

Early AW Faber Slide Rule “Quirks”

Odd Scale Lengths, Ghost Gauge Marks and More

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Abstract

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 well over 200 slide rule specimens, subsequently referred to here as TOMCAT. A complete list of TOMCAT articles to date, which were used in the compilation of this article and contain a full list of references and sources, can be found in the Bibliography.

Faber were among the pioneers of mass-produced slide rules. They were innovative and had a reputation for producing slide rules of the highest quality. However, the TOMCAT research, which covers about 30 years of Faber’s production from its start in 1892 to when dates were added to the side rules in 1920, uncovered some interesting quirks in the slide rules and designs. It appears in retrospect that at least during these formative years Faber were not immune to producing slide rules with strange or inconsistent features. The following are some of my favourites of these peculiarities, described in this article for your interest and delectation, with approximate dates of the occurrence of the curiosity:

1. Odd scale lengths (1892, c1922-).
2. Introduction of trig/log scales (c1893-5).
3. Railway-track scales (c1893-1928).
4. Cursor grooves and edge measuring scales (c1903-4).
5. Digit-registering cursor rivets (c1904).
6. Ghost gauge/index marks (c1905-8).
7. Stock slits on model 368 (c1905-8).
8. Wooden pins (c1907-9).
9. Edge facing on model 360 (c1915-20).

It is worth acknowledging that what appears strange in retrospect occurred for reasons that are now lost to us. There could be any number of explanations for these apparent oddities including, but not limited to, design faux-pas, limitations caused by other manufacturer’s design protection, manufacturing glitches, process anomalies, human error, poor quality control, and even deliberate copyright traps.

A tendency of collectors is to seek out different or unusual specimens in the hope of finding rarities, one-offs, or prototypes, and collections may well be biased towards these. However, in relation to mass-production, these are unlikely to surface, especially prototypes, although some are known to exist. Only a tiny proportion of the thousands of slide rules that Faber mass-produced in these early years have survived and are available for study over 100 years later, therefore the vast majority of these should be typical examples of the time, that is, not a “quirk”. That stated, the mass-production of slide rules was in its infancy in the late 19th and early 20th centuries. Manufacturers were learning their craft, often from each other, many manufacturing processes were manual, and designs and production processes changed a lot over a relatively short period as manufacturers improved and added new products. There are even examples of periods of several years where many slide rules were mass-produced from scale templates containing errors!

Unfortunately, official Faber documentation, the only definitive source of information that could give insight into apparent anomalies, is extremely sketchy and scarce from this time period, and virtually non-existent to the level of detail required. It is very difficult, therefore, to explain the apparent anomalies described herein. However, I have included some of Trevor and my thoughts of possible rationale behind the quirk where appropriate. I remain intrigued by the evolution of designs and production processes, and the minutiae of early Faber slide rules, and still find it fascinating to keep looking and trying to rationalise the apparent

anomalies and design quirks I find. Should anyone have any further insight to any of the topics mentioned in this article, please get in contact via the UKSRC.

1. Initial Odd Scale Length (1892, c1922-)

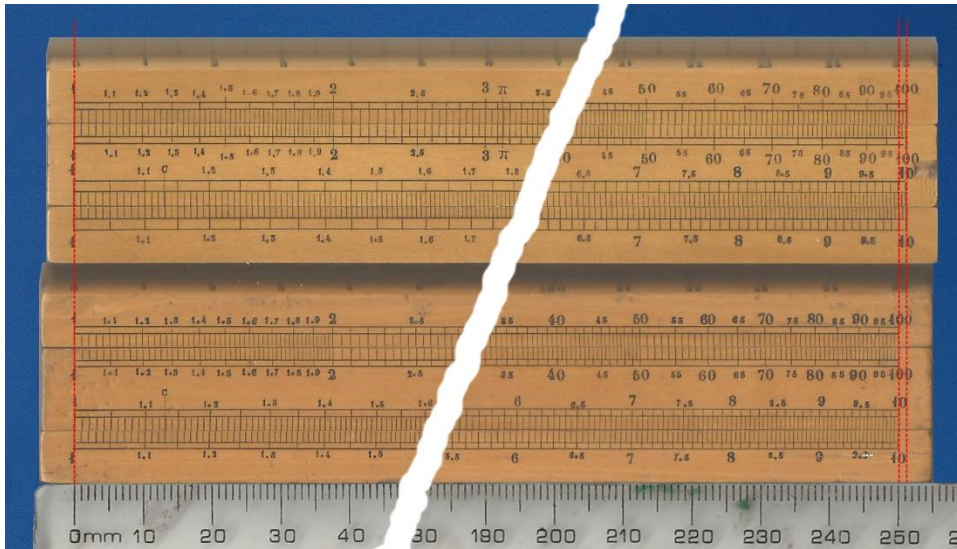


Figure 1: Scale length; just over 25.1cm to c1895 (top) against exactly 25cm from c1895 (bottom), shown shortened.

