First steps in History of Computing in the Czechoslovakia

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2017

Introduction

- The word: "ROBOT" in known all over the word. Its origin and birthplace is Prague, Czechia.
- In the year 1920 this term "ROBOT" was invented by Czech writer Karel Capek and his brother painter Josef.

- Karel wrote a play ***R.U.R - Rossum's Universal Robots,*** in which human beings like robots take over the world. The robots were source of cheap labor for humans. The word "ROBOT" is a derivative from the Czech word "robota" meaning slave-like work.

Z HISTORIE R.U.R.

Dr UR KaRURel Čapek, AUTOR UR RUR
(karikatura Josefa Čapka)

The first ideas of computer construction

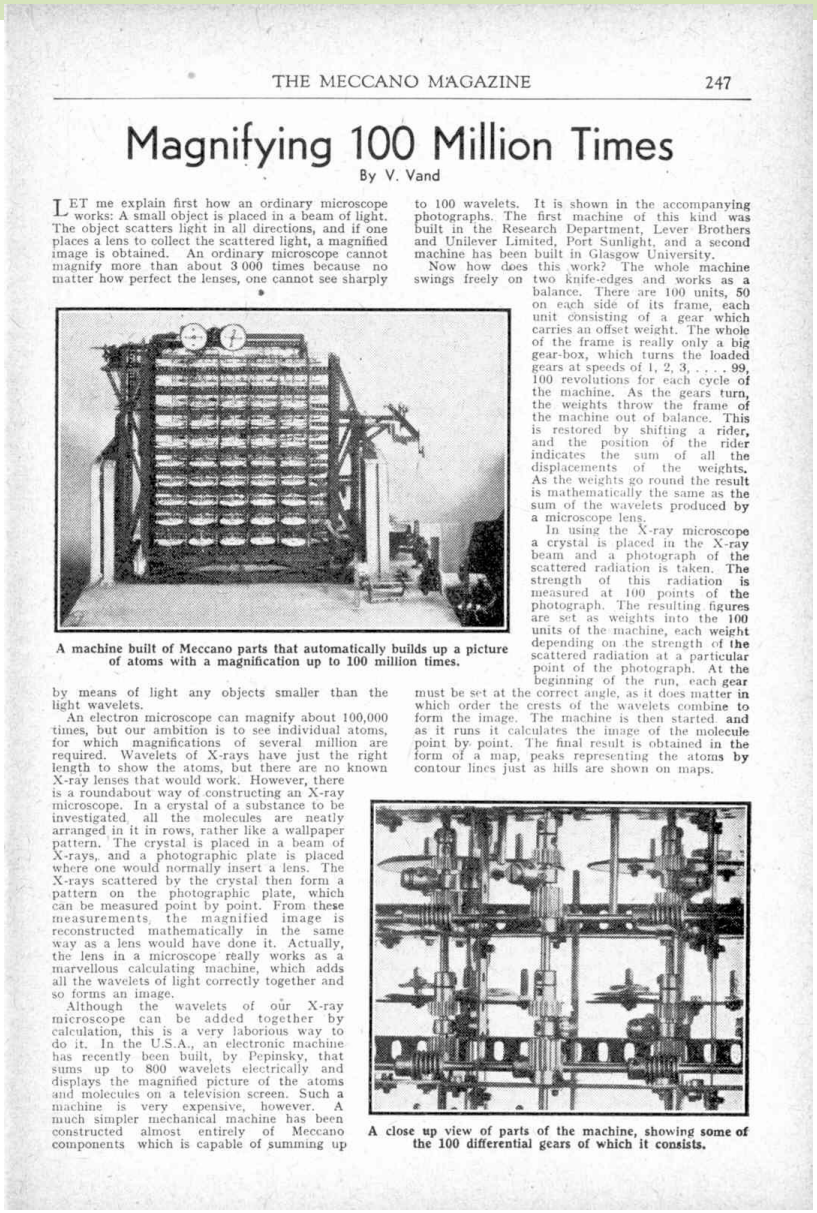
- The first ideas of computer construction started in the 1935 when Antonin Svoboda (1907 – 1980) and Vladimir Vand (1911 – 1968) began work at the Skoda Works.
- They designed an original position locator for use by anti-aircraft artillery.
- It was based on the concept of the analog solution of differential equations describing dynamics of the airplane.

