Book Review by Tom Wyman & David Sweetman

Our World Wide Knowledge on Calculating Machines, Slide Rules and Calculating Tools

Detlef Zerfowski

This massive tome (see image in the following article) is essentially a giant bibliography of virtually all published documents regarding non-electronic calculating devices. The book is a very well produced hardbound edition of 1574 A4 pages, weighing almost ten pounds (4+ kg). This is not your light entertainment for bedtime reading.

There are six pages of introduction and explanation (in German and English), the remaining 1568 pages contain alphabetical listing by author's name of published papers, documents, books, and other literature, in the original language, e.g., Latin, English, German. The time scale is from antiquity through 2012 and represents over 13 years of effort by the author.

The book divides into 13 sections: Discrete Calculating Machines; Sliding Rules, Scales, Disks, Calculating Tables; Planimeters and Integraphs; Nomographical Figures and Methods; Analog Machines and Others, with ~ 10,000 entries. Then there are eight sections listing ~18,000 patents for the devices.

The 286 pages (~ 6000 entries) for Sliding Rules, Scales, Disks, Calculating Machines encompasses authors from Oughtred through Napier, with many articles from the Journal of the Oughtred Society.

This is the most comprehensive reference available and belongs in the library of anyone interested in researching and writing articles on mechanical calculating devices, e.g., slide rules. This book is an extraordinary work and we commend the author for his dedication in assembling such a remarkable compendium. We have been in contact with Dr. Zerfowski and are delighted that he has agreed to write the following article for JOS about his experiences in compiling this enormous reference.

The cost is $135 or €94 (PayPal), including shipping from India that takes ~ 3-4 weeks. Go to https://www.zerfowski.com/rechengeraete.php to obtain more information and to order.

A 13 Years Project – An Adventure with Pain

Detlef Zerfowski

In September 2012, the longest lasting project of my life came to a successful end. Neither my time at school (13 years), my studies in computer science (6 years), nor my time in research at the University of Karlsruhe, Germany took a longer time. The continuing project of the relationship with my wife that has lasted more than 30 years is a different matter.

In 1999 I published my first small book [1] about the literature in the domain of mechanical calculation. More than 13 years later I published my latest book [2], which is the most comprehensive overview available on publications and patents on slide rules, calculating machines and tools, planimeters, etc.

The attributes of the book form a first impression of the amount of data compiled in the book:

- The book contains 1574 pages, in DIN A4 format, and is hardcover stitch bound;
- weighs 4 kilograms;
- contains more than 9000 references for articles and books on the topic of mechanical calculating;
- lists more than 9000 patents for mechanical calculating.

Observing these attributes and holding the book in hands, immediately you might question yourself: "Who might be so crazy to collect this data without
making any profit out of it? What drives this guy doing this over a period of more than 13 years?"

The same questions have arisen with some collector friends after receiving copies of my book; including David Sweetman, Editor of the Journal of the Oughtred Society, who sent an email to me:

> "Hello Detlef,…..
> Would you consider writing an article for the Journal describing your 13+ year journey to write the book? I suspect some of your adventures in research were quite daunting."

Therefore, in the following paragraphs I would like to share my experiences and will try to explain the intrinsic driving factors for me to complete such a long running project. For this explanation, we need to go back in time at least 28 years.

At that time my wife (then my girl friend) had an apprenticeship as a civil surveyor. Her older colleagues still used a mechanical calculating machine (Brunsviga brand) in their office. To keep my wife busy her boss asked her to

learn how to operate the machine. My wife showed the machine to me. This was my first contact with mechanical calculating machines. At the same time I was studying Computer Science at the university. Because my wife was so fascinated by this machine I managed to buy an Addiator for her as a birthday gift, which was a pretty good investment for all concerned.

Over the next few years my interest in the topic of mechanical calculating was slowly growing. I managed to purchase a Curta calculating machine in perfect condition for 300 Deutsche Mark (approximately 150 Euro). Nevertheless, mechanical calculating was more a sleeping interest than proactive collecting.

This changed suddenly during my research time at the University of Karlsruhe. There I had access to crypto machines like the Enigma. In the neighboring Geodetic Institute was a small collection of old mechanical calculating tools, which includes a circular slide rule by Sonne (see Figure 2 [3]).

These were the initial triggers to wake up my sleeping interest. I got really excited when attending my first auction at Breker in Cologne and the following private flea market for calculating machine collectors. From that point onwards I started to collect any kind of calculating machines and tools, slide rules, planimeters, etc.

Because my income as a research assistant was not so high, I could not afford to buy expensive machines. On the other hand, at the university I had very good access to all kind of old scientific literature. (Note: the University of Karlsruhe is where Heinrich Hertz discovered electromagnetic waves during his experiments and five Nobel Prize winners have worked there.) The access to the old literature laid the foundation for my book. I spend hours and hours in the university library and at the Geodetic Institute. In the beginning, I searched in the library catalog for literature on calculating machines and other keywords. I continued to scan systematically all issues of the *Zeitschrift für Vermessungswesen* and *Zeitschrift für Instrumentenkunde*. From more than 100 volumes of both journals, I scanned and copied each and every page on slide rule and calculating tool topics. These pages are still available in my private library. Be aware, at that time the Internet was just starting. The first fully graphical Internet browser called Mosaic had just launched (released on 1 April 1993) and revolutionized use of the Internet. Google did not yet exist.

