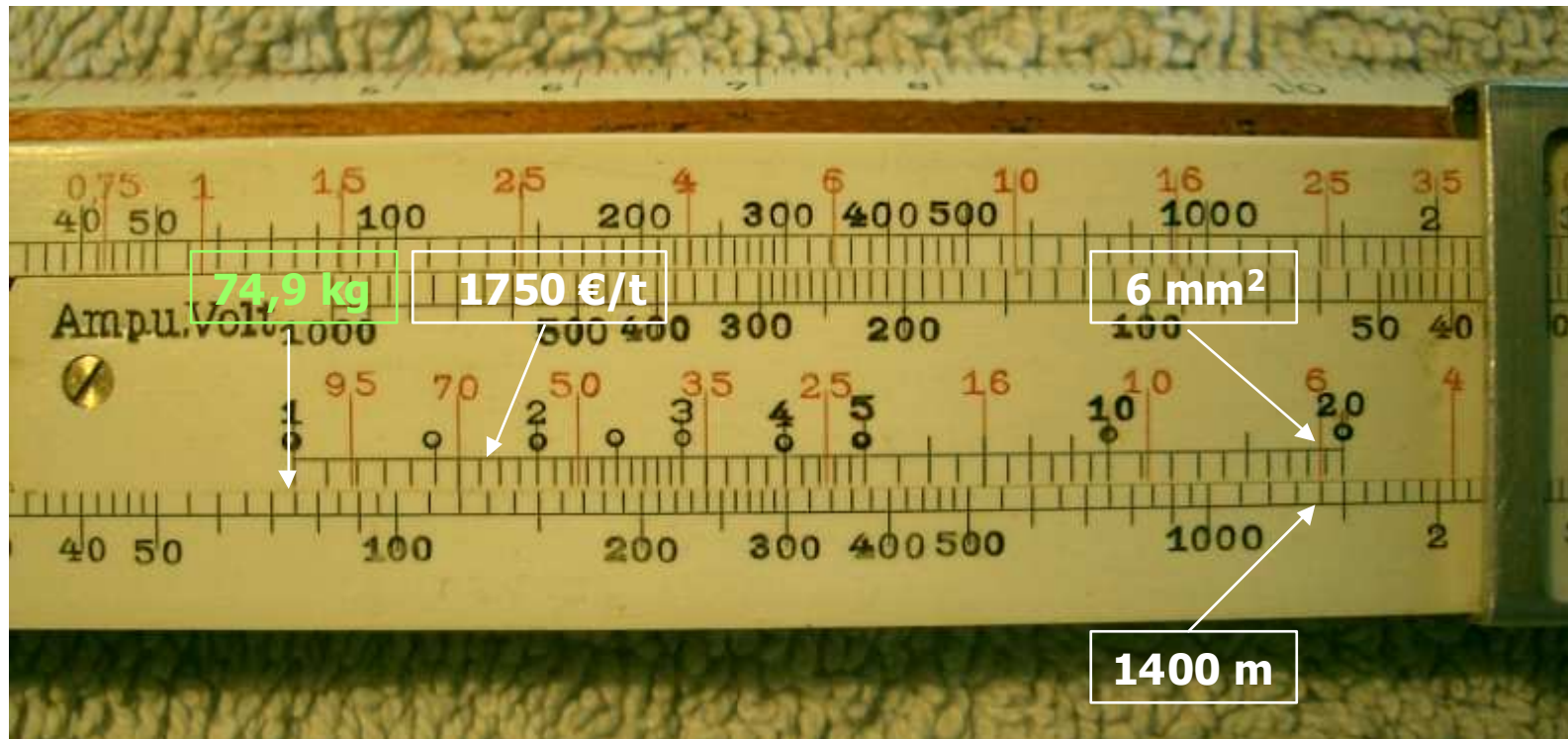
System Besser; Drahtgewicht und -Preis



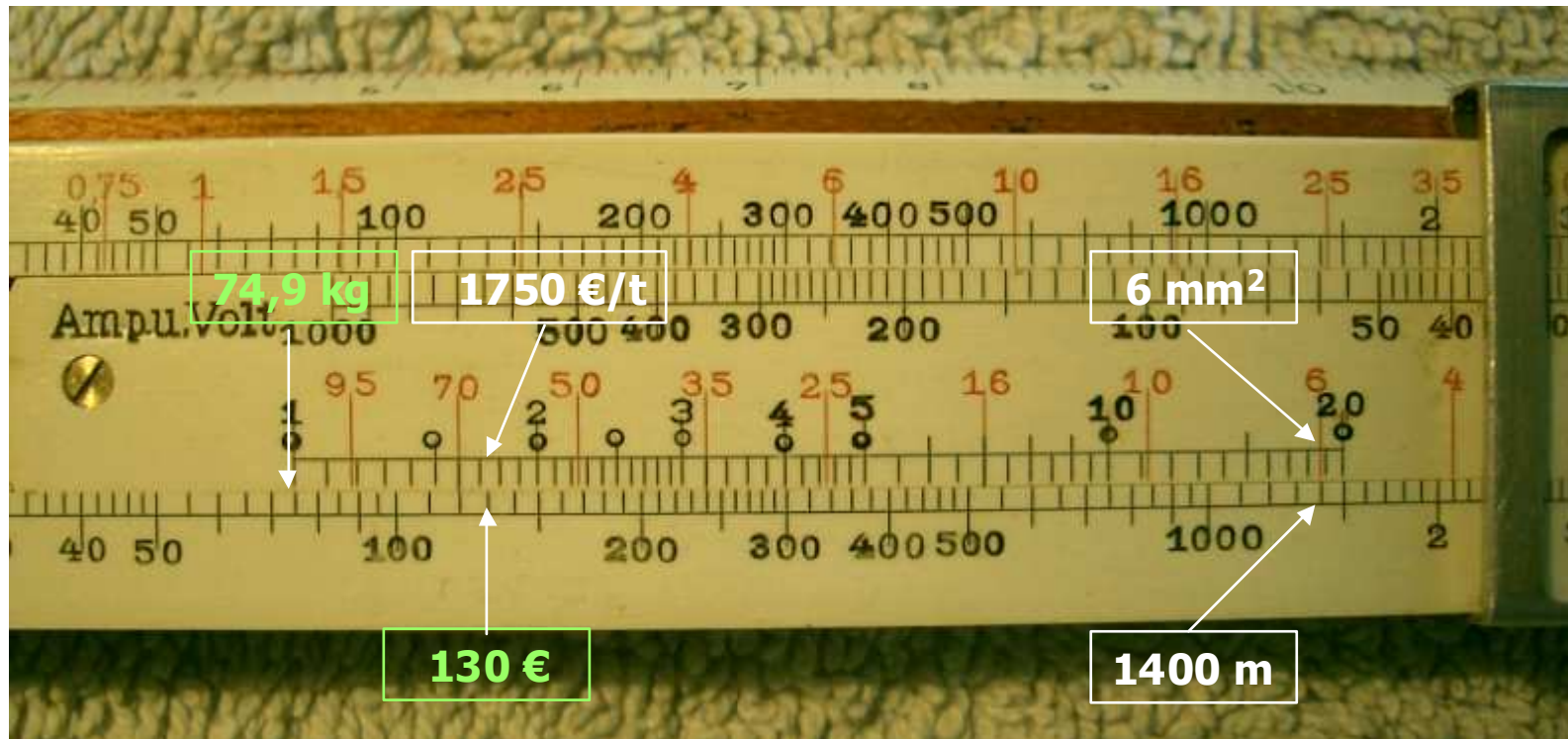
System Besser; Drahtgewicht und -Preis



System Besser; Drahtgewicht und -Preis



System Besser; Drahtgewicht und -Preis



Beim nächsten Mal mehr

Elektro,

Electro,

Electric,

Electronics ...

... wenn Ihr wollt

Danke für Euer Interesse!

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