Faber only produced one slide rule “model” until about 1895. The first few incarnations of this model, introduced in 1892, had a scale length of just over 25.1cm. When Faber introduced their second model, the scale lengths of both models became exactly 25cm, see Figure 1. This change can also be seen on slide rules with trig/log scales on the back of the slide, and an inch/cm conversion scale on the back of the stock. The left-hand end of the conversion scale was precisely aligned with the left-hand end of the slide rule scales, which were positioned centrally on the body and slide. So, for slide rules with just over 25.1cm scale length, the 25cm mark at the right end of the conversion scale does not align with the index mark in the slot for reading the scales on the back of the slide, it is just over 1mm short. Whereas once the scale length was changed to exactly 25cm, the 25cm mark and index mark align precisely, see Figure 2.

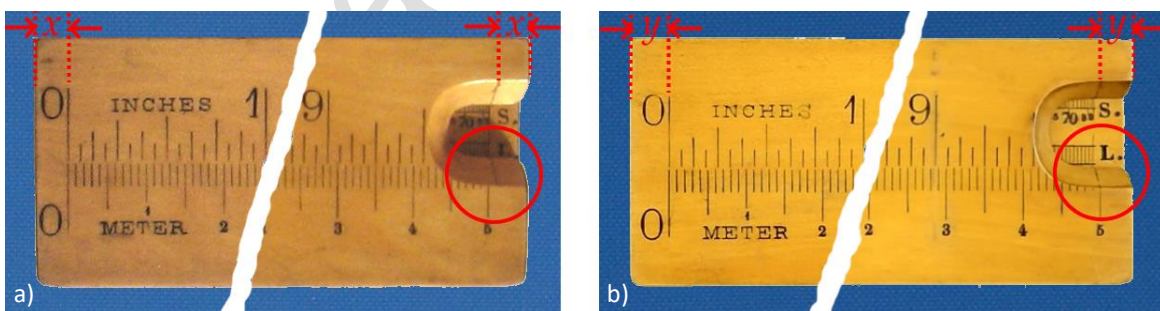


Figure 2: Scale length vs conversion scale; a) just over 25.1cm scale length, b) exactly 25cm, both shown shortened.

Trevor and I do not know the rationale behind Faber’s initial odd scale length, which lasted for several years and is neither exactly 25cm nor 10 inches, but we can be confident of the measurements. Since Faber’s early slide rules also featured measuring scales, we can test and compensate for expansion or shrinkage of the wood as appropriate. Little is known about how Faber created their first templates, from which the slide rule scales were marked by hand. We speculate that when Faber began designing slide rules, they wanted a scale length of about 25cm as this was a proven convenient size already popular among manufacturers. However, perhaps Faber considered that precisely aligning the scale length to a measuring scale was not important given that

they are not used together, and other design or manufacturing considerations then took precedence which defined the actual scale length. Then, after a few years of production, Faber apparently changed their marking methodology and their scale length became exactly 25cm, again for reasons unknown.

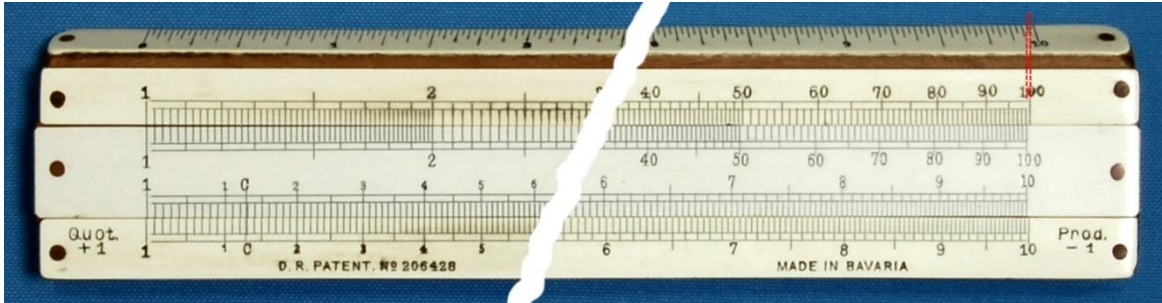


Figure 3: Shorter scale post-1922 model 360 slide in longer scale pre-1922 stock, shown shortened.

Later, from about 1922, Faber's slide rule scales once more became not exactly 25cm after they again updated their scale marking technology following several years of development. This time however, the scales were about 0.5mm shorter than 25cm, and the scales of Faber's wooden bodied slide rules remained this length until production ceased in the 1970's. This change can easily be seen by inserting a post-1922 slide of a model into a pre-1922 stock of the same model, having checked that the scales are not distorted. Figure 3 shows such a combination for the model 360.

2. Introduction of Trig/Log Scales (c1893-5)

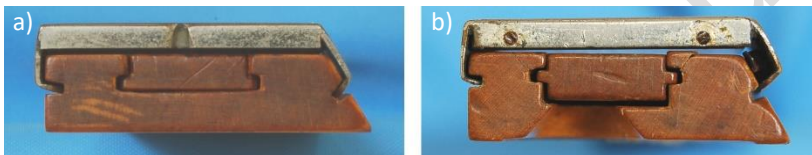


Figure 4: End profile of slide rules; a) before trig/log scales were present, b) after trig/log scales were added to the back of the slide.