Pioneers in Computing

- Antonín Svoboda in Prague and
  Vladimír Vand in Great Britain.
- In 1946 Vand´s mechanical computer helped in evaluating Fourier coefficients.
- This invention played the important role in the studium of the molecular structure and in the discovery of the structure of DNA.

Vladimír Vand (1911 – 1968)

Vand's Computer



THE MECCANO MAGAZINE 247

Magnifying 100 Million Times

By V. Vand

LET me explain first how an ordinary microscope works: A small object is placed in a beam of light. The object scatters light in all directions, and if one places a lens to collect the scattered light, a magnified image is obtained. An ordinary microscope cannot magnify more than about 3 000 times because no matter how perfect the lenses, one cannot see sharply by means of light any objects smaller than the light wavelets.

An electron microscope can magnify about 100,000 times, but our ambition is to see individual atoms, for which magnifications of several million are required. Wavelets of X-rays have just the right length to show the atoms, but there are no known X-ray lenses that would work. However, there is a roundabout way of constructing an X-ray microscope. In a crystal of a substance to be investigated, all the molecules are neatly arranged in it in rows, rather like a wallpaper pattern. The crystal is placed in a beam of X-rays, and a photographic plate is placed where one would normally insert a lens. The X-rays scattered by the crystal then form a pattern on the photographic plate, which can be measured point by point. From these measurements, the magnified image is reconstructed mathematically in the same way as a lens would have done it. Actually, the lens in a microscope really works as a marvellous calculating machine, which adds all the wavelets of light correctly together and so forms an image.

Although the wavelets of our X-ray microscope can be added together by calculation, this is a very laborious way to do it. In the U.S.A., an electronic machine has recently been built, by Pepinsky, that sums up to 800 wavelets electrically and displays the magnified picture of the atoms and molecules on a television screen. Such a machine is very expensive, however. A much simpler mechanical machine has been constructed almost entirely of Meccano components which is capable of summing up to 100 wavelets. It is shown in the accompanying photographs. The first machine of this kind was built in the Research Department, Lever Brothers and Unilever Limited, Port Sunlight, and a second machine has been built in Glasgow University.

Now how does this work? The whole machine swings freely on two knife-edges and works as a balance. There are 100 units, 50 on each side of its frame, each unit consisting of a gear which carries an offset weight. The whole of the frame is really only a big gear-box, which turns the loaded gears at speeds of 1, 2, 3, ... 99, 100 revolutions for each cycle of the machine. As the gears turn, the weights throw the frame of the machine out of balance. This is restored by shifting a rider, and the position of the rider indicates the sum of all the displacements of the weights. As the weights go round the result is mathematically the same as the sum of the wavelets produced by a microscope lens.

In using the X-ray microscope a crystal is placed in the X-ray beam and a photograph of the scattered radiation is taken. The strength of this radiation is measured at 100 points of the photograph. The resulting figures are set as weights into the 100 units of the machine, each weight depending on the strength of the scattered radiation at a particular point of the photograph. At the beginning of the run, each gear must be set at the correct angle, as it does matter in which order the crests of the wavelets combine to form the image. The machine is then started and as it runs it calculates the image of the molecule point by point. The final result is obtained in the form of a map, peaks representing the atoms by contour lines just as hills are shown on maps.

A machine built of Meccano parts that automatically builds up a picture of atoms with a magnification up to 100 million times.

