The Boucher Style Pocket Calculator

Bob Otnes

Introduction

Alexandre Emile Marie Boucher, *Agent Administrateur del la Société des Forges et Chantiers de la Méditerranée* invented a pocket watch-type calculator in the 1870s. Boucher was located in Paris at the time of the English Patent [5]. The Société is a ship repair and building company, still in business at the time of writing.

Boucher appears to have been a bureaucrat who represented the Société as an agent. That is, he was not an instrument maker. I guess that Boucher designed the rule and computed the positions for marks on the scales, and then had an instrument maker build the device, possibly using many stock parts available from the Swiss and French pocket watch manufacturers.

Description of the Calculator

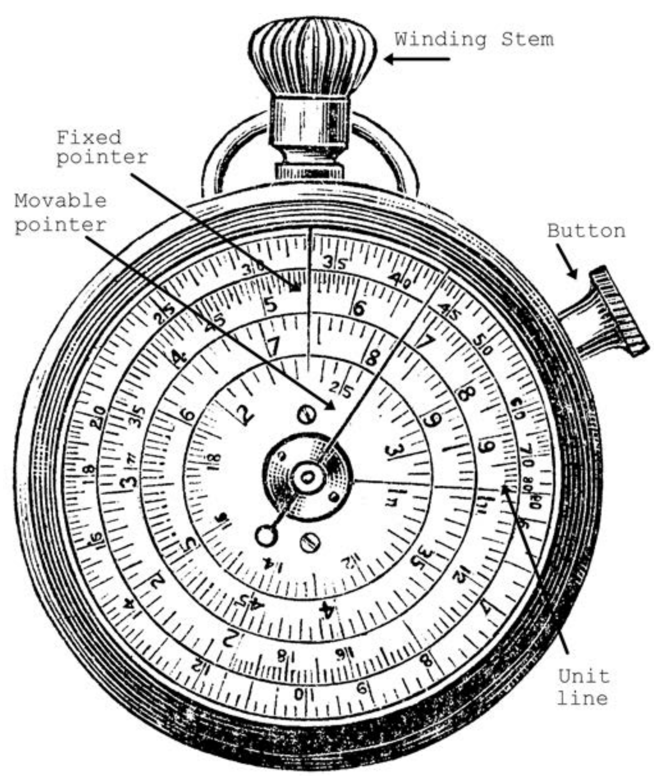


Figure 1. Drawing of the face of a later Boucher.

Figure 1 shows a Boucher circa 1900. It was taken from [6], page 78, and modified to indicate key points about the device. Some nomenclature is required here:

Front face The calculator has two faces. The front face is the one that turns.

Back face The back face, not shown, is fixed.

Winding stem The large knob at the top. Used to turn the front face.

Movable pointer There are two of these, one on the front and one on the back. They are connected and turn together.

Button This is the knob shown on the upper right side in the illustration. Turning the button causes the two movable pointers to turn together.

Fixed pointer This is on the front side of the calculator, directly below the winding stem. It is often the starting point for calculations.

Unit line This is on the front face and marks the start of the various scales.

Front face scales For the present, the scale of interest is the second one in from the rim. This is the single logarithmic scale, and is the primary scale for calculating.

The logarithmic scale is about 3.8 cm in diameter, or 12 cm in circumference. This roughly corresponds to the 12.5 cm of one of the single cycles that is usually found on the A, B, and C scales of a 25 cm *engineer's rule* which was in common usage at the time and on which most calculations were performed.

To compute $2 \times 3 = 6$, you would do the following:

1. Turn the winding stem so that the unit line is aligned with the fixed pointer.
2. Turn the button until the movable pointer is on the value 2.
3. Turn the winding stem so that 3 appears under the fixed pointer.
4. Finally, read the correct answer under the movable pointer as 6.

In summary, this calculator operates much like the more modern Gilson circular slide rule.

Figure 2. Front of Boucher 1.[1]

Figure 3. Back of Boucher 1.

First of Three Examples

Three different Boucher rules are shown in Figures 2 through 7. Peter Hopp has shown a similar one in [4], and Conrad Schure has an early one like this (though not identical) in his collection.

Figures 2 and 3 show a very early version. This one is clearly made in France.

This model is very similar to the one illustrated in the British patent, but simpler than the engraving shown in Figure 1. I had the pleasure of examining it in person at IM2003. It has (silvered?) metal dials with the scales engraved on them. The dials would seem to be oxidized.

The front face, Figure 2, has two scales: the outer one is linear; the inner one is logarithmic. The movable pointer is quite delicate. The dial reads "A. BOUCHER, 5, rue du Canal, HÂVRE." Hâvre is the earlier name for Le Hâvre.

