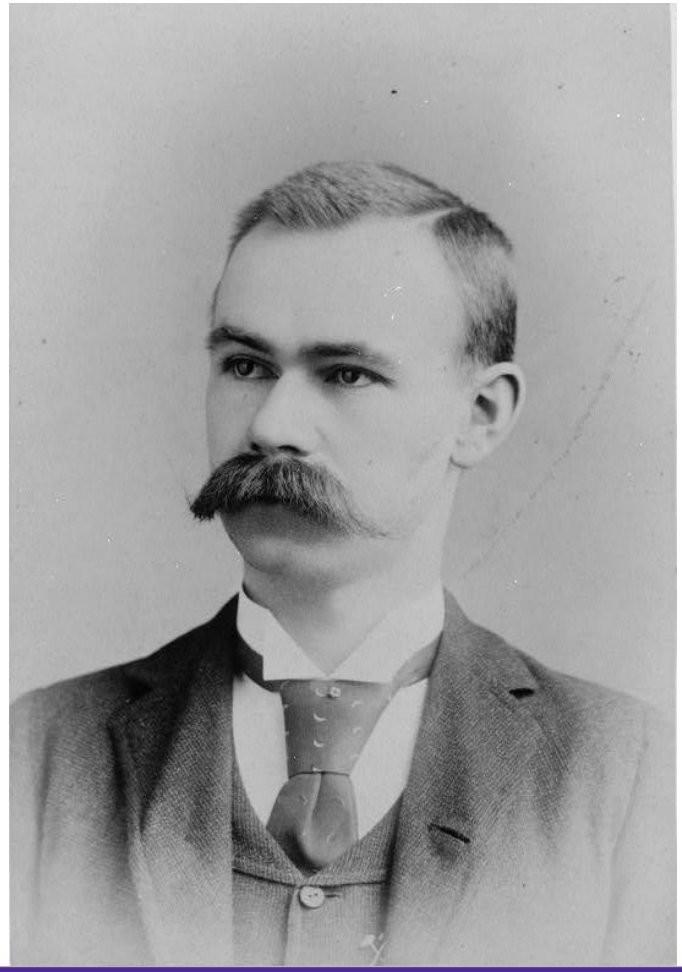
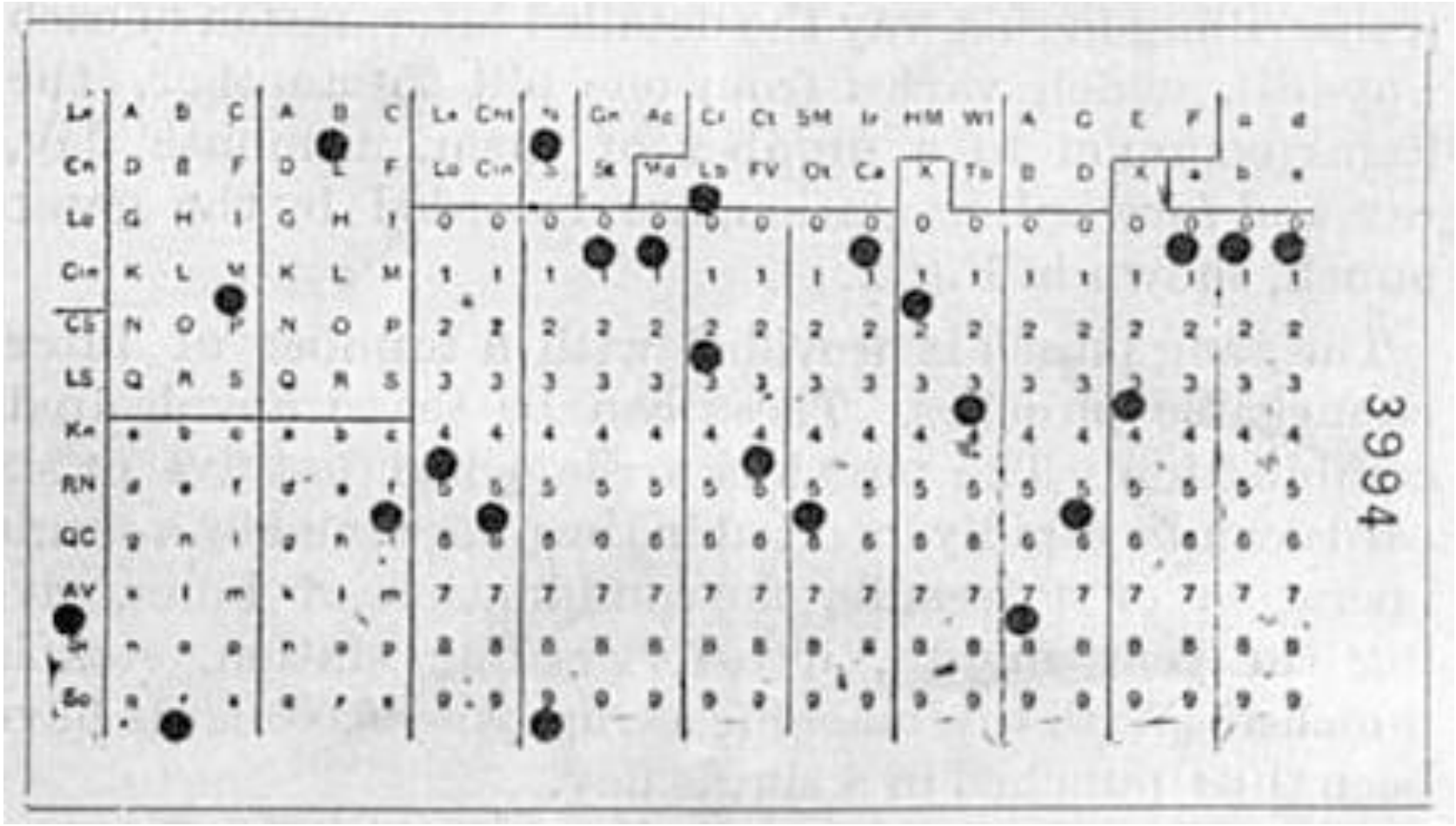
Universal Computers

