Wittgenstein and His Calculating Devices

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"It is known that the user of a circular slide rule has to make one or more rotations of the device until it is placed in a normal position for reading the result of the operation. It is also known, that this inconvenience does hinder an intensive development of the circular slide rule, in spite of its superiority compared to the linear one, due to the fact that the movable scale of the circular slide rule never gets out of the fixed scale's reach."

G.F. Wittgenstein in the French Patent 901.679, 1944 (translated)

Background

Figure 1. Juvenia slide rule wrist watch, the inventor's personal item.

Six years ago, at the beginning of my collecting activities, I encountered an unusual circular slide rule, the Swiss-made "Tesa Maximatic", in the Technorama, a Swiss technical museum in Winterthur with a small but nice slide rule exhibition. It took me five years to get such a Tesa for my own collection. I was rather proud of this acquisition, since Tesa slide rules seem to be quite rare. However, this find was just a beginning. In less than six months, two more slide rules of the same system turned up. Soon after I found a patent, and through this patent I discovered the inventor's name. Next, almost by chance, I discovered descendants of the inventor. They told me about a fourth slide rule and a slide rule watch. The watch factory, which still exists, helped me too, and finally I located the founder of the company that produced the Swiss version of the slide rules. Not only did he remember some important facts, but he was able to call my attention to a fifth circular slide rule, which probably was an improved imitation of the first one. As a result of all this I have now documented four slide rule watch types and four different circular slide rules, all of them intellectual products of the same inventor.

It would be tempting for me to expand on the story of this unusual string of finds, but instead I will try to describe the devices, and their inventor, from a more chronologically and systematically oriented perspective.

The Inventor

Gérard Francis Wittgenstein (1898-1974) was a Swiss electrical engineer who graduated in 1922 from the Swiss Federal Institute of Technology (Eidgenössische Technische Hochschule ETH) in Zurich. Later he moved to Belgium, but early in WW II he returned with his family to Switzerland. Due to wartime conditions it was difficult for him to find an appropriate job, so he occupied himself by inventing a new technical system for circular slide rules.

It is the family's opinion that the first application of this system was a line of at least four different slide rule watches built by "Juvenia". However, obviously the combination of a circular slide rule with a watch did not satisfy Wittgenstein: see his own text above at the beginning of this article, for he also developed larger circular slide rules that were independent of a watch. He was granted a whole series of patents. In addition to the French patent that I happened to find, his son remembers British, Dutch, German, Italian, Swedish, and Swiss patents. He also remembers that his father's slide rules were exhibited at the "Palais de la Découverte" (Palace of Invention) in Paris in the 1950s. A whole series of such slide rules is now known to me: a Swiss, two French and one of unknown nationality ("Tesa", "Stephens", and "Jedermann", respectively). The watches and the slide rules seem to have been produced on the basis of licenses granted by Wittgenstein to the producing companies.

The slide rule watches as well as the circular slide rules are all based on the same system. They have many characteristics in common and incorporate the main idea behind the different patents.

Later, G.F. Wittgenstein became the director of a company in Lausanne that produced maintainance equipment for railroad tracks.

The Common Technical System

Wittgenstein probably became fascinated by circular slide rules, because they were quite popular in Switzerland at the time. For example, Loga Ltd. of Zurich produced a rather large series of circular slide rules. However, Wittgenstein disliked the handling of contempory circular slide rules because the user was forced to rotate the whole rule and to change his grip repeatedly during operation. Furthermore the results were usually not readable without additional rotation of the device.

Wittgenstein's invention eliminated these inconveniences. His circular slide rule was built into a casing, making it possible to calculate without any rotation or change of grip. The operator merely rotated the movable wheel (or, in case of the slide rule watches, the movable bezel) with a finger tip, and the result always appeared upright and at the same place at the top of the device.

