The Evolution of Early AW Faber Slide Rule Models

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Introduction

This article is one of a series which details the early slide rules of A.W. Faber-Castell (hereafter referred to as Faber). The series, by Trevor Catlow and myself, is based on our research collaboration and the resulting development and analysis of a database of slide rule specimens, as described in [1] and subsequently referred to here as TOMCAT.

In their first 20 years or so of slide rule production Faber's portfolio went from 1 to 15 models, briefly peaking at 17 models. For most of this time the majority of models were the Mannheim layout with added trig scales only, and for about 10 years eight of these enhanced-Mannheim models were 25cm scale length. What was the difference between all these models; how did the consumer know what to buy?

This article attempts to unravel this early Faber model minefield by determining what each model was from Faber's marketing perspective. That is how the models were defined to the consumer so they could make an informed choice to best suit their needs. The article will show how, in these formative years, Faber's model definition and focus evolved from a confusing collection of similar rules to a more streamlined and well-defined model portfolio. Also included in two appendices are suggestions of some possible logic behind Faber's seemingly arbitrary model numbering, and observations on pricing.

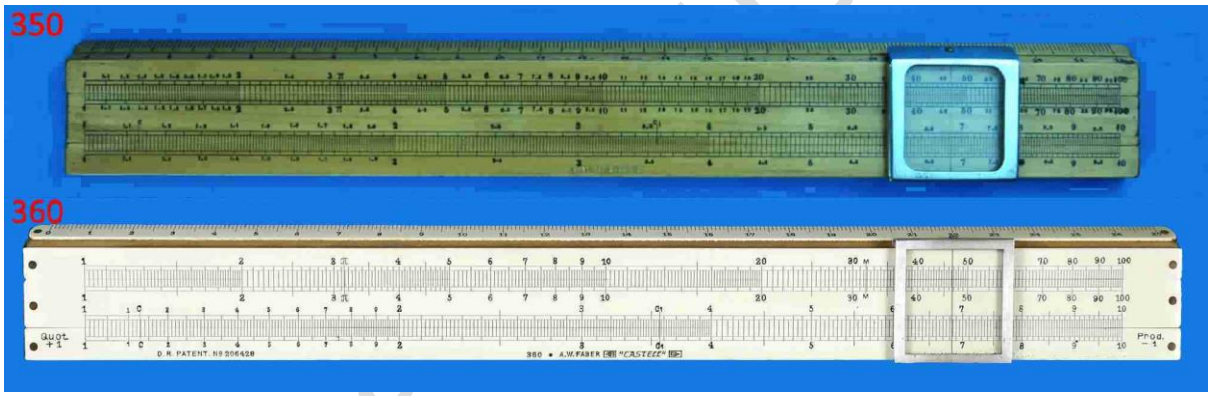

Figure 1: Faber's base models as of c1895 (top) and c1914 (bottom), the models 350 and 360 respectively.

Background and Methodology

Faber began selling slide rules in c1892 with a single model, an all-wood, closed frame Mannheim design [2]. This model did not have a number but was simply marketed as "AW Faber's Calculating Rule". While some design improvements were quickly made, and it gained trig. and log scales to become an enhanced-Mannheim scale layout rule, it remained Faber's sole model until c1895 when a celluloid-faced version was introduced [3]. At this point model numbers were first advertised, although they were not printed on the slide rules until c1908. The original all-wood model was numbered the 350, and its celluloid-faced clone was the 360. It is from this point in time, when Faber gave the consumer a choice of models, that this analysis begins.

After 1895, regarding enhanced-Mannheim models, first there was a rapid increase in 25cm scale models from two to eight in about five years, followed by around 10 years of relative stability during which Faber only introduced pocket and desktop versions. Then came a significant rationalisation of the enhanced-Mannheim range to five models over a few years to c1914 and the outbreak of the First World War. Other, non-enhanced-Mannheim, models were first introduced in c1906, with three new models. Over approximately four years to 1914 this number increased to nine as the enhanced-Mannheim range was simplified. Since there is

little information available from the war years and the consumer model portfolio appears quite static, this discussion ends at c1914.

During this 20-year period from 1895 to 1914 some models were defined primarily by the specialist scales they carried, but the majority were enhanced-Mannheim only models defined by certain usability and design features. Models came and went, definitions changed, and Faber's model focus shifted towards more scale options as design, production, competition and customer demand developed in this relatively new mass-production slide rule market. For example, a model 360 in 1895 was considerably different to a model 360 in 1914. Over this time Faber's base model (the simplest model that all others relate back to), a 25cm scale enhanced-Mannheim rule, changed considerably. In c1895 the base model was a 26cm solid stock, all-wood construction with decimal numbering (the 350) and by c1914 it was a 28cm steel-sprung split stock with non-decimal numbered scales printed on celluloid facings, an evolution of the original 360, see Figure 1. All models were numbered 3xx, and this number format continued until 1935 with model numbers never being reused. This article does not describe all the features of all the models, or all the changes, but just how the models were defined as being different and thus how they and the range changed from that perspective.

