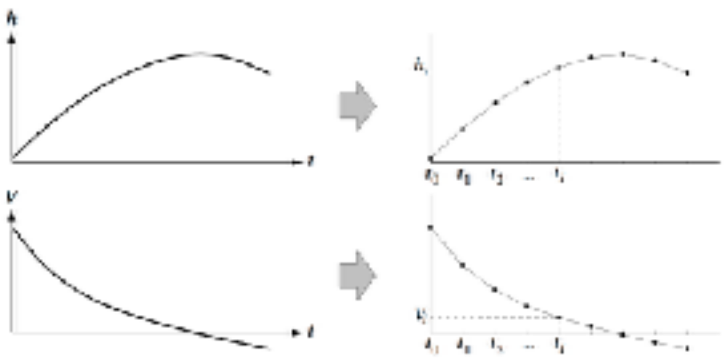
ENIAC

http://www.antiquark.com/sliderule/sim/n909es/virtual-n909-es.html

The governing ODEs (5) and (6) can then be used to determine the discrete rates at each



$$\dot{h}_i = V_i \tag{7}$$

$$\dot{V}_i = -g - \frac{1}{2}\rho V_i |V_i| \frac{C_D A}{m} \tag{8}$$

As shown in Figure 3, the rates can also be approximately related to the changes between two successive times.

$$\dot{h}_i = \frac{dh}{dt} \simeq \frac{\Delta h}{\Delta t} = \frac{h_{i+1} - h_i}{t_{i+1} - t_i} \tag{9}$$

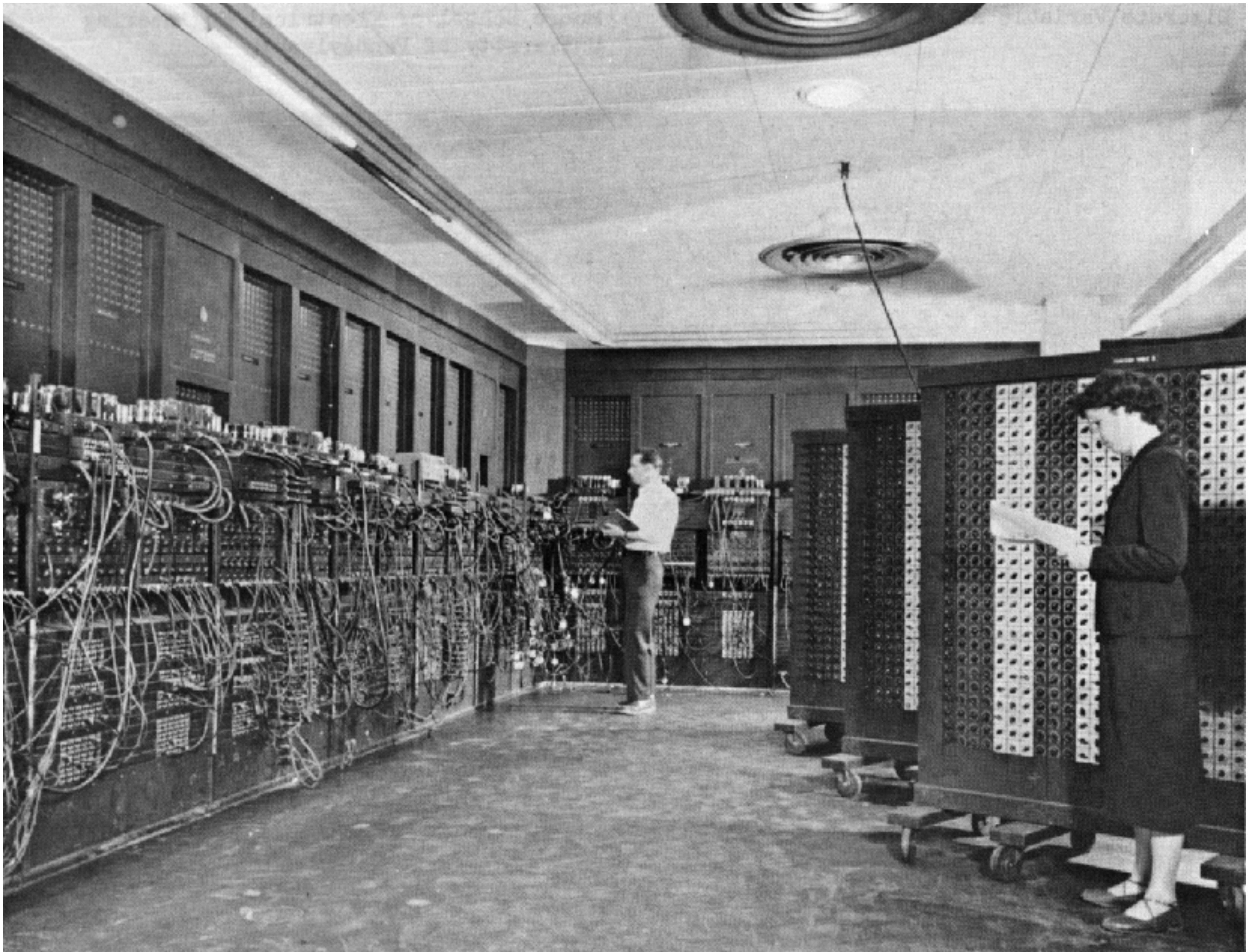
$$\dot{V}_i = \frac{dV}{dt} \simeq \frac{\Delta V}{\Delta t} = \frac{V_{i+1} - V_i}{t_{i+1} - t_i} \tag{10}$$

Equating (7) with (9), and (8) with (10), gives the following *difference equations* governing the discrete state variables.

