Biography: Otto von Geuricke (1602 - 1686)

Otto von Guericke (1602-1686), mayor of Magdeburg, diplomatist, physicist and inventor. He was the first one to conduct the experiments with producing the vacuum. The most famous one among them was the one with the Magdeburg Hemispheres which showed the large force of air pressure. Due to that, he began the new direction in research and applications – the vacuum technique.

Otto von Guericke was born on 30th November 1602 in a wealthy middle-class family in Magdeburg. His family was the owner of many buildings in the city and also of manors nearby. At the age of 15, Otto enrolled the faculty of Art at the University of Leipzig. He interrupted this studies in 1619 because of the outbreak of the Thirty Years' War. In 1620, his father died. In the years 1621-1623, Otto studied law at the University in Jena, and in the years 1623-1624 he studied mathematics, physics and fortification engineering at the Leiden University, Netherlands. After finishing his studies, he went on a nine-months educational trip to France and England, as it was the contemporary habit of the young, gent men. In November 1625, he came back to Magdeburg, where he soon became the member of the city council (Rats Collegium). As a councilman, he dealt with the problems of the city buildings.

In 1626 he married to Margarethe Alemann. He had three children with her: Anna Catherine, Hans Otto and Jacob Christopher, but two of them, Anna Catherine and Jacob Christopher, died in early childhood. In 1645 his wife, Margarethe, died. Seven years later Guericke married to Dorotha Lentke.

Between the year 1618 and 1648, there was the Thirty Years' War at the area of the countries of Reich. Magdeburg was besieged by the Habsburg army twice – in 1629 and 1631. During the second siege, the city surrendered. Around 20 000 habitants of the city were killed by the soldiers, their goods were plundered, and the city was burnt. Guericke, who was fighting in the defence of the city, luckily survived. However, he was arrested and imprisoned in the camp in Fermersleben (near Magdeburg). Soon Louis I, Prince of Anhalt-Köthen bought Guericke out for 300 thalers. Guericke moved then to Erfurt, where he became the fortifications engineer. In 1632, when Magdeburg was taken over by Swedish people, he came back to his homecity, where he started to work in the city's administration.

During the following ten years, he was involved in rebuilding the city after the war. In that time (1635) Magdeburg was transferred to the jurisdiction of August, Prince of Saxony. In 1641, Guericke took over the post of the city treasurer (Kämmerer). In September 1642, he undertook the difficult diplomatic mission, going to the court of the Saxony elector in Dresden, to solicit for tempering the severe treatment of Magdeburg inhabitants by the commander of the Saxon army occupying the city. Due to his involvement in the city's public issues, Guericke was chosen the mayor in 1646, and he held that office for the following 30 years.

While being the mayor, he still undertook various diplomatic missions on behalf of the city. He took part in the preparation and signing the Peace of Westphalia, which finished the Thirty Years' War in 1648. As the result of the arrangements of the Westphalia treaty, Magdeburg came under the jurisdiction of Country of Brandenburg, then ruled by Frederick William I. Guericke had an ambition to restore the old splendour of Magdeburg. To express its own prestige, the city was supposed to be the free imperial city in the Holy Roman Empire. Unfortunately, these political goals of Guericke became impossible because of the relentless attitude of Frederick William I, who was fulfilling the autocratic vision of governing the country. In 1666, Guericke, on behalf of the Magdeburg, agreed to receive the garrison of army of Brandenburg, and to pay the tribute to the Great Elector of Brandenburg, Frederick William I.

However Guericke failed, he kept in touch with Frederick William I very well. The Great Elector

was the founder of the scholarship and he employed Guericke's son, Hans Otton, as his resident in Hamburg. What is more, in 1666 he appointed Guericke to the Brandenburg City Council. Guericke devoted to Frederick William the remarkably kind dedication in the preface to his book entitled *Experimenta Nova* published in 1672. In 1666 Guericke was ennobled by the Holy Roman Emperor, Leopold I. since then he could use the nickname 'von'. With the agreement of the emperor, he also changed the spelling of his surname to Guericke from Gericke, converging it to the French spelling of the diplomacy of that time.

