How Well Known Were Slide Rules in Germany, Austria and Switzerland Before the Second Half of the 19th Century?

Werner H. Rudowski

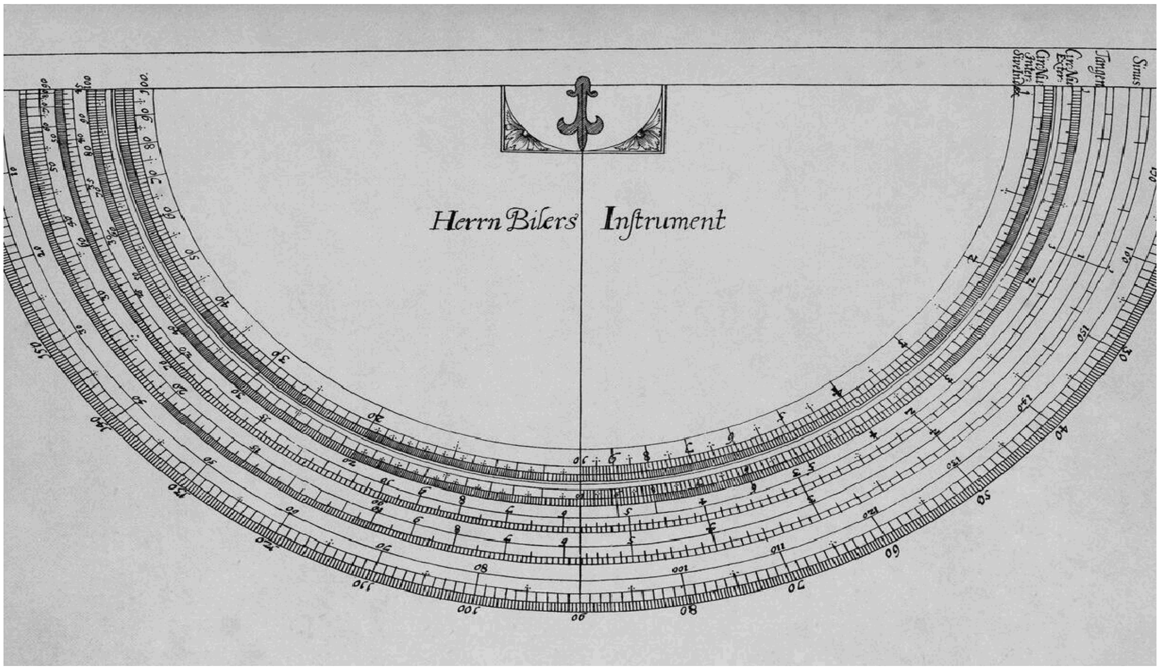

Figure 1. Biler's Slide Rule, 1696.

Introduction

There are still quite a few English slide rules from the 17^{th} century existing, and probably several thousands from the 18^{th} and beginning of the 19^{th} century. Most of these slide rules were designed for special applications like navigation, excise duties, or timber trade. They were made of boxwood, often with slides of ivory or brass, sometimes completely manufactured from ivory, which of course was much more expensive but also provided better legibility.

And how many slide rules have survived in Germany or Austria from this time? We know of only one. But does this mean that slide rules were unknown in this part of Europe before the second half of the 19^{th} century? We will show that this is only partly the case.

Biler's Instrument

As Cajori [1] pointed out, the first description of a slide rule dates from 1696. D.Joh. Matthaei Biler had a drawing of this instrument together with "5 Bogen Text" (40 large pages) of explanation printed by Crecker's publishing house in Jena. The title was: *Descriptio instrumenti mathematici universalis, quo mediante omnes proportiones sine circino atque calculo methodo facillima inveniuntur.* He called his instrument the *instrumentum mathematicum universale.* Figure 1 is taken from Jacob Leupold's THEATRUM ARITHMETICO GEOMETRICUM [2] and shows a semicircular instrument. Biler did not give the source of his idea and did not explain, in his description, the mathematical bases. It can be assumed that he had chosen the unusual semicircular form, because he was familiar with an ordinary protractor. Leupold had suggested extending Biler's instrument to a whole circle.

Leupold praised this instrument as being extremely quick and a pleasure to use for all mathematical applications, such as arithmetic, geometry, trigonometry, etc. It needs no dividers and no ruler, just a thin silk thread or a hair.

