
Pocket-Watch Slide Rules

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Introduction

This is an updated and simplified version of the paper from the proceedings of the 4th International Meeting in Huttwil, Switzerland which accompanied the talk I gave at the meeting. During the period between presentation of the original manuscript and now, more information has become available. As always, the generosity of the members in passing on information from their collections is exceptional. Yet the story is not finished. Even more data became available and a separate paper on Lord's Calculator was included in the Proceedings of the 5th International Meeting in Cambridge earlier this year! The publication of the article on Fowler's [1] last year also means that further simplification has been possible for this version for the *Journal*.

The Oughtred Society Survey of 1998 looked at "Watch Pocket" Slide Rules, a major subset of which are Pocket-Watch slide rules. This distinction is an important one and may have been the source of some confusion among the members, with consequential inaccuracy in the survey results. The confusion may be compounded by an accident of terminology and differences of language. On the terminology front, we have a number of pocket-watch slide rules called "Calculator", e.g. Lord's, Boucher's, etc., and we have to live with that. The language difference comes from the term "vest pocket", an English vest being somewhat different from an American vest. Nevertheless, I have changed the terminology slightly, borrowing the term "Vest Pocket Slide Rule" from Fowler to avoid the similarity of words between "Watch Pocket" and "Pocket-Watch".

It is worth looking at definitions a bit further: We have vest-pocket calculators, a generic term covering anything that can calculate and fit in a vest pocket. This includes:

- Vest-pocket slide rules, i.e., with at least one logarithmic scale and appropriate cursor(s).
- Pocket-watch calculators, i.e., a calculator that may be non-logarithmic in a pocket-watch format.
- Pocket-watch slide rules, i.e., those with at least one logarithmic scale and appropriate cursor(s) in a pocket-watch format.

Vest-pocket slide rules must encompass anything small enough to fit in the vest pocket and therefore include small circular slide rules such as the various Concise models, as well as a multitude of others, including the Small, Charpentier, and so on. Pocket-watch slide rules must be included in this definition; however, this leads to another problem of definition, that of size.

Pocket-watch slide rules are not the most accurate, particularly when compared to the large gridiron or indeed the larger cylindrical calculators such as the Fuller. However the pocket-watch types are excellent examples of high-quality mechanical engineering, capable of quite high accuracy with spiral scales, and with an incredible feel to them, that all must feel at least some admiration for them. On the face of it their manufacture was extremely widespread. However, further research indicates that there may have been few manufacturers and many more retailers. The earliest examples of the type are also surprisingly old.

Definition of a Pocket-Watch Slide Rule

My definition of a pocket-watch slide rule is basically a slide rule that looks like a pocket-watch, and that size is immaterial to the definition. The purist might argue that an upper limit of 3 inches diameter should apply here, and thus we would lose the larger Fowler's and some others. To accommodate all shades of opinion, perhaps these larger examples and other designs which can be mistaken for the type can be called pocket-watch format. A pocket-watch slide rule can have one or more stem winders, and it need not have a loop for a watch chain. Scales should be covered with a crystal of either glass or plastic. There is no limitation to the material it is made of, and it can be made in any country of the world. In other words, I am trying to spread the net as wide as possible to encompass a wide population of types. We will look at some apparent anomalies later.

Historical review

It is quite difficult to get a real perspective on early designs. The earliest patent for a calculating device in a pocket-watch case may be German as early as the mid-nineteenth century. The seminal patent for a pocket-watch slide rule is the 1876 UK patent by H.E. Newton for A.E.M. Boucher's pocket-watch calculator. This appears to have been succeeded by similar patents in a number of European countries. There were a number of "manufacturers" and retailers who sold pocket-watch slide rules as "Boucher's type". Lord's Calculators were produced in large numbers in a number of styles for a number of years. The first American patent would appear to be Elmer A. Sperry's patent of 1903, which was covered in some detail in a recent issue of *JOS* [2].

The following list of patents is surprisingly short. We do not claim it to be complete. Patents are possibly the best way of achieving a historical view; however, we will not be looking at patents further in this article. The information given will allow further study for those interested. Otherwise our historical view has to come from the catalogs and real examples of these devices.

