# *A.W. Faber Model 343 - System Baur. Another Unusual Slide Rule*

*Peter Holland*

## Introduction

Every reader of the *Journal of the Oughtred Society* has his personal favourite article of all JOS editions ever published. Mine is *A.W. Faber Model 366 - System Schumacher - A Very Unusual Slide Rule* by Dieter von Jezierski with Detlef Zerfowski and Paul Weinman. I always have dreamed of having the opportunity to write such an article: extraordinary, interesting, and understandable. But there is little chance to make a find of a rare and strange slide rule like the A.W. Faber 366. In 2008 I was able to find my A.W. Faber 343 at a collectors' meeting. A collector of dividers was selling it for little money.

Very soon I learned that there are only three other known A.W. Faber 343 slide rules in collections, one in the United Kingdom, one in Spain, and one in Germany. So this slide rule is rare. Because it has three strange scales on the upper beveled edge of the body it is unusual. So this slide rule gave me the chance to write an extraordinary and interesting article.

I have been waiting six years to write the article of which I have always dreamed. I hope to have met my own and the readers' expectations.

## A.W. Faber 343 - A regular Slide Rule

At the first glance the A.W. Faber 343 looks like most other wooden slide rules from the beginning of the 20th century. The scale layout seems to be cm, A | B, C | D, cm. The length of the scale is 25 cm. The back of the slide carries the S, L, and T scales. This slide rule was in catalogues from 1915 to 1928, at the beginning made of boxwood, from ca. 1920 made of pearwood.

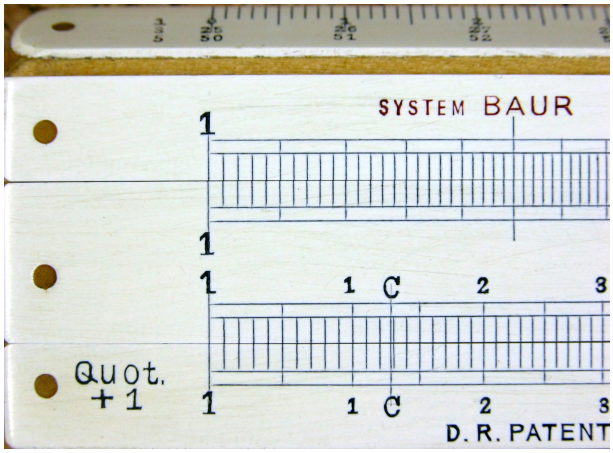


**FIGURE 1.**
**A.W. Faber 343, left part**

## A.W. Faber 343 - An unusual Slide Rule

When you look closely at Figure 1, you will notice an irregular appearance of the engravings on the top beveled edge. There is one scale which is labeled three times. Here are two closer looks at this scale.