The back face also has two scales: the outer one is for sines, and it runs from about 6° to 90° in a single turn; the inner scale is for tangents running a spiral from approximately 1° to 45°.

The back face also has on it the large initials "A B" for Alexandre Boucher.

As the two movable points are directly connected, values for either the sine or tangent can be read by turning the movable pointer on the back to the desired angle, and then reading the corresponding value on the front face on the logarithmic scale.

In summary, this version has the following capabilities:

- Using the logarithmic scale and the fixed and movable pointers on the face, it can multiply and divide.
- The logarithm to the base 10 can be read by finding the number, say 2, on the logarithmic scale, and then reading 0.301 on the outer linear scale. Powers and roots can then be computed. For example, to find the square root of two, one would divide 0.301 by two yielding about 1.50 on the linear scales; below this could be read 1.41 on the logarithmic scale.
- The trigonometric scales on the back face can be used as follows: suppose that the sine of 30° is desired. Turn the button so that the movable hand on the back lies over 30; then the movable hand on the front falls on 0.5 on the logarithmic scale.

[1]The example shown in Figures 2 and 3 is from the collection of Sigismond Kmiecik.

Figure 4. Front of Boucher 2.

Figure 5. Back of Boucher 2.

Second Boucher Example
This example has more scales. The scales appear to be printed on card stock.

The front scale at the center reads "Stanley, Maker, London", while the back reads "Boucher's Calculator".

I would guess that Stanley laid out and made the dials. The mechanism to turn the front dial and hands is probably unique to the design and might have been made by Stanley. As for the rest of the calculator, it was most likely outsourced whole or with the parts separately coming in bulk from Switzerland and France. I have no evidence to back up this assertion, other than the fact that the making of cases, knobs, and hands typically was the business of specialists, and it would be a waste of effort for Stanley to have acquired the capacity in-house.

The computational characteristics of this model are:

- As noted, the scales are printed on card stock, and there are more of them than on the earlier model.
- On the front (movable) face there are three scales: the outer one is a sine scale similar to the previous one, running from about 6° to 90° but now on the face; the second scale in is the standard logarithmic scale on which most calculations are performed; finally, the two inner circles are a single scale used for squares and square roots. As an example for the last of these, 9 on the outer of the two circles corresponds to 81 on the regular logarithmic scale.
- On the back (fixed) face are two scales: the outer ring is linear and serves to compute logarithms; the inner three rings constitute a single scale for computing cubes and roots. For example, suppose the front face has been turned so that the unit line is under the fixed pointer, and that on the back, the movable pointer has been turned to lie over 3 on the cube/cube root scale. Then on the front, on the regular logarithmic scale under the movable pointer, will be found 27.
- The glass faces on this example are both flat.

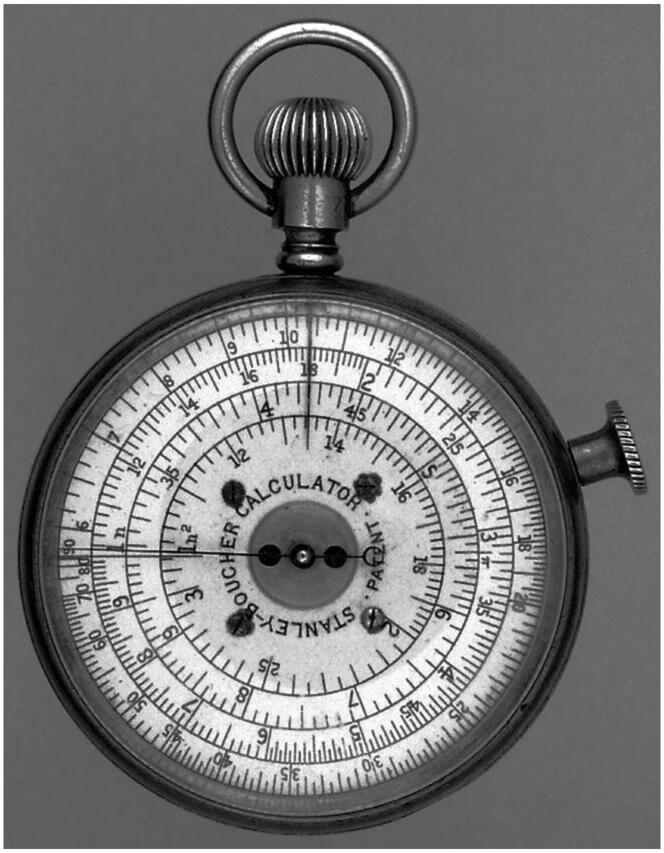
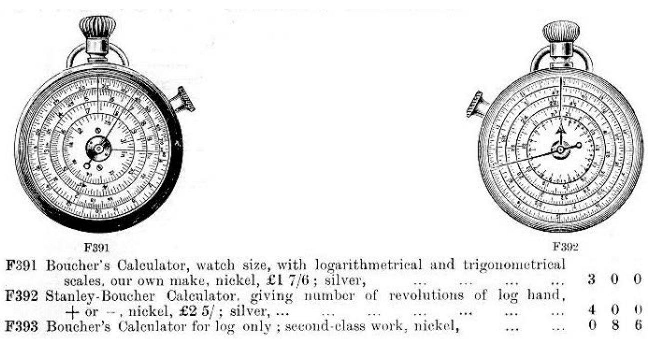