Table 1 – Patents

A chronological list of these gives a view as to how the design progressed:

c1850	??	German patent, watch calculator.
1876	4,310	Henry Edward Newton, for Alexandre Emilie M. Boucher’s patent
1888	10,311	Thomas Mudd patent - no examples known.
1892	22,210	Laurence Lord’s patent - calculators made by a number of manufacturers, e.g. Elliott Bros.
1903	7,081	Ernest & Wilkinson Lord’s patent (second Lord patent).
1903	750,500	Elmer A. Sperry patent in the USA
1908	1,012,660	George Lange patent for improvements to Sperry’s patent
1910	5,528	William Henry Fowler’s first patent
c1910	??	Halden’s patent for the Calculex
1912	20,416	William Henry & Harold Fowler’s second patent
1914	3,638	William Henry & Harold Fowler’s third patent for improvements in the design
1914	15,990	William Henry & Harold Fowler’s fourth patent for improvements in the design
1924	215,648	William Henry & Harold Fowler’s last patent for further improvements.

Manufacturers

Most of the countries that produced slide rules appear to have produced at least one design of a pocket-watch slide rule. A notable exception is Japan, but we may yet hear of a Japanese pocket-watch calculator. We do know that there were a number of wristwatch slide rules, these were covered in another recent *JOS* article [3]. It should be noted that these are generally different in design, not just size. They are effectively a circular slide rule on a separate bezel, which is not the same as pocket-watch slide rules that use mechanical “works” to drive hands and scales.

Providing an accurate or complete list of manufacturers is virtually impossible without considerable further investigation, and a lot of the data is no longer available. Who actually manufactured, and who sold these designs is not well documented, and further confusion arises from spurious claims of manufacturing capability by a number of retailers. This will be covered wherever possible in the following information on the various “manufacturers”. Looking at each country in turn gives us a view.

United Kingdom

The United Kingdom was well served with pocket-watch calculator manufacturers, many of whom exported as well as produced re-labeled examples that were sold by a number of foreign (to the UK) companies. I would claim that the premier manufacturer was English: Fowler and Co. of Manchester.

Fowler Fowler was started as the Scientific Publishing Company by William Henry Fowler in 1898, and continued to produce a wide range of pocket-watch calculators through to the 1970s. The company went into liquidation in 1988. We know that their calculators were exported in quantity, and that they featured in the catalogs of a large number of other manufacturers as well as retailers. Casartelli and Sons were their main retail outlet in the UK for many years.

There has been considerable debate whether the “Mechanical Engineer” Calculator came from Fowler, or their

predecessors, or another company. There is now at least one known example of a calculator which has the same scales as the M.E. and has the Scientific Publishing name on it. I believe that this proves the link to Fowler; however, there is no satisfactory explanation of the “made in Switzerland” evidence on two examples. Both Fowler and the “Mechanical Engineer” calculator have been covered in some detail in recent *JOS* articles, [1] and [4], and will not be further covered here. Nevertheless, an “ME” with what appears to be Calculigraphe scales has been seen very recently, creating another mystery.

Halden J. Halden & Co., Ltd. of Manchester was set up in 1877. We know that the Calculex was apparently granted a patent in 1910, but could have been invented some time earlier. The Calculex is not a true pocket-watch slide rule as it is worked by thumb-nuts and not “clockwork” mechanicals. There is further justification for excluding it as it was never supplied in a pocket-watch case (see Wichmann). However, the Calculex is a delightful vest-pocket slide rule with several variants, including chrome, German silver, with glass or plastic crystal, and with metal and paper scales, and they do look like a watch from a distance! What is less well known is that they also had a desk model, which must be one of the most spectacular pocket-watch format calculators.

They exported to agents in France, Germany, and the USA, and the Calculex was sold by a number of retailers and possible manufacturers throughout Europe and the USA.

Elliott Bros. Elliott Bros. of London is a well-known manufacturer known to have sold Lord’s pocket-watch calculator, sometimes described as a textile calculator. A number of variants of Lord’s calculator have subsequently appeared. Further investigation continues.

