

The Evolution of the 4092

Kate Matthews

Keuffel & Esser introduced the Log Log Duplex rule in its 1909 catalog. Although Cox had obtained the patent for the duplex rule in 1891 and K&E offered many “duplex” rules prior to 1909, [1] it appears that they didn’t really begin to grasp its potential until some time after the turn of the century. The great value of the duplex rule, of course, lies in being able to transfer a calculated value from one side of the rule to the other without having to reset the cursor. By being two-sided, a duplex rule also provides twice as much surface area for the placement of scales which increases its calculating capacity. Combined with the log log scales, this made the 4092 into a real calculating powerhouse when compared to the other more simple rules K&E was offering at the time. Over time, the 4092 evolved into a better and better calculating device. The various changes and refinements it experienced are the subject of this article.

In its earliest known form, the 4092 had only five scales on the front of the rule: The A/B, S, and the C/D scales, as shown below.

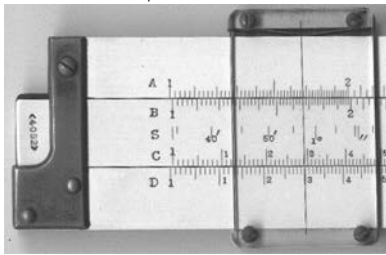


Figure 1: Scales of the 4092 (front) 1909-1915.

On the reverse side, as shown below, the rule had the scales LL1, LL2, LL3, C, T, CI, D, and L.

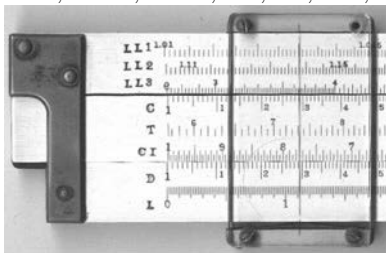


Figure 2: Scales of the 4092 (back) 1909-1915

In the 1909 catalog, the rule is described as “Patent Pending.” The patent in question is 907,373 filed by W.L.E. Keuffel on December 30, 1907 and granted on December 22, 1908. [2] The early known rules from this period show the Keuffel & Esser name and the patent dates (June 5, '00, Dec 22, '08) located on the bottom of the front.

The model number is depicted on the left side of the slide thus: <4092>. As has been noted elsewhere, these early rules were constructed with no laminate on the edges. [3]

Just how early prototypes of the 4092 were manufactured is unknown. Ed Chamberlain owns a very early version of the 4092 which clearly pre-dates the model shown in the 1909 catalog. His rule bears the 1891 Cox patent date and has no model number. It also has atypical non-adjusting stator bars, which suggests that it was probably a prototype or “mock-up” of a rule, rather than one that was manufactured for general sale. Manufacture of this rule surely pre-dated the patent application by W.L.E. Keuffel in 1907. It is interesting to note that Keuffel apparently timed his patent application so that it would be granted shortly after Cox’s 1891 patent expired (17 years after issuance date). [4] W.L.E. Keuffel was no stranger to the patent process. By 1907, he already had at least three patents under his belt (nos. 603,695, 621,348 and 651,142). These three patents had taken anywhere from eight to 13 months to be processed. [5] By filing his patent on December 30, 1907, Keuffel was virtually assured of it being granted no sooner than October 30 of 1908. Cox’s patent expired on Oct. 6, 1908.

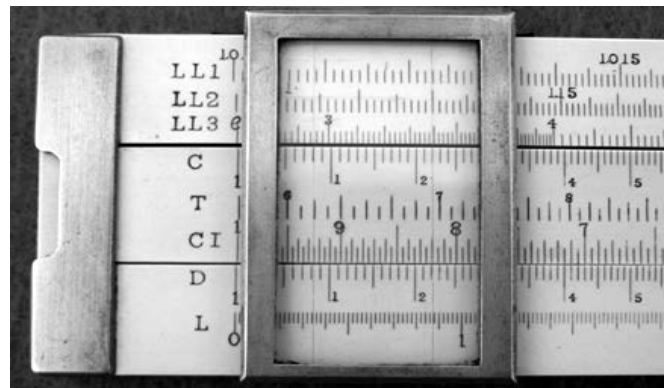


Figure 3: Ed Chamberlain’s Early 4092 “Prototype”

The first 4092 was equipped with the framed metal so-called “clamshell” indicator. There are a few rare examples of 4092s with the column type indicator, which was used briefly in 1913¹. [6] In 1915, 4092s began to be equipped with the new “frameless” indicator which was designed to eliminate problems reading numbers which the older metal frames had blocked. Mr. H.C. Stringfield, an East Coast collector, recalls touring the Keuffel and Esser factory during a high school field trip in 1928 or 1929 where his class was guided through the factory by “Mr. Keuffel himself” (most likely this was W.L.E. Keuffel). At that time, he vividly remembers seeing a row