The first Faber model, introduced in 1892, featured only the Mannheim A/B and C/D slide rule scales. The back of the stock featured an inch/cm conversion scale, and the back of the slide featured a centimetre measuring scale. The tongues for locating the slide in the stock were positioned along the long top and bottom edges of the slide, flush with the bottom face. Shortly after the model was introduced, sometime between about 1893 and 1895, Faber redesigned their slide rule. Among other changes, the re-design added trig and log scales to the back of the slide. This involved adding a cut-out "slot" at the right-hand end of the well of the stock with an index mark on the back for reading the sin and log scales, and moving the slide tongues to halfway up the edges so the slide could be inverted to use the tan scale, see Figure 4.

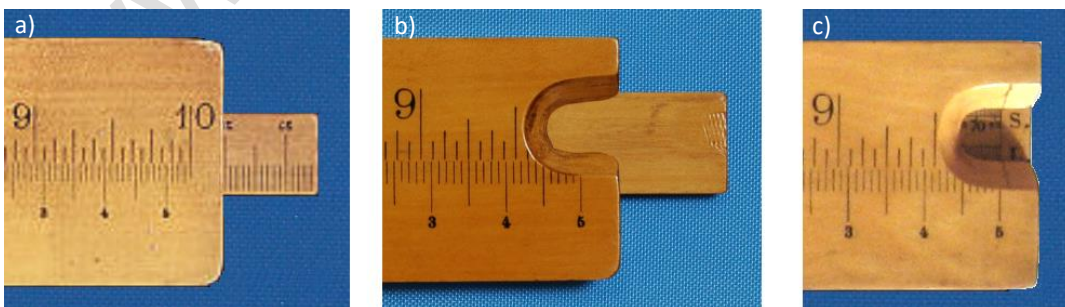


Figure 5: Back of the slide and stock slots; a) measuring scale and no slot, b) no scale and slot without index, c) trig/log scales and slot with index.

The TOMCAT research found two peculiar examples with a mishmash of features from both before and after the addition of the trig/log scales, see Figure 5. Figure 5 a) and c) show typical slide rules from before and after the change respectively. Figure 5 b) shows one of the anomalous slide rules found, which had the slide tongues still flush with the bottom of the slide, similar to the earlier design, but the back of the slide was completely blank. The measuring scale had been moved to the well of the stock, but the trig/log scales were not yet present. Despite this, the slide rules had the slot in the stock in the correct place to read trig/log scales on the back of the slide as they would appear in the later design, albeit the index mark is missing. These two examples, which must hail from the time of the design change, appear to indicate two stages of re-engineering to the stock and slide for the introduction of the trig/log scales. One stage when the slot was added for no apparent purpose, and another when the slide tongue position was changed. Two stages seem an unnecessarily complicated way to introduce the scales on the back of the slide, but it is also difficult to explain these two slide rules as production anomalies if only a single stage design change actually occurred.

3. Railway-track Scales (c1893-1928)

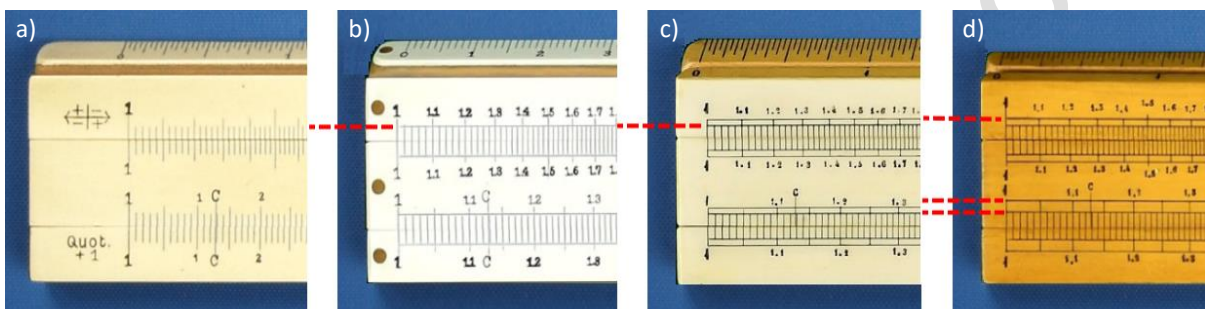


Figure 6: Railway-track scales; a) normal scale (no tracks), b) single track, c) double track, d) unequal double track.

Faber's very first slide rule model, introduced in 1892, had "normal" scales, which are simply vertical tick marks. Then, within the first couple of years of production, Faber switched to "railway-track" scales where the tick marks were joined together with lateral lines. Railway-track scales had been the norm for other manufacturers for many years by this time, so Faber's initial use of normal scales was unusual. For the next approximately 35 years of production of 25cm scale models until about 1928, Faber swapped back and forth between three subtly different types of railway-track scales as their standard scale format, see Figure 6:

- a) Normal scales: no lateral lines.
- b) Single railway-track scales: one lateral line above which some tick marks extend.
- c) Double railway-track scales: two lateral lines, one as single railway-track scales and a second at the end of the extended tick marks.
- d) Unequal double railway-track scales: as double railway-track scales, but the scale pairs A/B and C/D have different sized gaps between the lateral lines, with the C/D scales having a wider gap than the A/B scales.