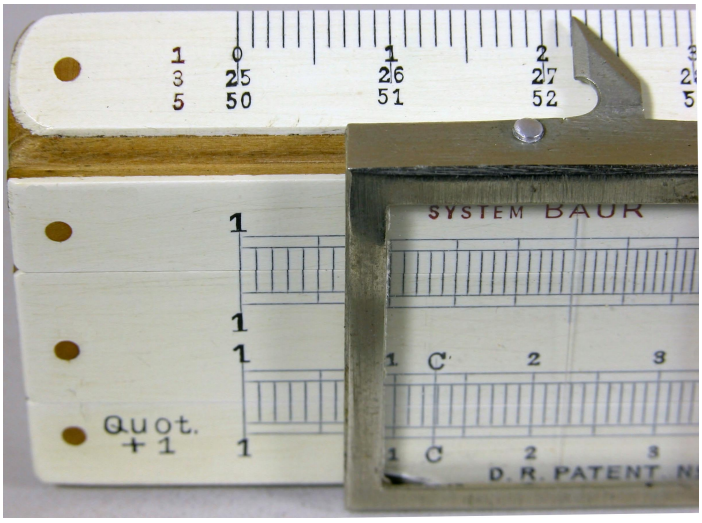


**FIGURE 2.**
**A.W. Faber 343, left part of the top beveled edge**

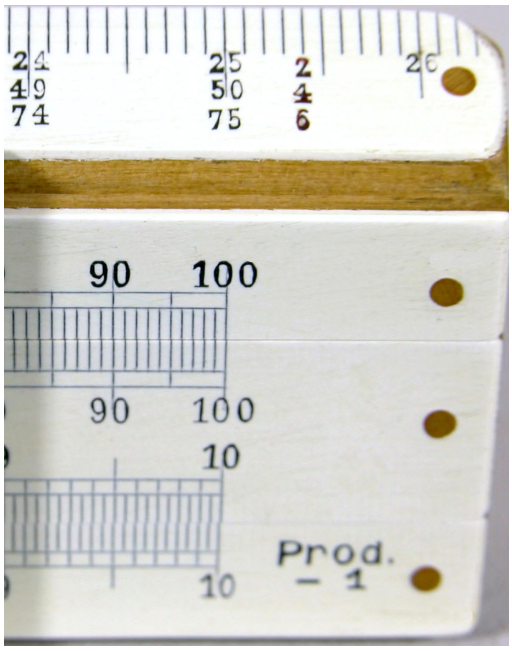


**FIGURE 3.**
**A.W. Faber 343, right part of the top beveled edge**

This scale is a linear divided scale running from 0 to 26. Corresponding to the range from 0 to 25 the slide rule has two more labeled scales: 25 to 50 and 50 to 75. Left and right of these numbers there are engravings in red. Grouped all together, below is the layout of the top beveled scales:

| | | | | | |
|---|---|---|---|---|---|
| 1 | 0 | ..... | 25 | 2 | 26 |
| 3 | 25 | | 50 | 4 | |
| 5 | 50 | | 75 | 6 | |

**Printed Instructions**

All sold A.W. Faber slide rules were normally supplied with a set of instructions, but no one of the four known 343 has the original instructions. But in some of the Pickworth Instructions for A.W. Faber slide rules there are two or three pages describing how to use the 343.