Waddington A short article on Waddington and its possible relationship to Lord appeared in the Proceedings of the 5th International Meeting.

Others: A number of other UK firms claim to have made pocket-watch slide rules, or at least sold them.

These include W.F. Stanley of Holborn, London; J.F. Steward of The Strand, London; Negretti & Zambra, London; and Manlove, Alliot & Fryer of Nottingham and Rouen; all of whom advertised Boucher type calculators. The last mentioned has also been seen as “Manloves, London,” though what the relationship to the Nottingham firm was and the relative dates is not known. W. Waddington of Coventry also sold a Lord’s calculator which could have the same parentage as the Elliott device. Another variant is by an unknown maker, and a third type of Lord’s is marked W. Wilson of London.

Germany

The two best-known firms that supplied pocket-watch slide rules were Schacht u. Westerich and Gebr. Wichmann, though there is some doubt as to whether they actually made pocket-watch slide rules.

Schacht u. Westerich This pocket-watch slide rule was covered in some detail in the *Journal of the Oughtred Society*.

rm This is not a Boucher style calculator; it is a circular slide rule in pocket-watch form.

Gebr. Wichmann It is asserted that Wichmann never made any slide rules. Whether this is true of standard rectilinear and normal circular rules is a separate argument. It is certainly true that they only sold other manufacturers pocket-watch calculators. Around 1910 Halden’s Calculex was featured in their catalog, and immediately prior to World War II they sold the Schacht u. Westerich calculator. Another catalog shows an interesting piece of “Science Fiction” - a Calculex in a pocket-watch case with the Wichmann label. Whether any such calculators were ever produced is not known.

Molters The Molter slide rule is described in *JOS* Vol. 8, No. 1 and *JOS* Vol. 8 No. 2.

Others: There were other manufacturers of pocket-watch type calculators. Possibly the earliest known device, a currency conversion calculator in pocket-watch form, was supposedly made in Bavaria in 1850 by an unknown maker. We also know of the MOKO Lightning Calculator, a pocket-watch calculator made by an unknown German maker, we are not sure when.

America

Despite the multitude of slide rule makers in the USA, only Keuffel & Esser and Dietzgen are possible manufacturers of these devices.

Keuffel & Esser K&E are known to have manufactured the Sperry Watch Calculator and the K&E Watch Calculator, both pocket-watch slide rules. These were covered in extremely fine detail in the *JOS* [2]), so that repetition would not do these devices any justice.

Eugene Dietzgen Dietzgen offered their Model 1797 Boucher calculator with card dials from 1902 to 1936, and a version with silvered dials from 1904 to 1931. No examples are known. Whether they actually made these

devices or if they only sold another manufacturer’s device is not clear. Dietzgen also sold the Calculex as United States sole agent for a number of years. The packaging for the Calculex was well covered with the Dietzgen name and type numbers.

Queen & Co. Recently the Internet showed an intriguing pocket-watch slide rule sold by Queen & Co. of Philadelphia. This was a Calculigraphe (with push button) labelled Boucher’s Calculator. No date was given.

France

A number of French “manufacturers” of pocket-watch slide rules in a number of different designs have come to light since the original paper. The “Calculigraphe” is a generic name for a variant of the Boucher design, and it may have been available from one (unknown?) maker and sold by a number of retailers. Cajori shows a Calculigraphe from 1878; that is, very shortly after the original Boucher patent date. The firm Henri Chatelain is given as the maker of a Boucher calculator from this date.

Henri Chatelain Henri Chatelain of Paris is now known to be the “H.C.” shown on the surprisingly numerous versions of the Calculigraphe that have survived to date. Very little is known of Chatelain. Catalogs of watch-makers show a number of watch and clock makers of this name, but none of them bear the same initial. Whether the family firm supplied watch cases, which Henri as the instrument maker filled with Boucher style innards, is an appealing speculation. The Calculigraphe lasted for many years. Versions with different cases, hands, winders, and so on, are known. Examples of an F-C and an A-F Calculigraphe are also known. The A-F type is known from one example sold (?) in Switzerland. It has five scales each side, compared with four on the H-C version.

