The Voith Slide Rule and Mechanical Pencil Combination

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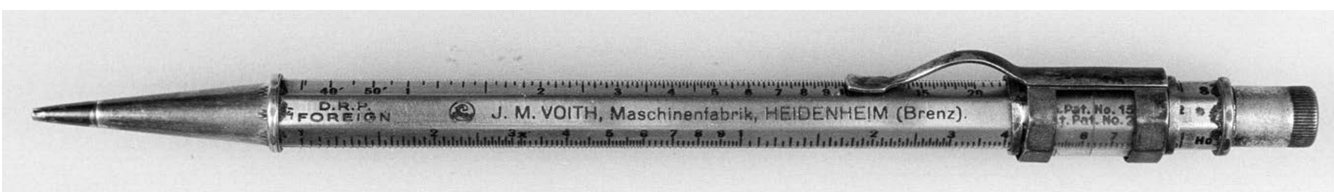
Introduction

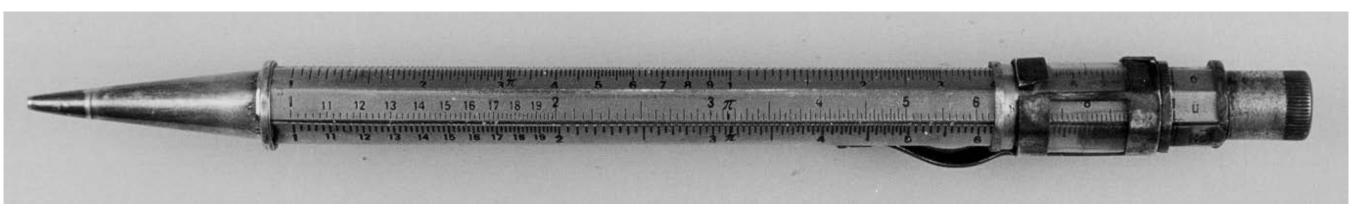
I have an interesting slide rule in my collection that combines the features of a mechanical pencil and a slide rule. Bob Otnes, who has several pencil slide rules (JOS, Vo. 1, No. 2, p. 11-12), suggested that I prepare an article on this one, as it appears to be unique and rare. In researching material for this article, I found some ingenious innovations on the number scales that facilitate efficient operation of a pencil slide rule. Unfortunately, these creative inventions were not executed on the rule in my collection, even though the same patent number appears on both the slide rule and the patent document.

The Voith Slide Rule

This slide rule appears to be made of nickel plated steel. It is about 15 cm long and 0.9 cm in diameter. Its cross sectional shape is an octagon - similar to the shape of an ordinary wooden pencil. It has an internal screw mechanism that feeds the lead as the end cap of the pencil is turned. There are seven scales - 10 cm long - marked: Ho [o, u] Hu, T, L, S, with the o and u scales being fixed to two adjacent flat surfaces on the pencil. The other scales are on a sliding sleeve that fits over the length of the barrel of the pencil. The sliding sleeve is constructed with a slotted window such that the o and u scales fastened to the side of the pencil are visible along the entire length of the scales. The sliding sleeve can be moved in both directions, much like the slide on an ordinary linear slide rule.

The Ho, o, u and Hu scales are equivalent to the A, B, C and D scales on a Mannheim type slide rule. The T (tan) scale runs from about 5°43′ to 45°, is divided into minute units and is referenced to the u (C) scale. The S (sin) scale runs from about 34′ to 90°, is also divided into minute units and is referenced to the o (B) scale. A runner is built into the metal bracket that attaches the pocket clip to the pencil slide rule. It is about 1.5 cm long and has a celluloid window – with a hair line – that wraps around the pencil. The slide rule is shown in the following photographs:





This rule functions much like an ordinary Mannheim slide rule and also like the Devco slide rule pencil described by Otnes. The one decade u and Hu (C and D) scales have 161 tick lines over the same length scales as the Devco slide rule pencil (which has 121 lines). The ends of these basic scales line up almost perfectly, the error being only discernible when viewing through a magnifying glass.

The barrel of the pencil slide rule has scales normally found on the slide on a linear slide rule and the shell or sliding part has scales normally found on the body or stators. In operation the roles of these two parts are actually reversed as the barrel of the slide rule is held at one end or the other and the sleeve is slid along the barrel. The runner functions as on most slide rules. However, the hairline on the runner cannot moved closer than to 116 on the left end and to 890 on the right end. This is not a problem when multiplying or dividing 2 numbers as the u and Hu (C and D) scales are adjacent, and the runner is not needed for their use. However, when using the S, L and T scales, the edge of the runner frame must be used in the dead regions at the ends of the scales.