Starting from the outside the instrument bears the following scales:

- 180 degrees
- Sinus from 30 minutes to 90 $^\circ$
- Tangens from 30 minutes to 45 $^\circ$
- Circ. Nu. Exter = double logarithmic line of numbers
- Circ. Nu. Inter = double logarithmic line of numbers

Values of sinus and tangens could be found on the logarithmic scales with the help of a silk thread.

The inner "Circ. Nu. Inter" can rotate against the "Circ. Nu. Exter", and therefore operates like a slide.

Biler called this inner circle “Indicem”. A hair or silk thread would be the cursor. Leupold is of the opinion that these scales are especially useful for “Regul de Tri” (rule of three) calculations.

Although it is not mentioned, it can be assumed that the printed instrument should be cut out and, if required, glued onto a wooden plate or onto cardboard.

Leupold describes the manufacture and use of Biler’s “Instrumenti Mathematici” in his book.

Scheffelt’s first “Maß=Stab”

Three years later, in 1699, Michael Scheffelt produced a book:

PES MECHANICUS ARTIFICIALIS
oder
Neu=erfundener
Maß=Stab [3]

(Newly invented ruler)

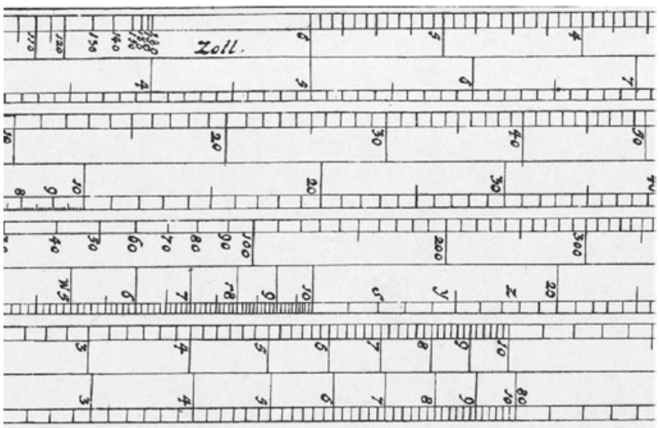

Figure 2. Opposite page 42 in Leupold.

Figure 2, taken from Leupold’s book, shows the four sides of this rule, which actually is not a slide rule, but needs dividers for doing the calculations.

Scheffelt gave a very extensive and complete description of his invention, and Leupold also explains very detailed design, manufacture, and use of this rule. He thought that it would be better to call the rule “Rechen-Stab” (calculating rod) because it contained all *noble scales for Arithmetica, Geometrica, Stereometrica, and also Trigonometrica &c.* Leupold points out that without troublesome calculations, and with only the help of a pair of dividers, all values could be found most quickly.

In his introduction to this instrument, Leupold mentioned that different versions of such instruments were invented, but he had concentrated on those with a complete set of scales.

In thirty pages of text plus two pages of illustrations Leupold describes this “Maß=Stab” in detail and explained the scales:

Scale 1: Line 1: one “Ulmer Schuch” divided in 10 Zoll with subdivision into 100 parts in total.

Line 2: right half: 6 Zoll subdivided into 12 parts each.

Left half: Linea Chordarum

Scale 2: Line 3: Linea Geometrica (Quadrat-Zoll): gives the square of line 1.

Line 4: Lineam Cylindricam (Cylinder—Zoll): gives the surface of a circle and is related to Line 1.

Scale 3: Line 5: Linea Cubica (Cubic-Zoll): gives the cube of Line 1

Line 6: Linea Arithmetica: two-radius logarithmic scale

Scale 4: Line 7: Linea Sinuum, related to Line 6

Line 8: Linea Tangentium, related to Line 6

The main point for Leupold is the construction of the scales, and only then did he describe the use of the scales. He not only gave detailed instructions for dividing the scales, but he also included tables with necessary data for all the lines (scales).

For the Linea Arithmetica (line 6) Leupold used the values from *Tabulis Logarithmorum Adriani Vlacquii.* The letters “a, q, F, u, etc.” were added just for explanation of the examples.

It is remarkable that Leupold does not mention what Albertus Veiel, in his introduction to the first edition of Scheffelt’s book, had pointed out:

> As it is not at anytime and at any location possible to find mechanics and artists who are *able to manufacture instruments with high accuracy many mathematicians made them by their own and to their own requirements. And by this they made new inventions.* Later Veiel said that the body of the Maß=Stab could be manufactured at low cost by any mechanic but the scales should be done by “artists”.