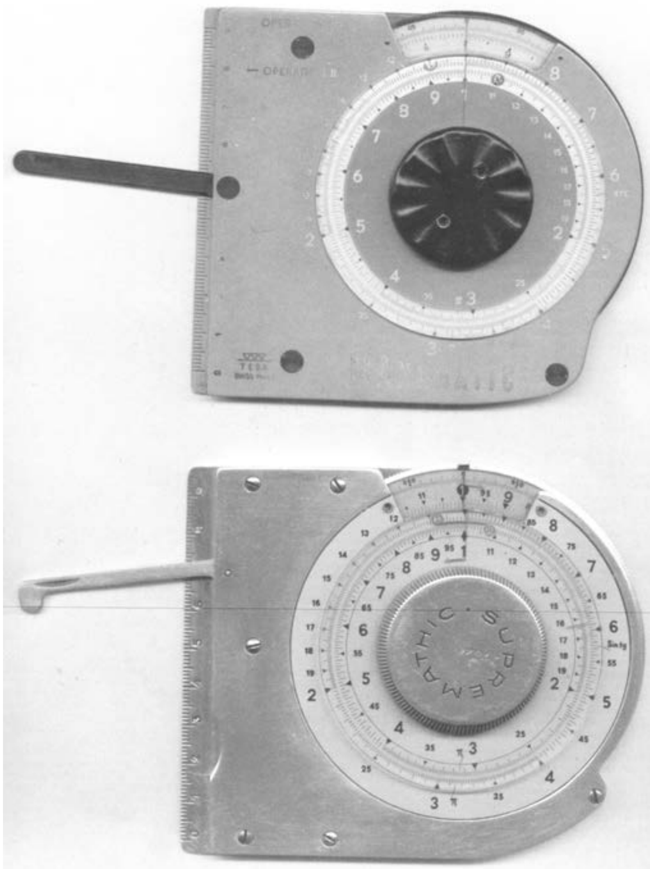

Figure 2. Front of the Swiss Maximatic, made by Tesa (above) and of the French Suprémathic, made by Stephens (below).

The Operation

All of Wittgenstein's calculation devices show three scales. The outer one is reciprocal (i.e., increasing anticlockwise) and turnable; it could be called a CI scale. The second one, inverse too, is fixed and intended for division. The third one is a fixed conventional scale (increasing clockwise) and serves for multiplication. These latter two scales could be called a DI and a D scale, respectively. In addition, the devices have a turnable cursor line.

The basic idea of this sophisticated design depends on the different effects of:

(a) turning the CI scale clockwise,
(b) turning the CI scale anti-clockwise, and
(c) turning the cursor separately.

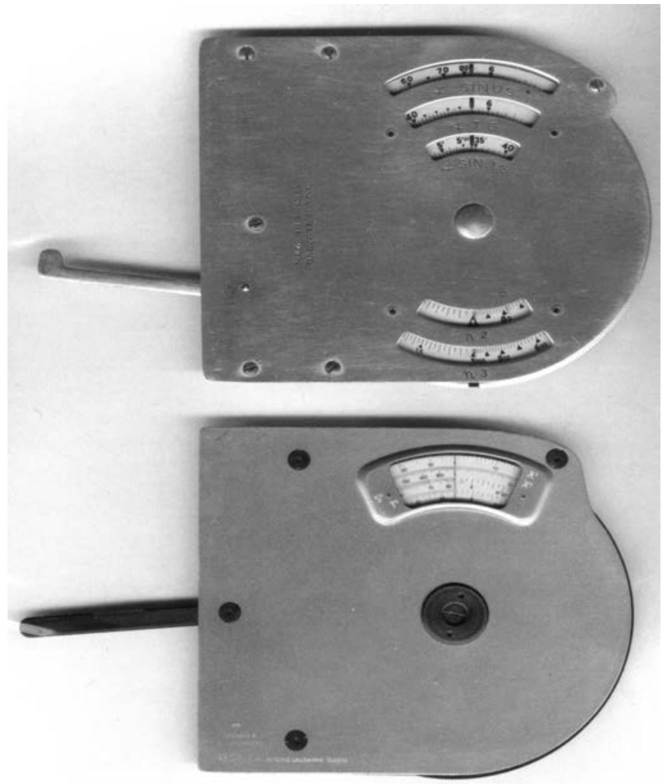

Figure 3. Back of the French Suprémathic (above) with five scales, each one in a separate window, and of the Swiss Maximatic (below) with four scales in just one window.

When the CI scale is turned clockwise, the cursor's hairline will stop at the top of the casing; this is called the target position. This target position is marked with a red hairline on a fixed perspex disc covering the scales. The user can continue to turn the scale clockwise after the cursor has stopped at the target line. If the scale is turned anti-clockwise, then it takes the cursor with it. However, the cursor can be turned separately by the central knob, but this does not influence the position of the movable scale. These three features of the device enable it to carry out all calculating tasks that the instrument was designed to do.