Looking at a selection of slide rules with their many, varied and evolving features, it is not necessarily obvious which features define the models at any point, and certainly not how this was communicated to the consumer. For this, Faber's marketing materials such as catalogues, pricelists, advertisements etc., are needed, with reference to the slide rules themselves and any other supporting material, for example instruction books, patents and other Faber documentation or references. Unfortunately, the most useful Faber company material is scarce from this time-period. Together with a page from an 1896 Faber catalogue [4] showing the models 350 and 360, five Faber catalogues/pricelists are used as the basis for this article. These sources provide time points around which periods for model definitions can be determined from the supporting material and the TOMCAT research collaboration. The catalogues/pricelists used are as follows:

- 1903 half-yearly report in English, prices in s/d [5]
- c1907 catalogue in English, prices in $ [6]
- 1910 catalogue in German, prices in Mk [7]
- 1913 pricelist in German, prices in Mk [8]
- c1914 pricelist in German, prices in Mk, Fr, Kr, Fl [9]

Two of these Faber sources were undated, but it is possible to date them to within a year or so from the TOMCAT research, as indicated above with "c" (circa).

Explanation of the Model Definition Tables

From the evidence described above it is possible to distinguish three time periods when different model definitions applied:

- c1895 - c1909 (Table 1)
- c1909 - c1912 (Table 2)
- c1912 - c1914 (Table 3)

These date ranges overlap slightly and are approximate due to the limited date specific evidence and the likelihood that all changes may not have all occurred together at precise times. For each of the time-periods a table (indicated above) has been created showing the models available in the period, their defining features, how they relate to other models in the period, and how they had changed since the previous period. These tables represent the main findings of this article, with an accompanying graphical representation presented in Appendix C.

In the tables, models are grouped into "Enhanced-Mannheim" and "Other Scale Systems" for analysis purposes. Model numbers that were new for, or in, the period are highlighted in green, and those that were removed during or at the end of the period are highlighted in red.

Blue headed and highlighted columns in each table show the model-defining features in the period concerned. The slide rules had other, sometimes unique, characteristics but they were not necessarily model-defining as represented by the descriptions in the catalogues/pricelists. For ease of comparison between time-periods, each table has the same columns but the blue highlighting changes as the features that defined models changed from one period to the next. There are three additional descriptive columns at the end of each table:

- "Model Definition" is a description of each model by concatenating the model-defining feature columns.
- "Model Relationship This Period" indicates how each model relates to its closest, more basic model.
- "Feature Changes Since Previous Period" details the changes to each model since the previous time-period.

Note that all blue highlighted columns are not always necessary to uniquely define each model in a time-period, since not all combinations were made, but each column is needed to uniquely define at least one model in the time-period. For example, in the c1895-c1909 period, slide-springs only uniquely define the model 365 (as a 360 with springs); or just scale system is required to uniquely define a 361 since it is the only pure Mannheim model. The models in the catalogues/pricelists were described with combinations of features that uniquely identified them plus features that Faber wanted to highlight as selling points. Faber also omitted mentioning some features in some model descriptions, particularly the specialist models which could often be defined by the scales alone. For consistency, all features are shown for all models in the "Model Definition" and blue feature columns. Therefore, the features and definitions listed in the catalogues/pricelists and tables are not necessarily the minimum needed to define each model uniquely.

Changes to individual features and model relationships since the previous time-period are highlighted in peach. By the nature of this analysis the "Model Definition" column is always different between tables, and the "Feature Changes…" column shows changes between periods, so for simplicity only the column headings are highlighted in peach. Non-model-defining features that were introduced or removed from a model during the period are indicated with "*" and "**" respectively. For ease of reading, a binary column, which indicates if a feature was present or not on a model, shows "Y" for the feature being present and is blank if the feature was absent.

Across all three time-periods, 25cm scale length and 28cm stock length are considered "standard", and celluloid-facings are considered standard as opposed to all-wood construction. This reflects the majority of models in each time-period. Non-standard values in these columns are <u>underlined</u>.

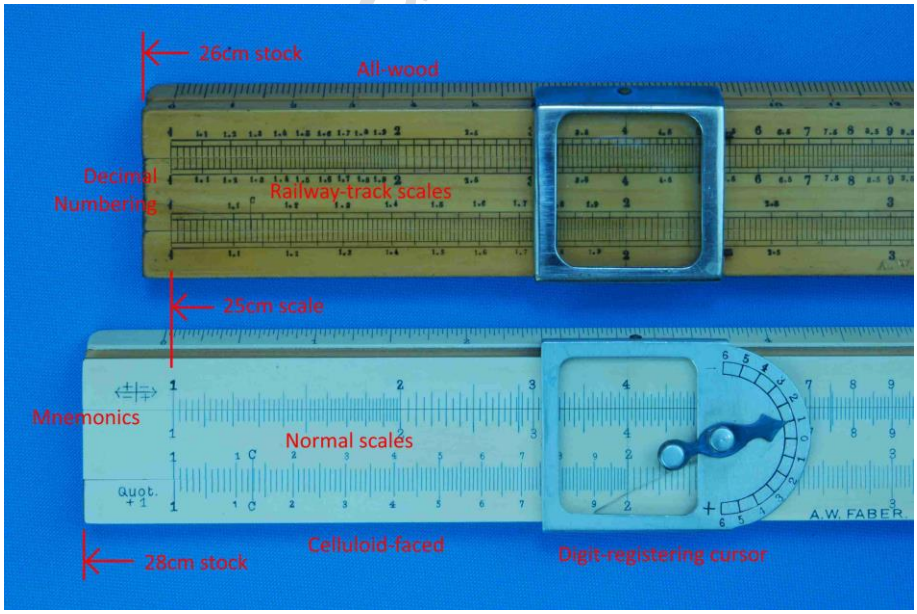

Figure 2: Materials, stock length, numbering, cursor, mnemonics and scale features.