And he added that this Maß=Stab and other instruments in wood or brass could be acquired from the author (i.e., Scheffelt).

Veiel also pointed out that Scheffelt had received the idea for his Maß=Stab from an instruction for design of fortifications by Wendelin Schildknecht and *Problema Mathematica* by the Austrian clergyman P. Lenepp.

Scheffelt’s Second “Maß=Stab”

In 1718, Michael Scheffelt published a second edition of his *PES MECHANICUS ARTIFICIALIS* (Figure 3 shows the front-page). It explains this new instrument on 263 pages (plus a bombastic dedication to his most-gracious sovereign, plus prefaces for the first and this new edition, plus 14 pages of register, plus 15 copperplates); it is indeed a slide rule, as it can be used without dividers.

Figure 4 shows the copper print for the three rods with the total of 12 lines, some with more than one scale. Thus, actually there are 19 scales. Scheffelt gave exact instructions for which scales had to be placed on each of the rods. In the following extensive explanations of the scales, and with many examples, Scheffelt described which two of the three rods had to be used together for finding the solutions.

Michael Scheffelts / Ulm.
PES MECHANICUS ARTIFICIALIS,
Oder:
Neu=erfundener
Maß=Stab,
Auf welchem
Alle Proportiones der gantzen Mathesis oh
mühsames Rechnen, so wohl mit=als ohne Hand=Circ
in Arithmetica, Geometria, Stereometria, als auch Trigonometria,
mit grosser Behendigkeit, zu höchstem Vergnügen eines Liebhabers,
können gesucht, und gefunden werden;
Jetzo bey dieser neuen Auflage so wohl mit mehrern Linien
und Figuren, als auch sonsten vermehret.
ULM,
Verlegts Daniel Bartholomæi, 1718.

Figure 3.

Figure 4.

It appears strange that Leupold did not mention this rule in his *THEATRUM ARITHMETICO GEOMERICUM* [2] printed shortly after his death in 1727. Did he not have a copy? And was he not aware of Scheffelt's small work of 1702, titled *Kurze Anweisung des neu=erfundenen Maß=Stabs* (short instruction to the newly invented rule)?

Scheffelt: *Soon after publishing the first edition of my* "Pedis Mechanici" *I had the idea how to use it without dividers.* He made two leather straps (with scales) and prepared, in 1702, this short instruction, where he explained how all mathematical questions could be solved with a sliding rule, or two suitable leather straps of 3 Schuch length (approximately 90 cm). He also pointed out that he had made many rules by himself from brass or wood with glued-on copper-prints, and had sold them at different places.

The two leather straps could be rolled as done with "Visier-Rollen" in wooden boxes, and then could be pulled out as required. It is interesting, that in June 2006 on ebay, just such a logarithmic slide rule, consisting of two steel tapes of eight-foot length, was offered. The brand name is MULTOR and it was sold for $480. See figure 5.

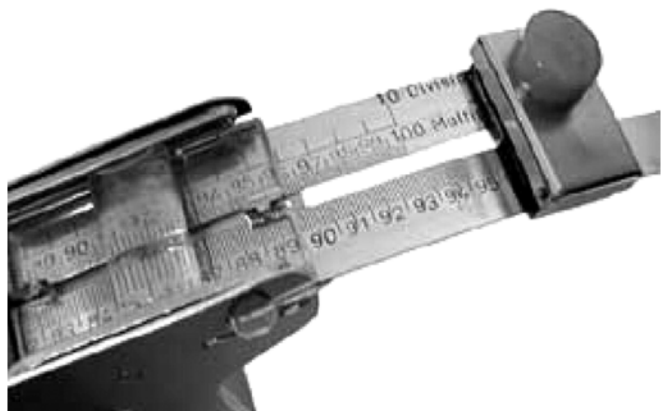

Figure 5.

As stated on the front page, the newly invented rule could be used with or without dividers. Scheffelt therefore described both rules—the old and the new one—in the second edition of 1718. Despite the copper-prints in his book he offered rules made from brass, which are more durable and more convenient. And he offered a folded rule that combines a sector and a slide rule, an easily portable instrument. All these could be bought from the author or his publisher for a reasonable price.

Making Scheffelt's Maß=Stab

In the second edition, Scheffelt explained how he made both versions of his *newly-invented Maß=Stab.* For the rule to be used with dividers he wrote:

> From a carpenter or cabinet maker I let make a rod of good, hard and white wood approximately one "Schuch" long and three-quarters of an inch thick or more. It is drilled and the opening can be closed by a screwed cover. So it could be used to collect a pen or pencil, *etc.*

Leupold specified wood of a lime tree to be used for this kind of rule.

