

Our lives would be very different without the inventions of Thomas Alva Edison. This prodigious creator changed our culture in countless ways with the seemingly miraculous devices that flooded out of his New Jersey laboratory

Thomas Edison was born in Milan, Ohio in 1847, and grew up in Port Huron, Michigan. He was the seventh and last child of Samuel Ogden Edison Jr. and Nancy Matthews Elliott.

Surprisingly, Edison did not learn to talk until he was almost four years old.

In 1854, at the age of seven, Edison attended school for a short period of 12 weeks. Being a hyperactive child and prone to distraction, his teachers could not handle him. His mother removed him from school and tutored him at home until the age of 11. So, Edison had very little formal education as a child. However, his removal from school proved beneficial for his career, as he developed self-learning skills and an ever increasing appetite for knowledge and reading.

Here's a couple of interesting facts about Edison:

- He was nearly deaf as an adult as he became affected with scarlet fever and ear infections in the early years of his life. However, he usually cited a train accident as the cause of his hearing loss. Interestingly, Edison had a chance to improve his hearing by way of an operation later in his life. He refused to take the option though. He simply did not want to go through the difficulty of relearning how to channel his thinking in a noisier world.
- Edison enjoyed reading and reciting poetry. His life-long favourite was Thomas Gray's "Elegy In A Country Churchyard."
- Out of his curiosity and appetite to learn, he read every book in the library starting with the last book on the bottom of the shelf. However, his parents guided him to become more selective with his reading.

At the age of thirteen, after selling sweets and newspapers on the trains running on the Grand Trunk Railway from Port Huron to Detroit for a short time, Edison decided to publish his own newspaper— the Grand Trunk Herald —and sell copies to his existing clients. He published up-to-date stories that became a hit with his customers. This began Edison's long streak of entrepreneurial ventures, as he discovered his talents as a businessman.

These talents eventually led him to found 14 companies, including General Electric, still one of the largest publicly traded companies in the world.

During this time, Edison also set up a small laboratory in a baggage car on the train. However, during one of his experiments a chemical fire started and the car caught fire. Edison was forced to leave the train and sell newspapers once again.

But fortune smiled on Edison and he got a chance to learn to operate a telegraph when he saved a three-year-old from a train accident. The child's grateful father, who was the station's agent, taught Edison telegraphy as a reward. So, at the age of 16, Edison became a proficient telegrapher and started working as one full-time. This job inspired many of his inventions in the telecommunications field.

Edison executed the first of his U.S. patent applications on 13 October 1868, at the age of 21. It was for a machine for electrically recording and counting votes cast by members of a legislative body, but there was no interest.

His first successful US patent – the first of **1,093** - was for the Quadruplex telegraph. This is a type of electrical telegraph which allows a total of four separate signals to be transmitted and received on a single wire at the same time (two signals in each direction).

This was pretty ground breaking and Edison sold the rights to the Western Union Railroad in 1874 for the sum of \$10,000. It was his first big financial success and he used the funds to set up his first lab in Menlo Park, California.

This was the world's first institution set up with the specific purpose of producing constant technological innovation and improvement. In some sense, this laboratory is also considered one of his greatest inventions. It was well equipped, and it's where Edison worked to change the world.

Thomas Edison went on to be known as the "The Wizard of Menlo Park". Incidentally, Edison nicknamed two of his children he had with his first wife "Dot" and "Dash" in honour of his early telegraph days.

Edison's first invention in Menlo Park was the tin foil phonograph. He was invited to demonstrate it to then president of the United States – Rutherford B. Hayes – in the White House.

(Some of you might recall that we first met this President in one of Geoffrey's talks. He was the one married to the tee total wife known as Lemonade Lucy.)

Edison was not a wholly attractive human being. He didn't worry about cheating or lying, and he was prepared to steal patents or bribe journalists for favourable coverage. Most of his inventions were not completely original but improvements of earlier inventions by other people. In the words of one of his contemporaries "he had a vacuum where his conscience ought to be".

But he was enterprising, hard working and a peerless organiser. One of his favourite sayings was - to have a great idea, have a lot of them!

Edison is credited with inventing the world's first practical incandescent light at Menlo Park. In fact a German chemist called Hermann Sprengel was the first to have the idea of a gas chamber with the air in it reduced to one millionth of its normal volume which would enable a filament to glow for hundreds of hours. What he couldn't find was a suitable material for the filament.

Edison was soon on the case. He sent his men to the far corners of the globe to search for potential filaments. He had teams working on 250 materials at a time in the hope of finding one that would do the trick. They tried everything, even the hair from the luxuriant red beard of a family friend!

Just before Thanksgiving in 1879, Edison's workmen developed a piece of carbonised cardboard, twisted thin and carefully folded, that would burn for 13 hours – still not long enough to be practical.

(Nowadays the filament is made from tungsten because it has a high melting temperature.)

Nevertheless, on Hogmanay 1879 Edison invited a select audience to come and witness a demonstration of his new incandescent lights at Menlo Park. As they arrived they were wowed by the sight of 2 buildings all aglow. What they didn't realise was that the light was mostly non electrical. Edison's overworked glass blowers had only been able to produce 34 bulbs so the bulk of the illumination actually came from carefully positioned oil lamps.

He soon got over this set back and wired a whole district of lower Manhattan, around Wall Street, to be powered by a plant installed in 2 semi derelict buildings. Through the winter,

spring and summer of 1881 – 1882 Edison laid 15 miles of cable and fanatically tested and retested his system. Not all went smoothly – horses behaved skittishly in the vicinity until it was realised that leaking electricity was making their horseshoes tingle. Back at his workshops, several of his men lost teeth from mercury poisoning – mercury was used in the pump that reduced volume of air in the light bulb.