Starting around 1900-3, Faber also offered normal scale versions of some models, but probably only for certain markets such as the US. Although beyond the scope of the TOMCAT research and requiring more detailed study, it appears that from about 1928 normal scales began to be used exclusively for certain models, and specific scale formats may have again been used for certain markets. Generally, however, normal scales gradually became Faber's standard format for most models from about 1928 until production ceased in the 1970's, although some models always appear to have had railway-track scales.

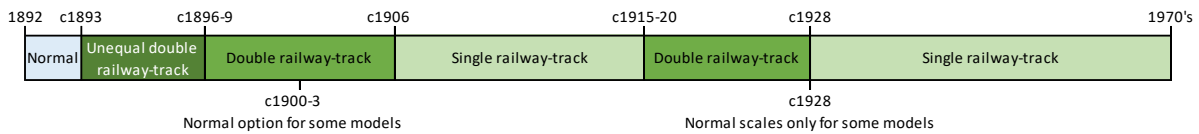


Figure 7: Timeline of railway-track scale format for 25cm scale models.

The timeline of the changes to the format of Faber’s 25cm railway-track scales is as follows, and also shown in Figure 7:

- 1892 Normal scales: Faber’s first slide rules.
- c1893 Unequal double railway-track: Faber’s first railway-track scales replace normal scales.
- c1896-9 Double railway-track: the double railway-tracks become a consistent width.
- c1900-3 Normal scale option: re-introduced as an alternative to double railway-track for some models.
- c1906 Single railway-track: railway-track scales lose one of their lateral lines.
- c1915-20 Double railway-track: re-introduced, replacing single track.
- c1928 Single railway-track: re-introduced, replacing double track. Normal scales also begin to be used exclusively for certain models.

Faber’s non-25cm scale length models are not discussed here due to an insufficient number of examples to study. However, the TOMCAT research indicates that they had different scale format evolutions to the 25cm scale length models, possibly due to lower production volumes.

The short period of a few years when unequal double railway-track scales were used is strange. Trevor and I found nine examples of this type, which indicates it was design decision to have different sized gaps between the lateral lines of the A/B and C/D scales when Faber first introduced railway-track scales. It would be interesting to know why Faber chose this design when they first adopted railway-track scales. Also intriguing, is why did Faber keep swapping between single and double railway-track styles?

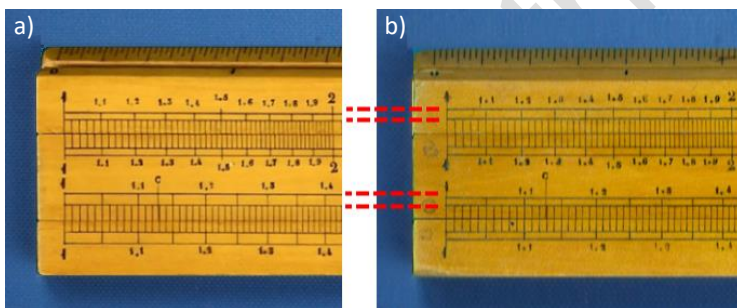


Figure 8: Unequal double railway-track scales; a) usual format, b) anomalous example with the gap widths reversed.

The TOMCAT research also found an anomaly in the unequal railway-track scales. One slide rule had the different gap widths of the scale pairs reversed. The A/B scales had the wider gap, and C/D scales had the narrower gap, the opposite to all the other eight examples, see Figure 8. The scarcity of these very early slide rules means we will probably never know if this particular slide rule was an example of another railway-track type, or more likely simply a manufacturing glitch during the scale marking, which was manual at this time.

4. Cursor Grooves and Edge Measuring Scales (c1893-4)

From the start of Faber’s slide rule production in 1892 until about 1903, the grooves along the length of the top and bottom edges which allowed the cursor to locate and slide, were positioned towards the vertical centre of the edges. Both edges also featured measuring scales, but the cursor grooves separated the number labels (above the groove) from the tick marks (below the groove) of these scales. In about 1903-4 Faber redesigned the cursors and stocks, positioning the cursor grooves slightly higher up on both edge faces. After

the redesign, the whole of the measuring scale, both numbers and tick marks, was below the cursor grooves on both edges.