For the "Maß=Stab" to be used without dividers, Scheffelt did not give such detailed instructions. He just mentioned that this rule consists of three thin rods of which both sides carry, in total, twelve scales. Again, this rule should be one "Schuch"[1] long (Figure 3). The three rods are **not** connected in any way. They could be laid together as required. But Scheffelt gave instructions in which order the twelve scales had to be arranged, and he recommended storing them safely in a box.

Generally Scheffelt gave detailed instructions about the design of the scales, but no hint as to how to draw a line or scale or a number. It does not say whether they are just drawn in ink, or cut respectively, punched and then blackened.

It would go beyond the limits of this essay if all the lines on Scheffelt's rules could be explained. Therefore, the only hint (that for the Linea Arithmetica) he gave is a list of the logarithms with four digits he had taken from *Tabulis Logarithmorum Adriani Vlacquii.*

"The Unknown Inventor"

Leupold, in his book of 1727 [2], described an old manuscript of 10 Bogen (160 Octavo pages) which he owned, but of which he did not know the author. He had never before seen a similar ruler, which *is a curious counting rod with a slide to solve all mathematical tasks extremely quick without dividers.*

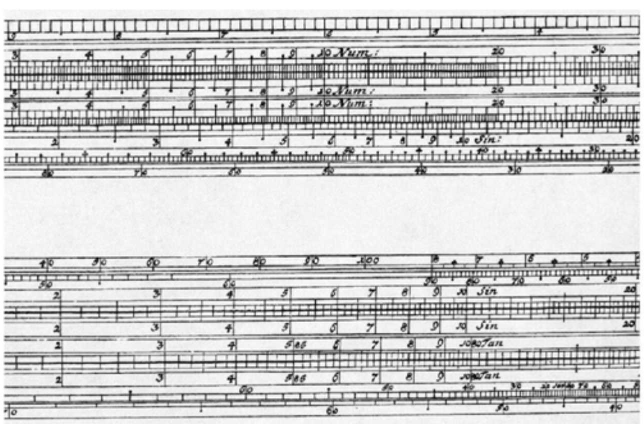

Figure 6.

Leupold had it made in boxwood by the mathematically experienced Georg John, Halle. Figure 6 shows this real slide rule, front (A) and back (B). In only five and one-half pages Leupold described this slide rule, but offered a copy of the original manuscript for a price. He also suggested a new subscription of the original should there be enough interest. This could include the slide rule made of wood or cardboard or even metal. The total price could be 16 Groschen.

The rule consisted of three rods, each approximately 1/2 inch wide and about 1/4 inch thick. The length could be 1, 2, or 3 feet, the longer the more accurate. The two outer rods must have the same length; the middle one must be a bit longer for ease in moving it. But all rods must have the same thickness. The outer two rods must be connected at each end by a small brass plate holding them tightly together but allowing sliding of the middle rod.

Leupold did not recommend self-manufacturing this slide rule because it would be cheaper to buy it from a maker experienced in fabrication of mathematical instruments and having the skill to produce all kinds of scales. He also gave no instructions as to how to design the scales, because he had done that already for the other instruments. But he noted that the *Linea Numerorum* has to be doubled and that the unknown inventor had called his instrument *Double Scala Proportionum.*

This slide rule had scales on both sides and Leupold suggested having even more or different scales on this rule, preferable on the edges; for example, an inch-scale, a Meridian line, or others as requested for a profession, etc.

Only a few examples and solutions were given by Leupold from the many in the original manuscript. A summary of the scales on both sides is given in the comparison table.

Leupold did not know the inventor, but we know him: it was Seth Partridge. In Chapter I of his book, *The Description and Use of an Instrument called the Double Scale of Proportion* [4], [2] we find exactly the description given in Leupold's book. This was translated into German. What we still do not know is the author who translated Partridge's book and got it printed. Leupold mentioned 160 pages of the German version, while Partridge's small book has approximately 200 pages. It can be assumed that the German "author" also has translated exactly all the examples given by Partridge. In all editions we find an *Advertisement* where Partridge explained why he did not include a drawing of his *Double Scale of Proportion,* but instead recommended buying it from accurate makers like *Walter Hayes at the Cross-Daggers in More-Fields.* According to Partridge's description, Leupold prepared the copper print (Figure 6).