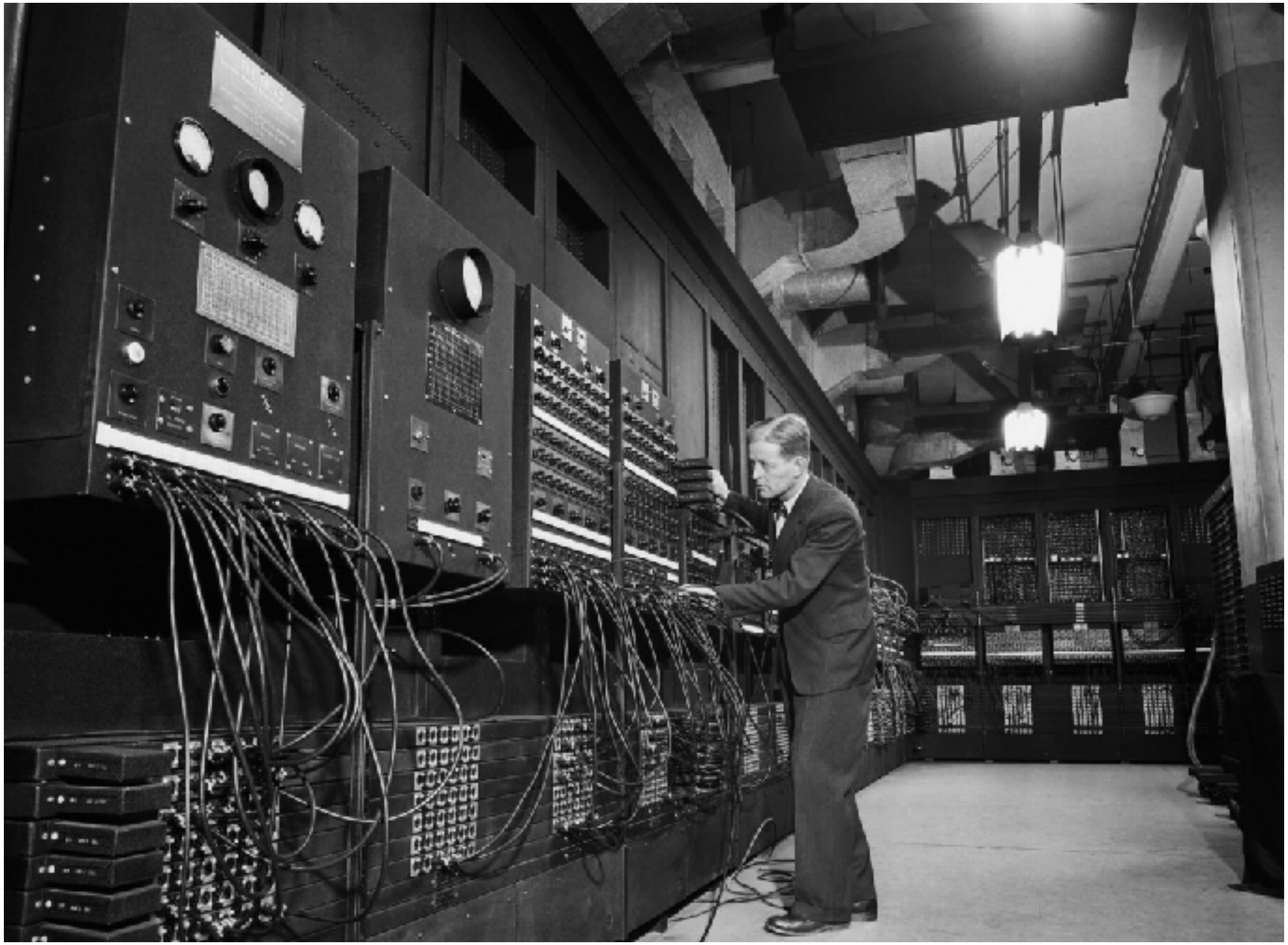
$$\frac{h_{i+1} - h_i}{t_{i+1} - t_i} = V_i \tag{11}$$

$$\frac{V_{i+1} - V_i}{t_{i+1} - t_i} = -g - \frac{1}{2}\rho V_i |V_i| \frac{C_D A}{m} \tag{12}$$