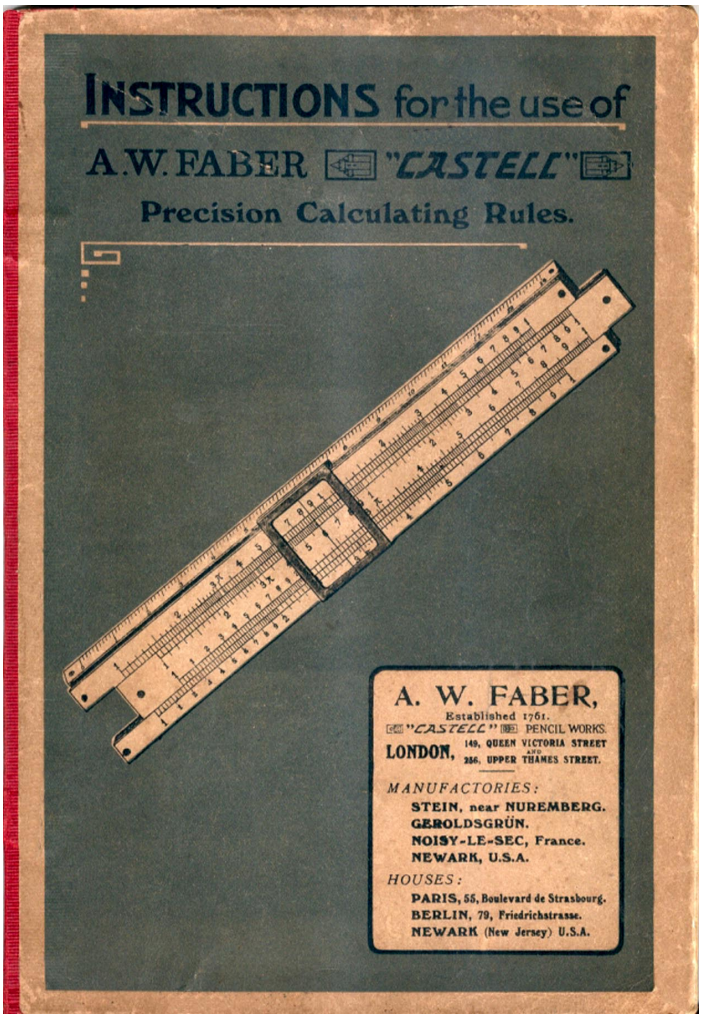


**FIGURE 4.**
**An example of Pickworth Instructions**

Pickworth at first describes the advantage of the 343: "... *it is possible, with the aid of the red coloured figures, to ascertain in a surprisingly simple manner any power and any root up to 6 places, without being doubtful as to the scale to be employed (whether 1-10 or 1-100), and as to the value read off."* Then Pickworth gives examples how to use this slide rule, which can easily be followed. But Pickworth did not write a single word explaining why one (or three) 25cm scales are able to calculate *"any power and any root up to 6 places"*.

**Studying the linear divided 25 cm scale**

I had some problems in understanding this scale. But Oughtred Society's member Dr. Günter Kugel worked out the main idea to understand this scale. His idea was quite simple: If this scale allows one to calculate any power and any root, then this scale is not a cm scale, it is a logarithmic scale. This ingenious idea opened my view to study this scale and learn why and how it works.

Every logarithmic scale must have a base. In the slide rule world this base usually is e (for most LL scales) or 10 (e.g. for A, B, C, D, and L scales). So what is the base of the logarithmic scale of the A.W. Faber 343 that looks like a 25 cm scale? What is the base of the Baur scale, as I will call this scale from now on?

This base can be found, because this equation always is true in every logarithmic system:

$$\log_{(x)} x = 1$$

Here are some examples:

$$\lg 10 = 1;\ \ln e = 1;\ ld\, 2 = 1;\ \log_{(15)} 15 = 1$$

If the cursor extension is placed on the digit 1 on the Baur scale, then the cursor hairline will read on scale A the base of the logarithm used for the Baur scale. Quite easy!

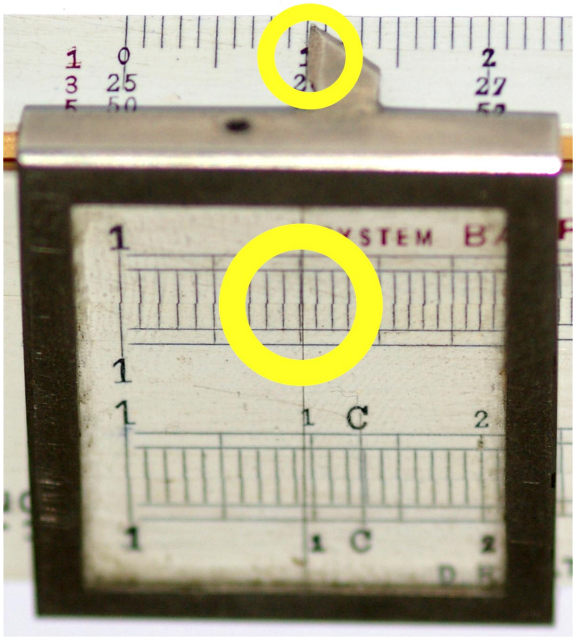

**FIGURE 5.**

$$\log_{(x)} x = 1$$

So the base of the Baur scale is $\approx 1.2$.

I did not like this number from the very beginning. After remembering that the Baur scale runs until 25 and the A scale runs until 100 everything became so obvious!

The base of the Baur scale is: $100^{\frac{1}{25}} = 1.2022$

Now the example in Figure 5 can be read as: The logarithm of $100^{\frac{1}{25}}$ to the base $100^{\frac{1}{25}}$ of is 1.