Multiplication, for example 2×3, is carried out in three steps: First, turn the CI scale clockwise to set the cursor to the target line and continue turning to reach the figure 2. (The cursor will stop and stay at the target line.) Second, turn the CI scale anti-clockwise to set the cursor line at 3 on the D scale. (The cursor will be taken with it.) Third, read the result 6 on the D scale at the target line.

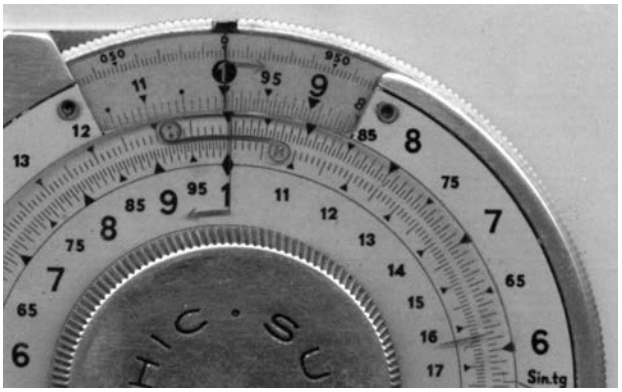

Figure 4. Window on front top of the Suprémathic: The hair lines are in their basic position, the two wings indicate the multiplication and the division scale, the two arrows show the sense of turning the wheel in order to reach figures on the wheel's scales (clockwise) or the figures on the casing scales (anti-clockwise). An index for calculating the weight of steel bars for reinforced concrete is visible to the right at position 163.

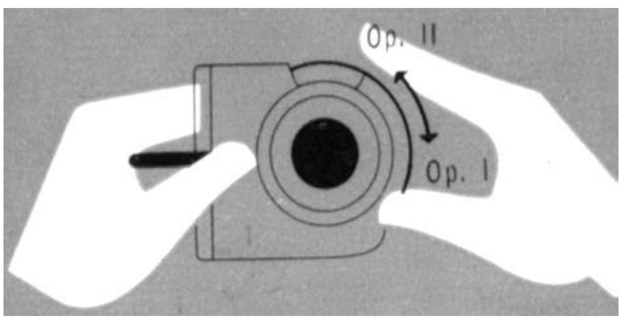

Figure 5. How to hold the calculating disc; schematical drawing from the Tesa manual.

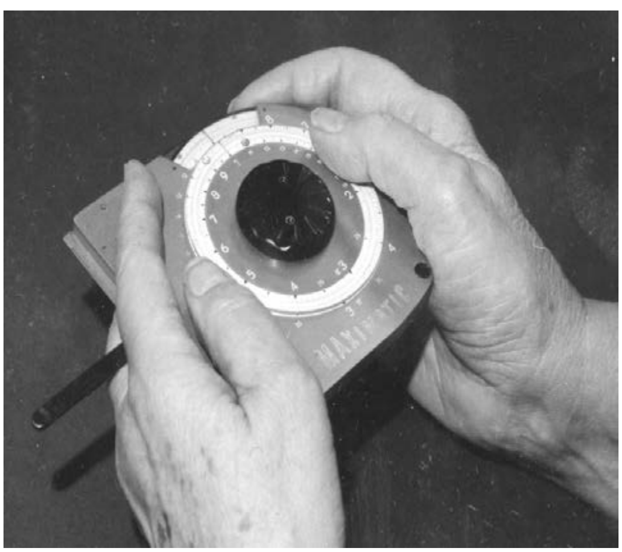

Figure 6. Best way to hold the calculating disc; result of my personal experiments.

To make division possible by exactly the same procedure, the separate DI scale is used instead of the D scale.

The watch slide rules employ the same principles; however, the turning directions are reversed (compared with the slide rules) and the cursor is not separately turnable. It is not clear to me whether experience with the watch was used to develop an improved design used in the circular slide rules, or whether the system used in the watches was a simplified version of the system used in Wittgenstein's slide rules.