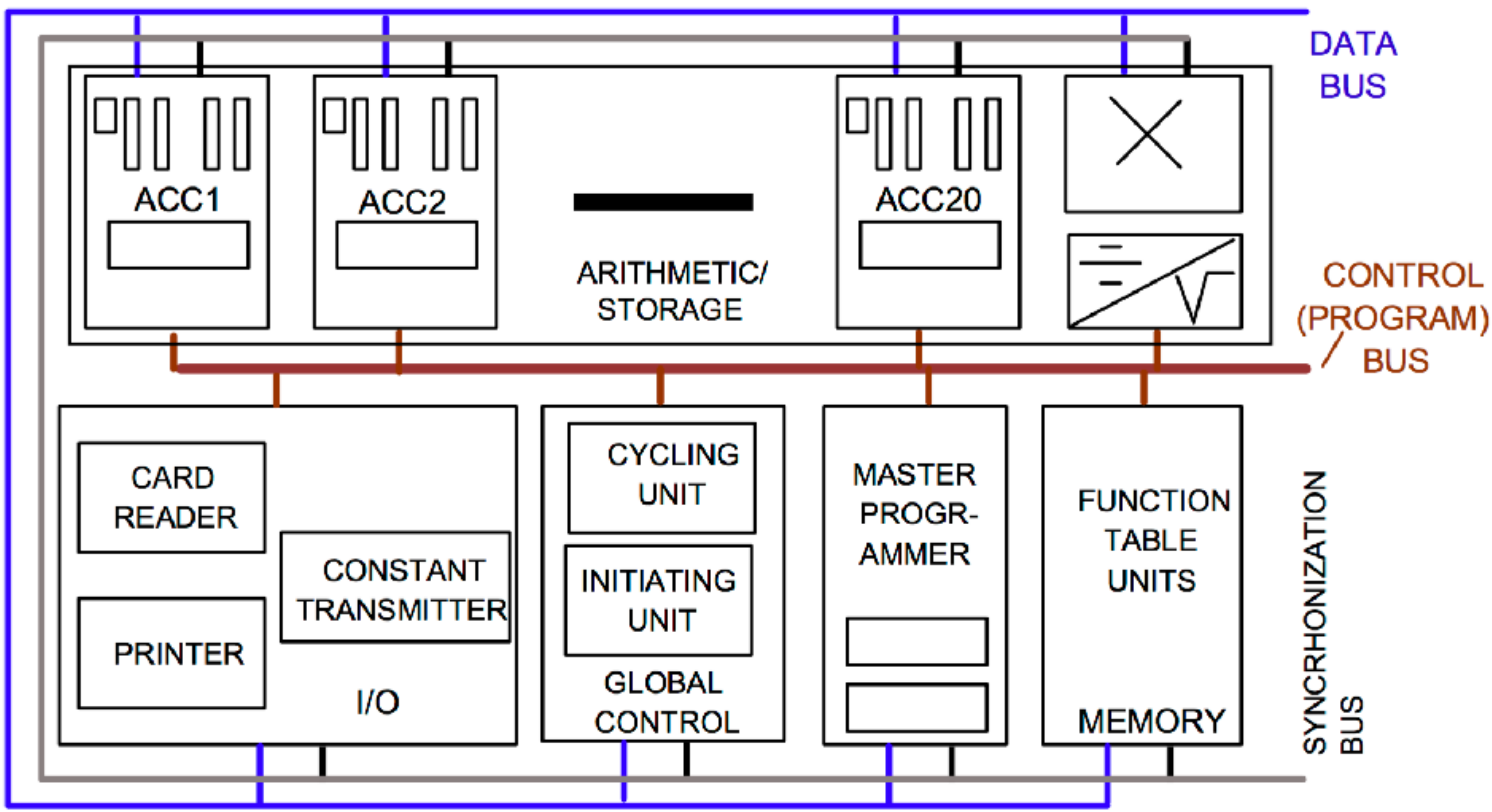
ENIAC

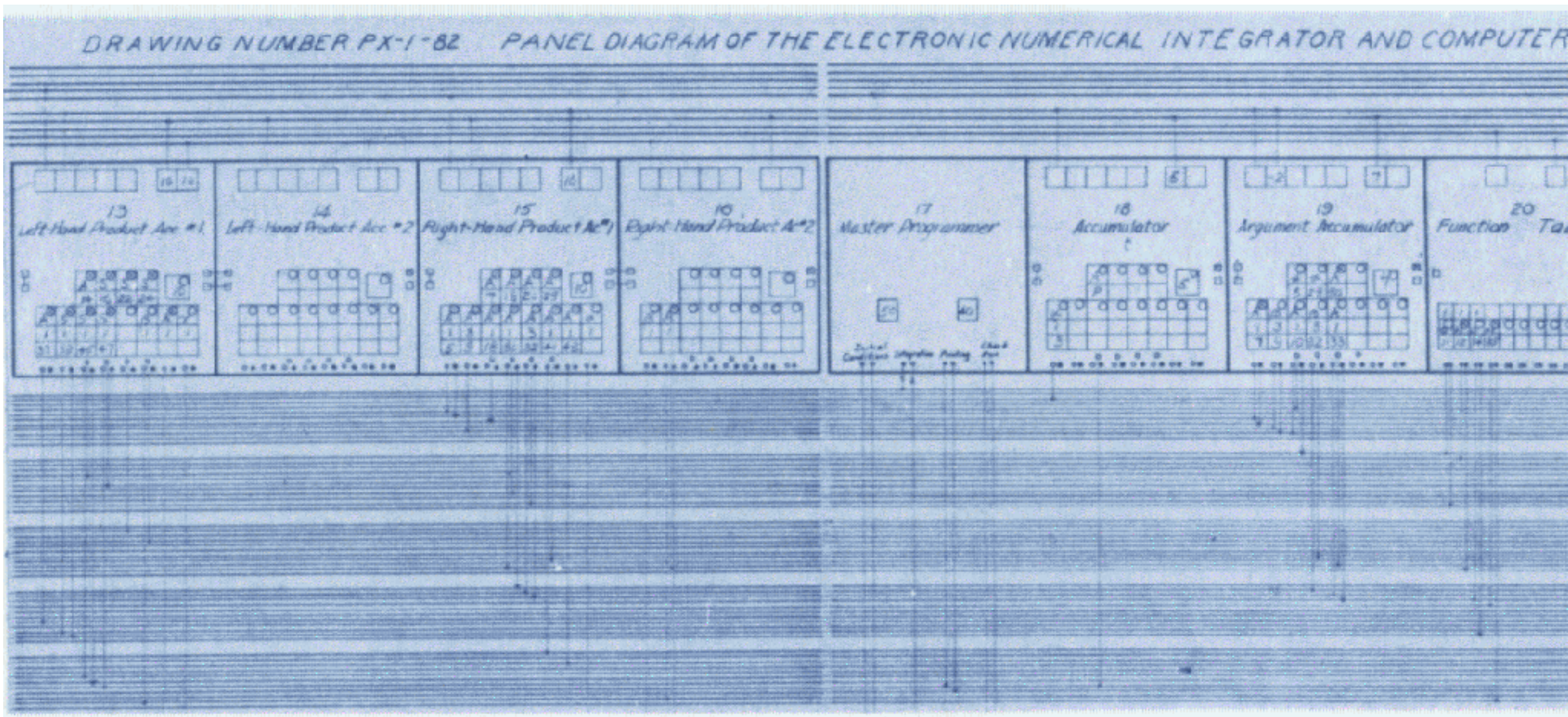


ENIAC



Kathleen McNulty Mauchly Antonelli, Jean Jennings Bartik,
Frances Snyder Holberton, Marlyn Wescoff Meltzer,
Frances Bilas Spence and Ruth Lichterman Teitelbaum


DATA BUS
ACC1
ACC2
ARITHMETIC/ STORAGE
ACC20
CONTROL (PROGRAM) BUS
CARD READER
CONSTANT TRANSMITTER
PRINTER
I/O
CYCLING UNIT
INITIATING UNIT
GLOBAL CONTROL
MASTER PROGR-AMMER
FUNCTION TABLE UNITS
MEMORY
SYNCRHONIZATION BUS


DRAWING NUMBER PX-1-82 PANEL DIAGRAM OF THE ELECTRONIC NUMERICAL INTEGRATOR AND COMPUTER
13
Left-Hand Product Acc #1
14
Left-Hand Product Acc #2
15
Right-Hand Product Acc #1
16
Right-Hand Product Acc #2
17
Master Programmer
18
Accumulator
19
Argument Accumulator
20
Function