Table 1: c1895 - c1909

Model No.	Scale (cm)	Scale System	Materials	Stock (cm)	Slide-Springs	Decimal Numbers	Digit-reg. Cursor	Mnemonics	Model Definition	Model Relationship This Period	Feature Changes Since Previous Period
Enhanced-Mannheim (E-M)											
350	25	E-M	all-wood	26		Y			25cm, E-M, all-wood, 26cm stock, decimals	base model	-
354	25	E-M	all-wood	28	Y			*	25cm, E-M, all-wood, 28cm stock, springs	350 with 28cm stock, springs, no decimals	
357	25	E-M	all-wood	28	Y		Y	*	25cm, E-M, all-wood, 28cm stock, springs, digit-reg.	354 with digit-reg. cursor	
360	25	E-M	faced	26		Y			25cm, E-M, faced, 26cm stock, decimals	350 with facing	
363	25	E-M	faced	28	Y	Y		*	25cm, E-M, faced, 28cm stock, springs, decimals	364 with decimals	
364	25	E-M	faced	28	Y			*	25cm, E-M, faced, 28cm stock, springs	354 with facings	
365	25	E-M	faced	26	Y	Y			25cm, E-M, faced, 26cm stock, springs, decimals	360 with springs	
367	25	E-M	faced	28	Y		Y	*	25cm, E-M, faced, 28cm stock, springs, digit-reg.	364 with digit-reg. cursor	
369	12.5	E-M	faced	15					12.5cm, E-M, faced, 15cm stock	12.5cm scale 364, without springs	
370	50	E-M	all-wood	53	Y		Y	*	50cm, E-M, all-wood, 53cm stock, springs, digit-reg.	50cm scale 357	
380	50	E-M	faced	53	Y		Y	*	50cm, E-M, faced, 53cm stock, springs, digit-reg.	50cm scale 367	
Other Scale Systems											
358	25	(farming/calliper)	all-wood	28					25cm, farming/calliper, all-wood, 28cm stock	-	
361	25	Mannheim	faced	28		Y			25cm, Mannheim, faced, 28cm stock, decimals	28cm stock 360 without trig scales & springs	
368	25	(log-log electro)	faced	28.5	Y			Y	25cm, log-log electro, faced, 28.5cm stock, springs	364 with 28.5cm stock, log-log & electro scales	

model defining feature
model introduced this period
model removed this period
change since previous period
* feature added to model during this period
** feature removed from model during this period
Non-standard feature

Table 2: c1909 - c1912

Model No.	Scale (cm)	Scale System	Materials	Stock (cm)	Slide-Springs	Decimal Numbers	Digit-reg. Cursor	Mnemonics	Model Definition	Model Relationship This Period	Feature Changes Since Previous Period
Enhanced-Mannheim (E-M)											
350	25	E-M	all-wood	28					25cm, E-M, all-wood	base model	now 28cm stock, no decimals
357	25	E-M	all-wood	28	Y		Y	Y	25cm, E-M, all-wood, springs, digit-reg., mnemonics	350 with springs, digit-reg. cursor, mnemonics	-
360	25	E-M	faced	28					25cm, E-M, faced	350 with facing	now 28cm stock, no decimals
363	25	E-M	faced	28		Y		Y	25cm, E-M, faced, decimals, mnemonics	364 with decimals	now no springs
364	25	E-M	faced	28				Y	25cm, E-M, faced, mnemonics	360 with mnemonics	now no springs
365	25	E-M	faced	28	Y				25cm, E-M, faced, springs	360 with springs	now 28cm stock, no decimals
367	25	E-M	faced	28			Y	Y	25cm, E-M, faced, digit-reg., mnemonics	364 with digit-reg. cursor	now no springs
369	12.5	E-M	faced	15					12.5cm, E-M, faced	12.5cm scale 360	-
370	50	E-M	all-wood	53			Y	Y	50cm, E-M, all-wood, digit-reg., mnemonics	50cm scale 357 without springs	now no springs
380	50	E-M	faced	53			Y	Y	50cm, E-M, faced, digit-reg., mnemonics	50cm scale 367	now no springs
Other Scale Systems											
358	25	(farming/calliper)	all-wood	28					25cm, farming/calliper, all-wood	-	-
361	25	Mannheim	faced	28		Y			25cm, Mannheim, faced, decimals	360 without trig scales, with decimals	-
366	25	System Schumacher	faced	28					25cm, Schumacher, faced	-	
368	25	(log-log electro)	faced	28.5					25cm, log-log electro, faced	360 with log-log & electro scales	now no springs, no mnemonics
374	25	System Pickworth	faced	28				Y	25cm, Pickworth, faced, mnemonics	364 with Pickwoth cube scale	
377	25	System Pickworth	faced	28			Y	Y	25cm, Pickworth, faced, digit-reg., mnemonics	374 with digit-reg. cursor	
378	25	(alt. layout log-log electro)	faced	29.5	Y				25cm, alt.layout log-log electro, faced, springs	368 with relocated log-log scales with springs	

model defining feature
model introduced this period
model removed this period
change since previous period
* feature added to model during this period
** feature removed from model during this period
Non-standard feature