M&P Meyrat & Perdrizet is known from a pocket-watch slide rule called “Cercle á Calcul”. This is a simple 2 scale circular slide rule with cursor. They also made another delightful device (1899) with similar scales that incorporated a timepiece within the circular slide rule mechanism. Minor variants are described, with and without a secondhand on the timepiece. A comparison would be very interesting. The history of M&P is not known.

Lafond A pocket-watch calculator, not a slide rule, is known from this manufacturer. Again its history is unknown; however, the technology required to make this stylus-driven calculator is easily good enough to have been utilised in a pocket-watch slide rule in this format.

Little or nothing is known about these French firms, and the relationships among the various types of Calculigraphe are completely unknown.

Switzerland

Despite the obvious and long-standing connections with the watch- and clock-making tradition, Switzerland is not known as a major supplier of pocket-watch slide rules. There were a number of watch makers who produced high quality chronometers with a slide rule on a separate bezel. However, only Pedos S.A of Renan is known as a possible pocket-watch slide rule manufacturer who made the Calculigraphe A-F, but nothing is known of the firm or its history.

Russia

The situation with Russian makers of pocket-watch calculators is not clear.

It is known that there were three or four retailers of two types. Another type does not classify as a pocket-watch slide rule; rather, it is a very nice circular slide rule, somewhat similar to the Calculex, with glass-covered faces. It featured on the Internet some while ago.

Sunrise and others Sunrise was based in Leningrad and made a small 2-inch diameter metal/plastic pocket-watch calculator in a bakelite case, several examples of which have come out of Russia. Nearly all are from the mid to late 1960s. It is a two-sided device with hands driven by separate winders. Some types are marked with KL-1, which may be a model number. This has a “circular arrows” logo. A second retailer has the logo “Matsku”. A possible third uses the circular arrows logo with a different name. The fourth is an earlier and somewhat cruder device, and has no logo.

Types of Pocket-Watch Slide Rules

There are two major types with numerous variants, and a third category which is used to cover a number of different designs that are not pure pocket-watch slide rules. Interestingly, these types appear to share physical characteristics, possibly due to the date they were produced.

The Boucher Calculator Boucher calculators feature a single scale, which may be spiral, that is used with a fixed index and a rotatable hand to perform the calculations. A number of the Fowler calculators use the same format, and the Russian examples follow this principle.

These are usually seen in a case that obviously has its roots in the watch-making trade, and with the exception of the additional press button on the Calculigraphe, generally, from a distance, can be mistaken for a pocket watch.

The way they work is also pretty consistent across all the makers, though that is probably a function of the excellence of the design and the patent that covers this. In general the winder rotates a scale on the reverse, the winder with the push-button activated, or a second winder, rotates the hands on both sides. There is a fixed index on the reverse which works with the rotating scale.

The Russian Sunrise types are extremely small. They are supplied in a plastic case which seems to have taken the brunt of all knocks in the examples seen. They work

in much the same way as the others, with each of the two winders driving a different feature of the calculator.

The Fowler Calculators The earliest designs from Fowler are also in a typically pocket-watch style case, though these soon turned into the more typically pressed metal case which we see for all the later types, and there were quite a few! These are covered in detail in [1]).

Circular Slide Rule Pocket-Watch Designs

These feature a C/D scale with cursor or cursors and include Schacht u. Westerich, Lord’s and M&P. Fowler’s Circular slide rule also features in this classification.

Schacht u. Westerich The center knob turns the inner of a standard circular C/D scale, the side stem turns the pointers, which in the case of some models is a wedge with a hairline scribed on it. Lord’s calculator is similar, but one version does not have hands or any sort of pointer.

Lord’s Calculators The original patent shows this as a calculator on a wooden box for the textile industry, and the second patent as a pocket-watch with a suite of scales similar to the Calculex. There were a number of variants with different scales and in different sizes. The Lord’s design is characterized by having rotating scales and some have cursors. Simplistically, it could be described as a circular slide rule in a pocket-watch case, driven by appropriate gearing from one or more stem winders, depending on the variant.

