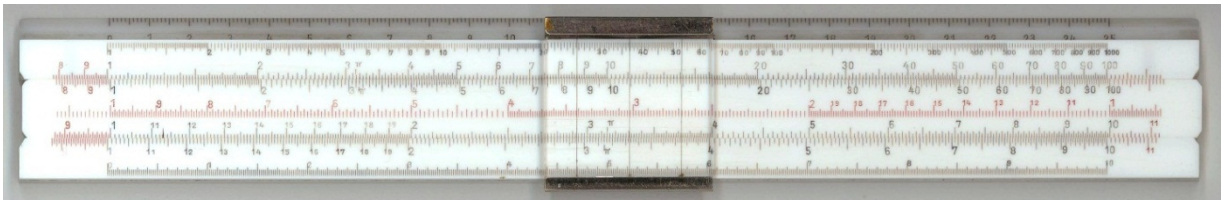
Mystery Slide Rule-with-Balls

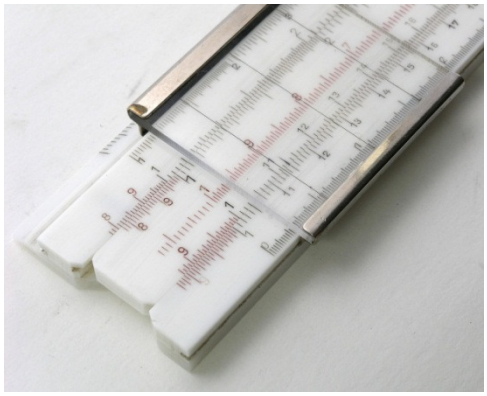
Otto van Poelje

Introduction

My latest Mystery Rule was a gift by a flea-market stand holder who sold me a nice Marc UNIS Beghin and obviously saw no selling opportunities for this very unremarkable and very “plastic” 25 cm slide rule that rested beside the Beghin. At the time I put this gift aside in my box of plain SR’s in good condition. When later I saw the *mystery-to-be* slide rule again I was piqued by the fact that its maker could not not be determined quickly, neither by captions on the rule nor by construction details (that so often help to identify a maker). Thus I took a closer look.



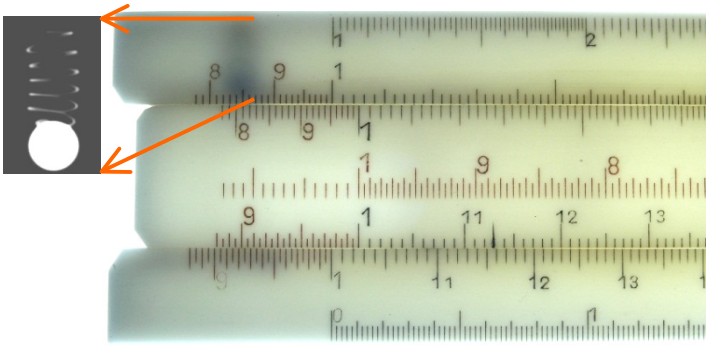
Description

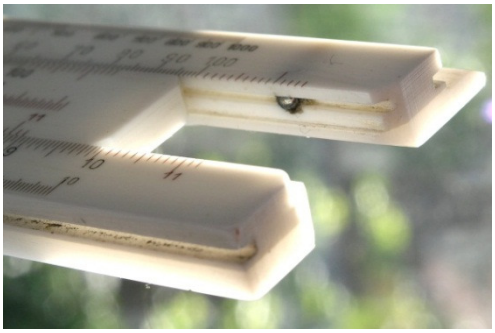


The slide rule has a solid full-plastic body and slide, probably acrylate with milk-white pigment. Looking at the cross-section, the body appears to be made of two layers, glued or melted together. The cursor (never garantueed to belong to the original rule!) has three hairlines on a plastic window, embedded in 2 plated metal guides (top left part of plating has come off). The scales are of the improved Rietz type, with S-ST-T on the back of the slide.
Nothing remarkable so far. The following observations however increased my interest in the rule. Looking at the lettering, we see the regular numerical values along the front side scales, but the fonts, font sizes and positions of numericals are somewhat inconsistent and varying. Especially the unit indication 1 is placed not under or above, but besides its corresponding mark: very unusual. The front scales do not carry the usual abbreviations (A, B, C etc.), only the trig scales on the reverse of the slide have their abbreviations inscribed at the right side. Otherwise the rule shows no captions or identifying text at all. On a heavily used slide rule such texts may have rubbed off, but this specimen looks scarcely used. Even under UV light no texts are visible at all.