To prove this, let us read three values from the Baur scale:

$$\left(100^{\frac{1}{25}}\right)^{0}\left(100^{\frac{1}{25}}\right)^{25}\left(100^{\frac{1}{25}}\right)^{18}$$

And these are the results

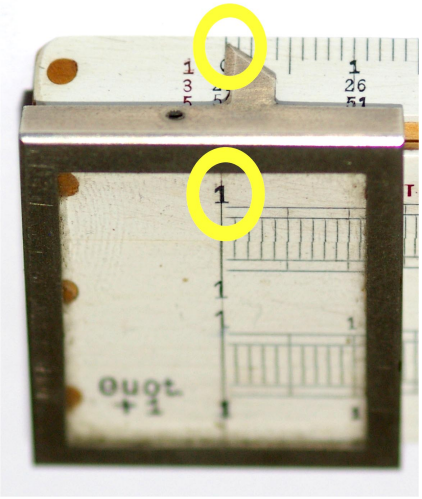


**FIGURE 6.**

$$\left(100^{\frac{1}{25}}\right)^{0} = 1$$

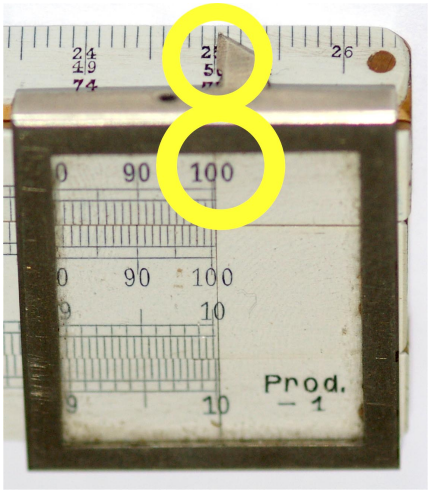


**FIGURE 7.**

$$\left(100^{\frac{1}{25}}\right)^{25} = 100$$

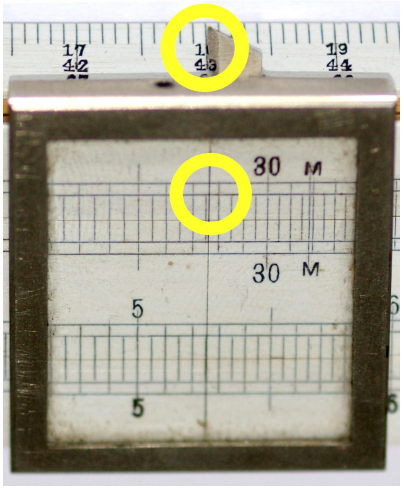


**FIGURE 8.**

$$\left(100^{\frac{1}{25}}\right)^{18} = 27.542$$

The Pickworth instructions say the A.W. Faber 343 calculates *"any power and any root up to 6 places"*.

To prove this, here is an example: $5.5^{3.5}$

The way of calculating this is:

$$5.5^{3.5} = 1.202^{\left(\log_{(1.202)} 5.5\right)\bullet 3.5}$$

Step 1: $\log_{(1.202)} 5.5$

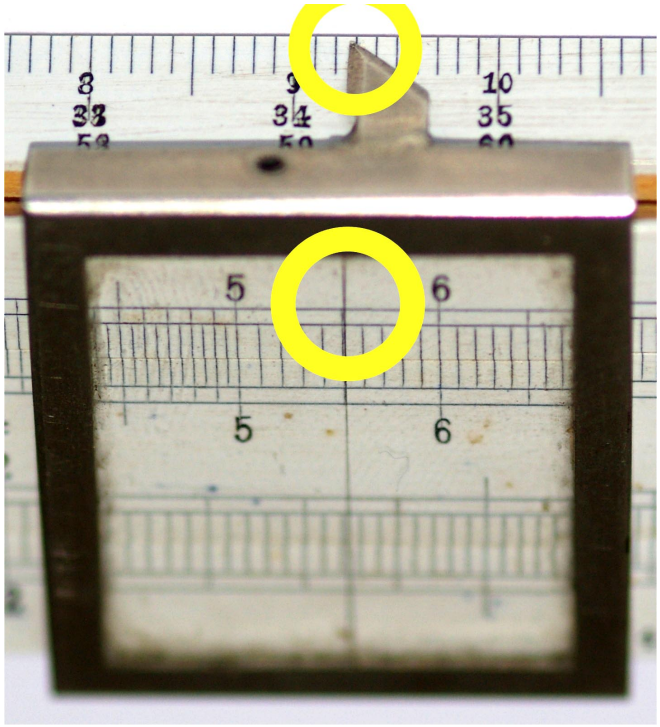


**FIGURE 9 (to right)**

$$\log_{(1.202)} 5.5 = 9.25$$

Step 2: $9.25 \bullet 3.5 = 32.375$

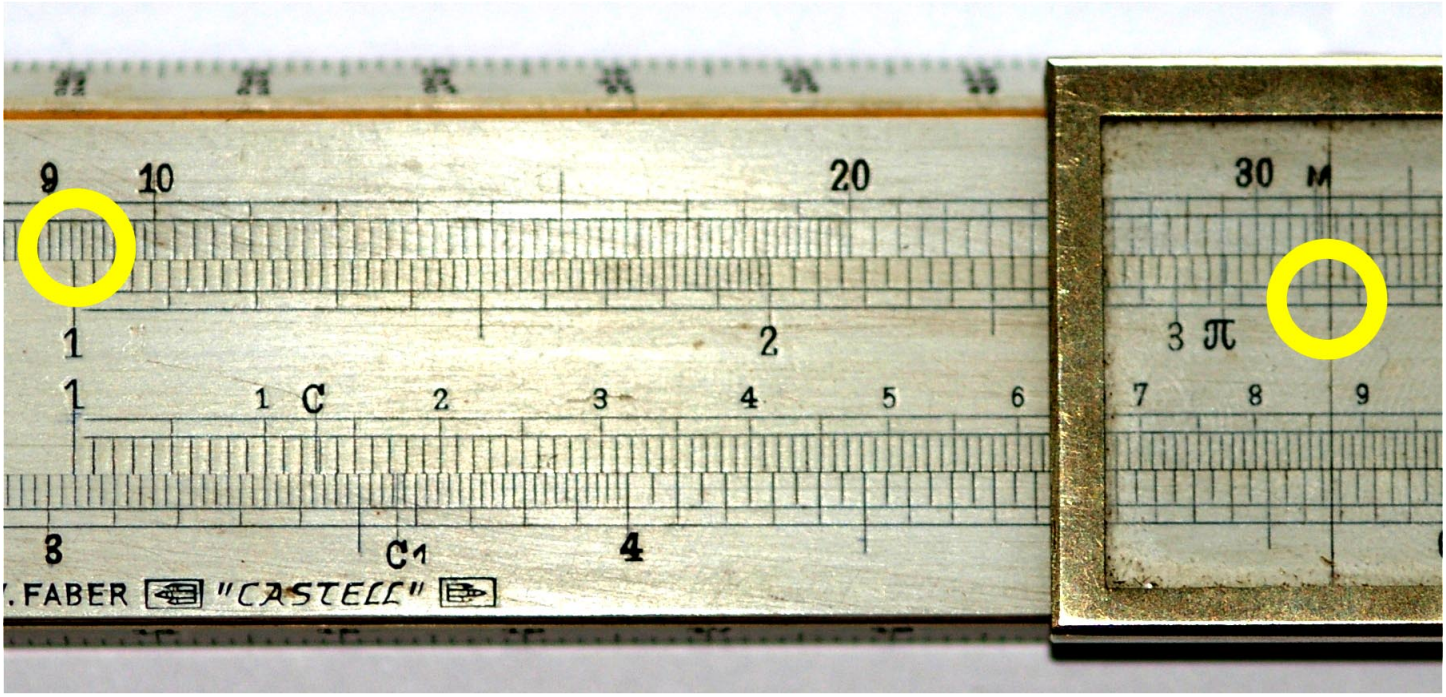


**FIGURE 10.**
$9.25 \bullet 3.5 = 32.375$

Step 3: $5.5^{3.5} = 1.202^{32.375} = 390$

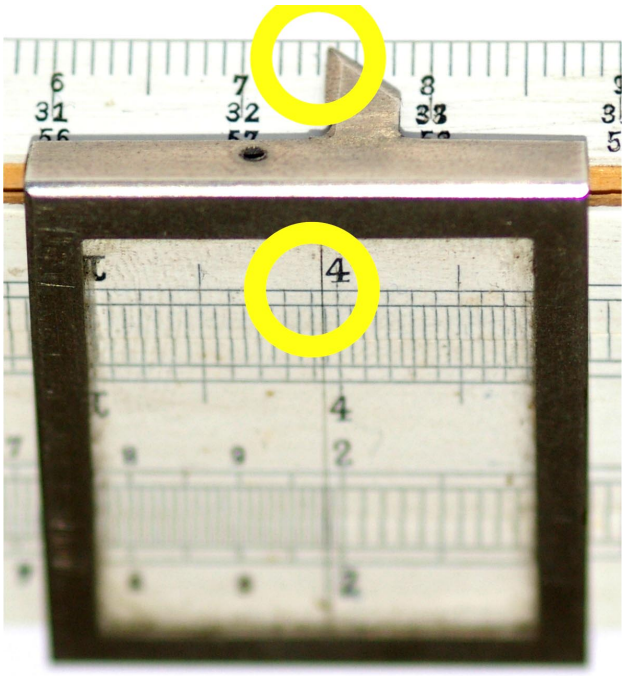


**FIGURE 11.**
$5.5^{3.5} = 1.202^{32.375} = 390$

From where do I determine that the result is 390, why not 3,900 or 39 or 3.9?

Now the purpose of the red digits on the upper beveled edge is known.

| | | | | |
|---|---|---|---|---|
| 1 | 0 ..... | 25 | 2 | 26 |
| 3 | 25 | 50 | 4 | |
| 5 | 50 | 75 | 6 | |

When I move the cursor extension to 32.375 on the Baur scale, I know I am on the first half of the scale, because 32.375 is smaller than 37.5 (the middle of the scale). And because I am on the left half, I look at the red digit on the left hand side. And there I find the red 3. This 3 tells me that the result has 3 digits left of the decimal point. That is why the result is 390.

## Conclusion

The Baur scale of the A.W. Faber 343 is a linear divided scale of 25 cm length, which can be used as a logarithmic scale with the base of $100^{\frac{1}{25}}$. The Baur scale starts with the value of 0 at the same position where the value 1 of the corresponding A scale is situated. The Baur scale works together with the A scale. Only this combination gives sense to the red digits on the upper beveled edge. These red digits show the relation between the value of the exponent and the number of digits of the result. The Baur scale enables the user to calculate powers up to 1,000,000 without having to think about the place of the decimal point.