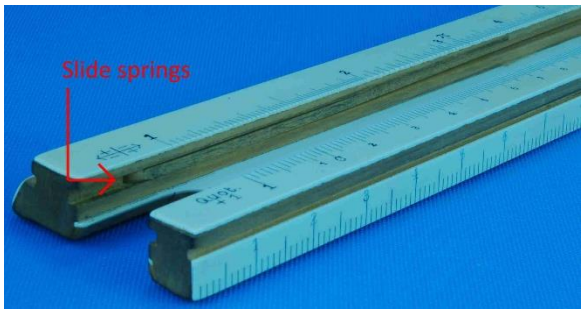

Figure 3: Slide-springs feature.

The model-defining features from all periods are:

- Scale Length - 12.5cm (pocket or half-size) for "outdoor use" [6], 25cm (standard) or 50cm (desktop or double-length) for greater mathematical precision [5].
- Scale system – e.g. Mannheim, enhanced-Mannheim, System Pickworth, log-log electro.
- Materials - all-wood or celluloid-faced for "greater clearness of the markings" [5], see Figure 2.
- Stock Length - 2 different sizes for 25cm scale rules, 26cm and 28cm. Longer stocks "affording a firmer hold of the cursor when nearing the extremities of the scales" [5], see Figure 2.
- Slide-springs - Longitudinal boxwood springs that apply pressure to the slide, to mitigate against when the slide "becomes too loose or easy in working" [5], see Figure 3.
- Decimal numbers (1.2, 1.3 etc, 2.5, 3.5 etc) - present or omitted for a less cluttered scale [5], see Figure 2.
- Digit-registering cursor - designed to keep track of magnitudes in long or complicated calculations [5], see Figure 2.
- Mnemonics - markings to assist in determining the changes of magnitude in calculations [7], see Figure 2.

Note: Faber's standard scale markings over all time-periods were "railway-track" scales with lateral lines, see Figure 2 (top). Some models had variants available with what are now referred to as "normal" scales without lateral lines, see Figure 2 (bottom). Other than this the two versions were identical, and the model numbers were the same, so this feature was not model-defining.

Period	Scale (cm)	Scale System	Materials	Stock (cm)	Slide-Springs	Decimal Numbers	Digit-reg. Cursor	Mnemonics	No. of Features
c1895 - c1909	Y	Y	Y	Y	Y	Y	Y		7
c1909 - c1912	Y	Y	Y		Y	Y	Y	Y	7
c1912 - c1914	Y	Y				Y	Y		4

Table 4: Model-defining features by period

Model-defining features for each time-period are summarised in Table 4. As can be seen, the defining features remained the same for many years. Then there was a small change that may have been the beginning of the major changes that occurred for the last time-period, when the definitions became much more succinct.

Period	Enhanced-Mannheim	Other Scale Systems	Total
c1895 - c1909	11	3	14
c1909 - c1912	10	7	17
c1912 - c1914	5	10	15

Table 5: Number of models by period

Table 3: c1912 - c1914

Model No.	Scale (cm)	Scale System	Materials	Stock (cm)	Slide-Springs	Decimal Numbers	Digit-reg. Cursor	Mnemonics	Model Definition	Model Relationship This Period	Feature Changes Since Previous Period
Enhanced-Mannheim (E-M)											
360	25	E-M	faced	28					25cm, E-M	base model	-
363	25	E-M	faced	28		Y			25cm, E-M, decimals	360 with decimals	now no mnemonics
367	25	E-M	faced	28			Y	Y	25cm, E-M, digit-reg.	360 with digit-reg. cursor	-
369	12.5	E-M	faced	15					12.5cm, E-M	12.5cm scale 360	-
380	50	E-M	faced	53					50cm, E-M	50cm scale 360	now no digit-reg, no mnemonics
Other Scale Systems											
343	25	System Baur	faced	28					25cm, Baur	360 with Baur scales	
344	25	E-M + K scale	faced	28					25cm, E-M + K scale	360 with K scale	
345	25	System Hohenner	faced	28					25cm, Hohenner	360 with Hohenner scale	
361	25	Mannheim	faced	28		Y			25cm, Mannheim, decimals	360 without trig scales, with decimals	-
366	25	System Schumacher	faced	28					25cm, Schumacher	-	-
374	25	System Pickworth	faced	28				Y	25cm, Pickworth	360 with Pickwoth cube scale	-
377	25	System Pickworth	faced	28			Y	Y	25cm, Pickworth, digit-reg.	374 with digit-reg. cursor	-
378	25	(log-log electro)	faced	29.5	**				25cm, log-log electro	360 with log-log & electro scales	-
379	12.5	(log-log electro)	faced	15					12.5cm, log-log electro	12.5cm scale 378	
384	50	System Pickworth	faced	53				Y	50cm, Pickworth	50cm scale 374	

model defining feature
model introduced this period
model removed this period
change since previous period
* feature added to model during this period
** feature removed from model during this period
Non-standard feature

The number of models in each model group for each time-period are summarised in Table 5. Clearly, Faber's focus for the majority of the whole time-span under discussion was offering a variety of enhanced-Mannheim model options, before rationalising this range and shifting their focus to other scale options. However, the total number of models in each of the periods did not change significantly.