Spring loaded balls

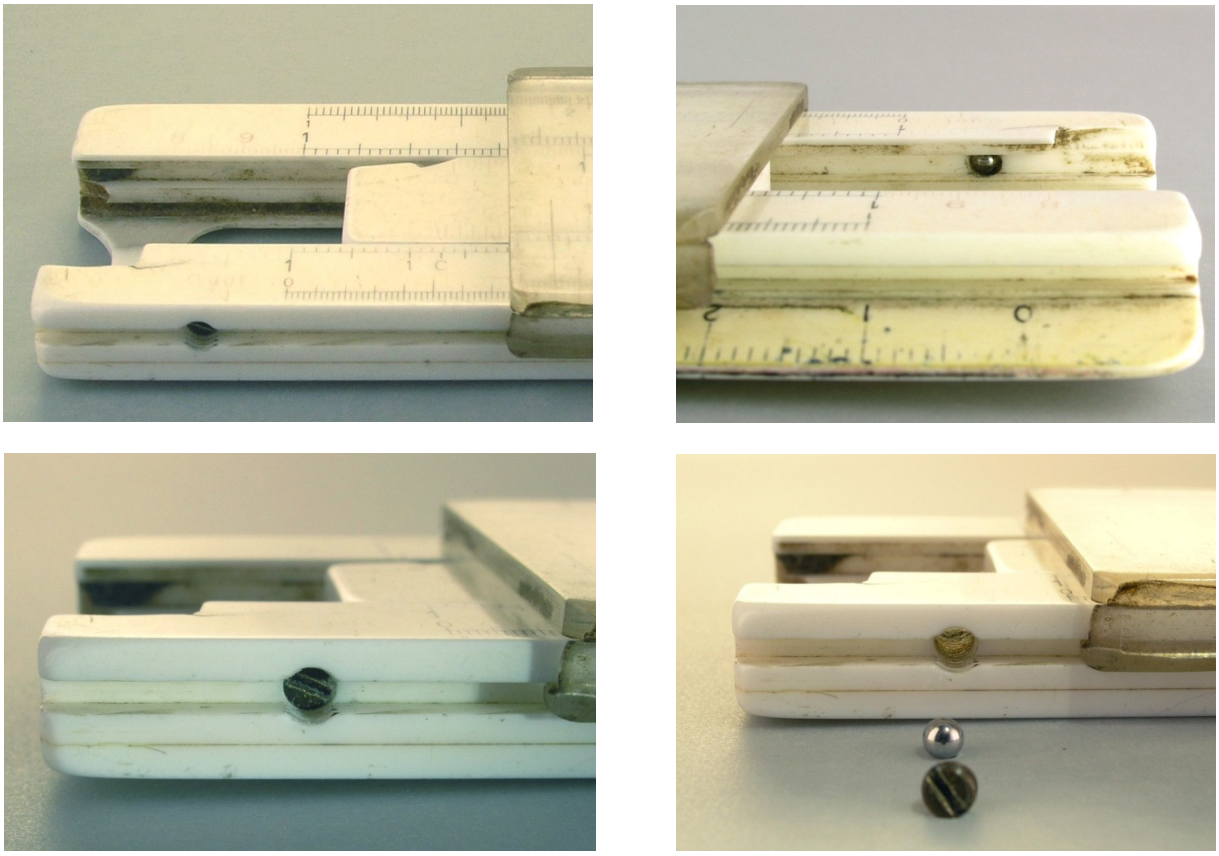
The differences with characteristics normally found on retail slide rules might suggest a prototype of some kind.
The following special feature of the mystery rule may have been the purpose of prototyping. When the inside of the gutter (which holds and guides the slide) is inspected in more detail, two very small metal balls can be seen in the upper groove of the body at the very left and very right side, see pictures below (the magnified window at the left is an actual X-ray exposure of the metal parts).



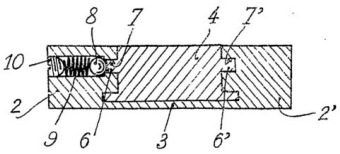


Each ball can be depressed, held by a spiral spring straight through the body up to the groove on the other side, the one that guides the cursor. Looking into that cursor groove, one can see a small circular discoloration that must be a plug that holds the other side of the spring. The hole has the same diameter as the ball (about 2 mm) and ends at the groove which is about 1 mm thick, thereby preventing the ball from being pushed out of the hole.
The function of the ball is clear: when the slide touches a ball (at either end of the rule) the slide pushes the ball, against the spring tension, toward the inside of the groove so that at any position of the slide a constant pressure is created while the slide moves inside the body, either at the left- or at the right-hand. This tension causes a constant friction between body and slide which is an advantage for the user as he can move the slide more smoothly, without the random hiccups that characterize so many common plastic slide rules.
Note that the ball does not “roll” during sliding: in principle this is not a proper *ball bearing* movement.

Other Slide Rules with Balls
Looking through my own collection for spring loaded balls, the only specimen I found was an old battered **Graphoplex** Rietz. This one has balls too, with an interesting variation: the tension can be adjusted by a screw and the balls and spring can even be dismounted, see pictures below. The Graphoplex has the balls in the lower body part while our mystery rule uses the upper groove. To make the last picture I turned the left screw loose, and out came the screw, a little heap of brown dust, and the metal ball: the spiral spring had completely turned to rust and dust.