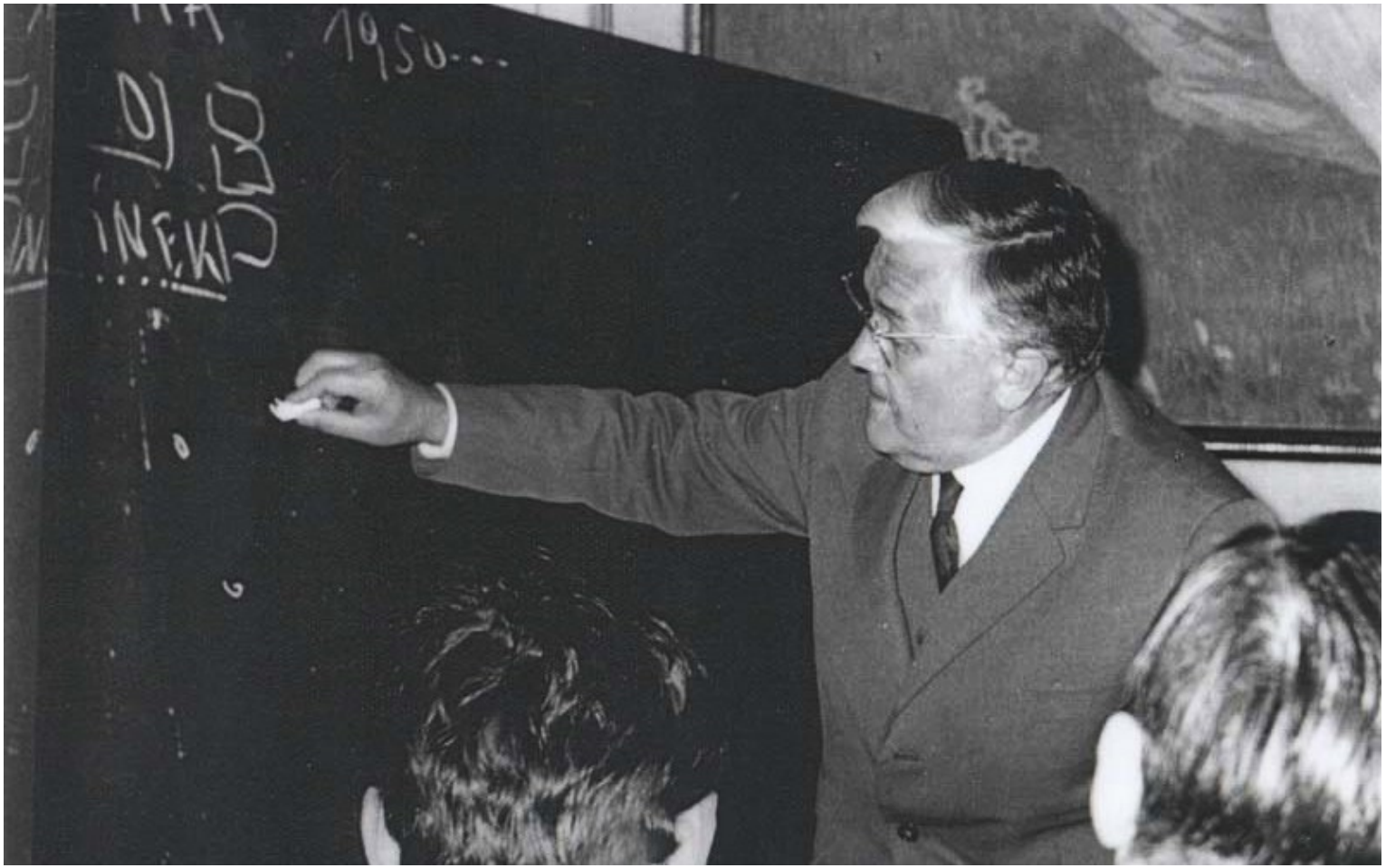
A close up view of parts of the machine, showing some of the 100 differential gears of which it consists.

- Nature
- One of pioneers of computer technology and numerical methods.
- Vand, V., Pepinsky, R.: *The Statistical Approach to X-Ray Structure Analysis*, 1953.

Svoboda´s Lectures at CTU

- In 1947 Antonin Svoboda designed a sophisticated semi-automatic punch card computer and began to teach a course entitled "Mathematical Machines" at the Czech Technical University in Prague.
- In 1947 *„Computing Mechanisms and Linkages"*, MIT Cambridge Mass., Radiation Laboratory Series – one of the first textbooks on computers

Antonín Svoboda (1907 – 1980)



Svoboda's Idea

1958 - Antonín Svoboda expressed *1st National Conference of Computational and Organizational technology,* Prague:

Mathematical machine couldn't be a sensational surprise for young man.

He has to know it as usual device, which is one from common ways for mining of means of subsistence.

SAPO

- In 1950-1956 SVOBODA designed and supervised the construction of the first fully automatic digital computer in Eastern Europe – SAPO.
- Second similar computer was used for driving system of the project Apollo.
- Svoboda had experience from building electromechanical computers in the USA, where he worked at MIT until 1946.

SAPO – SAmočinný POčítač

- The **SAPO** (short for SAmočinný Počítač – the Automatic Computer) was the first Czechoslovak computer.

- It operated in the years 1957-1960 in the **Research Institute for Mathematical Machines -** *Výzkumný ústav matematických strojů* (VÚMS), part of the Czechoslovak Academy of Sciences in Prague.
- The computer was the first fault-tolerant computer
- It had three parallel arithmetic units, which decided on the correct result by voting, an example of triple modular redundancy (if all three results were different, the operation was repeated).