The concept of the Baur scale is very elaborate, but is only of limited use, because results of powers are limited to 1,000,000.

Understanding the Baur scale enables collectors to use cm or inch scales on many slide rules as Baur scales, if they start at the same position as the A scale starts. The base of a 12.5 cm scale regarded as a Baur scale is $100^{\frac{1}{12.5}}$. The Base of a 5 Inch scale regarded as a Baur scale is $100^{\frac{1}{5}}$.

I suspect that the A.W. Faber 343 System Baur stayed for such a long time (13 years) in the company's portfolio because the first production run could not be sold.

**Acknowledgments**

Dr. Günter Kugel provided me the fundamental idea to see a scale looking like a cm scale as a logarithmic scale.

An unknown collector of dividers sold me this rare A.W. Faber 343 System Baur.

I would like to thank David Sweetman for editing my English.

**References**

1. Jezierski, Dieter von; Zerfowski, Detlef; Weinman, Paul, *A.W. Faber Model 366 - System Schumacher - A Very Unusual Slide Rule*, Journal of the Oughtred Society, Vol. 13, No. 2, 2004, Pg. 10-17.
2. Shepherd, Rodger: *The Faber Slide Rule Manuals by Pickworth*, Journal of the Oughtred Society, Vol. 10, No. 1, 2001, Pg. 2-12.
3. Pickworth, Charles N.: *Instructions for the Use of A. W. Faber Castell Precision Calculating Rules*, Newark, NJ, no year given.