The Slide Rule Watches

The Juvenia Montres SA (Juvenia Watch Ltd.) is a well known Swiss watch company in La Chaux-de-Fonds.[1] The watches with Wittgenstein's slide rules were called "Juvenia Arithmo" and were produced around 1945 in at least four different types, all of them with mechanical watch mechanism. (That was still the "pre-quartz" period!) One type of "Juvenia Arithmo" was a table and pocket watch. The second one was a wrist watch. The third one was a wrist watch too, but of self-winding type. The fourth one was the table and pocket type in form of a wrist watch. At that time Bernard Didisheim, the inventor's father-in-law, was the owner of the Juvenia company. Later he became a partner.

Obviously Juvenia watch slide rules have not yet become well known among slide rule collectors. For example, Peter Hopp and Conrad Schure did not mention them in their contributions to the 1998 International Meeting in Huttwil, Switzerland, where they discussed watch slide rules in great detail. Nor had the Juvenia Arithmo come to my attention during my own previous research in this field.

Calculating with the Arithmo slide rule watch works as described above scale and cursor are operated by rotating the bezel clockwise and anticlockwise by the tips of thumb and index finger. The figures of the three scales are rather small, but the watch's synthetic crystal has a special shape. It is not just vaulted in the way that watch glasses used to be; above the slide rule's scales the glass in the Arithmo is vaulted additionally in a ring form, in order to enlarge the scales and their figures. This unusual double-vaulted form of the glass with magnifying and also illuminating effects was called a "refrascope" in the Juvenia advertisements and makes it almost impossible to photograph the watch without distortions and reflections.

The watches have a bezel diameter of 36 mm, about 1-1/2 inches, and the scale length is about 9.4 cm, slightly more than 3 inches. The table and pocket model has a slightly larger case, but the watch's dial and hands as well as the slide rule's scales are absolutely the same; in contrast to ordinary pocket watches (also slide rule types), it has no chain loop and the winding button is placed at the three o'clock position instead of twelve o'clock. The larger diameter of the case allowed a lowered winding but-

[1] La Chaux-de-Fonds, a watchmaking town in Western Switzerland, not far from the French border, has a marvellous clock and watch museum that is well worth visiting.

ton. While the wrist watch is watertight (screwed back cover), that is not true of the table and pocket model. To increase the variety of the Arithmo models, one of the table and pocket types has also been provided with gold-plated lugs to take a wristlet, so the table and pocket type exists also in the form of a wrist watch. There is one more difference: the wrist watch has a knurled bezel, while the table and pocket's bezel is not knurled. (The bezel can be rotated so smoothly, that knurling was not necessary.)

My knowledge about these watches is based on a patent, on information sheets I obtained from the manufacturer, and on the description and pictures in the Juvenia Centenary book "The art of dressing time" by Henri Marquis (1995) where a double page is dedicated to the "Juvenia Arithmo" models. In addition, at the moment, I have in my hands the wrist watch which the inventor himself used to wear (and now belongs to his daughter), as well as the table/pocket/wrist type from the manufacturer's archives.

The Three Aluminum Slide Rules

Wittgenstein, apparently not being satisfied by demand for the watch slide rules, also granted licenses for production of medium-size circular slide rules that were based on the same technical principles but improved by a separately rotatable cursor. Three different metal types are known to me, but I do not know in which order these three types were produced. However, I will describe them here in an order that is probably chronological, judged by their individual design.

The Swiss "Tesa Maximatic" was produced by Tesa Ltd., in Renens, a small place on Lake Geneva, in the French-speaking part of Switzerland. Tesa Ltd. still exists, and the company is famous for its outstanding vernier caliper gauges and micrometers. Unfortunately, Tesa Ltd. has not answered my questions about their former slide rule production. Probably there is no one left who remembers that time.

However, Hans Meyer, now age 87, the founder of Tesa Ltd., and the company's director at the time of the slide rules' production does remember: the Maximatic was produced in 1945 in a lot of several hundred, but certainly not more than a thousand. (My own item shows production number 247). The slide rule was not a commercial success for the Tesa company. There appear to be at least three reasons for this. First, the company's marketing was focused on measuring devices. Second, at that time slide rule users were asking for straight slide rules, and the technically oriented clients were not ready to give up carrying a straight slide rule visibly in the breast pocket as a status symbol. Finally, Tesa's decision to produce their circular slide rules in 1945 (at the end of WW II) appears to have been based on the assumption that the German and Japanese slide rule producers would not be able to return to their former dominant positions in the world slide rule market.