Figure 6. Front of Boucher 3.

Figure 7. Back of Boucher 3.



F391 F392

F391 Boucher's Calculator, watch size, with logarithmetrical and trigonometrical scales, our own make, nickel, £1 7/6 ; silver, ... 3 0 0
F392 Stanley-Boucher Calculator, giving number of revolutions of log hand, + or −, nickel, £2 5/ ; silver, ... 4 0 0
F393 Boucher's Calculator for log only ; second-class work, nickel, ... 0 8 6

Figure 8. From page 25 of [7].

Third Boucher Example

As will be explained, the calculating scales on this model are the same as on the second example.

The calculator is shown in Figure 8, taken from a 1902 Stanley catalog (the catalog pictures do not show any other type)[7]. The differences are as follows:

- The name on the face now reads "Stanley Boucher Calculator Patent" without serifs in a circle around the hub.
- The text on the back has been replaced with a new dial inside the previous one. It has its own hand, and is employed to set the decimal point. See the explanation below. This has made the case slightly thicker.
- On this example, the glass faces are now curved slightly.

The back of this calculator is shown as Figure 6 in Pickworth [6]. Pickworth's rule for locating the decimal point is:

> Rule for Number of Digits in a Product.– *The number of digits in the product is equal to the* SUM OF THE DIGITS IN THE TWO FACTORS *if the answer is obtained* WITH THE SLIDE PROJECTING TO THE LEFT; *if, however, the slide projects to the* RIGHT, *the number of digits in the product is* EQUAL TO THE SUM OF THE DIGITS IN THE TWO FACTORS, LESS 1. (Page 27)
>
> It is important to note that for these rules to apply, the dial must always be turned *against* the hands of a watch when *multiplying* and *with* the hands of a watch (right-hand) when *dividing.* (Page 82)

See also Chamberlain [1] on this topic.

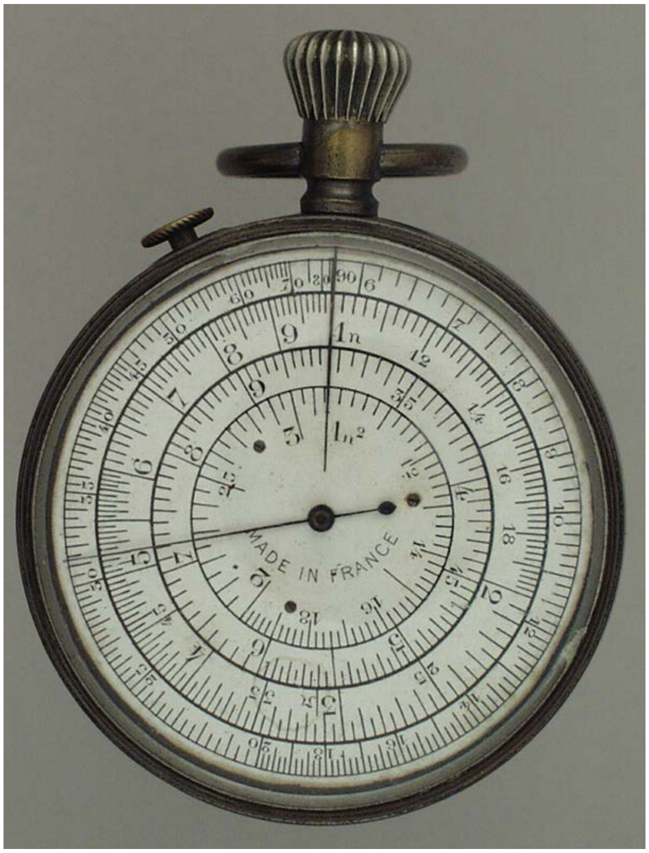


Figure 9. Front of the Calculigraphe by H.C.