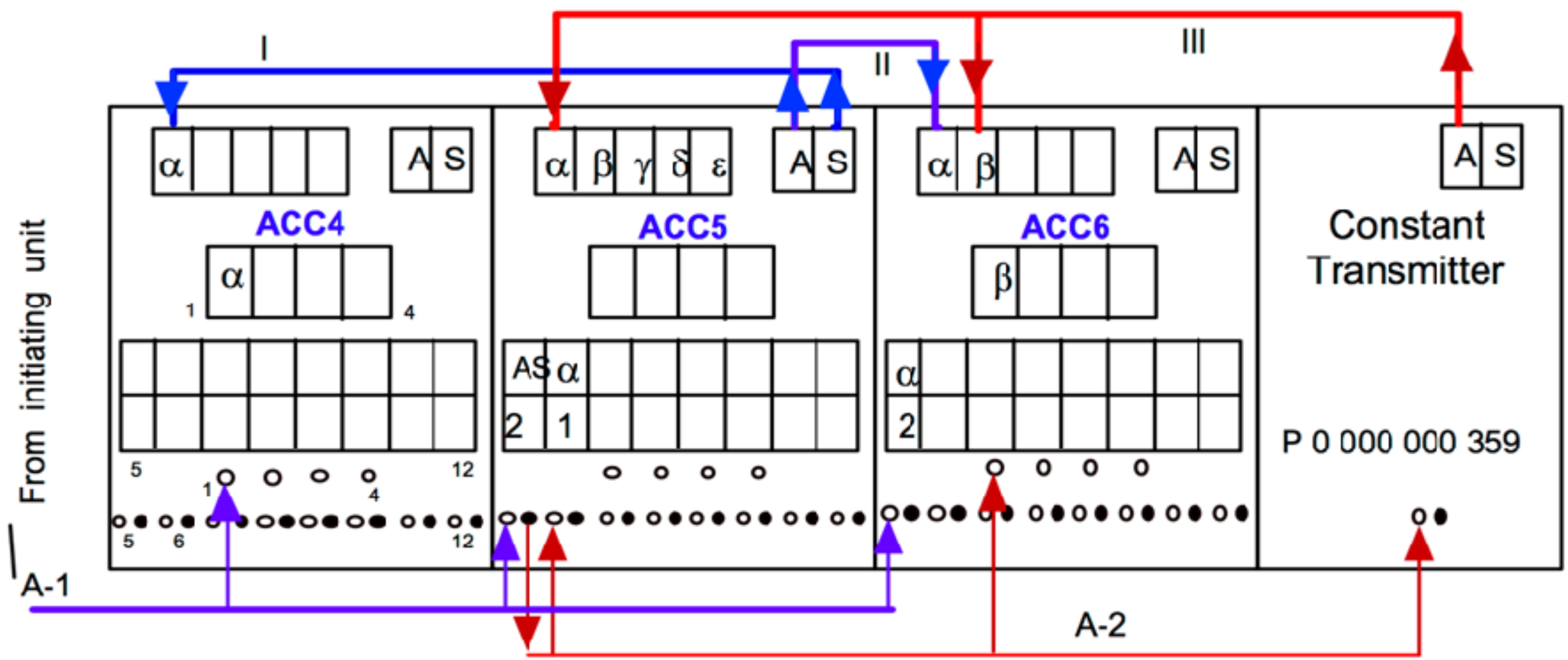


Figure 4: The connections for an ENIAC program. Three results are computed in parallel in each accumulator. Taken from [2].