The Tesa slide rule is marked "Tesa, Swiss Made, Maximatic" (front) and "CH, Brevets + et Étrangers, Tesa SA, Renens-Lausanne, Suisse" (rear). CH stands for Confederatio Helvetica, the Latin name for the Swiss Confederation, and the cross symbolizes Swiss, so the text means in English: "Switzerland, Swiss and foreign patents". The logo of Tesa Ltd. shows three triangles on a basic line; this mark was used in former times as a standard drawing symbol (DIN) for the highest quality treatment of metal surfaces. (Lower quality items carried two triangles or just one.)

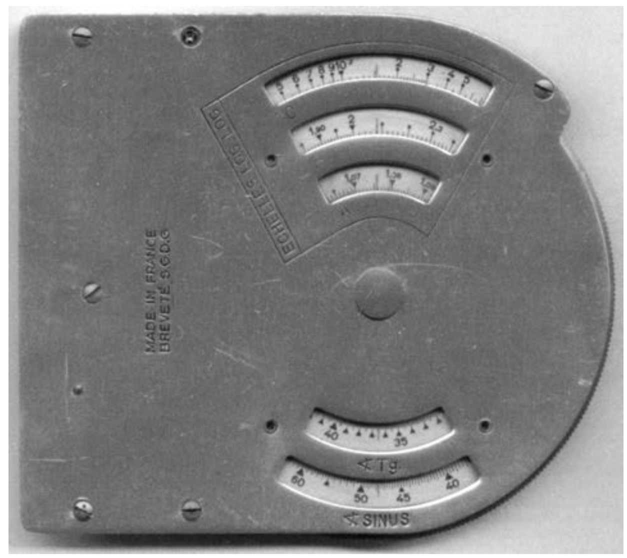

Figure 7. Back of the French Stephens' Log Log Suprémathic, the handle being folded in.

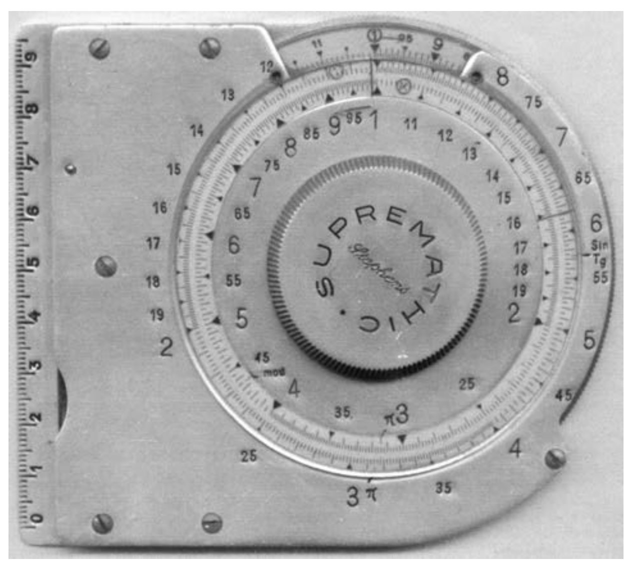

Figure 8. Front of the French Stephens' Log Log Suprémathic, the handle being folded in.

The French slide rule is marked "Stephens Suprémathic (front) and "Made in France, breveté S.G.D.G." (back). The letters SGDG stand for "Sans Garantie du Gouvernement", i.e. "patented without responsibility of the Government", a condition known only in French patents. The name “Stephens” (written without an apostrophe) does not sound very French and the name “Suprémathic” seems to be a combination of the French words “suprématie” (superiority), “mathématique” and the English word “automatic” (in French it would read “automatique”), a language mixture being called “Frenglish” in later years.

On the Stephens slide rule itself, there is no indication about the place in France where it was made, but in its manual one can read “Fabrication Stephens; Établissement Jora, distributeur exclusif, 38, rue de Lorraine, Levallois-Perret” (a place northwest of central Paris and nowadays a well-known station of the Paris underground network). I interpret this text to mean that Stephens was the maker and Jora was the general representative for the Suprémathic slide rule.

Both the Tesa and the Stephens show, on their front, the three scales described above, as well as a sine scale, a tangent scale, and a scale for small angles on the back, but the windows for these scales are placed differently. The scale length is 23.5 cm or 9-1/4 inches.

