# A Vernier for Slide Rules - US Patent 2,424,713

My son & I got to wondering if it was possible to make a Vernier for a slide rule. It seemed like such a thing couldn't work on a logarithmic scale, so we were surprised to discover US Patent 2424713 (2,424,713) "Vernier for Slide Rules".

Perplexed as to how such a thing could possibly work, I read the patent in detail and constructed a slide rule out of paper (my real slide rules disappeared years ago).

The short answer is that this idea DOES WORK, but it is not a Vernier in the sense that the word is commonly used.

By "Vernier", I think that most people mean specifically that extra scale on a caliper (or similar instrument) that improves the accuracy to which the scale can be read by the special way the markings line up. The principle is simple enough (the scale has a 9:10 or 11:10 relationship to the main scale) but it works in a way that seems to have an almost magic quality – or maybe I'm just easily impressed! Dictionary definitions of "Vernier" usually don't fully describe how one works, so it is not completely clear whether it is legitimate to use the term to other techniques – but it is my opinion that the term probably refers specifically to an 11:10 or 9:10 scale.

Patent 2424713 uses a different (but related) technique to "magnify" a distance to allow it to be read more easily. This is how it works:

A slide rule has a transparent index or cursor that slides from end to end. It is marked with a thin vertical line which is used to help read the result of a calculation. The patent describes an additional transparent slider which slides UP AND DOWN on the existing cursor. The inventor refers to this as the "Vernier".

The "Vernier" has two lines on it. One has a slope of 1:10 and the other has a slope of 9:10. When placed either side of the regular cursor line (gradient 0) they can be used to magnify a small distance (to the left of the cursor line) by a factor of 10. The Vernier is slid up and down to match the particular part of the scale one is working on.

Now, you would think that this would not be much use on a logarithmic scale – but it turns out that it is. Quite simply put, although the scale on a slide rule is clearly logarithmic over the length of the rule, locally it is as near to linear that you can't see the difference (3½% at the steepest part of the slope, but less than ½% over most of the scale) .

Having re-read the patent a few times, and having fiddled around a bit with a home-made scale, I was reasonably convinced that this idea can be made to work in practice. Now I wondered why didn't it catch on.

I think the reasons are probably quite simple.

Firstly, it is a bit cumbersome to use. The tick marks on a slide rule are 0.01, 0.02 or 0.05 apart on different parts of the scale – so you need to be careful how you interpret the result. True, it involves only simple arithmetic, but it would be easy to make a mistake.

Secondly, the old method of squinting at the scale and estimating an extra digit works quite well enough in may applications.

Thirdly, there are other ways of getting more digits of accuracy. One can simply use a larger slide rule. Also, "long scale" slide rules were available (for example ones with a helical scale).

If you found this article useful, or if you have comments or corrections, please feel free to email me.