Obviously, my approach and activities were a bit strange. Without a clear target with what to do with the information, I simply collected more and more data. I remember that I always thought that I was nearly finishing my work. But again and again I became "frustrated" when I found a new reference to more resources on calculating tools.

Figure 1a. The First Book from 1999 (held by my wife)

For this kind of operation I needed a lot of patience and persistence. I am pretty much convinced that I learned this persistence during another parallel activity. I started to practice running and finishing a marathon (42.195 km). Triggered by watching a marathon race in Karlsruhe, I decided that I should be able to complete the full marathon distance within a time span of one year. The day after I watched the race I started from scratch to practice. After some months of practicing I faced a severe set-back. I suffered a fatigue fracture in my knee (the pictures of the fracture in my knee are still available on my Internet page [5]). So I was forced to stop my preparation for the marathon race. The project "Completion of a Marathon" had to be postponed by one year.

The significant physical and mental pain developed the necessary trait of persistence One year later I finished my first marathon and completed five more in following years.

During this time I decided to publish my first overview on mechanical calculating machines [1]. One year after I entered into the industry, the 199 pages of my first book were ready for release. I searched for a printer that was able to manufacture the book for an affordable price. I had no clue about potential sales for this publication and did not want to have a big financial risk.

Figure 1b. My Second Book from 2012

My wife did not believe in the potential success of the project and told me: "This book will not sell! Who will be interested in this kind of book?"

Fortunately I did not listen to my wife. I had the book printed for public distribution and surprisingly for my wife and myself, the book sold out within a short period of time.

After I received some more orders for the sold-out book a decision was required (Some time was required for me to make a decision):

- Should I stop the activity of collecting further literature references?
- Should I ask for a reprint of the existing book?
- Should I look forward for a second extended edition?

The first alternative was answered with "no". I was too interested in the topic.

The second alternative got also a "no go", because a reprint with a smaller number of copies would have been too expensive. Furthermore the contents of the edition were already out-of-date.

Therefore, I decided to go with the third alternative.

Figure 2. "Sonne's Rechenscheibe" (1878) at the Geodetic Institute, University of Karlsruhe, Germany

I started to visit the German patent office at Stuttgart on a regular basis and made a lot of copies of various patents. Over time, the Internet improved and more and more information became available online. I used my capabilities as a software engineer to collect more and more information with self-made tools support.

I joined different collector communities (Oughtred Society, UKSRC, IFHB) and ordered all available journal issues and proceedings from international meetings. Every time I opened a new source of information I became frustrated again. Especially the International Meetings of Slide Rule Collectors and the Journal of the Oughtred Society always provided a lot new references that were not covered by my database. There was always a feeling of being like King Sisyphus (from Greek mythology [4]), who was forced to roll a huge boulder up a steep hill. But before he was able to reach the top of the hill, the stone always rolled back down, forcing him to begin again. Collecting information seemed to be a never ending task, but I was not able to stop (like Sisyphus).

About five years ago I realized, that the book had grown to such an extent that publishing in Germany would become too expensive; therefore, impossible. Again a decision had to be taken:

- Should I stop the activity of collecting further literature references?
- Should I provide the contents freely on the Internet?

As before, I eliminated the first alternative. I still was very much interested in the topic. But alternative two also got a "no". I was not keen to give away all the results of my hard

work for free. There should be an option that was more viable.

In this situation of "no decision", work brought another solution. My employer offered me an interesting job opportunity at India. By end 2008 my family and I had moved to Bangalore, the Silicon Valley of India. This was the opportunity to publish the book at a low-cost-location.

Suddenly there was a clear target line: By end 2012 (planned end of our stay in India), the book needed to printed and published.

This target was like the last miles of a marathon race. You are exhausted, but the finish line is in sight. Some small challenges were still ahead. Reviewing 1574 pages of book contents and finding errors was really challenging. For this purpose, I spent a lot of my free time and time on business trips. Flights are the best time to do such tedious and boring tasks. Additionally, I developed some tools for automated checks and tests to make my author and editor life easier.

In August 2008, the very last mile towards the finish line began. First of all I investigated how to get an Indian ISBN. The positive part was that the ISBN number is for free. Negative part was that the time line for receiving the number is unpredictable in India. Even following-up by email and phone was not possible. No answers on email, nobody picked up the phone. Nearly four months were needed to receive the ISBN number.