I do not know if the other Stephens’ type, the “Log Log Suprémathic”, was built at the same time as the basic type or later. It shows three log log scales (“échelles log log A, B, C”) instead of the square and cubic scales. Because the construction of the device has changed slightly, I assume that it is a later, improved model.

The Tesa and the two Stephens models are made of aluminum. The Swiss one is anodized in a clear greenish colour which was some sort of an “eyesaving” standard colour for tools and machines before and after WW II; the central cursor knob is made of black plastic. The French models show polished aluminum surfaces in the natural colour of this material; their cursor knobs are made of aluminum. All three have scales appearing clearly in black on white ground; these scales are printed on paper that is glued to the aluminum parts of the discs.

All of these three slide rule models show a detail that has racked the brains of several collectors (including mine): namely, a small arm that folds out from the left edge of the rule. Is it a help for drawing right angles? Is it a device for fixing the slide rule on the desk? The manuals provide the answer to this puzzle. In both the Swiss and the French manuals, this arm is called a handle, and a schematic drawing in the Swiss manual shows that this handle is to be placed in the left hand. (In my own experience, this handle fits best between the index and the middle finger, and fixes the slide rule quite securely in the left hand.) The knurled wheel with the turnable scale is operated by the index finger tip of the right hand, while the four other fingers help the left hand to hold the device. In order to read the scales on the back of the slide rule upright, the rule must be rotated on its horizontal axis, and this arm prevents the device from being rotated on its vertical axis.

The Manuals

The French manual (Stephens) is four pages long and large (23.3 × 31.7 cm or approximately 9 × 12 inches), whereas the Swiss manual (Tesa) is eighteen pages long and small (8.5 × 11.5 cm or about 3 × 5 inches) fitting into the device’s leather case. Although the Stephens manual is only in French, the Tesa version is in both German and French, the two main languages of Switzerland.

The French manual explains in great detail the ideas behind this slide rule, its construction, and its use. The Suprémathic is described as “a device which has absolutely nothing in common with all known circular slide rules, showing advantages which make it the only circular rule really able to replace a straight one and being a real revolution”. The many advantages mentioned there are as follows: “semi-automatic (self setting cursor)”, “results appearing always at the same fixed place”, “very easy to handle, making it appropriate for everybody”, “metallic construction making it immune against humidity”, “extremely exact product”, “small size, appropriate to carry in the pocket, but equivalent to a 27 cm straight rule” (that is, approximately 11 inches), “continuous reading of the results”, “position of the figures always vertical” and “protection of the dials by perspex (plexiglass)”.

The manual describes the device as consisting of a casing, a knurled disc operating as a wheel, provided with scales on both sides and a perspex cursor disc with a red hair-line, marked with two wings, indicating the multiplication and the division scale, respectively.

The Plastic Slide Rule

Though the Stephens’ manual stated the metallic construction provided immunity against humidity, the inventor’s daughter remembers her father not being happy with this construction because the paper scales glued on the metal came off under humid conditions. (My own three items do not exhibit such a defect.) Consequently, Wittgenstein looked to plastic, a material that began to be broadly used at that time. The result was one more circular slide rule, the “Jedermann” (German for “Everybody”).

The “Jedermann” followed the same basic ideas as the three aluminum predecessors, but with some differences. The use of a clear, greenish plastic material instead of aluminum allowed him to print the scales directly on the slide rule’s parts and dispense with paper scales. The rear scales and the handle described above were eliminated — probably to simplify manufacture.

This simplification was reflected in the name “Jedermann”, a much more modest designation than the ambitious and artificial words “Maximatic” and “Suprémathic”. The new name seems to declare the new model’s goal, i.e., an inexpensive slide rule for everybody. Perhaps the inventor or the manufacturer realized that a large proportion of potential slide rule users just wanted to use a slide rule to multiply and divide and that every supplementary scale only caused confusion.

Unfortunately, there is no indication on the “Jedermann” concerning the producer of this fourth Wittgenstein slide rule. Perhaps the change from the French and

"Frenglish" names "Maximatic" and "Suprémathic" to the German "Jedermann" was related to a new maker in the German-speaking part of Switzerland, in Germany, or in Austria. However, this name change could just as well have been due to a new marketing strategy aimed at German-speaking slide rule users.