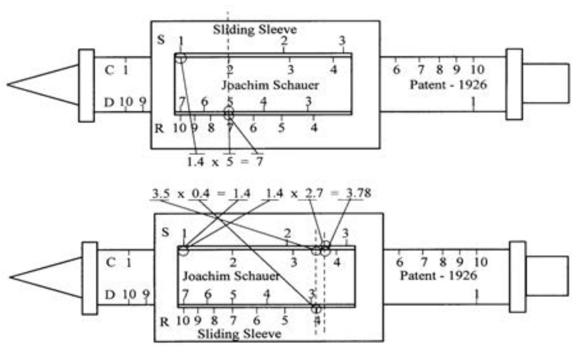
The surface of this slide rule has patent markings and, also, what appears at first glance to be a makers name. It has the patent markings: D.R.P. Foreign, US Pat. No. 1599102 and Brit. Pat. No. 259112. The US patent document attributes the patent to Joachim Schauer of Lwow, Poland. It is also marked: J.M. Voith, Maschinenfabrik, HEIDENHEIM (Brenz.). It is uncertain if Voith was the maker of this slide rule.

In a discussion with my engineer brother-in-law who lives in Stuttgart, Germany (near by to Heidenheim), he mentioned that J.M. Voith, Maschinenfabrik is a manufacturer of heavy industrial equipment. He thinks that it is unlikely that Voith would have manufactured slide rule pencils.

The uncertainty about this slide rule was deepened after I read the patent document. It gives September 7, 1926 as the patent date for a *Combined Logarithmic Calculating Device and Writing Instrument* by Joachim Schauer of Lwow, Poland. The patent narrative, however, describes a pencil slide rule quite different from the one I described above. The patent describes some very interesting details that facilitate use of the pencil slide rule as both a pencil and a slide rule. The patent points out that a pencil slide rule – configured as the Voith is – has certain drawbacks, the principle one being that when the sleeve is moved to the left that it covers the pencil point. To write down an answer calculated with the Voith slide rule, the sleeve has to be moved back away from the point.

The Schauer Slide Rule

Schauer overcomes the drawback of the sliding sleeve covering the writing point of the pencil by arranging the scales in a special way and using a sliding sleeve with a length half that of the fixed scales. The half length sliding sleeve feature of the Schauer rule was patented earlier in Germany, the scale arrangement being the subject of the present patent. Schauer wrote that: "with this arrangement (of a half length sleeve), however, the disadvantage arose that in many cases the length of the missing half of the scale on the slide (sliding sleeve) had to be made up for by corresponding (extra) movement of the slide which led to inaccuracies and loss of time." His invention under this patent is to eliminate this drawback by: "the use of reciprocal logarithmic fixed scales and reciprocal logarithmic slide scale halves". Figure 1a illustrates the form of this slide rule. The basic scales are labeled S, C, D and R, which are equivalent to the A, B, CI and DI scales on a modern slide rule.



Figures 1a and 1b.

The C (B) and D (CI) scales are arranged parallel to each other, fixed to the outer surface of the pencil. The C (B) scale runs from left to right and the D (CI) scale runs from left to right as the CI scale does on modern slide rules. The split cylinder sliding sleeve has on each of the two longitudinal edges adjoining the C (B) and D (CI) scales one half of a complete logarithmic scale. The first of these half scales S (A), which is adjacent to the C (B) scale, has the range of 1 to 3.162 (square root of 10) running from left to right while the second opposite half R (DI) scale (adjacent to the D (CI) scale) has the range from 3.162 to 10. This arrangement works well in multiplication or division along as the two numbers in the operation are in the same range, with both less than 3.162 or both greater than 3.162. In both cases the slide movements are carried out from left to right.

In the case where one of the numbers is in one range and the other in the other range, the method of "scale extension" must be employed. This is done by setting the point on the S (A) scale on the slide (corresponding to the number in the 1 to 3.162 range) opposite the larger number on the D (CI) scale, and reading the answer on the R (DI) scale. For instance (Figure 1a) to multiply 1.4 by 5, 1 on the S scale is set opposite 1.4 on the C (B) scale and the answer, 7, is found on the R (DI) scale opposite 5 on the D (CI) scale. A disadvantage of this method is that the solution is found on the sliding sleeve rather than on the body of the slide rule. Calculations with more than two factors can not be done without resetting one index of the sliding part on the intermediate solution on the body of the slide rule.

Schauer provided an alternative method for the case of 3 factors referred to as the "reciprocal" method. With the reciprocal method, the product of 3 numbers can be found with a single positioning of the sliding part. For instance, the solution of 3.5 times 0.4 times 2.7 is shown in Figure 1b. The number 4 on the R (DI) scale is set opposite the number 3.5 on the C (B) scale by means of the hairline on the cursor. The product 14 (of 3.5 and 4) is found under the index 1 (on the S (A) scale) on the C (B) scale. The product 3.78 of 3.5 and 0.4 and 2.7 is found on the scale C (B) under the number 2.7 on the S (A) scale, the result for both the intermediate and final products being found on the body of the slide rule.

Division of numbers is equally well facilitated with the Schauer scale arrangement. The patent describes this process in detail, and also gives details for locating sine, tangent, and logarithm scales on the sliding sleeve.

Conclusion

It is curious that the Voith slide rule has the same drawbacks that the Schauer slide rule is designed to overcome, yet both have the same patent number. Because of this, and because it appears that Voith is not the maker of the Voith pencil slide rule in my collection, the maker and origins of this slide rule remain uncertain. The Schauer pencil slide rule described in the patent is very unique, and if one is found, it would make a valuable addition to a slide rule collection. In the meantime, the Voith slide rule remains another interesting example of pencil slide rules.