PERCY LUDGATE, THE UNKNOWN COMPUTER PIONEER

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Written on 17.01.2020 by HNF [Ralf Buelow]

The Englishman Charles Babbage was the first in the 19th century to combine a digital computing device with a program control. His "Analytical Engine" was never built. Irish office worker Percy Ludgate described a programmable "analytical machine" in 1909. It also remained unrealized. Little is known about Ludgate's life and work; he died in 1922 at the age of 39.

In the only photo he has, he may be 35 or older. He has straight hair and a mustache, his head is supported by a strikingly high collar. Something like that was worn in the British Empire in the late 1910s. The man in the picture looks like the perfect office worker and is called Percy Ludgate.

He was born on August 2, 1883 in the south of Ireland, in the town of Skibbereen. The father had been a soldier until 1876. The Ludgates then moved to Dublin, where Percy went to school. Then he tried in vain to find an office in the civil service; his health didn't play along. He ended up working in a grain shop for years; during the First World War he dealt with the feeding of the cavalry. Later he continued his education and worked as an auditor. On October 16, 1922, Percy Ludgate died of pneumonia in Dublin.

There is no written estate. Only one article survives, which appeared in the Scientific Proceedings of the Royal Dublin Society in April 1909. It is entitled "On a Proposed Analytical Machine" and fills fifteen pages. Of course, the Analytical Machine is reminiscent of the Analytical Engine, the mathematician Charles Babbage's design for a giant mechanical computer. Percy Ludgate also envisioned a program-controlled digital computer. He came up with it on his own; he only learned about Charles Babbage in the course of his work.

The device should be about 65 centimeters long, 60 centimeters wide and 50 centimeters high. The input was made using a paper tape with coded numbers and commands, the so-called formula paper. It contained the respective program. Ludgate's machine had a keyboard for perforating paper tape; a row of keys entered a number, a second a calculation instruction. At the end of the program, the result was printed out or stamped on a paper tape.

Memory was an important element of the analytical machine. It consisted of two rows of 192 compartments, each sitting in rotating rings. The rings rotated around the same axis as seen in the reconstruction. Each compartment held twenty rods, which a mechanism set in ten different positions. This way they saved a decimal number with a maximum of twenty digits. The compartment also contained another two-position staff that expressed the sign of the number.

Ludgate's computer did not perform any real multiplication, but calculated with discrete logarithms. Unlike normal ones, they take integer values. The machine found index numbers

for two digits and added them. The sum was another index number, it was the product of the digits. The indices were in a read-only memory. Ludgate also found a new method for the division. It came down to a converging sequence of numbers. For their calculation, Ludgate invented what is now called subroutine.

The analytical machine was to be equipped with an electric motor that brought the central axis to three revolutions per second. That would correspond to a clock rate of three Hertz. Percy Ludgate estimates that an addition would take three seconds and a multiplication would take ten seconds. A division could take up to ninety seconds. The Irish office worker sacrificed his free time to design this machine for six years and made many drawings. Unfortunately, they are missing except for one.

In 1914 Percy Ludgate mentioned a second computing device, a difference machine.

The science magazine “Nature” and the technical journals “Engineering” and “English Mechanic” reported on Ludgate's ideas in 1909. In 1914 the Irishman wrote a second essay on mathematical machines; it was in the companion book of an exhibition in Edinburgh about John Napier. The short text described Charles Babbage's difference machine and analytical machine. In the end, Ludgate mentioned that he also designed a difference machine; however, we do not know any details about her.

After his death, Ludgate was completely forgotten. It wasn't until the early 1970s that he was rediscovered by the English computer scientist and IT historian Brian Randell. Brian Coghlan has recently been doing further research in Dublin. What probably only analog fans know: Ludgate's strange logarithms were realized in a slide rule, the Faber-Castell 366 System Schumacher - certainly not being aware of his article. Here* and here** there is more to him.

Finally, we bring the full report of the quoted "English Mechanic". It appeared in the September 3, 1909 issue, and contains a drawing that could have been made by Percy Ludgate. The article previously appeared in the magazine "Engineering". It mainly deals with the multiplication process of the analytical machine. We thank Eric Hutton for the scan of the article and recommend his website www.englishmechanic.com. We thank Professor Brian Randell for the Ludgate photo. Jade Ward from the library at Leeds University found the original version in "Engineering".

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- http://www.mechrech.info/exhibit/emulthilf/emulthilf1.html#emulthilf28

The idea

The principle of simplifying multiplications using logarithms is to add the logarithms instead of multiplying two numbers:
Because of bm x bn = bm + n one can replace a x c = d with log d = log a + log c

You need either a logarithmic chart or a logarithmic slide rule. Because the numbers are plotted on it at the distance of their logarithms from the zero point, a simple addition of distances enables the product sought to be determined.
Schumacher used the procedure to assign so-called indices to the whole numbers (numbers) 1 to 100 (and only to these), so that multiplication of numbers can be carried out by adding their indices. The picture below shows this assignment in a table.

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