

Herzstark's daughter

The pocket mechanical calculator

Jenny Smith

In the Surveying and Geomatic Engineering Collection at the University of Melbourne is a 'Curta' model field calculator, made in 1958 by Contina AG of Liechtenstein, serial no. 40349 (pictured opposite). This instrument, an example of the first handheld mechanical calculator, has all the characteristics of a cult gadget: it is small, ingenious, practical and elegant. It was widely considered the most reliable on the market until cheaper electronic calculators were mass-produced. It also has a long, strange, and somewhat tragic history.

Its inventor, Curt Herzstark (1902–1988), was the son of an Austrian manufacturer of calculators. By the 1920s he was working as a precision mechanic in his father's factory, which taught him 'to think out a project from the beginning, how [to] produce something in a reasonable way'.¹

Portable calculators at that time needed a separate set of gears for each calculation, which made them look, and weigh, like early typewriters. On sales trips, Herzstark heard complaints from engineers, architects and others, who could not move to what was essentially a desktop machine every time they needed to make a calculation. Slide rules could not add or subtract and were accurate only to three decimal

places: not enough for an invoice or a blueprint.² These clients needed an accurate four-function handheld calculator.

Herzstark developed a design based on a series of stepped drums wrapped around a cylinder. The same set of gears could thus be used for each consecutive calculation, which meant the machine could be held in one hand and worked with the other.

But two problems remained: mechanical calculators could not borrow or carry numbers. Herzstark managed to solve both problems by using two carriages: one for addition, the other for subtraction, together with a revolution counter.

This allowed for nines-complement calculation, or simulated subtraction by addition.³ For example, to find 169,437 minus 1,958, subtract each digit of 001958 from nine to find the nines complement: 998,041. Adding this to 169,437 gives 1,167,478. Removing the highest-order digit (leaving 167,478) and adding 1 gives the answer: 167,479.

Multiplication and division were calculated on a similar principle: the user simply lifted the crank a few millimetres to engage the other carriage. To solve the problem of carrying tens, the machine included a revolution counter, so that to calculate 133×89 , the operator could simply:

1. reset the sliders to zero, with carriage in position 1
2. enter 133 using the sliders
3. pull up the crank and make one subtractive revolution: $133 \times (-1)$
4. set carriage in position 2 (experienced users could do this with the left hand)
5. make one subtractive revolution: $133 \times (-10)$
6. set carriage in position 3
7. push crank down 3 millimetres for addition, and make one additive revolution: 133×100
8. the result, 11,837, is shown in the result counter.

Thus—in three revolutions rather than seventeen—the machine calculates $133 \times (-11 + 100)$, equal to 133×89 .⁴ Later manuals included algorithms for cubes and square roots.⁵

The design was all but finished by 1937—and then came the Anschluss. The Herzstark factory was ordered to build measuring devices for the German armed forces. In 1943 two employees were arrested for listening to and transcribing English radio broadcasts, and Curt Herzstark was sent to Buchenwald. As a well-known engineer, he was put to work in the factory attached to the camp, where both he and his idea for a pocket

Contina AG (Liechtenstein), 'Curta' field calculator with case, 1958, serial no. 40349, metal and plastic, 10.7 × 5.3 cm (calculator). Reg. no. 20, Surveying and Geomatic Engineering Collection, University of Melbourne.

calculator were recognised. Herzstark was offered the chance to draw and develop his calculator after hours, with the idea that the model would be given to the Führer as a present after the war, and Herzstark, whose father was Jewish and mother was Christian, might be made an 'Aryan' and allowed to live. The drawings were finished just before the liberation of Buchenwald. Production began in 1948 in Liechtenstein, and continued until 1972.

Herzstark had originally called his machine the 'Lilliput', but salespeople did not like the 'cleverness' of the name. A sales correspondent suggested that the machine was its inventor's 'daughter', and should therefore be called the 'Curta', a feminine version of Hertzstark's first name.⁶ Its mechanical operation is not only reassuringly tactile and interactive, allowing the user to feel each number as it is entered and to check the results, but so robust that it became a favourite among car rally drivers.⁷

From the later 1940s until the 1970s, approximately 149,000 Curta calculators were produced and exported around the globe.⁸ Many were used by students, academics and engineers, such as this example now on display at the University of Melbourne.



Jenny Smith works in administration in the Department of Infrastructure Engineering at the University of Melbourne. In 2011–12 she audited the School of Engineering's cultural collections, including the Surveying and Geomatic Engineering Collection.

The Surveying and Geomatic Engineering Collection is on display in the hallways of the Department of Infrastructure Engineering, Engineering Block C, Level 4, and can be viewed whenever the building is open. See also www.ie.unimelb.edu.au/collection.

- 1 Curt Herzstark, Oral history interview, 1987, Charles Babbage Institute. University of Minnesota Digital Conservancy, <http://hdl.handle.net/11299/107358>, viewed 15 August 2016.
- 2 Herzstark, Oral history interview.
- 3 Cliff Stoll, 'The curious history of the first pocket calculator', *Scientific American*, vol. 290, no. 1, January 2004, pp. 82–9.
- 4 Peter Kradolfer, 'Curt Herzstark and his pocket calculator CURTA', *Backup: Informatikzeitschrift für Schule und Weiterbildung*, no. 1, 1989, pp. 41–5, www.vcalc.net/cu-bckup.htm, viewed 15 August 2016.
- 5 [David G. Hicks], 'Curta handhelds', *The Museum of HP Calculators*, www.hp-museum.org/ffcurta.htm, 1995–2013, viewed 15 August 2016.
- 6 Herzstark, Oral history interview.
- 7 Stoll, 'The curious history of the first pocket calculator', p. 89.
- 8 Rick Furr, 'The Curta Calculator page', www.vcalc.net/cu.htm#stats, viewed 15 September 2016.