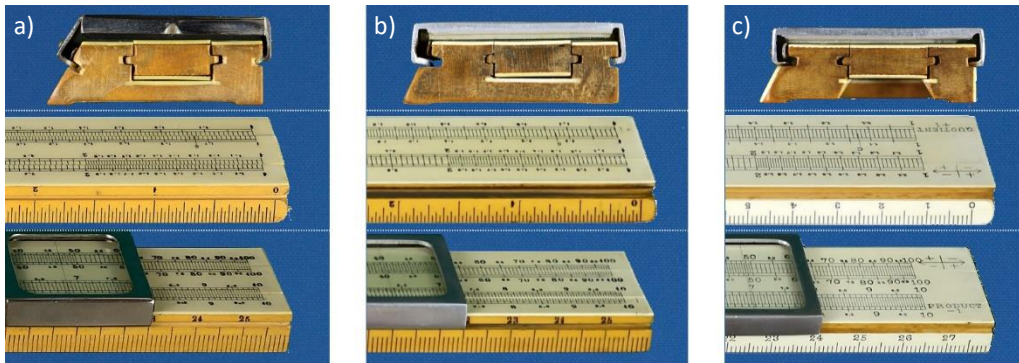


Figure 9: Cursor grooves, end profile (top), top edge (centre) and bottom edge (bottom); a) split both measuring scales, b) split bottom rail only, c) split neither scale.

Trevor and I came across one slide rule that had the new higher cursor grooves, with the entire top edge measuring scale (numbers and tick marks) below the groove as expected, but the bottom edge scale numbers and tick marks were split by the groove, similar to the old design, see Figure 9. We wonder if there are other examples of this hybrid of old and new measuring scale printing, which may then indicate an interim design, or if this slide rule is simply a manufacturing anomaly relating to the switch to the new design.

5. Digit-registering Cursor Rivets (c1904)

Faber introduced their digit-registering cursor, an aid to help keep track of magnitude during calculations, with their new model 367 in about 1899. This elaborate cursor featured a pointer with two rivets, one in the middle enabling the pointer to pivot, and one at the opposite end to the pointer arrow, which may have been to provide anchorage for the fingers to enable the pointer to be positioned more easily. The cursor design was protected by the German registered design DRGM 116832 (1899) for six years until 1905. Up until about 1904-5, both rivets featured a domed profile, and after this both rivets featured a flat top until the cursor was discontinued in about 1947.



Figure 10: Digit-registering cursor rivets; a) two domed, b) one domed and one flat, c) two flat.

Intriguingly, Trevor and I found five examples where the centre rivet has a flat top and the end rivet has a domed profile, see Figure 10. This volume, and the fact that we found no examples where the rivet types were reversed, suggests an interim production period with this configuration, rather than these slide rules simply being production anomalies from around the time of a change in rivets. If this is the case, it is interesting because it is not obvious what Faber's strategy was when, for whatever reason, they decided to change the rivets. Did they choose this configuration specifically while using up the old rivets, rather than simply using up all the old rivet first and then switching to the new rivets? Or was this a new design that used the different rivets in this configuration, which they then changed again shortly after to use only flat-topped rivets? Or something else entirely? The change in rivets also appears to have occurred around the time that Faber's design protection lapsed, was this relevant to the change? Once the design protection lapsed, other

manufacturers began producing their own versions of the cursor, for example K & E in around 1906. It would be interesting to know what Faber's rationale behind the rivet timeline actually was.

6. Ghost Gauge/Index Marks (c1905-8)

By 1903 Faber was in the process of designing a log-log slide rule, as evidenced by their German registered design DRGM 197393 (1903) and UK patent 10230 (1903). An incarnation of this design was eventually available from about 1905-6 as the model 368, a 25cm scale log-log electro slide rule with scales incised on celluloid facings glued to a 28cm wooden stock. To assist with some electrical calculations the slide rule included on the A and B scales the labelled gauge marks 28.7, and either 736 or 746 for metric or imperial versions respectively. The model also included a "W" labelled index mark at the right end of the slide, which was used to read Faber's 2-base log-log scales.