Figure 3. Employees Doing the Book Binding

Another important and critical step was the identification of a reliable and high quality printer and book binder. Finding the right supplier in India is not easy, e.g., like searching for a needle in a haystack. At that point of time, I had already stayed in India for more than two years. So I was aware how to address this problem: Use the avalanche approach.
I asked several colleagues to ask their friends and relatives for a reliable supplier. After about one month I received a list of potential printers with a rating of their performance. Based on this and the results from some telephone interviews, I short-listed some of them.

The next step was visiting these printer and book binder candidates. Based on my experiences in India, I wanted to see the production facilities to convince myself about the book manufacturers' capabilities. So I did a walk-through at various Indian manufacturers. In India this is an absolute must to avoid negative surprises after placing an order.

After finding a good book binder and some negotiation rounds we agreed on payment and delivery terms.

At the next visit I brought some pictures for the book cover. Within 2.5 hours a design expert at the print shop designed the cover according to my requirements. This was really a great and highly professional service and extremely customer oriented.

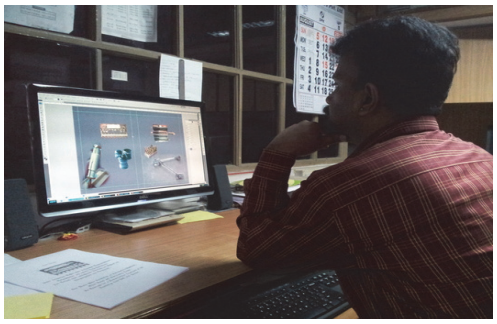

Figure 4. Professional Book Cover Design Done in 150 minutes

Figure 5. Delivery of the Entire Edition, Already Partially Unloaded

Two months later and two weeks before the committed delivery date, the entire printed edition was delivered at our house. Just in time to send two copies to the organizers of the IM 2012 "18th International Meeting of Slide Rule & Historic Calculating Instrument Collectors" at Bletchley Park. On 21th September the book was released and brought to public by Peter Hopp. The project had successfully reached the finish line.

Prolog: You might ask: "Will the story continue"?

The answer is "yes, I am still interested in the topic". But I will use a different approach. All owners of a book will get access to the online database, which will be available on my Internet page [6]. In the database the latest updates are included. But you need to have the book on hand to get access to the database. You can order directly via an email to Detlef@Zerfowski.com. I am still in progress of recovering my investment.

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Transistors, Computocracy, and Jobs

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Abstract

Our Fall 2012 JOS article [1] took us from the 17th century beginnings of mechanical and slide rule computers to a special SHORAN slide rule, which implemented a WW II bombing system. The article concluded by calling attention to Shockley's postwar invention of the sandwich transistor that launched the modern Digital Computer Age (DCA) and the eventual demise of the slide rule. In this follow-up paper, we summarize the subsequent history of the DCA up to today's Information Technology (IT) Age. In the 300-year slide rule and mechanical calculator period, computers were simply tools. In the DCA, however, the possibility of the computer becoming the master of or the replacement for people is now a matter of public concern.

1. Shockley and the Transistor

World War II, with its remarkable radar, jet engines, rocket propulsion, and nuclear energy developments, illustrates how wars often advance technologies. After WW II Bell Laboratories, the research arm of American Telephone and Telegraph, saw the need to replace unreliable vacuum tubes with more rugged solid-state diode rectifiers and triode amplifiers. William Shockley, the team leader for this project, drafted Bell Lab's Walter Brattain, an experimental physicist, and hired John Bardeen, a theoretical physicist from the University of Minnesota. In December 1947, Bardeen and Brattain built a point-contact germanium transistor that could rectify alternating currents. Only a few weeks later, Shockley conceived the junction (sandwich) transistor. After two years of development, it proved to be more rugged than the point-contact transistor as well as easier to manufacture. The transistor, though slow to gain Bell Labs or public recognition, eventually became the centerpiece of the DCA. [2]

Shockley left Bell Labs and formed Shockley Semiconductor in the heart of what is now called Silicon Valley. Shockley's scientists were among the brightest in the country, but they were unhappy with his management style. The "Traitorous Eight" [2] left his firm to form Fairchild Semiconductor. Fairchild developed the silicon integrated circuit and invented the planar process for making it. Two of the eight, Bob Noyce and Gordon Moore (famous for Moore's Law - "the number of transistors in an integrated circuit doubles every two years"), later founded Intel Corporation.

Continued development of transistor-based microprocessors and data storage along with advances in photolithography has played a major role in the growth of the DCA and IT age. Today Intel makes billions of transistors each day for its integrated circuits. Ironically, Shockley, Bardeen, and Brattain, despite receiving the Nobel Prize, earned comparatively little money from their groundbreaking research. [2]

2. Slide Rules and Calculators Become Collectibles

Throughout the 1950s and the early 1960s, the general slide rule remained the major computing tool of engineers and scientists. The aircraft industry and American space program were largely brought to their great heights, including reaching the moon, by engineers who carried out their calculations with general slide rules.

The importance of the general slide rule and mechanical calculators began to diminish as mainframe electronic computers became widely available to STEM (Science, Technology, Engineering, and Mathematics) workers. A new programming language, FORTRAN, which greatly reduced