Others: The third type is a bit of a catch-all, in that it includes all the other styles that could be called pocket-watch but lack at least one feature. There is a certain commonality of design.

The most immediately obvious other design is the Halden Calculex. This is much more like a traditional circular slide rule, operated by the thumb nuts through the glass faces. These drive the inner scale of a traditional circular rule, supported by a rich collection of supplementary scales. The Calculex is probably even more robust than the other watch designs as it has no additional cogs and similar to go wrong. On the other hand, it is not as accurate as the other designs such as Fowler’s long-scale. The circular slide rule types such as Lord’s have similar scales driven from a winding stem. Examples of the Calculex are known with amber lenses; these may have been for use in bright sunlight.

The Russian circular slide rule with glass-covered faces, and some of the Molter’s designs share features with the Calculex, though they do not have a chain loop.

Some anomalies There are a number of vest-pocket slide rules which have been described as pocket-watch types which do not fit the criteria. In general, this follows from a misuse of the terminology, with the most obvious being the confusion between vest pocket or watch pocket with pocket-watch type. With one exception, all classify as a vest-pocket slide rule! The exception is the Graphoplex Roplex.

Fowler's Circular slide rule This is an example of imaginative use of existing designs. Fowler's took the scales used in some of their pocket-watch types and turned them into a more normal circular slide rule, albeit within a metal armature. Clever, yes, but pocket-watch: No!

The SMALL Calculator This is definitely small enough to fit into a vest pocket, but the physical layout is such that it could never be called a pocket-watch type, and it meets none of the criteria set.

The Charpentier Calculator It has a chain loop, but that is the only criteria for a pocket-watch type which it meets. Otherwise, it is a very neat and small circular slide rule which could be carried in the waistcoat pocket on a watch chain.

I believe that there are many devices which can be counted as vest-pocket slide rules. It would make an interesting article to try and classify all types of vest-pocket slide rules.

Conclusions

The pocket-watch slide rule is a delightful part of the slide rule collecting world. Unfortunately, the information available to identify true manufacturers versus those who simply retailed is not available and needs considerable further study. There are many unanswered questions. For instance:

- Who made the International Currency Watch – was it ever actually made?
- Who made the MOKO Lightning calculator, and did they make other similar calculators?
- Was Molters truly the manufacturer of the Schacht u. Westerich pocket-watch slide rule? What else did they make?
- Who was the early patentee of the Money Converter?
- What is the history of Henri Chatelain, and why did he not make any other calculator?

- What was the relationship between the various types of Calculigraphe?
- What was the relationship between Manloves, London; and Manlove, Alliott and Fryer of Nottingham?
- What is known about Waddington, Wilson and the other so called "manufacturers"?

Despite, or perhaps because of these questions, they are a delight to collect and study.

Acknowledgements

Numerous people were very kind in providing information and illustrations for the talk. I must single out Bob Otnes for the scanned illustrations of Sperry and K&E devices, Gunther Kugel for Schacht u. Westerich, as well as an illustration of Lord's Calculator. Jim Bready also let me have a number of pictures of pocket-watch types; Colin Barnes, John Knott, and Tom Martin for a number of illustrations of Fowler's. Finally, I must thank the Oughtred Society for giving me full access to the 1998 Readers' survey which provided many useful contacts who have provided, and continue to provide, a wealth of detail.

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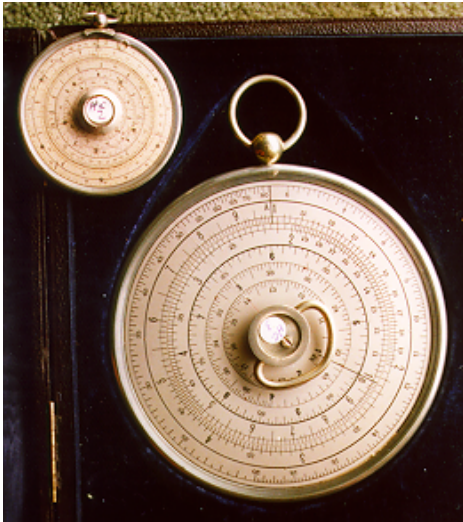