*Steve Champion, September 2013*
*Steve (a) stevechampion period com*

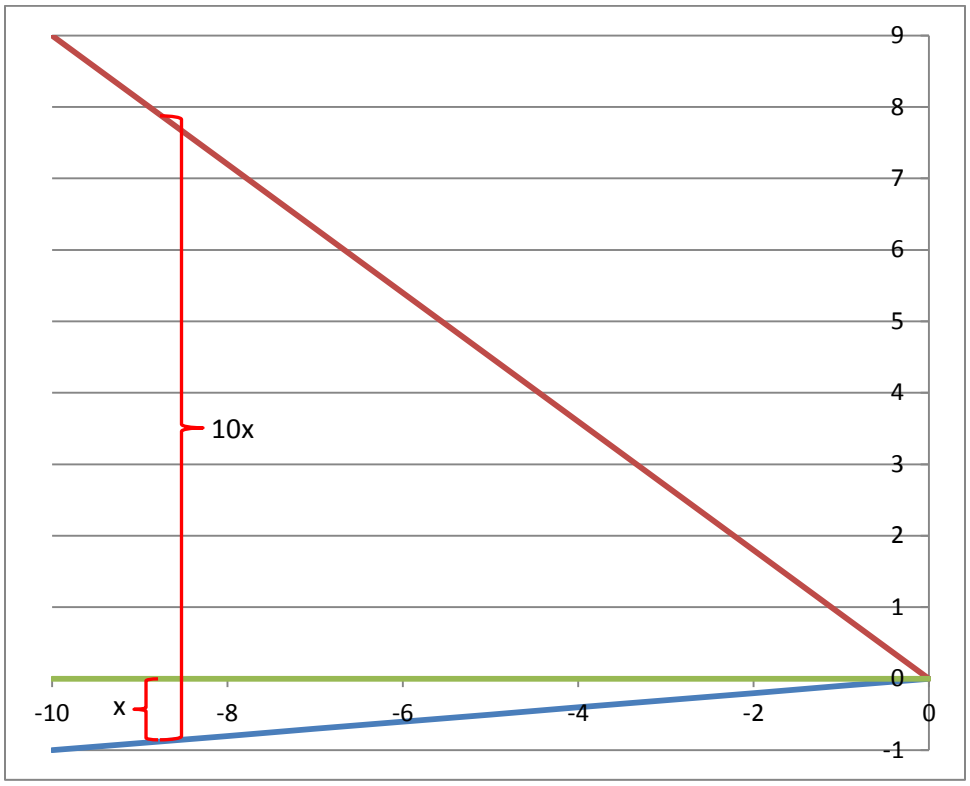


**Figure 1 – The Vernier**

This scale is turned through 90 degrees CW so that the green line becomes the regular cursor. The distance between the blue and red lines is ten times the distance between the blue and green lines. The patent describes how it is used.

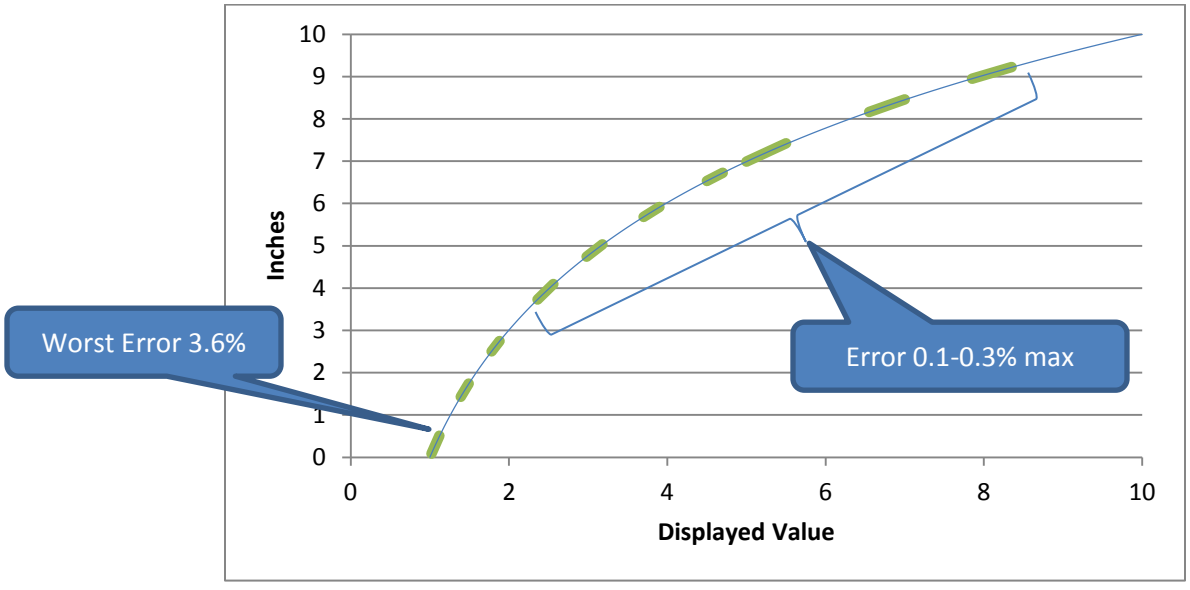


**Figure 2 – Linear approximation at various points on the scale**

The green segments are ten ticks long and have a slope determined by the first pair of ticks (i.e. they are linear extrapolations). The application limits the usage to a maximum of ten ticks, hence limiting the log/lin error.