The right side of Figure 7 (Leupold: Tab. XII) shows a different method for dividing the logarithmic line—a logarithmic diagonal transversal scale. Leupold mentioned that he had gotten this idea a long time previously, and explained the letters on top as the initials of the author, but did not give his name.

This scale measures only 243 mm (not in scale), i.e., it comes from a different source than the slide rule on the same copper print that is 273 mm long. As one needs two cycles, the scale would require double the length, and thus a huge pair of dividers. Leupold therefore recommended halving the scale.

[1] See the article "How Long is One Foot" on page 63, this issue.

[2] First published in 1661, with at least three more editions in 1671, 1685, and 1692.

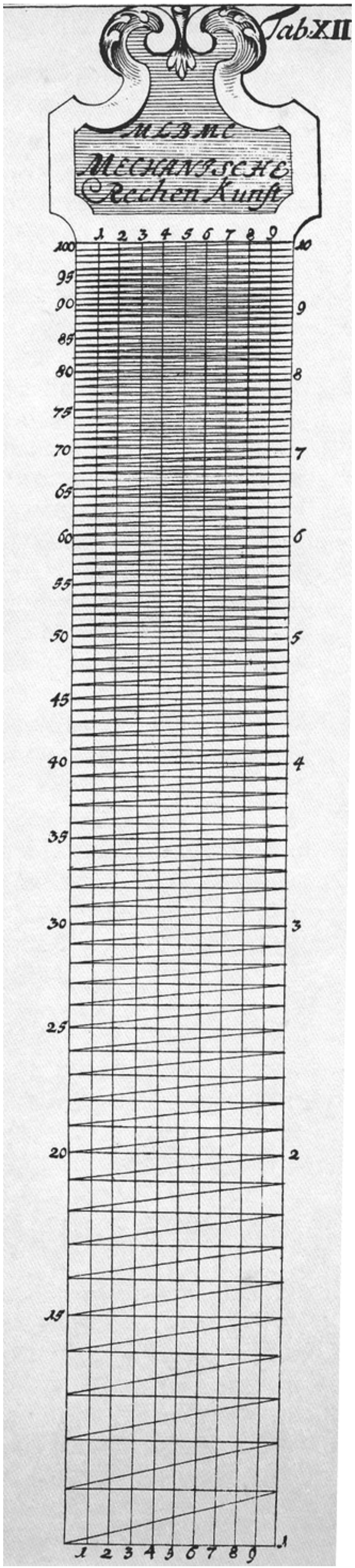

Figure 7, a logarithmic diagonal transversal scale.

The Lambert-Brander Slide Rule

There is a period of about half a century until another slide rule design is known. The famous German astronomer and mathematician, Johann Heinrich Lambert (1728-1777) described a slide rule in 1761 in his *Beschreibung und Gebrauch der Logarithmischen Rechenstäbe*[3] (Description and Use of Logarithmic Slide Rules) which was then manufactured by one of the most experienced German instrument makers, G.F. Brander from Augsburg (1713-1783). It consisted of two separate rules of about four feet in length, with only mathematical scales (log, sin, tan, linear). It was a very precise instrument made in wood and in metal, with an accuracy of 0.002, i.e., ten times better than conventional rules. The two rules were not connected and therefore had to be shifted against each other on a fixed base. Although probably quite a few of these rules were made, it is not known if any still exist.[4]

According to Cajori [1] Johann Andreas Segner (1704-1777), professor of mathematics in Göttingen, described a slide rule in 1750 and had it engraved upon copper. But his efforts had but little influence on the introduction of slide rules in Germany.