Figure 1. Halden



Figure 4. Henri Chatelain

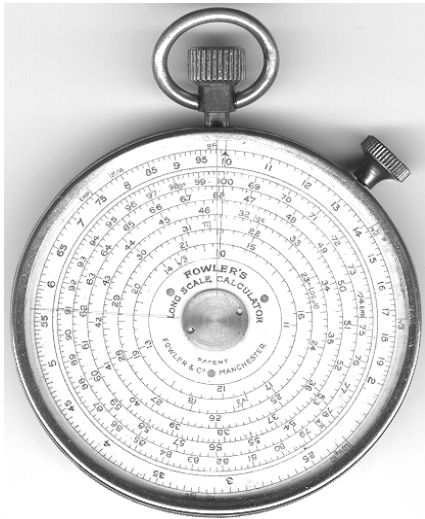


Figure 2. Fowler



Figure 5. Calculigraphe A-F

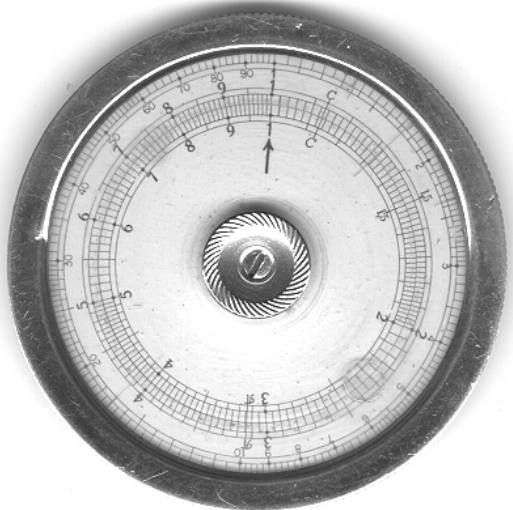


Figure 3. Molter



Figure 6. Russian example

Table 2. Summary of Characteristics

COUNTRY:	MAKER:	TYPE:	Made or Sold:	Date:
United Kingdom:	W.H. Fowler	Numerous (1)	Made	1898 - 1975
	J. Halden	Calculex	Made	1910 - ?
		Desk Calculex	Made	
	W.F. Stanley	Boucher	Made?	1895?
	Manlove, Alliot & Fryer	Boucher	Sold?	1895?
	J.F. Steward	Boucher	Sold?	1895?
	Elliott Bros.	Lord's Calculator	Made?	1910?
	"Manloves"	Boucher	Sold	??
	Army and Navy	Calculigraphe	Sold	1906
	Negretti & Zambra	Boucher	Sold?	??
	W. Waddington	Lord's Calculator	Made & sold?	??
	W. Wilson	Lord's Calculator	Sold?	??
	Casartelli & Sons	Fowler's	Sold	??
Germany:	Schacht u. Westerich	Non-Boucher	Made?	??
	Gebr Wichmann	S u. W.	sold	c1938/9
		Calculex	sold	c1900 - 1910
		Fowler's	sold	??
	MOKO	Lightning Calculator	made	??
	Unknown	Currency Calculator	made?	c1850?
	Molters	S u. W.	made?	1920?
United States:	Keuffel & Esser	Sperry calculator	made	c1903
		K&E Calculator	made	1908 - 19
	Dietzgen & Co.	Boucher (card dial)	made?	1902 - 1936
		Boucher (metal dial)	made?	1904 - 1931
		Calculex	sold	??
France:	Henri Chatelain	Calculigraphe H-C	made?	1875?
	Unknown	Calculigraphe F-C		
	Pedos S.A. (?)	Calculigraphe A-F	made/sold?	??
	M&P	Cercle a Calcul	made?	??
Russia:	Sunrise	KL-1	made?	??
	Matsku	"KL-1"	sold	
	Unknown (Sunrise?)	"KL-1"	sold	1960's
	Unknown	earlier	sold?	< 1960
Swiss:	Pedos S.A.	Calculigraphe A-F	made/sold?	??