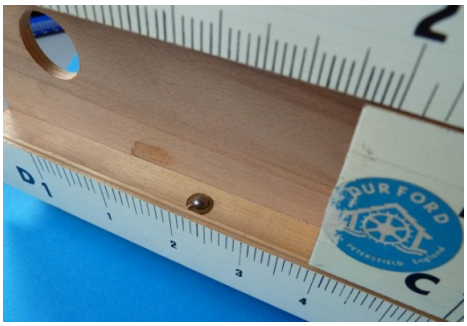


Graphoplex-with-Balls, adjustable by screw



In 1948 Graphoplex has been granted a French patent nr. 961545 for (amongst others) the method by screw. In one of the drawings of the patent the cross-section is shown with the ball (8), the spring (9) and the screw (10), see picture at the left. The spring loaded ball mechanism of our mystery rule is very similar to the Graphoplex patent.
It would be very interesting to know if the mystery rule was designed earlier or later than the Graphoplex: who borrowed the idea of the spring loaded balls from the other? Might another patent have been granted to the designer of the mystery rule, even though the differences are so small: only the leaving out of the screws and the choice of the other groove.

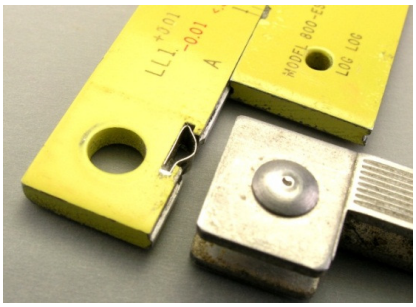
The Graphoplex screw mechanism has been identified by Daniel Toussaint in his IM2010 paper *Contribution à la Reconstitution de l'Histoire de GRAPHOPLEX*, and on his website linealis.org, though without further details. He mentions three ways of slide control: by screw (*par vis*), by two transverse metal strips (*par lame*), or by just flexing the bottom of the body (*par déformation*). In my correspondance with Daniel on the subject, he did not exclude the possibility that Graphoplex might have been the maker of the mystery rule, possibly under a different name as Graphoplex did supply to resellers, e.g. to GED. Other firms in France have produced Rietz slide rules which resembled the Graphoplex 620 closely, e.g. Tavernier Gravet, Duval, Minerva: perhaps one of those did derive their own version of spring loaded balls from Graphoplex?



Another example with balls was contributed by David Rance and Colin Barnes: the **Tiger Toys** wall-mounted slide rule for classroom demonstrations, made by Durford, UK. It is a Mannheim type with a scale length of some 2½ feet. This specimen had four balls in the lower groove, however not adjustable by screws, see picture at the right.

Slide tension control and gutter width control

The function of the spring loaded ball is comparable to the "spring tension" mechanism that can be seen in most of the aluminum duplex slide rule types by **Pickett**: these do not use spiral spring-loaded balls, but instead curved leaf springs are inserted in the groove of the body (under the end straps), see picture at the left, with dismounted strap. Such a slide tension mechanism is not exactly the same as other known mechanisms which aim to adjust the *gutter width* to fit the slide more closely. Pickett slide rules had both the slide spring tension control AND the gutter width control which was done manually while the screws on the duplex end straps were loosened.



No patent appears to have been granted for slide spring tension control by the Pickett leaf springs. Surprisingly there is a German patent nr. 1135686 (1962) by Faber Castell for a mechanism very similar to the Pickett leaf springs, but F-C has never introduced this method in their main product lines.

Numerous patents have been granted for gutter width control, mostly based on one of the following two general principles:

- lateral shifting a section of the body by four or more screws over the full length of the body. One of the early patents for this method was USA patent nr. 606388 (1898) by J.G.D. Mack.
- adjusting gutter width by flexing the bottom plate of the body to a larger or lesser degree. This method distorts the geometry of slide and gutter slightly, but it was easier and less expensive to manufacture. One of the early patents related to flexing was the German patent nr. 126499 (1901) by Dennert & Pape.
  Blundell (BRL) applied a tension device on some of their more expensive models (e.g., AG.5, AL.6, C.21, D.26, E.13, T.11, 401 , …), with only 2 screws in the lower edge of the body. Their position is about the same as the spring loaded ball mechanism of our mystery rule and Graphoplex, but these screws do not control spring loaded balls: the screw heads are actually connected to transversal wires with a slight bend inside the slit under the slide, again to control the gutter width by flexing.

Note that gutter width control also creates some slide tension control but in a rather crude way: the transition from a "slipping" slide to a "sticking" slide can be quite sudden. On the other hand, pure tension control does not create any gutter width control; for example a slide rule-with-balls may have a perfect slide tension, but at the same time show a significant slit between A and B, or C and D-scales.

Questions about the Mystery Rule

The three questions about this Mystery Rule I would like to ask you, Dear Reader, are the following:

1. Do you know who was the maker of this Mystery Rule?
2. Do you know of any patent other than the Graphoplex one, related to the spring loaded balls?
3. Have you seen other specimens with spring loaded balls, except the examples given?

Acknowledgments

Thanks for all contributions to this article by Andries de Man (patents), David Rance & Colin Barnes (Tiger Toys), Peter Soole (Blundell), Daniel Toussaint (Graphoplex).