Herman Hollerith

- Employee of the US Census Office
- Running a census was slow!
  - It took 8 years to tabulate the 1880 census
- 1890 census only took 1 year after his system was in place
  - Population had increased by 30%

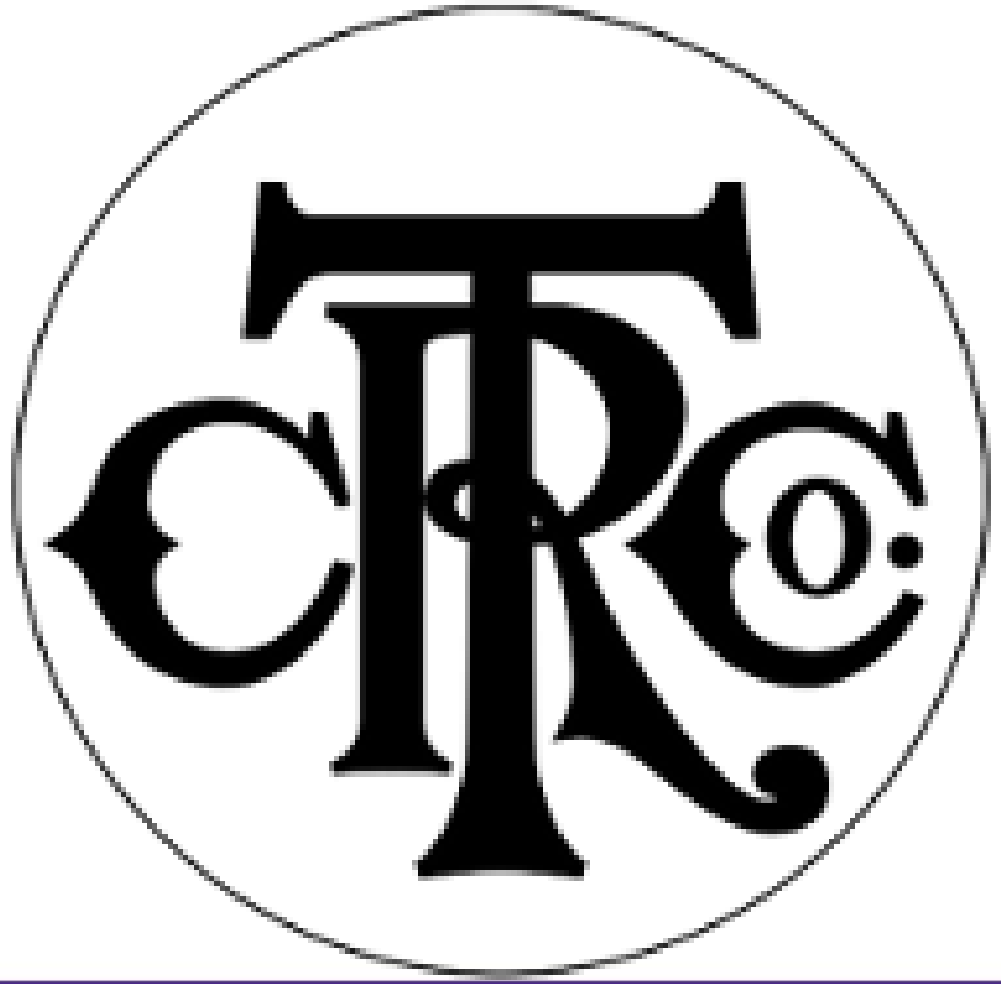


Punched Cards



Hollerith Tabulating Machine

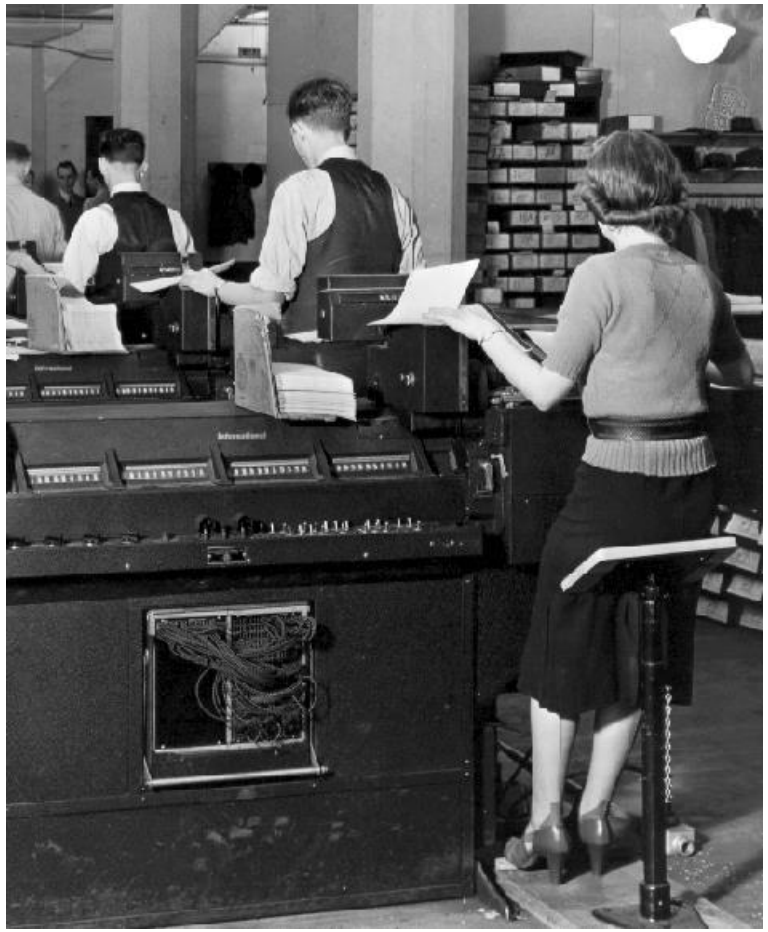
The Computing Tabulating Record Company



That company would be renamed to something a bit more familiar, International Business Machines