Observations From c1895 - c1909, Table 1

Table 1 shows the 14 models available during the period c1895 to c1909. The majority, 11 models, were enhanced-Manheim scale layout with no additional scales, and eight of these were 25cm scale models. Some models were introduced during this period as indicated, but all models were available at the end of the period. The "base" model in this first period is considered to be the 350 as it existed in the same form previously, when it was the only model but unnumbered. The models were defined by the following features:

- Scale length - 12.5cm, 25cm or 50cm
- Scale system
- Materials - all-wood or celluloid-faced
- Stock Length - 26cm and 28cm for 25cm scale rules.
- Slide-springs
- Decimal numbers
- Digit-registering cursor

Although 28cm stocks are considered standard in this period because the majority of 25cm scale rules had stocks of this length, for the first few years the only models available were the 26cm stock 350 and 360. Only one 26cm stock model was added, the 365, before 28cm stock models began rapidly appearing around the turn of the century. Mnemonics appeared on some existing models about half way through this period, but they were not yet model-defining.

The double-length 50cm scale 370 and 380 desktop rules were Faber's first non-25cm scale rules, introduced c1903. The half-length 12.5cm scale 369 was Faber's first pocket rule, introduced c1906. These three models, all enhanced-Mannheim, could be uniquely defined by their scale length, for the 369, and in addition whether they were faced or not for the 370 and 380, although the catalogues/pricelists also described some of their other features. Faber was making enhanced-Mannheim scale rules exclusively until c1906 when the three new non-enhanced-Mannheim rules were introduced. All these non-enhanced-Mannheim models could be uniquely defined by their scale system, although the catalogues/pricelists also highlighted other features.

Note the "Feature Changes…" column is blank for all models other than the 350 as they were introduced in this period, and the 350 was itself unchanged.

<u>Enhanced-Mannheim models</u>

The 11 enhanced-Mannheim models can be evaluated in two convenient ways:

- Scale length:
  - 1 model 12.5cm scale (none previously)
  - 8 models 25cm scale (1 previously)
  - 2 models 50cm scale (none previously)
- Material:
  - 4 all-wood models (1 previously)
  - 7 celluloid-faced models (none previously)

The eight standard 25cm scale models can also be grouped by stock length:

- Stock length (25cm scale models only):
  - 3 models 26cm stock (1 previously)
  - 5 models 28cm stock (none previously)

Beyond these groupings the models were defined by combinations of the other features; slide-springs, decimal numbering and digit-registering cursor. Each of the four all-wood models had a celluloid-faced equivalent which was otherwise identical from a definition perspective; the 25cm scale 350 and 360 were equivalent, as were the 354/364 and 357/367. The 50cm scale 370 and 380 were equivalent. The celluloid-faced 363, 365 and 12.5cm scale 369 did not have all-wood equivalents.

The 369 was listed in the c1907 catalogue as for "outdoor use" and was a 12.5cm version of the 364 but without slide-springs, perhaps deemed unnecessary due to the short stock length. Slide-springs only uniquely defined one model, the 365, which was a 360 with springs. On other models, springs appeared with other differences, such as stock length on the 363 when compared to the model 360.

Other Scale System models

Faber's first three non-enhanced-Mannheim scale models, introduced late in this period, were:

358 (farming/calliper) - C & D scales with a calliper cursor linked to a cm scale. Basic all-wood slide rule designed for farming applications.
361 - Mannheim scales only, designed for school use.
368 (log-log electro) - Enhanced-Mannheim scales with additional log-log scales on the stock edge, and power and efficiency scales in the well, designed for electrical and mechanical engineers.

All three models could be uniquely defined by their scale systems alone, but the catalogues highlighted other features in the descriptions. For more information on Faber's early log-log scales see [11], and for their electro rules see [12].

Figure 4: 2-part celluloid-sprung stock (left) and 2-part steel-sprung stock (right).

Observations From c1909 - c1912, Table 2

Between the c1907 catalogue and the 1910 catalogue, Faber made several significant changes to the construction of their slide rules. The enhanced-Mannheim range was simplified a little and several other new models were introduced. The 350 is still considered the base model in this period as it was still available even though during the last period Faber clearly began focussing on celluloid-faced models rather than all-wood models.

Table 2 shows the models listed in the 1910 catalogue. One enhanced-Mannheim model had been discontinued and four new non-enhanced-Mannheim models had been introduced taking the total number of models in the catalogue up to 17 from the previous 14.

The shorter 26cm stock had been discontinued for 25cm scale rules, all now had a standard 28cm stock. As a result, stock length was no longer model-defining. Faber had also introduced two-part celluloid-sprung stocks, see Figure 4, on all celluloid-faced models. This improvement eliminated the need for slide-springs on celluloid faced rules, although one model had retained this feature and slide springs remain model-defining. Mnemonics, which were introduced on some models during the previous time-period, were now a model-defining feature. Model-defining features in this time-period were:

- Scale length - 12.5cm, 25cm or 50cm
- Scale system
- Materials - all-wood or celluloid-faced
- Slide-springs
- Decimal numbers
- Digit-registering cursor
- Mnemonics (new)

As previously, the three non-25cm scale models were all enhanced-Mannheim models and could still be uniquely defined by scale length for the 12.5cm scale 369, and additionally whether they were faced or not for the 50cm scale 370 and 380. Catalogues/pricelists continued to describe other features on these models.