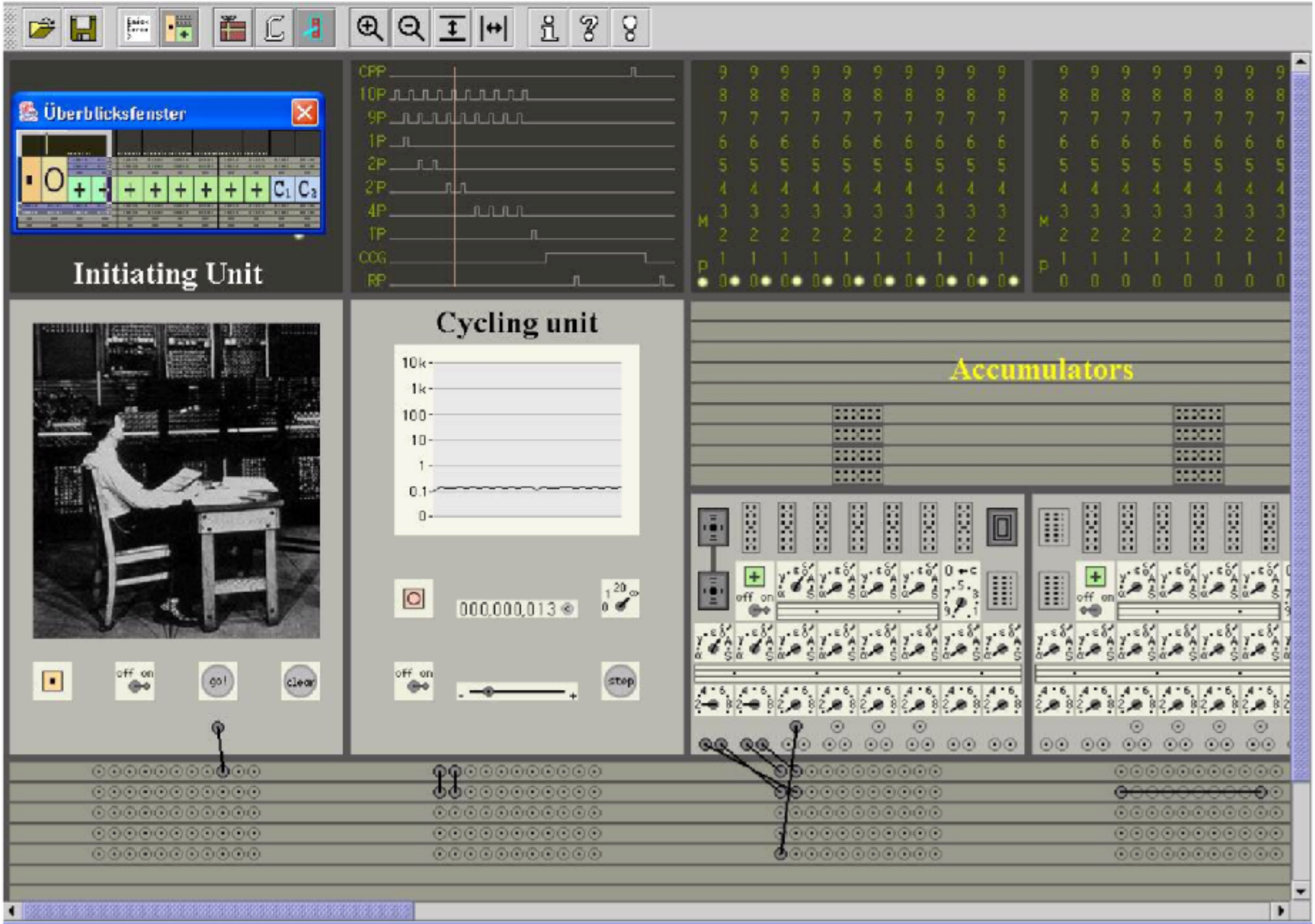
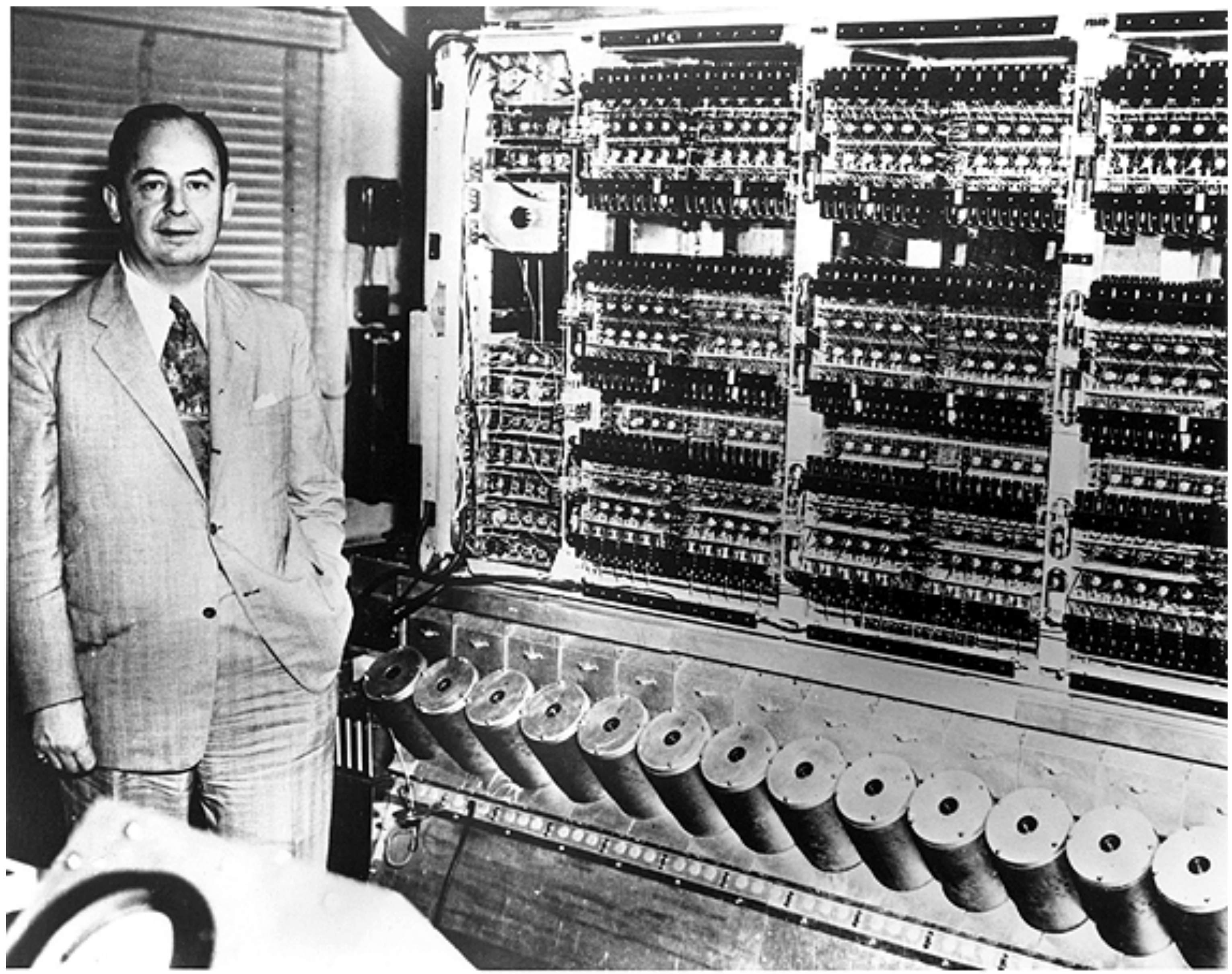
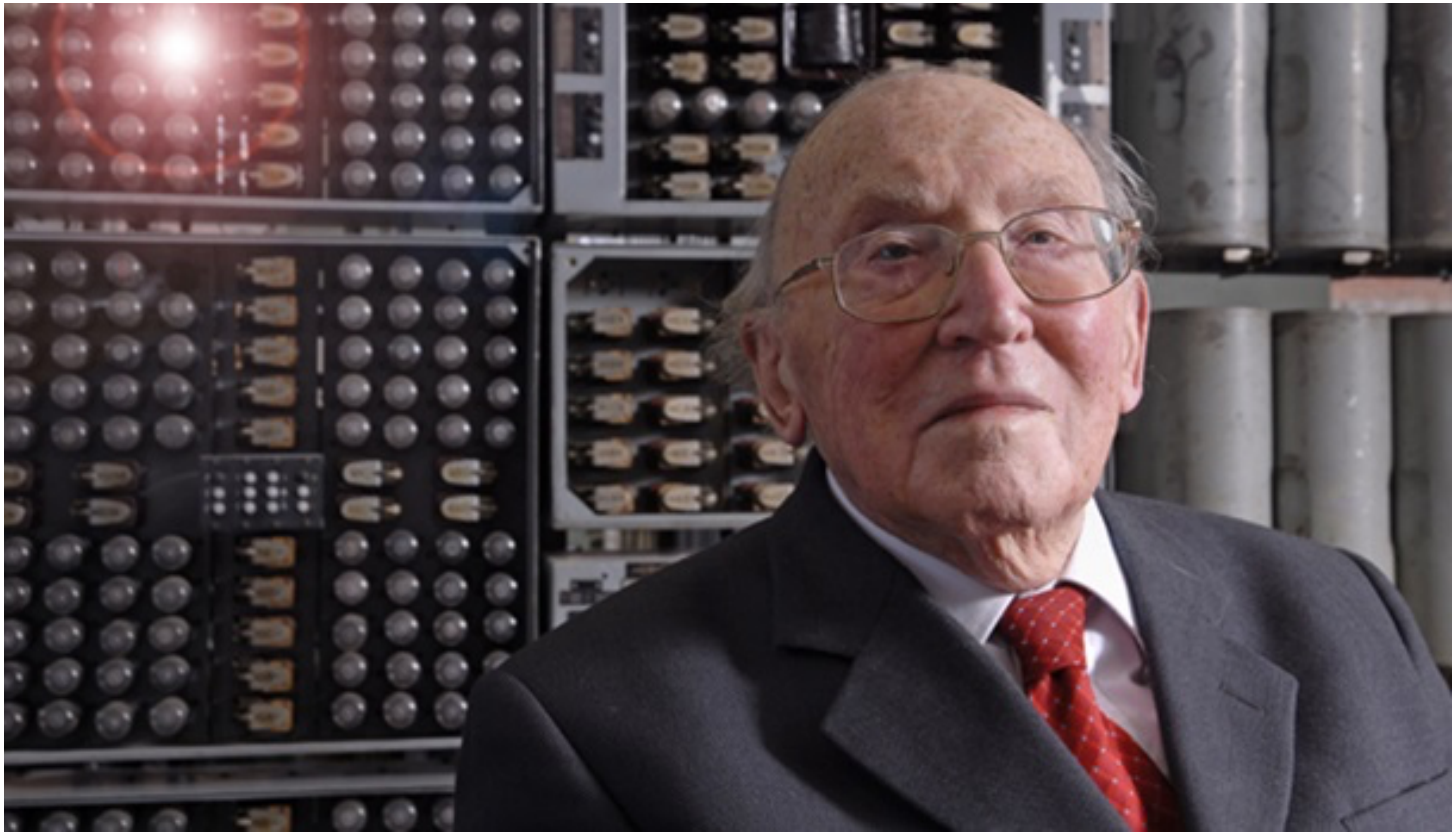