¹Bob DeCesaris has one in his collection, as does Ed Chamberlain.

of women who were employed in the activity of drilling the individual screw holes into the “frameless” indicator windows by means of drill presses. [7] Sadly, it has been those screw holes themselves which have caused so many collectors (and users) so much grief, as they introduced an area of weakness into the indicator window, a feature which almost always resulted in broken corners and unusable indicators. Now, it is very unusual indeed to find intact frameless indicators. Clearly, this was a well-acknowledged problem for K&E, because in 1933 they introduced the “framed” indicator to alleviate the problems associated with broken indicator glasses.

Although never depicted in any catalog, at some point early in the history of the 4092, K&E also offered the 4092 $\frac{1}{2}$. Evidence for the existence of the 4092 $\frac{1}{2}$ exists in the form of an early undated instruction manual entitled “K & E Log Log Duplex Slide Rules”. [8] Based on the depiction of the slide rule, its cursor and scales, this manual (from Rodger Shepherd’s collection) appears to date from between 1915 and 1920.



Figure 4. The Inside Page from the K&E Publication *Log Log Duplex Slide Rules* Circa 1915.

The inside page (shown above) describes the 4092 $\frac{1}{2}$ as a smaller rule identical to the 10-inch rule but without “...the D scale on both sides”. For the most part, from a study of the early catalogs (1900-1913), it appears that K&E generally used the $\frac{1}{2}$ designation to indicate a variation in a rule when the next sequential whole number had already been designated. Based on a study of these catalogs, it appears that by 1913 the $\frac{1}{2}$ designation was generally being phased out in favor of the -3 and -2 designations for the 10-inch and 8-inch rules, respectively. In 1915, the -3 suffix had not yet been adopted for the 4092.

Dates for the adoption of certain features of the 4092 are hard to ferret out. There is clearly a discrepancy between the depiction of the 4092 rules in early catalogs and how the rule actually looked. Although the 4092

continued to be depicted in catalogs without the model number, in reality, it is probable that from 1909 to sometime between 1915 and 1921, all rules were inscribed with <4092>. Interestingly, the model number does not appear at all in catalog depictions of the 4092 until 1925, and then the model number is shown as <4092>, when in reality, the actual imprint of the model number on the manufactured slide rule of that time is clearly <4092-3>.

After 1921 a host of changes took place. Sometime between 1921 and 1922, the LLO and the folded scales were added to the 4092. The early 4092 had characteristic serif style letters and a pleasing hand-stamped appearance. After 1921, the serif style lettering took on a more precise appearance which suggests that hand stamping had gone by the wayside. It was around this same time that serial numbers began to be placed on the slide and edge of the 4092 rule and the model number was redesignated as <4092-3>. Also, the placement of the patent information and the Keuffel and Esser name was moved from the center of the bottom rail to the center of the top rail.

By far the most sweeping change, however, was the addition of the LLO scale. The log log scales on the original 4092 had only covered values of $e^{0.1}$ to e^{10} (1.01 to 22,000). According to Shepherd’s early instruction manual, this range was “...quite high and low enough for practical purposes”. Indeed, the instruction manual goes on to explain (somewhat defensively) that “A log-log scale of fractional or decimal quantities is not required, as such quantities may be readily handled by the method of reciprocals.”² It is clear that as time passed, the method of reciprocals proved to be too cumbersome (i.e., the log log range was not quite “high and low enough”). The newly added LLO scale captured the previously unrequired log log graduation values between .97 and .05.

This improvement was the subject of the 1924 patent issued to A.W. Keuffel. [9] During the brief period between the filing and the granting of the patent, the 4092 rules show the original two patent dates plus a patent pending on the center of the front top rail (shown below).

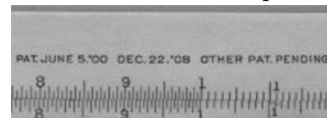


Figure 5. 4092 patent dates 1922-1924.