<u>Enhanced-Mannheim models</u>

Of the 11 enhanced-Mannheim models from the previous period 10 were still available, with the 354 having been discontinued and there were no new models. Most models had some feature changes since the previous period. All 25cm scale models now featured 28cm stocks and all now did not have decimal numbers, with one exception, the 363 for which it was model-defining. Only two models were unchanged, the all-wood 357 and the 12.5cm scale 369.

The profile of the enhanced-Mannheim range is therefore very similar to the previous period, except that there is now no stock length distinction in the 25cm scale models:

- Scale length:
  - 1 model 12.5cm scale
  - 7 models 25cm scale (8 previously)
  - 2 models 50cm scale
- Material:
  - 3 all-wood models (4 previously)
  - 7 celluloid-faced models

Most models were defined by the scale length, materials, the presence of mnemonics, and whether the model was supplied with a digit-registering cursor. Only two models now feature slide-springs, the higher specification all-wood 357, and the 365 for which springs are model-defining. Oddly, the 365 also had a celluloid-sprung stock making the slide-springs appear superfluous. Slide springs had been removed from the

50cm scale all-wood 370. Mnemonics only uniquely define one model, the 364, which is a 360 with mnemonics, on other models mnemonics were combined with other feature differences.

While the all-wood 354 had been discontinued, the 350 with its changes (28cm stock and no decimals) had essentially become the previous 354 model, albeit without mnemonics. Or to look at it another way, the 354 had been renamed the 350 and mnemonics removed. Similarly, the 360 had turned into a 364 without mnemonics, although in this case the 364 is also still available. The 12.5cm scale 369 is now a half-size 360, rather than a half-size 364 as it was previously.

The three remaining all-wood models, 350, 357 and 370, still had celluloid-faced equivalents, 360, 367 and 380 respectively. The celluloid-faced 363,365 and 369 did not have all-wood equivalents, as previously, but now the 364 also did not.

Other Scale System models

There are now seven non-enhanced-Mannheim scale rules available, compared to three in the previous period:

- 358 (farming/calliper) - 25cm C & D scales with a calliper cursor linked to a cm scale. Basic all-wood slide rule designed for farming applications.
- 361 - 25cm Mannheim scales only, designed for school use.
- 366 System Schumacher - (new) 25cm special scales designed for education, teaching algebra and number theory.
- 368 (log-log electro) - 25cm enhanced-Mannheim scales with additional log-log scales on the stock edge and power and efficiency scales in the well, designed for electrical and mechanical engineers.
- 374 System Pickworth - (new) 25cm enhanced-Mannheim with additional cube scale system.
- 377 System Pickworth - (new) 25cm enhanced-Mannheim with additional cube scale system and digit-registering cursor.
- 378 (log-log electro) - (new) 25cm enhanced-Mannheim scales with new layout of additional log-log scales on the stock front, and power and efficiency scales in the well, designed for electrical and mechanical engineers.

The three rules from the previous period, the 358, 361 and 368, were still available, and were unchanged in terms of features other than the 368 losing its slide-springs.

There were four new models available. The two System Pickworth models, the 374 and 377, were versions of the 364 and 367 respectively with a unique cube scale system accessible via a cut-out in the back of the stock, for more information see [13]. Faber improved their 368 log-log electro model to the more user-friendly model 378, but both were available for a short time around 1910 before the 368 was discontinued. While the 368 had lost its slide springs, the 378 was introduced with them even though it had a celluloid-sprung stock, perhaps because its stock was wider than all other stocks. The other new rule was the 366, a specialist academic rule not designed for normal calculations. For more information on System Schumacher see references [14] and [15].

The 358 farming/calliper and 361 Mannheim models could both still be uniquely defined by their scale system, as could the new 366 System Schumacher. The System Pickworth and log-log electro models must be uniquely defined with additional features as there are two models in each of these systems.

Due to the changes in the 360, the 361 is now a Mannheim only 360 with decimals, rather than a 28cm stock Mannheim 360 as it was previously. The 368 is now a 360 with log-log and electro scales rather than a 364 with the additional scales as it was previously.

Observations From c1912 to c1914, Table 3

By the 1913 pricelist all-wood models were discontinued, and the remaining enhanced-Mannheim models had been rationalised and re-defined, with their number reduced to five. In contrast, by the c1914 catalogue the overall number of non-enhanced-Mannheim models had increased by three, with some models discontinued and several added, thus keeping the total number of all models similar to before at 15. The 360, the most basic rule now available, is now the considered the base model following the removal of the all-wood models. Table 3 shows the list of models available in this time-period.