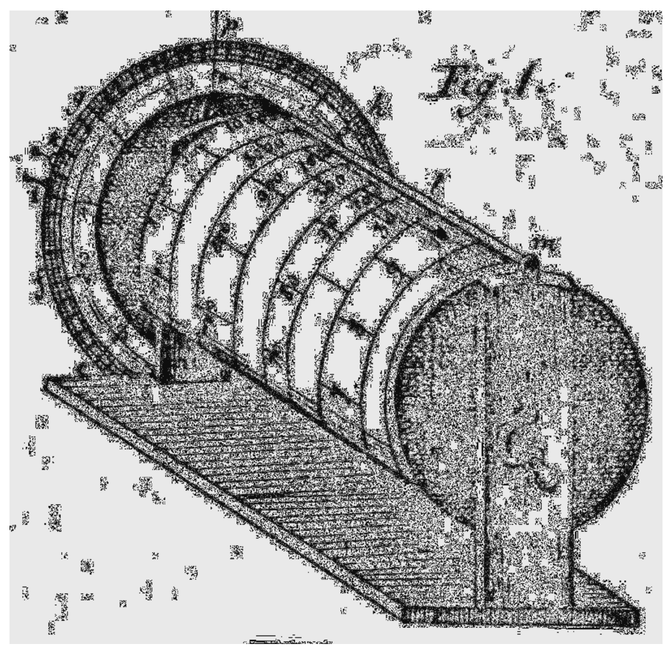

Figure 8.

The First Logarithmic Calculating Cylinder?

In 1801, Johann Christian Wiegleb, succeeded by Gottfried Erich Rosenthal, published in Berlin and Stettin *Die natürliche Magie aus allerhand belustigenden und nützlichen Kunststücken.* [7] (The Natural Magic consisting of a Medley of Amusing and Useful Clever Tricks). In the sixteenth volume they described a *Cylinder Machine for Calculation.* Figure 8 is unfortunately, a rather bad copy, but shows this machine. The cylinder carries eight windings with a logarithmic line from 1 to 10,000; on the left side there are a fixed and a revolving disc. And fi-

[3] second edition 1772

[4] More details of this rule were given by Professor Karl Kleine during the IM 2006 in Greifswald.

nally, a piano string works as an indicator. The usage of this machine is rather complicated and may be explained in a future article.

Still Existing Old German Slide Rules

Horsburgh [12] listed all exhibits gathered for the tercentenary of the invention of logarithms, 1914 in Edinburgh. Here we find under *Exhibits* by Lewis Evans, Esq.:

Boxwood rule, (German) 11 1/2 x 1 3/16 x 5/16 inch having one slide, to draw out only. Radius 10 1/4 inch. With its original leather case.

Date 1737

No details were given about the scales and the inventor or maker. I do not know of it or where this slide rule could be found today. But it can be assumed that after 1914 such a rare piece would not have been thrown away. Therefore it might be an interesting task to find its current domicile.

During the IM 2001, the *Deutsches Museum* in Munich presented an early Austrian slide rule for *Chemical Equivalents.* It was invented in 1814, and signed *Benjamin Scholz MD & Prof., Wien 1821.* Scholz lived from 1786 to 1833. The slide rule consists of wood with glued-on paper and measures about 30 cm in length. However, it is doubtful if this is a real logarithmic slide rule. A similar Wollaston's slide rule for chemical equivalents is listed in the Science Museum Catalogue; it was made in boxwood, ca. 1820, by Newman.

The *Astronomisch-Physikalische Kabinett der Staatlichen Museen Kassel* owns a double-sided ivory slide rule with silver connections for the outer parts. It is from the first half of the 18^{th} century and probably from the private collection of the *Hochfürstlichen Landgraf Carl* from Hessen.[5]

Many Efforts at the Beginning of the 19^{th} Century

At the beginning of the 19^{th} century slide rules were known in Germany but only little used. One remark in a book published in 1808 [11] may be typical of the attitude of German mathematicians. It is a dictionary of logarithms, with their calculation, etc., explained in great detail. At the end of this essay there is just a bit more than one page about the slide rule. The author mentioned the Lambert-Brander slide rule and finished with a remarkable sentence (translated):

These slide rules are not needed by good arithmeticians, but they are quite useful for beginners to better understand calculations with logarithms.

During the 1820s, more articles on slide rules appeared in books and magazines; for example, in J.G. Dingler's *Polytechnischem Journal* or in a book by Fr.W. Schneider (1825), *Instructions for a slide rule for foresters, technicians, and young mathematicians.* A Berlin craftsman, F. Dübler, in 1825 offered slide rules (on the cover of Schneider's book) made from boxwood for 5 Reichstaler 5 Silbergroschen = 9 Fl 18 Kr., in brass, silver plated for 8 Reichstaler 5 Silbergroschen = 14 Fl 42 Kr. In 1847, they could have been bought for less than half of these prices from other makers.

Eduard Harkort, a surveyor, published in 1824 an essay titled *Plani-stereometrisches Schieberlineal* for technical artists and workmen, which made this useful instrument somewhat common in Germany.