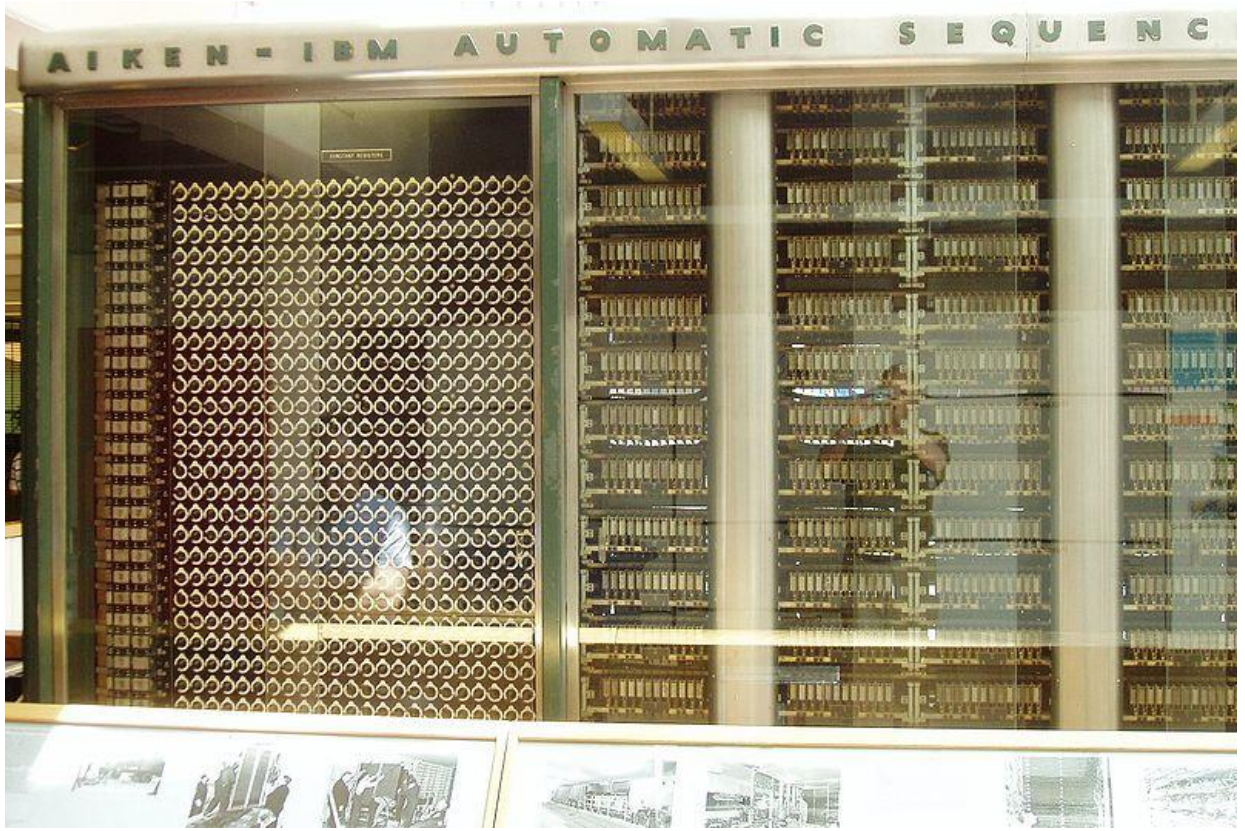
IBM Type 285

- IBM tabulating and sorting machines
- Sorting machines became very advanced and used for a variety of things like billing
- Used well into the 1950s and 60s