Discussion

The Maximatic, Suprémathic and Jedermann circular slide rules are based on a very valuable idea, i.e., building the discs of a circular slide rule into a casing, so that:

(a) the device rests fixed and safely in both hands;

(b) most of the calculating operations can be done with the right index finger alone; and

(c) the results always appear at the same place and in vertical position.

Even before I became aware of Wittgenstein's watch slide rules, I tended to view his circular slide rules as related to pocket watch slide rules, and I still do. The inventor himself seems to have had an ambivalent attitude toward watch slide rules. In the text of the French patent cited above he declared that the invention of his circular slide rule was not only an improvement over common circular slide rules, but he also describes the wrist watch types as the most unsuitable of circular rules, since they are fixed at the wrist and cannot be turned in order to make the result of the operations readable in the vertical. (That was only one year before production of his "Juvenia Arithmo" watch started!) Nevertheless I learned from Wittgenstein's daughter that he used to wear and use a watch with a slide rule.

An Imitation?

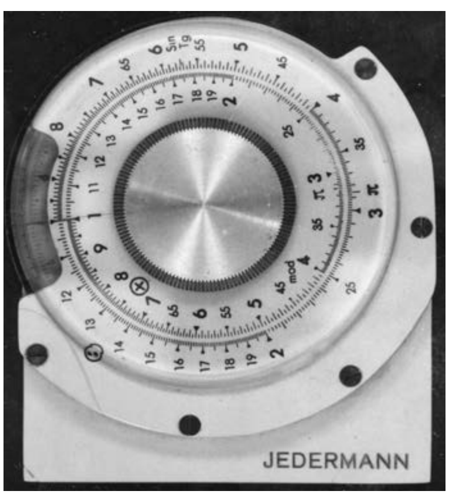

Figure 9. Front of the Jedermann, Unknown nationality.

I tend to view the Wittgenstein circular watch and slide rule types as related to the French "Roplex" by Graphoplex, which can be regarded as a large rectangular slide rule of pocket watch type. However, there may be an even more closely related slide rule.

In the archives of the Winterthur Technorama I found a pamphlet praising a Swiss-made circular slide rule, produced by Samia Ltd., Renens (the same place as Tesa Ltd.!). Hans Meyer remembers Samia as a company that was founded by some Tesa people who were trying to imitate the activities of Tesa. However, they went bankrupt after a few years. The Samia slide rule does look somewhat similar to the Tesa. While the Tesa slide rule was called semi-automatic, the Samia pamphlet calls the Samia slide rule "automatic". To set the Tesa's cursor to the target position, the wheel has to be turned clockwise; the Samia's cursor is set to the target line by pressing a lever. The Samia company, being geographically much too close to Tesa Ltd, probably did not have a license granted by Wittgenstein. The Samia slide rule is called "System Rognon"; I only know that Rognon had been a former employee of Tesa. Unfortunately, I have never seen a Samia slide rule; I just know the pamphlet showing a picture (see Proceedings of 4th International Meeting of Slide Rule Collectors, Huttwil, 1998, p.63 ff.). Perhaps my string of lucky discoveries will continue in the future, and I will find more information about this interesting device.

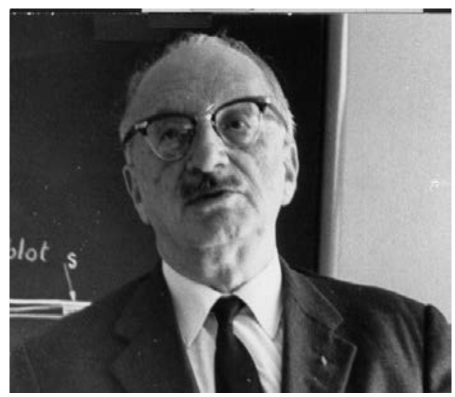

Figure 10. Photo of Gérard Francis Wittgenstein.

Acknowledgements

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- Martial Leuba, current Director of Juvenia Ltd. He provided valuable information, gave me a book which describes the Juvenia Arithmo, and lent me another version of this slide rule watch.
- Hans Meyer, founder of Tesa Ltd., and the company's director at the time the "Maximatic" was produced. He provided several interesting bits of information.
- Rodger Shepherd. Not only did he contribute to this article by streamlining my English, but he also provided me with the Stephens' Log Log model from his collection.