Model definitions were much simplified due to the rationalisation of the enhanced-Mannheim models, with celluloid facings, slide-springs and mnemonics no longer being model-defining. There were no new model-defining features so models were now defined only by the following four features in this period:

- Scale length
- Scale system
- Decimal numbers
- Digit-registering cursor

The new model 379 log-log electro is Faber's first pocket non-enhanced-Mannheim rule, and their second 12.5cm scale model after the enhanced-Mannheim 369 which was introduced about seven years earlier. The new 50cm scale 384 is Faber's first non-enhanced-Mannheim 50cm scale desktop rule, and the first new desktop model for about 10 years. Due to the removal of all-wood rules, all the non-25cm scale length models could now be uniquely defined by scale length and scale system only.

Note, celluloid-sprung stocks were replaced with two-part steel-sprung stock, see Figure 4, between the 1913 and c1914 pricelists, although this did not affect model definitions.

<u>Enhanced-Mannheim models</u>

The enhanced-Mannheim models removed are the all-wood models 350, 357 and 370, and celluloid-faced 364 and 365. No models had been added so there were now just five models in this period from the 10 previously:

- 1 model 12.5cm scale
- 3 models 25cm scale (7 previously)
- 1 model 50cm scale (2 previously)

The 25cm scale models simply comprise:

- 1 base model
- 1 model with decimals
- 1 model with a digit-registering cursor

The features on the models had not changed since the previous period, other than the 380 no longer sported a digit-registering cursor. The models had simply been re-defined due to the simplification of the range by discontinuing models.

Since the 380 is no longer supplied with a digit-registering cursor, it is now a double-length 360 rather than the double-length 367 it was in the previous time-periods.

Other Scale System models:

There were now 10 non-enhanced-Mannheim models in this period compared to seven previously:

343 System Baur - (new) 25cm enhanced-Mannheim with 3 additional special scales for roots and powers
344 - (new) 25cm enhanced-Mannheim with additional K scale.
345 System Hohner - (new) 25cm enhanced-Mannheim with additional temperature compensation scale
361 - 25cm Mannheim scales only, designed for school use.
366 System Schumacher - 25cm special scales designed for education, teaching algebra and number theory.
374 System Pickworth - 25cm enhanced-Mannheim with additional cube scale system.
377 System Pickworth - 25cm enhanced-Mannheim with additional cube scale system and digit-registering cursor.
378 (log-log electro) - 25cm enhanced-Mannheim scales with additional log-log scales on the stock front and power and efficiency scales in the well, designed for electrical and mechanical engineers.
379 (log-log electro) - (new) 12.5cm enhanced-Mannheim scales with additional log-log scales on the stock front and power and efficiency scales in the well, designed for electrical and mechanical engineers.
384 System Pickworth - (new) 50cm enhanced-Mannheim with additional cube scale system

Two models (357 and 368) had been discontinued since the 1910 catalogue, five carried through (361, 366, 374, 377 and 378), and five were new (343, 344, 345, 379 and 384). The 366 appears in the 1913 pricelist but not the c1914 pricelist. Of the new models, the 379 and 384 appear in both pricelists, but the 343, 344 and 345 only appear in the later pricelist.

The new 379 log-log electro is a 12.5cm scale version of the 25cm scale 378 log-log electro, and the new 384 is a 50cm scale version of the 25cm scale 374 System Pickworth. For more information on the model 343 and System Baur see [16]. The 374 System Pickworth and 378 log-log electro are now both based on the 360 rather than based previously on the 364 and 368 respectively.

Conclusion

In the beginning it appears that Faber concentrated on many different versions of enhanced-Mannheim rules with different feature options, rather than specialist systems or slide rules with additional scales. As a result, model definitions were mainly a complicated combination of usability features. Eventually Faber rationalised their enhanced-Mannheim offering and expanded their range of slide rules with additional scales and specialist systems, which significantly simplified the model definitions.

While the enhanced-Mannheim range appears confusing in retrospect, each model had distinct features according to the catalogues and pricelists of the time, allowing the consumer to make an informed decision as to which model was most suitable for their needs.

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A full bibliography of sources used in the development of this article can be found in [1].

Appendix A - Indications of a model numbering system

Concerning a structured model numbering system, it is my belief, based on the consistencies outlined below, that Faber did have an intended system when they began numbering their models. However, it became unworkable or just fell by the wayside and so is not obvious. Certainly, in the 1920's and early 1930's when Faber went model-mad, eventually offering in excess of 50 models, any system they may have had is not apparent to me. In the late 1930's Faber transitioned to a new system that remained in place until the end of production in the 1970's.

c1895 - c1905

Faber introduced model numbers to the consumer with the introduction of their second model in c1895. Model numbers were three digits beginning with a "3". As more models were added it suggests that Faber may have had a system of number bands as follows:

- 35x - 25cm scale all-wood models
- 36x - 25cm scale celluloid faced models
- 37x 50cm scale all-wood models
- 38x 50cm scale celluloid-faced models

Between the ranges, equivalent models had the same last digit, e.g. the 350 and 360 were equivalent, as were the 354 and 364, and the 357 and 367. The 358/368 were not equivalent, but they were both specialist models with unique cursors, all-wood and celluloid-faced respectively. The last digit could indicate certain model features, e.g.:

- 3x0 - base model in the range
- 3x7 - digit-registering cursor models

This range numbering could indicate that Faber intended to introduce more 50cm scale models, however in this period there was only one model in each of the 37x and 38x ranges, perhaps due to lack of demand for desktop models.