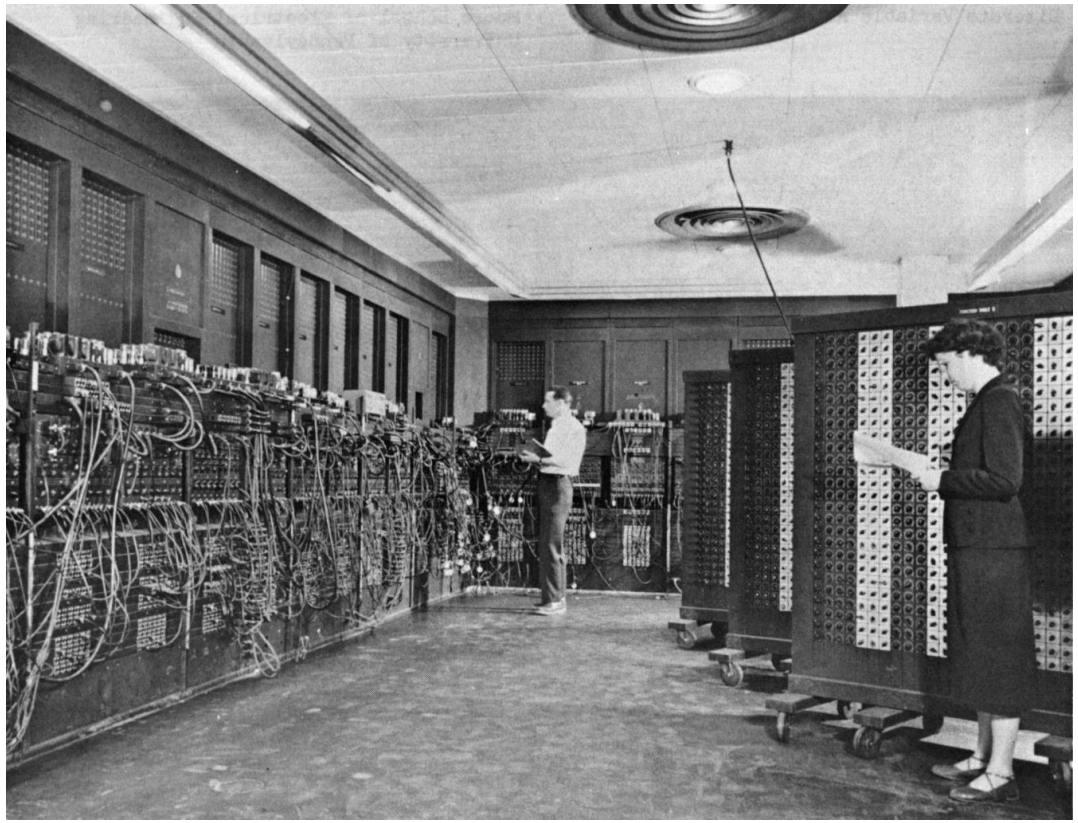
Mark 1

- Computing shifted from tabulation of sales and census records to secret codes and ballistics
- 1931, US Navy worked with Harvard to create the Mark 1
  - Weighed 5 tons
  - 500 miles of wire
  - 3 million connections
  - 35,000 contacts
  - 5 Horsepower (motor to synchronize the calculations)!