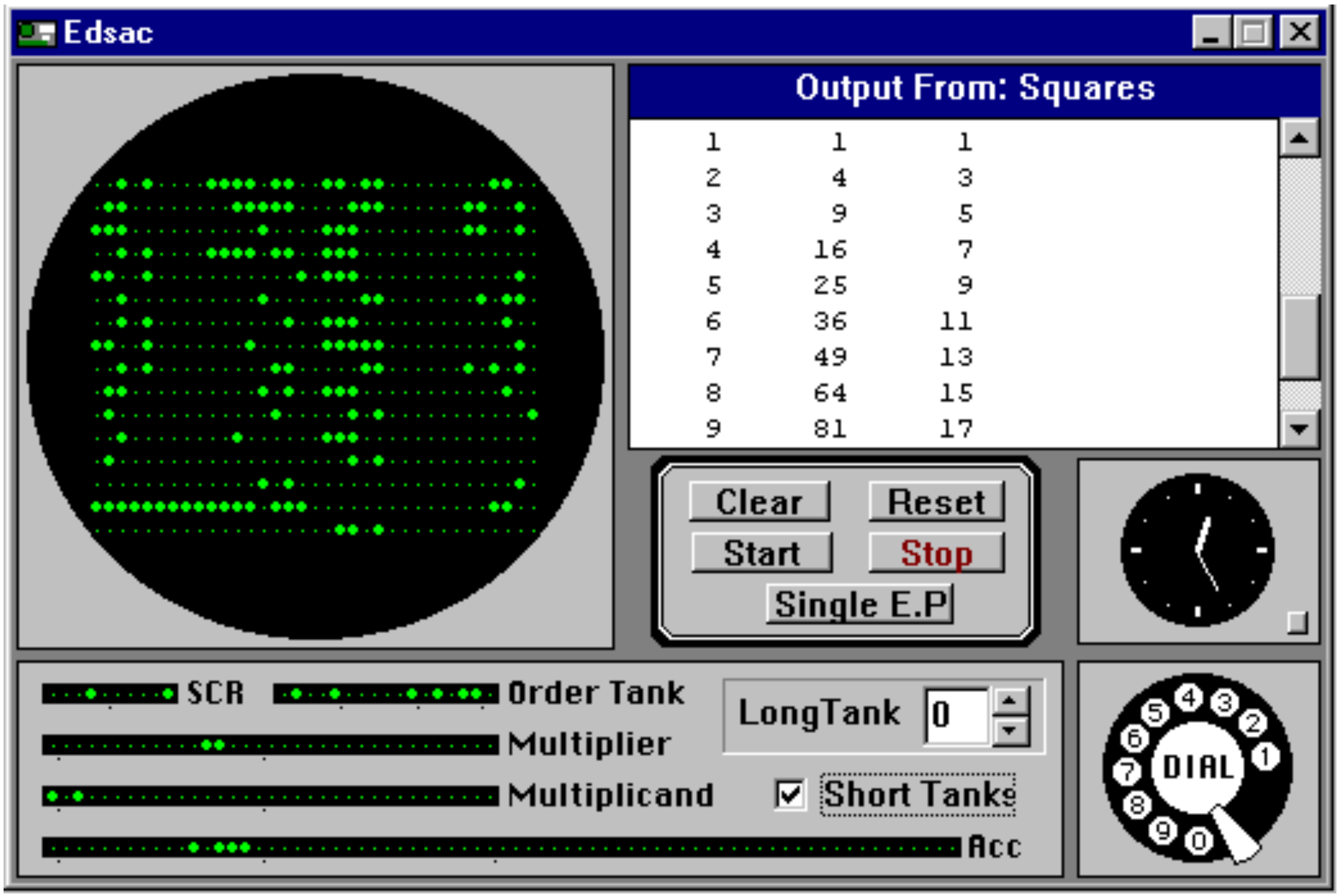
Figure 5: Screenshot of the Initiating Unit, Cycling Unit, and two accumulators (labeled). The first accumulator is switched on and shows its contents (ten decimal digits, all zero). The second accumulator is switched off. A few cables have been laid down, interconnecting the units to the control bus.