c1906 - c1912

The above system now starts to fail. In c1906 the first 12.5cm scale celluloid-faced model was introduced, the 369, which does fit because of its short scale. Then from c1909 the new Pickworth models 374 and 377, and log-log electro 378 were introduced that do not fit the 50cm scale all-wood 37x range band. Otherwise the system still works with equivalent models having the same last digit, the new 374 and 377 (with digit-registering cursor) are equivalent to the 364 and 367 respectively, with the addition of the special cube scale. The 378 log-log electro may have been numbered as such because it was an improved 368 log-log electro.

c1912 - c1914

The all-wood 35x models and 370 were discontinued and new celluloid-faced models were introduced in a new 34x number band. A new 50cm scale rule was introduced in the 38x range, but this is now the only band that still has any connection to the original number band system above. The new 379 log-log electro may have been given this number because it is a 12.5cm scale model like the 369. The consistent last digit numbering between equivalent all-wood and celluloid-faced models is no longer relevant as there are no all-wood rules left. There are some consistencies of numbering left however:

- 360/380 - 25cm scale and 50cm scale equivalent enhanced-Mannheim models
- 374/384 - 25cm scale and 50cm scale equivalent System Pickworth models
- 367/377 - digit-registering cursor models
- 369/379 - 12.5cm scale models

Appendix B – Observations on Pricing

Faber obviously needed to set their prices according to their competitors depending on how many sales they were hoping to make, and for the consumer price is obviously a consideration when buying a slide rule. Although price does not directly affect Faber's model definitions, scrutiny of the catalogues and pricelists revealed the noteworthy points included here.

c1895 - c1909

In the 1903 half-yearly report, celluloid-faced rules were the same price as their all-wood equivalents and digit-registering cursor models were the same price as their normal cursor equivalents, despite both features being more complicated constructions. The 25cm scale models with longer stocks and more complicated features, such as slide-springs, were more expensive, which seem logical. Desktop 50cm scale rules were nearly four times the price of their 25cm scale equivalents, which also makes sense as they were more expensive to produce and likely to sell in smaller numbers than the smaller rules.

Although the c1907 catalogue only shows one all-wood rule, the 350, it is now slightly cheaper than its celluloid-faced equivalent, the 360. Features such as longer stocks and slide spring still increase the slide rule price. Oddly the 367 with its complicated digit-registering cursor is slightly cheaper than the same rule with a normal cursor, the 364, and the specialist 368 log-log electro rule with its own intricate cursor is the same price as the 364. The short 369 pocket rule is the cheapest enhanced-Mannheim listed. The 50cm scale versions remain expensive compared to their 25cm scale equivalents, at around 3½ times the price. Railway-track and non-railway-track versions of the same model were the same price. The c1907 catalogue also showed that cases, instructions, cursors and replacement springs were available to purchase separately.

c1909 - c1912

In the 1910 catalogue, the pricing appears more logical than in the previous pricelists. Celluloid-faced models were now more expensive than their all-wood equivalents, reflecting their more complex celluloid-sprung split stock construction. The more complex digit-registering cursor versions were now more expensive than their normal cursor equivalent. The sole model with decimal scales, the 363, is slightly more expensive than its non-decimal scales equivalent, the 364, which may be due to lower production numbers. The pocket 369, simple student 361 and the 358 basic all-wood farming model were the cheapest models. The complex log-log electro 368 and 378, and Pickworth models were understandably the most expensive 25cm scale models. 50cm scale models were now even more expensive than their 25cm scale equivalent at around five times the price. This catalogue lists a new magnifying cursor available for various models.

c1912 - c1914

The price structure from the 1910 catalogue where larger, more specialist or rules with a more complicated construction were more expensive continues in the 1913 and c1914 pricelists.

The 1913 pricelist showed prices in the same currency as the previous catalogue, but the individual models were significantly cheaper in the 1913 pricelist compared to the 1910 catalogue. The 12.5cm scale 369 and all 25cm scales models were all about 30% cheaper than previously, and the 50cm scale 380 was about 70% cheaper. The economic climate of the time may well have impacted this, but more efficient methods of manufacturing the two-part celluloid-sprung stock which had only recently been introduced in 1910 could have been a factor.

Conversely, comparing the c1914 pricelist to the 1913 pricelist, which also both showed a common currency, most models show a significant increase in price from about 25% to 55%, and the 50cm scale 384 System Pickworth increased by 70%. Again, the financial environment may have influenced this increase, but the introduction of the new two-part steel-sprung stock construction, which was more complicated and probably more difficult to manufacture than the celluloid-sprung stock, may also have impacted on the price.

Appendix C – Graphical Representation of Model Relationships

The diagrams presented here are a graphical representation of Faber models and their features for three distinct time periods of model definition. For each period a "standard" definition is listed indicating the most prevalent form of those features in that period. Models that boast different forms of those features are grouped by enclosing them in coloured bands with appropriate labelling. Thus, it is possible to see the relationship of each model to other models in the period, and how this evolved. For example, in the defining features for 1895-1909, a 354 only differs from a 363 in that a 354 is all-wood (not celluloid faced like the 363) and the 363 has decimal numbering (whereas the 354 does not); in 1909-1912 the 377 was the same as the 367 except the 377 had System Pickworth scales in addition to the standard enhanced-Mannheim layout of the 367.