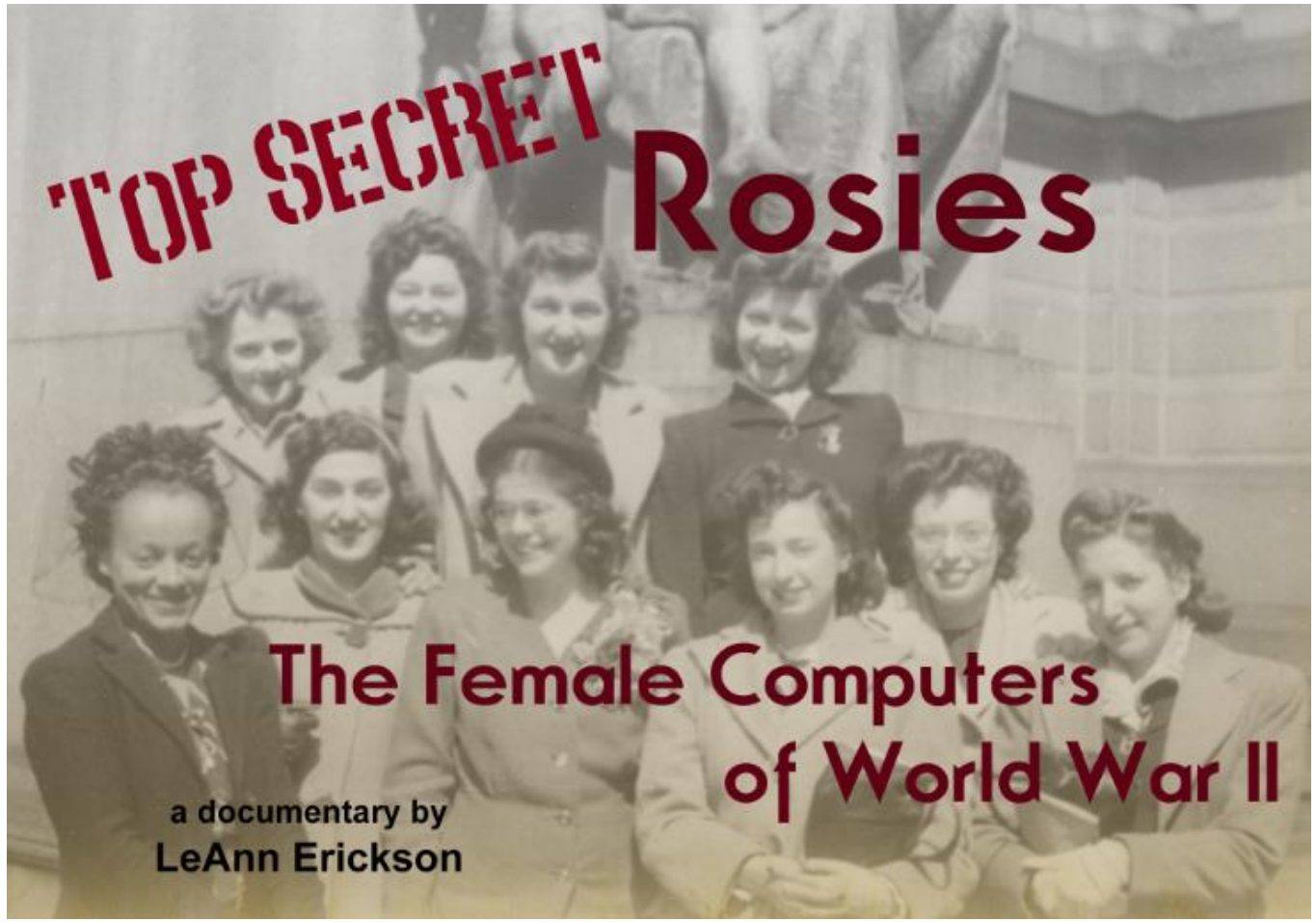


ENIAC

- Construction started in 1943 by the Army and the University of Pennsylvania
- Completed in 1946, it was 1000 times faster than Mark I
  - 17,468 Vacuum Tubes
  - 70,000 resistors
  - 10,000 capacitors
  - 5 million hand-soldered joints
  - 150 kW of power!