EDVAC

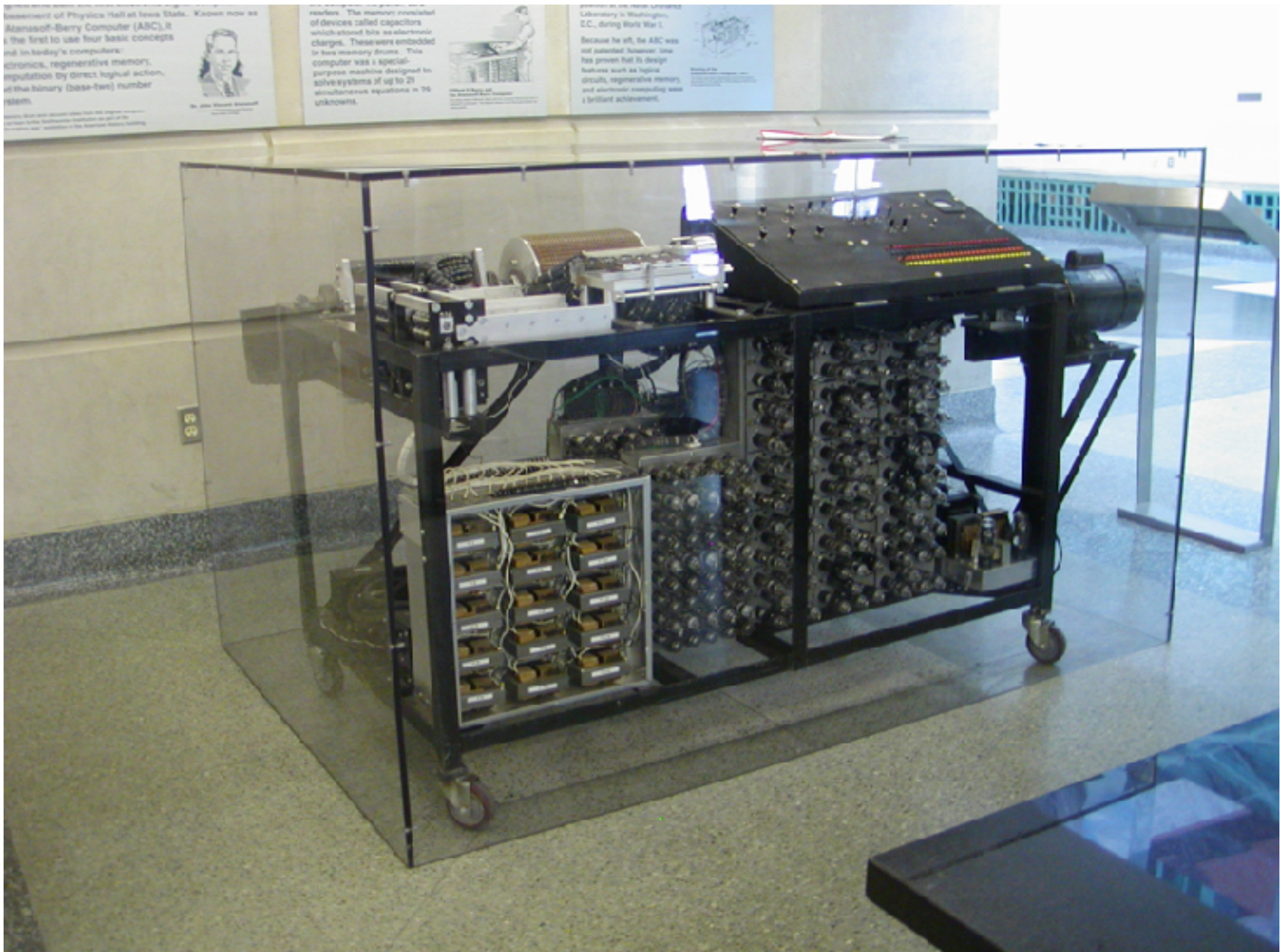


EDSAC




Edsac
Output From: Squares
1 1 1
2 4 3
3 9 5
4 16 7
5 25 9
6 36 11
7 49 13
8 64 15
9 81 17
Clear
Reset
Start
Stop
Single E.P
SCR
Order Tank
Multiplier
Multiplicand
Acc
LongTank
0
Short Tanks
DIAL
1 2 3 4 5 6 7 8 9 0

