Early Mechanical Computers: Part 2

This section covers mechanical (physical rather than electronic) calculating devices


Samuel Morland (1625 – 1695)

- Due to the political strife in England he attended university at an older than average age.
- He received a BA from university (usual profession was in the clergy) but instead he took up Mathematics.
- Also he was a capable mechanic and invented several devices, "…ranging from calculating machinery to barometers, speaking trumpets and water pumps."

Image: "A history of computing technology" (Williams)
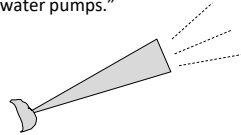
Morland's Adding/Subtracting Machine

- Carry handling (Williams):
  - Schickard: carries propagated multiple times could damage the machine
  - Pascal: the carry mechanism was delicate and sometime unreliable.
- Morland's machine implemented a partial (manual) carry

'Pocket' calculator 4" x 3" x 0.25"

Re-creation from: http://collectionsonline.nmsi.ac.uk

Morland's Adding/Subtracting Machine

- (Auto carry Morland machine)
  - "As far as the author is aware, no instruments of this design were actually constructed or if they were, none survived to modern times" (Williams)
- Morland also designed another machine for multiplication, division, square and cube roots
  - Based on Napier's bones (circular)

External Extra Videos: Morland Machine

- https://www.youtube.com/watch?v=XJ7cscFVNF0

René Grillet

- "Very little is known about René Grillet or his accomplishments…" (Williams)
  - Birth? Death?
  - One source: He was appointed clockmaker to very prestigious position to a royal!
  - Second source: His working machine was exhibited in county fairs for a silver (Williams)
- In 1678 he published information about his calculating machine.
- Unfortunately the article was short on details ("marketing brochure")

It does it all!
Here's how you can get one…

René Grillet (2)

- Some additional details came from a manuscript from Charles Babbage (discovered by Michael R. Williams).
  - As compared to Morland's machine:
  - Morland's machine had the more useful mechanism Napier's bones (multiplication) while Grillet's had the larger capacity adding mechanism.

James Tam

Commercially Produced Machines

- These machines that achieved (varying degrees of) commercial success and were based on the older designs:
  - The Thomas Arithmometer
  - Baldwin-Odhner Machines
  - Key-Driven Machines: Comptometers

James Tam

The Thomas Arithmometer (1820s ~1914)

- M. Charles Xavier Thomas de Colmar applied modern engineering and design practices to the Leibniz mechanism.

Image: www.cis.cornell.edu

James Tam

The Thomas Arithmometer (1820s ~1914): 2

- Thomas created an industry in which mechanical devices were used to aid in calculation (Williams).
- However the device was fairly large:
  - Big foot print
  - Not very portable

Image copyrights unknown

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External Extra Videos: The Thomas Arithmometer

- Besides showing how the Arithomometer works it shows how Leibniz's stepped drum design is employed inside the device
- https://www.youtube.com/watch?v=h8DVTAeyXK4

James Tam

Baldwin-Odhner Machines (1885 - ~1965)

- It consisted of two different sets of machines
  - US: Frank S. Baldwin (Baldwin machines: America)
  - Russia: W.T. Odhner (Odhner machines: Europe)
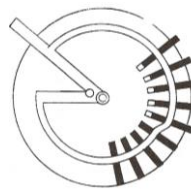- They used a variable toothed gear (# of protruding 'teeth')

Image: "A History of Computing Technology" (Williams)

James Tam

Baldwin-Odhner Machines (1885): 2

- It was a 4 function calculator that could now sit on a corner of a desk

Baldwin-Odhner

Leibniz

www.teachingcollegemath.com

www.vintagecalculators.com

James Tam

Baldwin-Odhner Machines (1885): 3

- Even with the improvements of the other machines (Arithmometer and the Baldwin-Odhner Machines), the UI (User Interface) was still too awkward and time consuming for general office tasks (e.g., adding up long columns of numbers).

Example balance sheet		
Assets		**Liabilities**
Inventory $100k		Short term funds $125M
Machinery $50M		Bonds $25M
Furniture $15k		Deferred taxes $15k

James Tam

Baldwin-Odhner Machines (1885): 4

- Example of data entry with an Odhner machine (non-key driven)

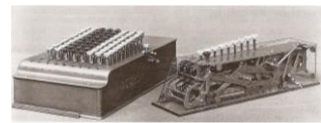Image: https://ca.wikipedia.org (last accessed Jan 2016)

James Tam

Key-Driven Machines

- Mr. Dorr E. Felt was the person who made a functional key driven machine "Comptometers":
  - Prototype completed N.Y.D.: 1885:
  - First fully working model completed: Autumn 1886

"Macaroni box"

Production model

James Tam

Images: "A History of Computing Technology" (Williams)

Key-Driven Machines (2)

- "Felt was able to speed up the addition operation by an order of magnitude above the times available with other mechanical calculators" – A History of Computing Technology (Williams) p. 151

James Tam

External Extra Videos: Comptometer Video #1

- External operations & explanation of the input and display mechanism: https://www.youtube.com/watch?v=I41k4q755yE

James Tam

External Extra Videos: Comptometer Video #2

- Internal mechanisms:
- https://www.youtube.com/watch?v=SbJpufimfdM

After This Section You Should Now Know

- How Morland's adding (subtracting) machine worked (including the handling of the carry)
- The approximate date in which Grillet published work on his calculating machine
- What were the three commercially produced mechanical calculators and roughly when were they available
- The impact of the Thomas Arithmometer
- How the variable toothed gear mechanism in the Baldwin-Odhner Machines worked and the benefit of this design
- What was the advantage of the key-driven machines
- The history behind the development of the first key driven machine

CPSC 409: Early mechanical computers