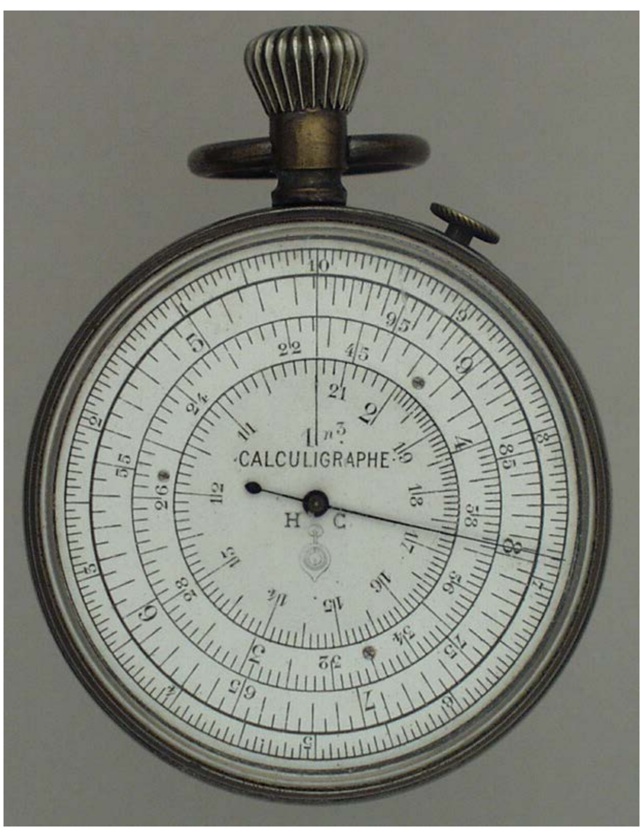


Figure 10. Back of the Calculigraphe by H.C.

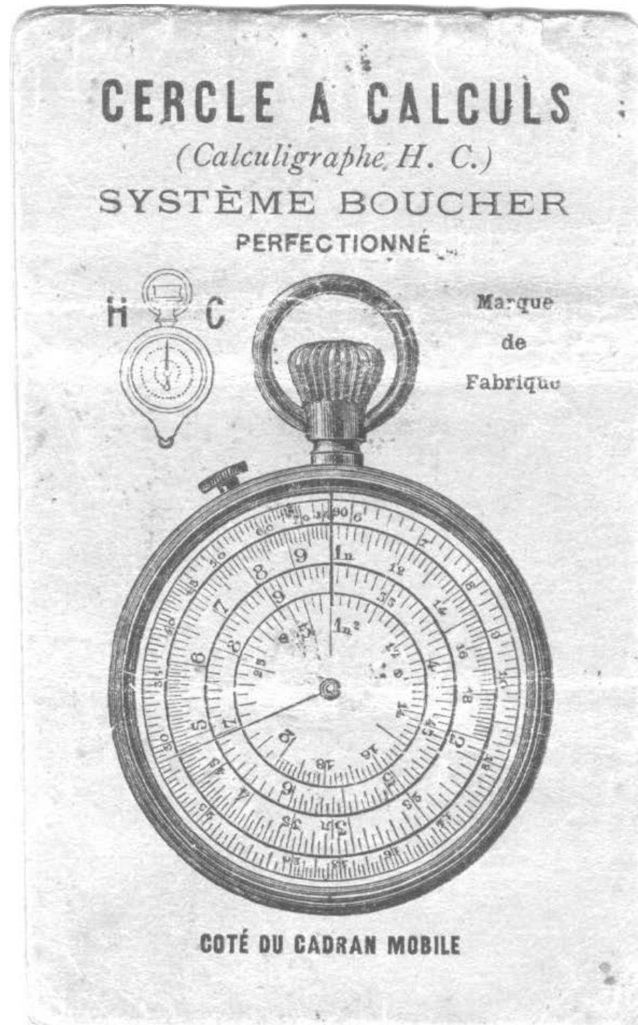


Figure 11. Instruction book for the Calculigraphe.

Glancing at Figures 10 and 11, the Calculigraphe by "H.C." appears to be very similar to the Bouchers shown in previous figures. And, in fact, the computational scales are identical.

The operation is somewhat different, as the mechanism inside the calculator is very different.

First, the differences in operation:

- Looking at the front, notice that the "button" in this case is on the left. It is *pushed,* not turned.
- When the button *is not* pushed, turning the stem turns the front dial only.
- When the button is pushed, turning the stem jointly turns the two movable hands only.