We know of a Swiss slide rule designed by Felix Donat Kyd (1793-1869). Kyd was a gunpowder maker, and originally interested in making known the oriental abacus. In 1830, he had seen an English *Slidingroule* when he visited the astronomer Johann Kaspar Horner, and—although knowing nothing about logarithms—decided to develop a special slide rule for Swiss currency. With Horner's assistance and a lot of money he made his *Schiebelineal* and a description *Gebrauchslehre des schnellschiebenden Schiebelineals von J.K. Kyd* in 1834. It had only three scales (Value, Wares, Price), no cursor, and was probably made of wood with glued-on copper prints. Dr. Kugel explained this rule in more detail [13]. Kyd made many of his *Schiebelineal* in two lengths, but none is known to have survived. In 1851, when the Swiss changed their monetary system from Gulden and Shillings to Francs, his slide rule became useless. It is also reported that Kyd used a scale dividing machine for the matrix to engrave the copper. Horner had prepared, by hand, a special logarithmic table for the mechanic, *Oeri.*

In *Jahrbücher des kaiserlichen königlichen polytechnischen Instituts in Wien*, sechzehnter Band [9] in 1830, a most interesting article appeared, written by Adam Burg (1797-1882) Professor of mathematics at the K.K. Polytechnischen Institute. The title (translated):

About Design and Usage of a Sliding Rule common with English Engineers and Workmen, used for all kind of Calculations related to their Work and done very easily and quickly.

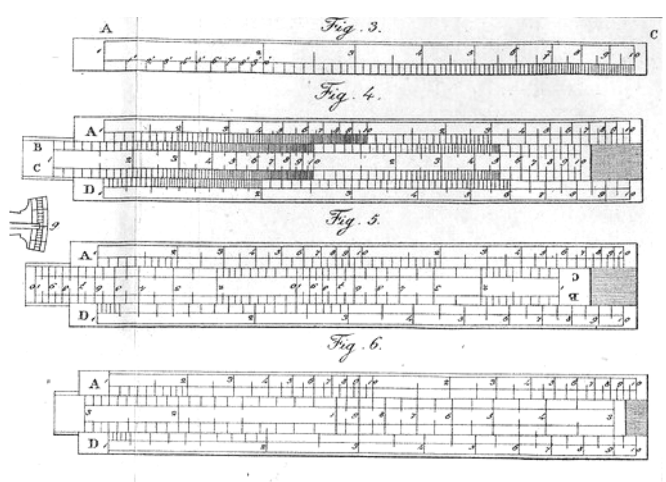

Figure 9.

Attached was a copper print (Figure 9) which showed a slide rule with A, B, C, D scales but without a cursor. Figure 5 had the B & C scales inverted and Figure 6 had

[5] Details of this very interesting instrument are given in a separate article in this issue.

an additional slide with an inverted line shifted by "3".

Adam Burg, early on, praised the English sliding rule as most beneficial to the community, more than other devices like Napier's rods or complicated calculating machines. He admired the confidence and quickness of the ordinary workers in an English workshop for steam engines, which he was able to recognize when he was still involved in mechanics. And he praised all the other advantages of this rule, especially for workers in noisy workshops. According to Burg, in England grammar school pupils were learning how to use a slide rule.

Burg was convinced that Austrian workers—at least the clever and sensible ones—would appreciate such a simple and useful instrument. Therefore he decided to write a treatise on the slide rule, and finally to export the fruits of his efforts to Germany. He also hoped that his essay would inspire skillful craftsmen of mathematical instruments to fabricate such slide rules, but with the main condition that they have an accurate graduation. He offered to assist with his own two examples, an English and a French one, and his knowledge.

Burg then described in detail the theory of logarithms, and design and usage of the slide rule (55 pages). He explained the Soho slide rule, designed with the assistance of the mathematician, Southern, for use in the factory of Bolton and Watt.

This rule was $10^1/_2$ inches long, $^4/_5$ inch wide and $^1/_5$ inch thick and consisted of boxwood. According to *Farey* he suggested using the back side of the Soho Rule for an additional slide rule with the inverted and shifted scales on the slide. The usual tables of the back side could then be placed on the back of the slide or beneath the slide on the body.

There was just a short note that the *Règles à Calculs* by *Lenoir de Paris* did have additional scales like Sines and Tangents. Burg also made a note that in England more exact slide rules of 28 and 56 inches were available, and that the optician *Bate of London* had made the most perfect slide rules from boxwood and ivory.