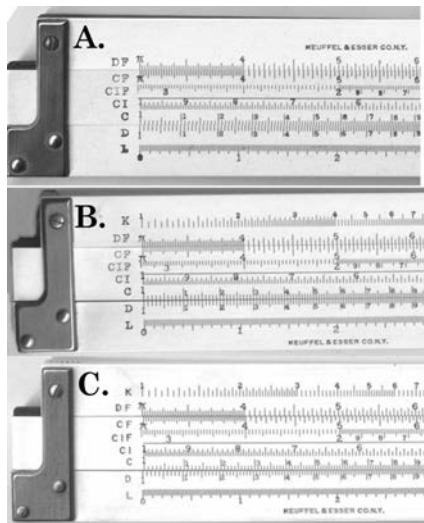
Addition of the LLO scale necessitated a sweeping change in the layout of the rule. The log log scales in the older versions of the 4092 had been referenced to the C/D scales, but in the new version, the log log scales are referenced to the A/B scales. The position of the A/B scales was therefore transferred from the front of the rule to the back adjacent to the log log scales. Likewise, the C/D scales were swapped from the back to the front. Other corresponding scales went along for the ride. Concurrent

²See Bob Otnes’ article “Log Log Scales” in *JOS* Vol. 1, No. 1 to see how ‘easy’ this method actually is.

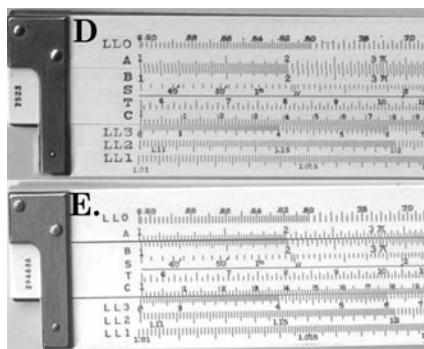
with the addition of the patent pending and LLO scale, the 4092-3 was also equipped with full laminate cladding.

A.W. Keuffel also introduced other new scales to simplify calculations. He added a folded C/D scale (the CF/DF) and an inverse folded scale (the CIF) to the front face of the rule. The resulting slide rule was really a fairly radical departure from its predecessor.

In 1924, the patent was granted and for a short time (1924-1927), the 4092-3 sported three patent dates, the newest being April 22, '24. When the patent was granted, in an additional improvement, the K scale³ was added to the front face of the rule. Variations of the 4092 are shown in Figure 6.



Front A: (1915-1921), B: (1922-24), C: (1924-on)



Back D (1915-1924), E (1924-on)

Figure 6: Scale Variations of the 4092 post 1915

The changes to the 4092 were significant enough that when it was introduced in a special edition of the K&E catalog in 1925, it was given the designation N for “new.” Unlike some of the other models so designated by K&E, the N designation was never actually imprinted on the slide. The rules continued to be imprinted with the model number <4092-3>. Another change to the rule in 1924

was that the serif style of lettering was dropped in favor of a more contemporary sans serif style. One can speculate that the lettering style was modernized to reflect the more innovative design.

Beginning in 1927, due to a legal change in the documentation of patents, all 4092s began to carry patent numbers in place of patent dates. The location of the Keuffel & Esser name and the patent numbers was transferred from the center of the front top rail to the center of the bottom front rail.

Alas, the new and improved 4092 of the late 1920s and early 1930s was actually on its deathbed. A.W. Keuffel’s innovations led quite naturally towards other improvements which could not be handled within the scope of a single slide rule. In 1933, K&E introduced three variations of the log log duplex rule, each targeted toward a different audience. 1936 saw the last presentation of the log log duplex rule in the K&E product line. Its innovative design led directly to the introduction of the Log Log Trig, Decitrig and Vector slide rules, whose calculating abilities eliminated the role of the Log Log Duplex forever. It had evolved itself right out of existence.

Acknowledgements

The author would like to thank the following for their assistance with this work: Rodger Shepherd, without whose generosity and encouragement this article could not have been written. Bob Otnes for his ever-helpful insights. Bob DeCesaris and Ed Chamberlain for sharing their rare 4092 material.

References

- Otnes, R., “Keuffel and Esser Slide Rules”, *Historische Burowelt*, 24, p20, July 1989.
- Price, O., “Keuffel & Esser Patents”, *Journal of the Oughtred Society*, 2:1, p35, March 1993.
- Otnes, R., “Log-Log Scales”, *Journal of the Oughtred Society*, 1:1 p22, February 1992.
- Otnes, R., “Keuffel and Esser Slide Rules”, *Historische Burowelt*, 24, p24, July 1989.
- United States Patent and Trademark Office Patent Database, (<http://www.uspto.gov>), patent nos. 603,695, 621,348 and 651,142.
- Larson, M., “The Runner”, *Journal of the Oughtred Society*, 1:1, p41, February 1992.
- Stringfield, H.C., personal communication.
- Keuffel & Esser Co., “Log Log Duplex Slide Rules”, np, nd, (*from the collection of Rodger Shepherd*), circa 1915.
- United States Patent and Trademark Office Patent Database, (<http://www.uspto.gov>), patent no. 1,488,686, *Log Log Duplex Slide Rule*, issued April 1, 1924 to A.W. Keuffel.

³Scale of cubes, so designated apparently from the German word for cube root: “kubikwurzel”.