In 1676 Guericke quit the post of the mayor of Magdeburg. In January 1681 he left Magdeburg because of the fear of the pestilence. He moved to his son's, Hans Otto's, house in Hamburg, together with his wife. He died there on 11 May 1686.

However he had many activities and public functions, Guericke was able to find time to conduct various experiments in physics. Around the year 1650, he constructed the air pomp, containing a piston and a barrel. Later he was improving it and conducting various experiments, using it. The first one was the creating of vacuum by pumping the water out of the hermetically closed wooden barrel. He started to use metal vessels in the following experiments. The first attempt with the copper sphere ended up with the crush of the sphere, accompanied with the noise which frightened the participants of the experiment. Guericke saw the cause of his failure in the careless creation of the sphere by the craftsman. He conducted the following experiments with the vessels of the ideal spherical shape.

In 1654, during the parliamentary session of Reichstag in Regensburg, Guericke conducted few experiments in the presence of emperor Ferdinand III and many imperial dignitaries, using the air pomp built by him. These experiments included the crushing of a non-spherical vessel, overcoming the force of several dozen men by the piston in the cylinder out of which the air was pumped, the damping of the flame of the candle in the hermetically closed vessel, the raising of water by drawing in, the demonstration of the air's weight, creating the fog in the vessel by the sudden sucking the air out of it, and many more.

Guericke's stay in Regensburg resulted also in establishing the contact with the maths and physics professor in the Jesuit College in Würzburg, Jesuit Gaspar Schott. In 1657, Schott published the work entitled *Mechanica hydraulico-pneumatica*, in which one of the chapters was devoted to describe all of the Guericke's experiments to date. It was the first scientific publication of Guericke's achievements. Few years later (1664) Schott published another book entitled *Technica Curiosa*, in which he included another Guericke's experiments, the famous one with the Magdeburg Hemispheres was among them.

Guericke conducted that experiment, showing the force of the atmospheric pressure in a spectacular way, in 1657 in front of the audience. In that experiment, he used two sulphur hemispheres with the diameter of nearly 67 100 Magdeburg ells (approximately 40 centimetres). One of the hemispheres had a valve, which helped in pumping out the air from the inside and close the entrance for the air from the outside. These hemispheres were connected by a grummet and then the air was pumped out of them very quickly. Due to the surrounding air pressure, the hemispheres were joined so strongly that 16 horses couldn't disrupt it all or with huge effort. When finally, with great effort, they were separated, it was accompanied by the explosion similar to the fire from the cannon. When after opening the valve, the air was let inside, the hemisphere could be separated with the force of the hands. Guericke repeated that experiment in 1663 in Berlin in the presence of the Great Elector of Brandenburg, Frederick William I.

Having learnt about the experiments of Torricelli and Pascal, Guericke constructed the water barometer and he interlinked the fluctuation of the water column with the changes in the atmospheric pressure. The sudden fall in the pressure observed in 1660 allowed him to forecast the huge upcoming thunder storm. It was the first weather forecast.

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Guericke conducted the experiments also in other fields, for example, he constructed the original electrostatic generator, with the sulphur sphere as the basic element.

In 1672, in Amsterdam, the work of Guericke's life entitled *Experimenta nova (ut vocantur) Magdeburgica de vacuo spatio* was published. He included there the full description of all of his experiments and his own thoughts about space, time and matter.

References

Otto von Guericke, Ein Leben für Magdeburg and *Neue Magdeburger Versuche* in http://www.ovgu.de/org/ovgg/deutsch

Andrzej Kajetan Wróblewski, *Historia fizyki*, Wydawnictwo Naukowe PWN, Warszawa 2007

http://en.wikipedia.org/wiki/Otto_von_Guericke

http://de.wikipedia.org/wiki/Otto_von_Guericke

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