Adam Burg talked about slide rules in Sunday lectures concerning *popular topics* and attracted large audiences. Also the mathematician Leopold Karl Schulz von Straßnicki for many years gave Sunday lectures in Laibach and later in Vienna at the Polytechnic Institute. He wrote instructions and designed a special slide rule for the Austrian system of measures and money, and for architects and surveyors. For his Sunday lectures he used a huge demonstration slide rule designed by Sedlarczek—who also gave such lectures—and fabricated by the craftsman F. Werner of Vienna. The instrument was of maple and measured 8 feet (Wiener Schuch) and 6 inches in length, was 8 inches wide, and 2 inches thick. This slide rule had four slides and, in total, 12 logarithmic scales, including a log log scale and a scale shifted by π. Werner also made a Tachymeterschieber and an ordinary slide rule of boxwood (ca. 1850).

Similar to Adam Burg, Sedlarczek mentioned that "*it is said that the use of the slide rule in England is so widespread that no tailor makes a pair of trousers without including a pocket just for carrying a sliding rule. It is difficult to understand why the slide rule does not enjoy such well-deserved recognition in our own country."*

At that time (1840 to 1850) slide rules of cardboard, handmade by Prof. G. Altmüller, could be bought in Vienna for 2 fl, the same in boxwood made by F. Werner, for 3 to 5 fl Konventionsmünze. English slide rules were also available. More essays are known by Schwind, Wien, 1844 (Easy instructions…), and Schefczik, 1845.

These Austrian mathematicians influenced the distribution of slide rules not only in Austria but also in Germany. Due to their efforts, slide rules officially became part of the lessons in high schools and technical colleges in Prussia.

At the same time, 1847, in Berlin, C. Hoffmann published lectures on slide rules, delivered by him before the Polytechnic Society of Berlin. In his preface he mentioned three makers of slide rules in Berlin: Th. Baumann, C.T. Dörffel, and C.G. Grunow.
Cajori listed some more slide rules, available or described around 1850:

- Eschmann – Wild's Tachymeterschieber; *Der topographische Distanzmesser mit Rechenschieber* von J. Stambach was used in Switzerland about 1847.

- Prestel's Arithmetrische Scheibe, Hannover, 1854.

Conclusions

Below there are ten statements and possible reasons why slide rules from the seventeenth to mid-nineteenth century hardly can be found in Germany, Austria, and Switzerland:

1. Slide rules were known in German-speaking countries since the end of the 17^{th} century. But only one is known to have survived (or two or even three?).

2. Before the early 1800s all publications give no hint of English slide rules. It can be assumed that Biler, Scheffelt, Leupold, etc., made their own inventions, with one exception: Partridge's invention became "the unknown author".

3. There were many interesting new ideas: like semicircle design; leather straps (tapes); a folded slide rule; hollow slide rule body to collect pens, etc.; a logarithmic transversal divided scale; a logarithmic calculating cylinder; "shifted" scales, etc.

4. Usually early German slide rules had only mathematical scales, i.e., they were not designed for specific trades or applications like forestry, excise, navigation, etc.

5. Obviously many slide rules were handmade by just glueing the copper prints on wood or cardboard. If they were made of wood or brass the information given for designing the scales was rather poor. Instructions did not give advice on how to produce mechanically scales and numbers on wood or brass.

6. At the same time logarithm tables and sectors (Proportionalzirkel) and other scientific instruments were well known and used.

7. Germany at this time was split into many small principalities. Very often war erupted in this part of Europe. This was different in England; their wars were in other countries or on the sea.

8. Germany, Austria and Switzerland were not seafaring nations and had little need for Gunter scales or navigational rules. The same applied to spirit and excise slide rules: there was no common tax system, and the measuring and monetary systems were even more chaotic than in England. For forestry, timber trade, etc., Germans preferred books with lots of (more precise) tables. Finally, in England industrialization was far more developed.

9. Perhaps English people were more pragmatic; for them very often the accuracy of a slide rule was good enough for most daily tasks.

10. I leave it to the readers to propose more, or other reasons. It can be assumed that there are more publications and information, and hopefully sometimes an old German/Austrian slide rule will appear, not necessarily on the market, but in a museum, perhaps in a small local museum.

Acknowledgements

Dr. Karsten Gaulke of *the Astronomisch-Physikalische Kabinett der Staatlichen Museen Kassel* has allowed me to study in detail probably the oldest German slide rule, and Professor Karl Kleine has supplied additional information on the Lambert-Brander slide rule.

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