SAPO – the end in 1960

- It was electromechanical design with 7,000 relays and 400 vacuum tubes, and a magnetic drum memory with capacity of 1024 32-bit words.

- Each instruction had 5 operands (addresses) - 2 for arithmetic operands, one for result and addresses of next instruction in case of positive and negative result. It operated on binary floating point numbers.

- In 1960, a spark from one of the relays fired the greasing oil, and the whole computer burnt down.

Obstacles in the SAPO development

- One of the greatest obstacles slowing down the SAPO development was a lack of adequate components which the Czechoslovak electro-technical industry was not able to produce neither in the required quality or quantity.
- In 1950s the relay construction elements of SAPO were outdated as regards computer technology and they were used as a substitute for non-available electron tubes.
- Unlike in the USA or the Western European countries, where in 1950s electron-tube computers fully dominated the field.

EPOS

- EPOS – Elektronický POčítací Stroj (Electronic Computer or Calculating Machine)
- In 1957-1963 designed and supervised the construction of automatic digital computer EPOS 1 - electrone-tube computer
- In 1963-1964 worked on EPOS 2 – transistorized computer, an advaced version of EPOS 1.

Parameters of EPOS in the VÚMS

- In the Research Institute for Mathematical Machines (VÚMS), was of the highest standard and its staff managed to design original computing equipment (e.g. **EPOS 1**), that often had the same parameters as top computers produced in capitalist countries.

Computers or tractors?

- The policy for the production of digital computers adopted by the government Resolution No. 935/61 (VHJ ZJŠ Brno, Aritma Praha) was not complied with by the Ministry of General Engineering, since the Brno production facility did not focus that much on the production of computers, but rather on the production of tractors.
- As a result, no production facility for mathematical machines was constructed before 1965.
- In 1964 the government responded to the lack of digital computers by the Resolution No. 335/64 that catered for the needs of the Czechoslovak economy for mathematical machines by **importing them from abroad**.

Emmigration of Svoboda´s Team

- Then, in 1964, Svoboda escaped from the Czechoslovakia to U.S.A.

with 80 young colleagues!

„We don’t need similar people here!”,

our president Antonín Novotný answered students during their discussion.

URAL and Minsk

- Jaroslav Kožešník, the director of the Institute of Theoretical Informatics and Automatization of Academy
- He was secretary of Academy of Science in Prague a black figure in the development of computing in the Czechoslovakia.
- He organized cooperation with Russian computer scientists.
- **URAL I** spent about one year in the monastery Emauzy, then was quickly changed for **URAL II** and **MINSK**.

MINSK

- Then we used computers Minsk.
- Minsk family of computers was developed and produced in the Byelorussian SSR from 1959 to 1975.
- The most advanced model was *Minsk-32*, developed in 1968. It supported COBOL, FORTRAN and **ALGAMS** (a version of ALGOL). This and earlier versions also used a machine-oriented language called *AKI* (*AvtoKod* - i.e., "Engineer's Autocode").
- It stood somewhere between the native assembly language *SSK* (*Sistema Simvolicheskogo Kodirovaniya*, or "System of symbolic coding") and higher-level languages, like FORTRAN.

EC – clone of IBM 360

- **ES EVM** (ЕС ЭВМ, Единая система электронных вычислительн машин, meaning **"Unified System of Electronic Computers"**) was **a series of clones of IBM's System/360 and System/370** mainframes, released in more countries under the initiative of the Soviet Union starting in the 1960s.
- Production continued until 1998. The total number of ES EVM mainframes produced was more than 15,000.
- In the period from 1986 to 1997, a series of PC-compatible desktop computers, called ПЭВМ ЕС ЭВМ (Personal Computers of ES EVM series), was also produced; the newer versions of these computers are still produced under a different name on a very limited scale in Minsk. These computers were used in Czechoslovakia.

Computers for schools!

- **IQ 151** - in the Czech schools

First step in 1982 in the CTU.

Second step: ZPA Nový Bor, North Bohemia – 50 copie of **IQ 150**

Third step: Ministry of Education – 2 000 copies

Fourth step: **IQ – 151G** – expensive toy for heads of factories

- Similary: **PMD – 85** or **Didactic** in Slovakia
- Majority of young people used **ZX – Sinclair**, **Commodore**, **Atari** etc. in the same time.