Herman Hollerith

THE
Inventor

History of Computing
Professor T. Bergin
Bibliographic Paper

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> "Be it known that I, Herman Hollerith a citizen of the United States, residing in New York City, in the county and State of New York, have invented certain new and useful improvements in Apparatus for Compiling Statistics" (H. Hollerith).

Educational Background

Herman Hollerith was born in Buffalo, New York, in February 1860. From an early age he showed a great interest in visualizing and organizing large amounts of information. He attended two colleges. One of them was the College of City of New York and the other one was the Columbia School of Mines. By the age of nineteen Hollerith graduated from the College of City of New York where he had received excellent grades in graphics, geometry, surveying and drawing. After graduating he was offered a job in Washington D.C. by one of his professors. His job required him to collect and analyze data concerning steam and waterpower that were used by steel and iron industries. As a very intelligent and enthusiastic person, Hollerith soon received respect from his colleagues.

Census problem

According to the United States Constitution, there has to be a gather of information about population every ten years. The first Census did not appear to be a problem, but as the population grew it became a difficult task to accomplish an enumeration of residents. In addition, the variables that had to be gathered had increased. For example, Census gathered information on age, sex, race, place of birth, occupation and much more. All the gathered information was used to make sure that there is a reasonable representation and taxation among all the states. In addition, Census was used for policy and law regulation. Therefore, it was very important to collect all the necessary

information and analyze it in a reasonable period of time. It was estimated that the Census of 1890 would take approximately ten years to be completed. This was unacceptable and defeated the whole purpose of Census; therefore, something had to be done to improve the process.

In 1870 Francis A. Walker was a superintendent of the census. He felt the need to find the solution for the census problem. Walker decided to hire more people to an already large member's staff. Hollerith was one among them. Right away he started to work on the problem. He worked closely with a young physician John Billings, who actually gave him the idea for a machine that would calculate and record population statistics using punched cards. "One evening at Dr B's tea table he said to me 'There ought to be a machine for doing the purely mechanical work of tabulating population and similar statistics'" (Hollerith). Unfortunately, Hollerith was not able to come with a solution as he did not have enough time and did not receive Dr. Billings' additional help.

In 1882, Hollerith moved to Boston to teach mechanical engineering at Massachusetts Institution of Technology, but soon learned that teaching was not his passion. The idea to solve the Census problem had not left his mind. He came back to Washington as an assistant examiner in the U.S. Patent Office. After mastering the art of patents and completing his entire workload, Hollerith resigned from the Patent Office to open up his own business. His new working position gave him an opportunity to work on the Census problem.

Tabulating Apparatus

Hollerith started to work on a machine that would "read" census information. He thought of an idea of storing information on a roll of white paper tape with round

punched holes. Each round hole would correspond to a piece of data about a human being. After conducting a few experiments, Hollerith found out that the using a roll of white paper was not the best way due to alphabetic limitations. He remembered Billings' suggestion of using punched cards. Each card would represent information of one individual. A single punched hole[1] in a selected area of the card would represent numerical data. A combination of two punched holes on the same column would represent letters of the alphabet. In order to record the information a card had to be passed between a metal drum and a set of wire brushes. When a card was passed through a metal drum and a set of wire brushes, a pin would fall through each card hole into a pan of mercury. This event would trigger the closing of an electrical circuit, which would register a count on a meter. Unlike the tape, punched cards were fed to Hollerith's machine one at a time. This method proved to be very useful when there was a need to conduct calculation based on age, sex, occupation etc.

In 1886, the first test of tabulating apparatus took place in Baltimore's Department of Health. Hollerith used his machine to record information about deceased people. " The operator began the tabulation process by placing a punched card on a hard rubber surface that contained an array of tiny cups of mercury, so spaced that there was a cup directly under each of the possible hole locations. Then as the operator pulled down the handle of a hinged "pin box" that held an identically spaced array of spring-loaded pins, each pin either passed through one of the punched holes into a cup of mercury or was restrained by the card. Pins that contacted mercury closed an electrical circuit that advanced the corresponding counting dial by one unit. After a number of the cards were

[1] Before using a combination of two holes, Hollerith used just one hole.

processed, the operator wrote down the dial readings and reset the dials to zero"(Pugh, pg. 7). In addition to inventing the tabulating machine, Hollerith developed a sorting machine that was used for apparatus. It was used to sort punched cards. Each time a punched card was processed an electrical signal was passed to the sorting machine. The signal would open a special compartment were the punched could be inserted for storage. The whole machine that included tabulating and sorting apparatuses worked very well. The only flow that was found did not actually involve the apparatus itself; it involved the making of punched cards. In order to create a punch card, Hollerith used a hand-held punch similar to what conductors used at that time. It worked very well for making a few cards, but it became insufficient for large amounts of cards. Hollerith developed a pantograph punch to solve the problem. The procedure of pantograph was quite complicated. "Near the operation was a large flat plate with holes corresponding in their locations to possible hole locations in the much smaller card. By moving the stylus by hand and pushing it into the selected hole in the plate, the operator caused a punch on the levered arm to create a similarly located hole in the card"(Pugh, pg. 10). This new device helped operators to create roughly 500 cards each day.

Soon after the development and successful testing, Hollerith filed for a patent for his inventions. A patent is an "exclusive right granted by a government to an inventor to manufacture, use, or sell an invention for a certain number of years" (T. Bergin, pg. 2). He was granted a patent of seventeen years. This means that no one is allowed to copy the machine or put it in use without Hollerith's authorization. "The purpose of patent laws is not to protect the inventor, but to encourage disclosure of new discoveries for the benefit of society" (T. Bergin, pg. 2). Hollerith was granted a patent not because he used

punched cards and electricity, which were already invented by previous individuals. He was granted a patent because he was the first one to combine those two elements to create a new device that was not obvious.

Due to thriving results of presentation of Hollerith's invention in Baltimore, the apparatus would soon be installed in New Jersey and New York City. The success did not stop there, shortly Australia, Canada, Italy, and Norway had Hollerith's apparatus installed in various places. In 1880, the department of Census decided to do trials. Hollerith, Pidgin and Hunt were competing to have census use one their machines. The competition was based on recording and tabulating of 10,491 individuals.

Results:

	Record	*Tabulate*
Hollerith	72.5 hours	5.5 hours
Pidgin	111 hours	45 hours
Hunt	145.5 hours	55.5 hours

Source: (T. Bergin, pg. 3). It is very obvious that Hollerith had won the competition and in 1890 his apparatus was selected and used in the census. It was estimated that Hollerith's machine saved around five million dollars. The tabulation apparatus became a widely used machine. In 1928 IBM came up with 80-column punched card with rectangular holes. In 1930 RemRand developed a 90-column card with round holes. All of these additional developments were based on Hollerith's original inventions. It greatly improved the speed of procession information for various institutions and organizations.

Conclusion

Besides being a first person that invented tabulating apparatus, Hollerith had many other honors. For example, he was a worldwide highly praised speaker at places such as the Royal Statistical Society in London. In 1890, Hollerith was awarded the prestigious Elliot Cresson Medal by the Franklin Institute of Philadelphia. In 1893, he was honored by Gold Medal of the Paris Exposition and the Bronze Medal of the World's Fair. Hollerith proved to be a very important figure in the history of computing. Although in modified form, some of his inventions are still used today. Hollerith made a big contribution to society and his work should not be forgotten.

Reference:

Emerson W. Pugh, "Building IBM shaping an industry and its technology," *Cambridge Mass*.: MIT Press, c1995.

Thomas J. Bergin, "Herman Hollerith and the Evolution of Electronic Accounting Machines," *Handout*, 2001.