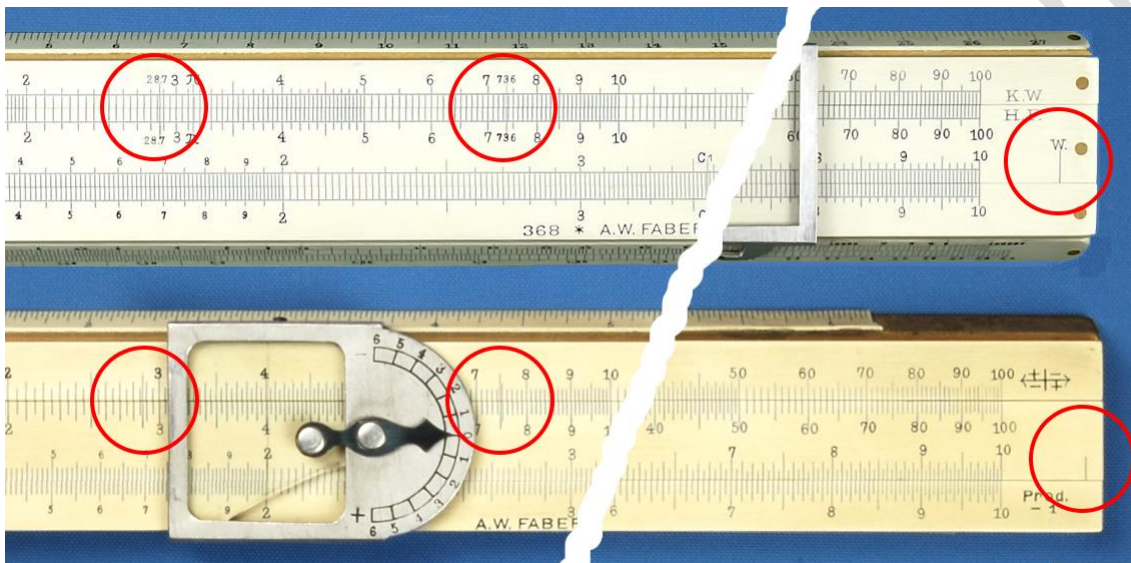


Figure 11: Electro gauge marks; metric electro model with railway-track scales and labelled marks (top), imperial non-electro model with normal scales and unlabelled "ghost" marks (bottom), shown shortened.

The model 368 was Faber's only electro model until about 1910, but for approximately two years until about 1908, all Faber's other non-electro 25cm scale length celluloid faced models also had these gauge and index marks inscribed, but unlabelled. Since these marks were unlabelled and superfluous to the non-electro models, Trevor and I called them "ghost" electro gauge marks. These ghost marks appeared on the scales of metric and imperial versions, and on both railway-track and normal scales, although the "W" index did not always appear, see Figure 11. We speculate that Faber had a single production process for marking the divisions of 25cm scales on the celluloid before the introduction of the 368. When the model 368 was introduced, the electro gauge and index marks were added to this process, which may then have been split to mark metric or imperial slide rules. The railway-track lines and gauge/index labels were then added as appropriate. Thus, these marks appear on all 25cm scale models from this time but not necessarily labelled. The production process was subsequently changed and only the electro model featured these gauge marks.

Another phantom gauge mark, ghost "M" gauge marks, also appeared around the time of ghost electro gauge marks. Faber introduced the labelled M gauge mark, $100/\pi \approx 31.83$ for ease of calculating circumferences, on their new 25cm scale length celluloid faced model 367 in about 1899, where it featured on the B scale only. By around 1905 the M gauge mark was appearing on at least one other similar model, the 364, but still only on the B scale. When Faber introduced the model 368 electro slide rule in about 1905-6, the M gauge mark was added to both the A and B scales to all their celluloid faced 25cm scale models with trig/log scales. As described above, all non-electro models had ghost electro gauge marks at this time. However, the TOMCAT research found two slide rules from about 1905-6 which had ghost M gauge marks, that is the gauge mark without the "M" label, on both the A and B scales, see Figure 12. They are different non-electro models, a 360

and a 363, and also feature ghost electro gauge marks, as expected from TOMCAT timelines. These two slide rules may indicate another distinct period of production of the model range, when only the electro model 368 featured the M gauge mark on the A and B scales, and/or some other design or production changes. However, they could simply be production process anomalies.

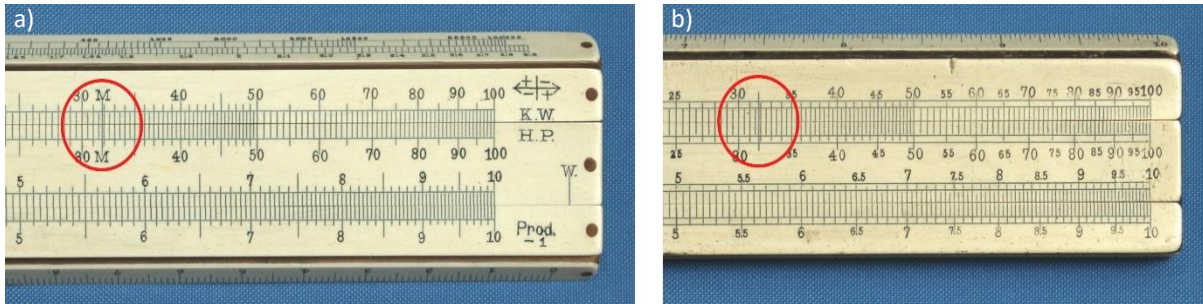


Figure 12: “M” gauge marks; a) labelled on a c1905-6 model 368, b) unlabelled “ghost” marks on a c1905-6 model 360.

7. Stock Slits on Model 368 (c1905-8)

The stocks of Faber’s earliest slide rules were made from a single piece of wood, with the scales marked directly on the wood, as they also were on the slide. From about 1895, the scales of some models were marked on celluloid facings attached to the stock and slide which, according to contemporary Faber literature, provided “greater clearness of the markings”. A celluloid facing was also added to the well of the stock, which featured a centimetre scale at this time. In about 1899 Faber introduced two longitudinal slits in the well which cut fully through the wood and any celluloid facing, corrupting any scales marked there. Faber literature stated that the slits were to “provide against the possibility of warping”. Around this time Faber also introduced wooden springs in the stock (DRGM 98350, 1898) that applied pressure on the slide to prevent it becoming “too loose or easy in working”, again from Faber literature. Around 1907-8 the stock slits and springs were replaced with a superior design comprising a two-piece wooden stock joined by springy laminate in the well (DRGM 296340 and 306107, 1907), and longitudinal metal inserts in the wood (DRP 206428, 1908). The metal inserts were to prevent warping, while the split, springy stock provided grip on the slide. The design also meant that any scales in the well were uncorrupted.