Note that in the Stanley catalog excerpt, Figure 8, item F393 is listed as "Boucher's Calculator for log only; second class work ... ". Might this be referring to the Calculigraphe?

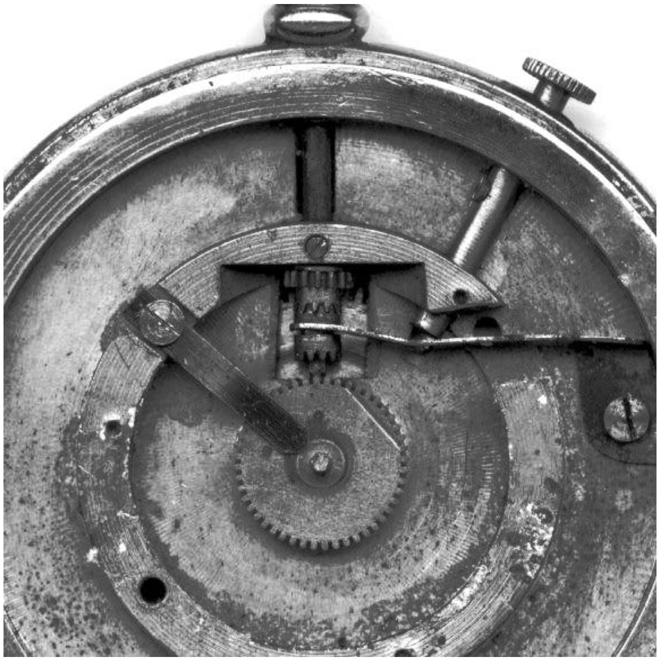


Figure 12. Mechanism of the Calculigraphe.[2]

The mechanism in the Calculigraphe is much simpler than that of the three models of the Boucher shown in this article. Pressing the button causes a gear shift, so that the hands turn rather than the front dial when the button is pushed.

The Boucher in the United States

The Calculiagraphe appears in the 1895, 27th edition of the Keuffel & Esser catalogue, and is referred to as a "Boucher". It would seem that the term "Boucher" had become a generic term and most calculators referred to as Bouchers are in fact Calculigraphes.

The Eugene Dieztgen Co. catalog of 1902-1903 (6th edition) is another example of this: showing and describing a Calculigraphe, but referring to it as a "Boucher".

The Technical Supply Co., Scranton, PA, catalog of 1913 shows a "Boucher Calculator" that is clearly marked on its face "Calculigraphe".

The above examples are just a random sample of American catalogs. It is likely that the majority of the so-called Boucher rules sold in the US were actually Calculigraphes.

Conclusions

The Boucher and the closely related Calculigraphe appear to have started the rise of many other pocket-watch type slide rules such as the Calculex, the Fowler, the Lords, the Meyrat & Perdrizet, the Sperry, etc. Some of these were quite elegant: the Boucher was available from Stanley, London, in a silver presentation model, and it is rumored that a gold case model was available.

The Boucher style itself was on the market until the 1920s, and its relatives survived for quite a bit longer: a Russian pocket watch slide rule is now common in the market place, and appears to have been made well after WWII, as were the Fowlers.

As noted above, their accuracy corresponds roughly to that of a five-inch Mannheim rule, or a ten-inch engineer's rule, "good enough" for many calculations. And they have a certain elegance to them.

Acknowledgments

My thanks to Sigismond Kmiecik, Richard Cook, and R.C. Blankenhorn for the information and advice provided to me on this subject.

References

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2. Chatelaine, H., *Cercle a Calculs, (Calculigraphe H.C.), System Boucher, Perfectionne,* 32 page booklet, no address or date listed.

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4. Hopp, P., "Boucher Calculators (Continued), *Slide Rule Gazette,* No. 4., Autumn, 2003.

5. Newton, H.E., *Substitute for the Slide Rule,* English patent number 4310, 7th of November 1876. It is listed in the patent as "A communication from abroad by Alexander Emile Marie Boucher, Agent Administrateur de la Société des Forges et Chantiers de la Méditerranée, of Paris, in the Republic of France." The French patent is *Breveté* 114,520, September 13, 1876.

6. Pickworth, C.N., *The Slide Rule,* Fifth Edition, London/New York, Emmott and Co., Limited, 1899.

7. Stanley, W.F. & Co, *Catalogue F,* London, 1902.

[2]Instrument and its photograph supplied by Richard Cook. The picture originally appeared in *Skid Stick,* [3].