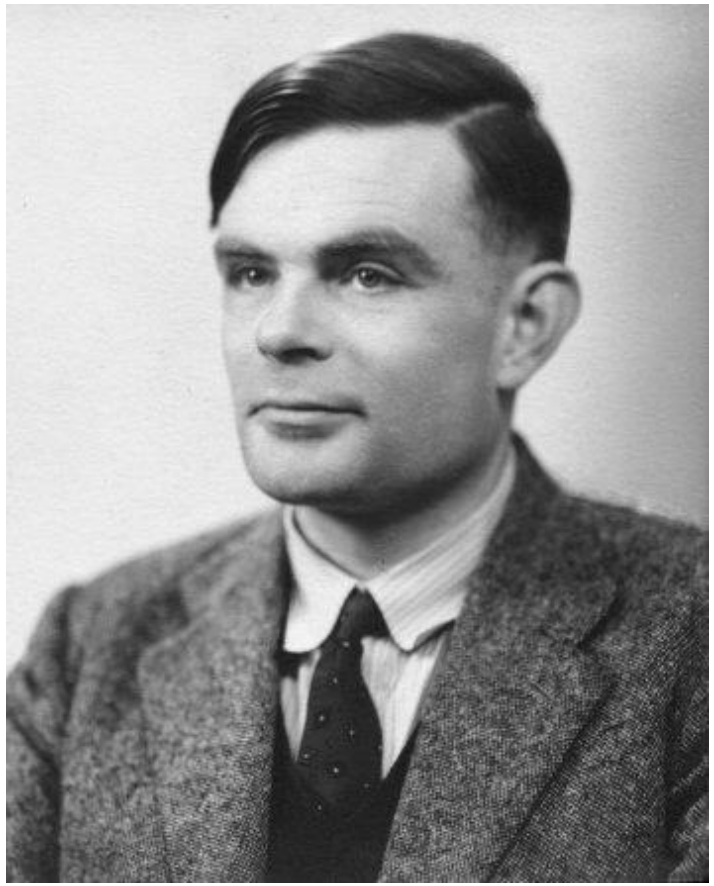


Top Secret Rosies



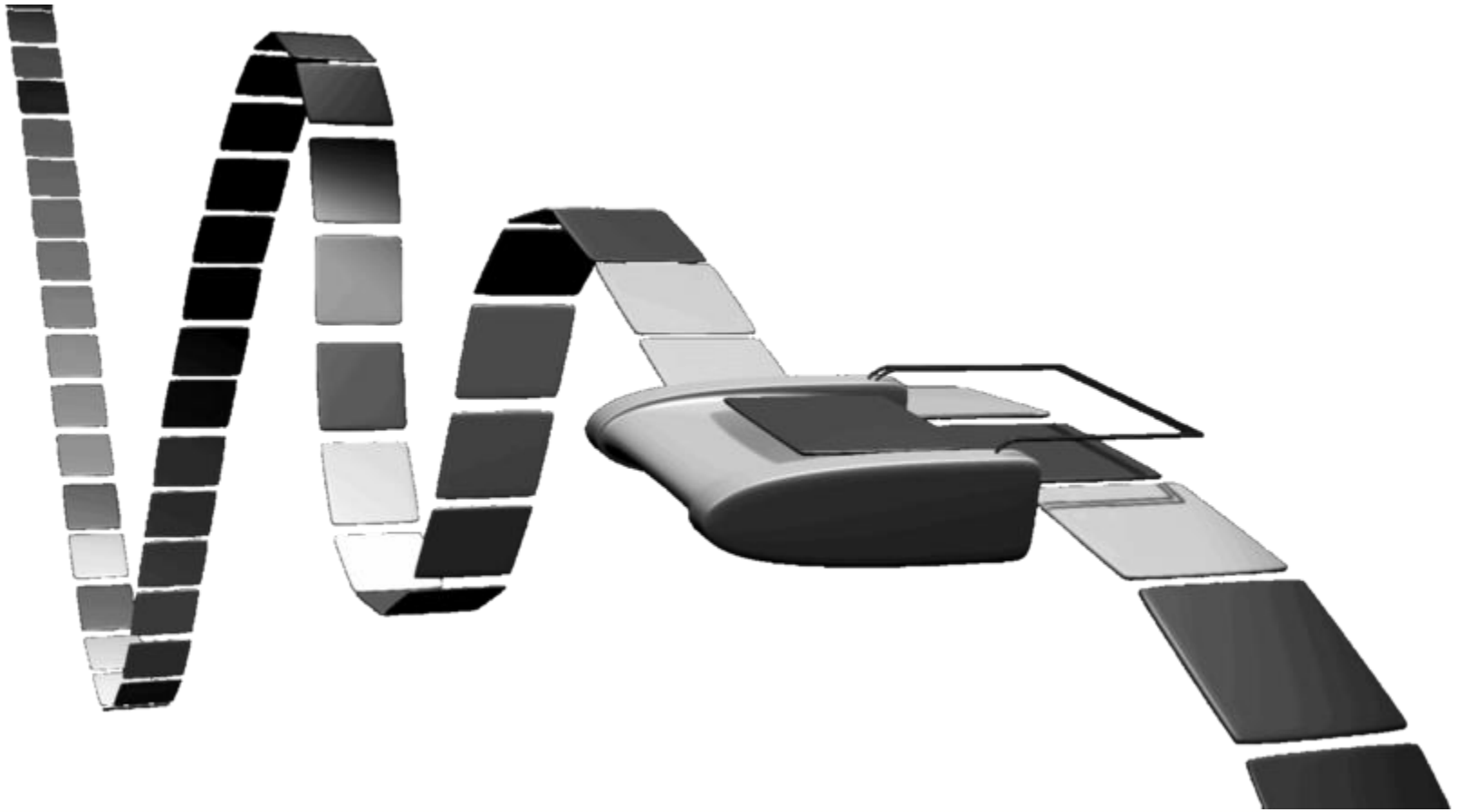
What is a Universal Computer?

Alan Turing



- Proposed an imaginary computer in 1936
- Some work showcase in the movie *The Imitation Game* (more on that in a later lecture)

Turing Machine



Turing Machine Instructions

- Move Left 1
- Move Right 1
- Write 0
- Write 1
- If 0, Go to #
- If 1, Go to #
- Go to #
- Stop

Turing Machine Example 1

Start with 2 items on a tape

1. If 1, go to #5
2. Move left
3. If 0, go to #9
4. If 1, go to #6
5. Move Left
6. Move Left
7. Write 1
8. Stop
9. Move Left
10. Write 0
11. Stop

V Or

John Von Neumann

Last of the Great Mathematicians

Von Neumann Architecture

- Sets the standard for how computers are designed to this day
- Storing the actual instructions to be used for the program in the same memory as the data
  - Could simply be stored and retrieved just like any other data element
  - Very similar to what we use today