Figure 13: Stock slits; front/back \ front of typical non-electro model with wood and celluloid cut through (top), and electro model 368 with only the wood cut (bottom).

In about 1905-6 Faber introduced the celluloid faced electro model 368, which was their first model to have slide rule, rather than measuring, scales in the well. However, on this model while the two slits were present in the wooden stock, the well celluloid was not cut leaving the well scales uncompromised, see Figure 13. All examples of the model 368 with a solid stock and slits that Trevor and I found, ten in total, did not have the celluloid cut. This was a departure from all other celluloid faced models at this time, and indicates that on this model Faber may have been willing to make a small compromise in the mitigation against warping of the stock

in favour of the readability of the new and important well scales. This compromise remained for about 2 years, until the celluloid sprung stock was introduced, making the slits redundant.

8. Wooden Pins (c1907-9)

When Faber added celluloid facings to the wooden stocks and slides of some of their models from about 1895, the celluloid was simply glued to the wood. From around 1907, Faber added wooden pegs, or pins, at both ends of each celluloid strip, excluding the celluloid in the well, to all celluloid faced models. The pins were flush with the top of the celluloid, passed through it, and extended into holes in the wood. Faber catalogues of the time indirectly referred to the pins stating, *“a new method of fastening the celluloid facings to the body of the Rule is now employed, which prevents the celluloid from becoming loose”*. The electro model 368 already had a metal rivet at the left end of the slide passing through the celluloid and wood to secure the metal index edge for reading the scales in the well, so a wooden pin was only added to the right end of the slide. Although Faber registered their pin design in Germany, DRGM 371190 (1908), they did produce slide rules with the pins before the design protection was granted. When it was granted, they printed the DRGM number on the slide rules with pins until it lapsed after six years.

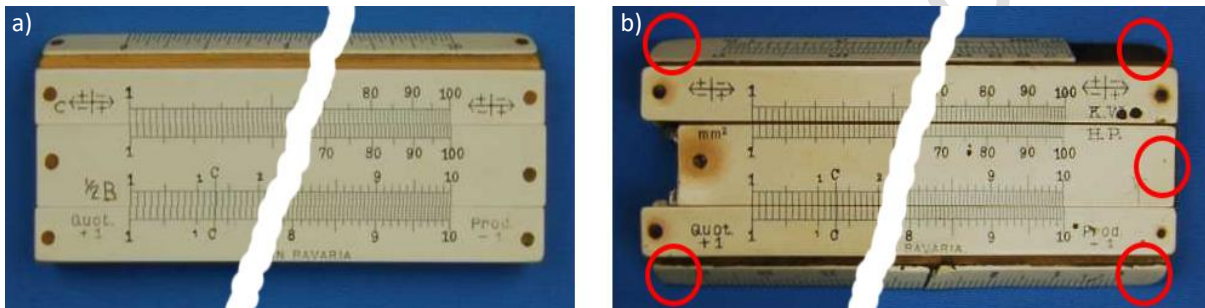


Figure 14: Wooden pins; a) typical example with pins at each end of all celluloid strips, b) a model 368 with no pins on edge measuring scales or right end of the slide, both shown shortened.

Trevor and I found one peculiar slide rule, a model 368, that had wooden pins at the ends of the celluloid facings on the upper and lower rails of the stock only. There were no pins securing the celluloid measuring scales on the top and bottom edges, or at the right end of the slide, as was found on all other slide rules with pins, see Figure 14. This slide rule did not have the wooden pins DRGM printed on it, and other features, such as the lack of a model number printed on it, date it to before about 1908. This anomalous slide rule could simply be a production glitch, or if there are other examples like this it may indicate there was an additional stage to the implementation of the wooden pins, where they were only present on the stock rails, although this seems unlikely.

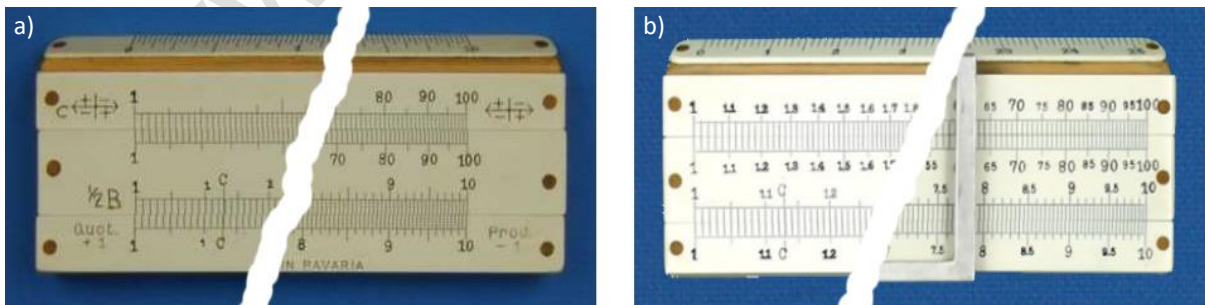


Figure 15: Wooden pins; a) spacious ends of 28cm stock model, b) crammed in pins on 26cm stock model, both shown shortened.