Atanasoff-Berry

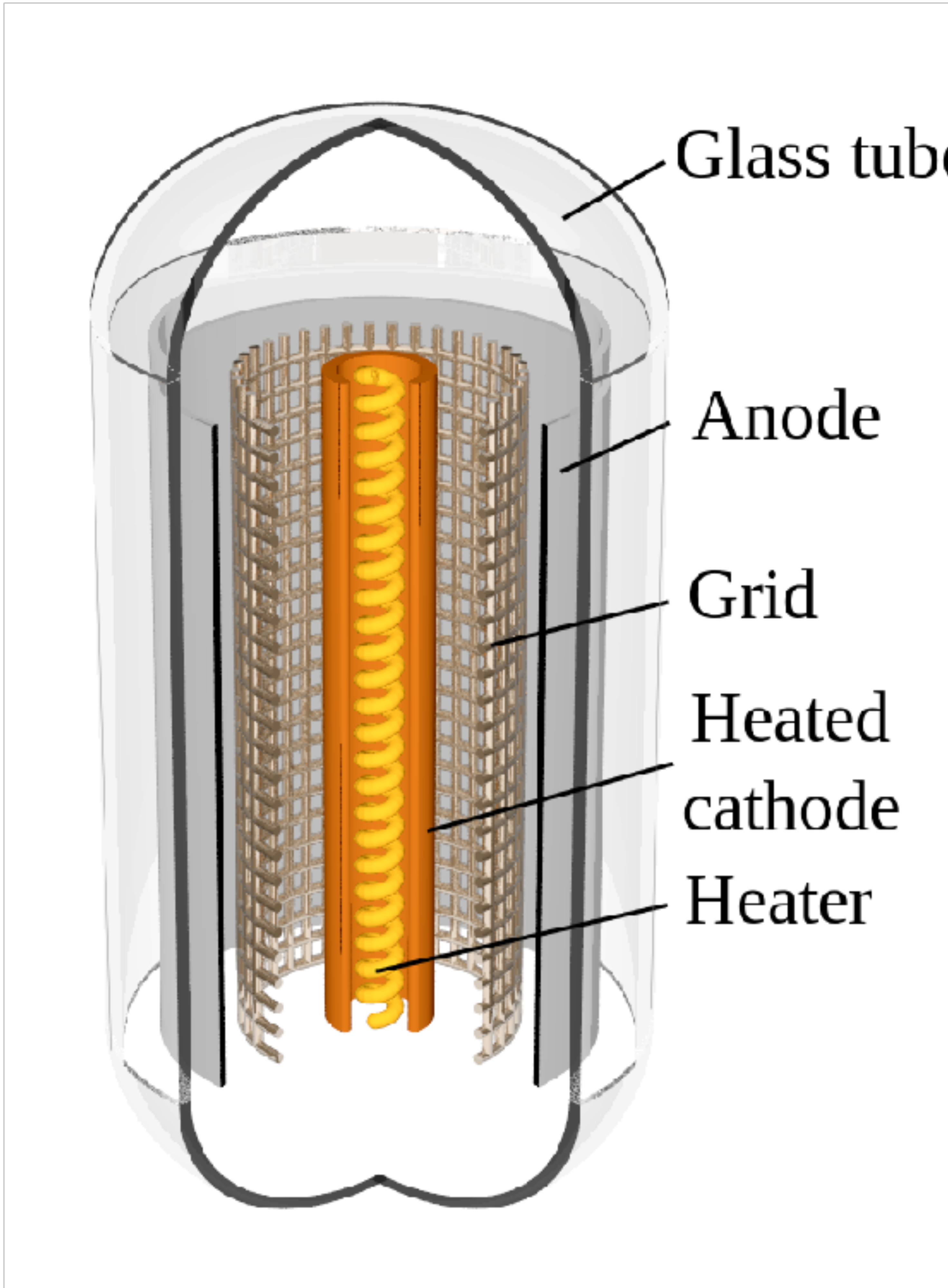


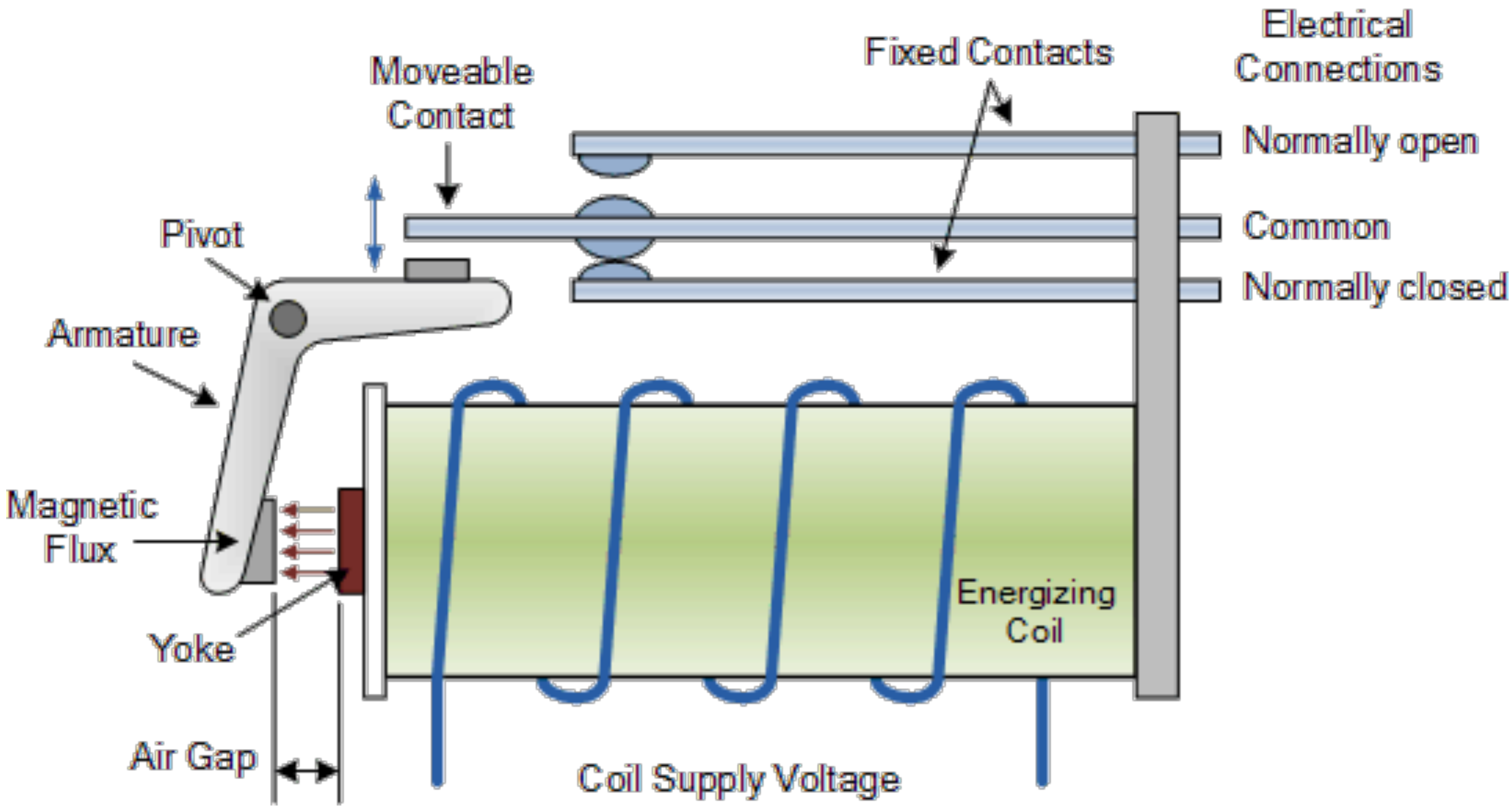
What was new here?

- a computer!
  - and general purpose too
- the stored program concept
- this thing was big
  - ~ 1Mwatt!
  - a couple rooms
- compared to humans it was pretty fast
- compared to the differential analyzer, fast too
- punch card I/O

What was the technology ?

- 17K vacuum tubes
- A boat load of resistors
- A few capacitors
- relays
- a big nest of wire
- sweat


Glass tube
Anode
Grid
Heated
cathode
Heater


Electrical
Connections
Fixed Contacts
Moveable
Contact
Normally open
Common
Normally closed
Pivot
Armature
Magnetic
Flux
Yoke
Energizing
Coil
Air Gap
Coil Supply Voltage

What struck you as interesting/unique?

- Weird to not imagine having memory
    - why was it programmable at all?
    - didn't want to build one for each use case
    - maybe they thought ahead?
- Only 6 programmers?!?
- How did you cool this thing?
- Did they trust the output?
    - You could single step the machine to debug it
- Was it dangerous to work on? (the technology yes!)
- Even with the stored program concept, I/O was still the bottleneck