Another design oddity regarding wooden pins is entirely subjective. In my opinion, the introduction of wooden pins on certain models uncharacteristically compromised Faber’s usually elegant designs. Faber’s celluloid faced 25cm scale 28cm stock models, introduced in about 1899, were designed to have space between the ends of the scales and the ends of the stock for *“stabilising the cursor at these extremities”*, according to Faber

catalogues. The new pins were unobtrusive at the end of this space on these models. However, Faber's celluloid faced 25cm scale 26cm stock models, introduced slightly earlier, also had the pins added but these models had much less space available at the extremities, see Figure 15. I think the pins on these models look very cramped in, giving them a clumsy, cluttered aesthetic not normally associated with Faber slide rules. The TOMCAT research found six examples of these 26cm stock models with pins, spanning approximately two years until about 1909. The model range was then revamped and 26cm stocks were discontinued. I wonder if Faber had similar qualms about the change in appearance of these models, but initially decided that the benefits outweighed the compromised aesthetics, and if this then had any influence on the subsequent revamping of the model range.

9. Edge Facing on Model 360 (c1915-20)

When Faber introduced their second model, the 360 in about 1895, it was their first model to feature scales marked on celluloid facings attached to the wooden stock and slide. It subsequently became their "standard" or "base" model. The facings were initially only used on the front of the stock and slide, the back of the slide, and in the well, which featured a measuring scale. The long top and bottom edges of the stock were not faced, with the measuring scales featured there marked directly on the wood, as they were on the first model. More celluloid faced models were subsequently introduced, also without facings for the edge measuring sales. In about 1903-4, Faber added the measuring scale facings to the top and bottom edges of all celluloid faced models apart from the budget, student model 361, to which they were added sometime around 1908-13. Facings remained in this configuration until they began to be added to the back of the stock of some models in the 1950's.

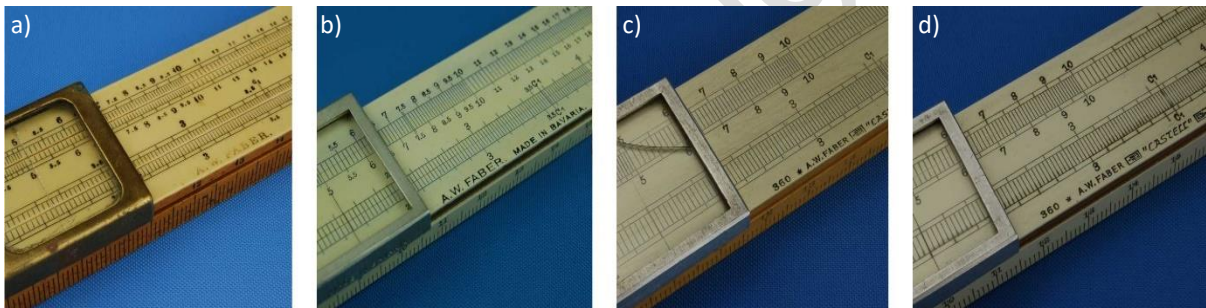


Figure 16: Model 360 edge facing; a) c1896-9, b) c1906-7, c) c1915-20, d)1922.

In the period covered by the TOMCAT research, from the start of Faber's production in 1892 to 1920, Trevor and I found an anomaly in celluloid facing timeline relating specifically to their base model, the 360. Of six examples of 360's that we can date to 1914-1920, only four have celluloid faced top/bottom edges and facing in the well, see Figure 16. Two examples have their top/bottom measuring scales marked on the wooden stock as they were before about 1905, but in addition the well measuring scale is marked on the wood unlike the earlier models. In all other respects these two examples are the same as the other four specimens from this period. All examples of other celluloid faced models that we studied, a total of 18 slide rules covering nine different models from around 1914 to 1920, follow the above-described timeline for facings without anomalies. Unfortunately, we have found it impossible to date any of the six 1914-20 model 360's more accurately, which may have given us a better understanding of this change. However, because of the dates involved, we speculate that this change of design of Faber's base model 360, which was later reversed, may have been related to production during the First World War.

Bibliography - TOMCAT Articles

A complete list of TOMCAT articles to date, which contain full information of sources used in the TOMCAT research:

- [1] *Every Slide Rule Tells a Story - Establishing an Early A.W. Faber-Castell Chronology* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 15
- [2] *Overview of A.W. Faber-Castell Slide Rule Dating Chronology 1892-1920* (Colin Tombeur), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 49
- [3] *How did A.W. Faber-Castell Mark their Scales?* (Trevor Catlow), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 70
- [4] *The Earliest Faber Slide Rules* (Trevor Catlow), United Kingdom Slide Rule Circle (UKSRC), Slide Rule Gazette, Issue 17, Autumn 2017, Page 100
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