Finally, all the problems were resolved and on the afternoon of 4 September 1882 Edison threw the switch that illuminated 800 bulbs in the 85 businesses that had signed up to his scheme.

The invention of the light bulb was a wondrous thing but not really of much practical use when no one had a socket to plug it into. Edison had had to design the entire system from scratch, from power stations to cheap and reliable wiring, to lamp stands and switches. This is where his organisation of systems excelled.

Within months he had set up no fewer than 334 small electrical plants all over the world and within a year or so his plants were powering 13,000 light bulbs. Edison was careful about where he put them and made sure that they would make maximum impact. He put them in the New York Stock Exchange, La Scala opera house in Milan and the dining room of the House of Commons. Electrical lighting became the wonder of the age but, for Edison, it turned out to be one of the remarkably few inventions that actually did what he hoped it would do.

As an aside, Edison briefly had a partner – a fellow inventor called Franklin Pope. He developed a system which tracked and printed the prices of gold and stocks.

Pope partnered with Edison in 1869, forming the company Pope, Edison & Company Electrical Engineers, and they invented a one-wire telegraph in 1870. This telegraph is now known as a stock ticker, and was widely used in large cities for exchange quotations. Pope's partnership with Edison ended shortly after it was formed and he electrocuted himself while working on the wiring in his own house thus proving to many people that electricity was too dangerous even for experts.

Edison continued to invent and file patents at an incredible rate, for example during 1882, he filed 106 successful U.S. patent applications. This was the maximum number of successful U.S. patent applications filed by Edison in any year.

He was of course immensely successful and a huge generator of wealth. By 1920 it was estimated that the industries his inventions spawned were worth \$21.6bn. But he was terrible at working out which of his interests had the best commercial prospects. He simply persuaded himself that whatever he invented would make money. In fact, more often than not it didn't, and nowhere was that more true than with his long and costly dream to fill the world with concrete homes.

The biggest failure of his lifetime occurred whilst he was experimenting to invent a method of separating ore from rock. This would mean that abandoned mines could be profitable once again through the extraction of iron from sand still inside them. At the time, iron ore prices had risen to unprecedented heights.

Edison's laboratory was preoccupied with developing a magnetic ore-separator and putting it to practical use. He acquired the rights to 145 abandoned mines and set up a pilot project at the Ogden mine in New Jersey.

Edison poured funds into the project, gradually selling most of his interest in the General Electric Company to pay for his work. But the engineering problems were never worked out and the price of iron ore fell, leading Edison to finally abandon his precious separator.

After putting over \$2 million of his own money into this venture - a huge amount in those days - Edison was forced to abandon it when the discovery of large iron ore deposits in the Great Lake region made his concentrated low-grade ore too expensive for steel mills. However, he was able to recoup part of his investment by transferring his rock crushing technology to the production of Portland cement, and that brings us to the story from Bill Bryson's book that sparked my interest in Edison.

Concrete was one of the most exciting products of the 19th century. As a material it had been around for a very long time – the great dome on the Pantheon in Rome is made from concrete and Salisbury Cathedral sits on concrete foundations – but the modern breakthrough for it came in 1824 when a chap called Joseph Aspin, a bricklayer in Leeds, invented Portland cement which set harder and smoother than anything that had gone before.

Edison was captivated by concrete's possibilities and set up the Edison Portland Cement Company in 1899. He built a huge plant in New Jersey and by 1907 he was the 5th biggest

cement producer in the world. He patented over 48 ways of making quality cement in bulk and built the Yankee Stadium with it together with the first stretch of concrete highway.

But his dream was to fill the world with concrete houses.

His plan was to make a mould of a complete house that concrete would be poured into. But Edison wasn't just sticking to the walls and floors – his mould would include baths, toilets, sinks, cabinets, door jambs, even picture frames. The walls could even be tinted so that painting wouldn't be necessary..

Edison calculated that a 4 man team could build a new house every 2 days and he planned to sell them for \$1200 – about a third of the cost of a conventional house of the same size.

SHOW PATENT

It was a wild dream and far too complex to work. The moulds were the size of the house so they were far too cumbersome but the main problem was filling them smoothly. Concrete is a mixture of cement, water, gravel and small stones and Edison's engineers simply could not formulate a mixture that would flow into every part of the mould without the gravel and stones sinking to the bottom. Also, even if they'd been able to overcome this problem, the house would have weighed 450,000 lbs or 225 tons causing all manner of structural problems.

To make matters worse, Edison pressed on and designed a range of concrete furnishings – bureaus, cupboards, chairs, even a concrete piano! He promised he would offer a double bed that would never wear out for \$5.

The entire range was to be unveiled at a cement industry show in New York in 1912. In the event, when the show opened, the Edison stand was bare. No one from the Edison Company ever offered an explanation and it was the last anyone ever heard of concrete furniture. As far as we know Edison never discussed the matter again.

A few concrete houses were built though, and some still stand in New Jersey and Ohio but the idea never caught on and concrete houses became one of Edison's most costly failures.

After this he moved onto yet more ideas that were impractical or hare brained.

He developed an interest in warfare and announced that he would be able to induce mass comas in enemy troops through “electrically charged atomisers”.

He concocted a plan to build giant electro magnets to catch enemy bullets in flight and send them back they way they had come.

He also invested heavily in an automated general store in which customers would put a coin in a slot and a moment later a bag of coal, potatoes, nails, hairpins or whatever you fancied would come sliding down a chute. The system never even came close to working.

A more successful idea was his Electric pen. This worked by quickly punching holes in a sheet of paper to form an outline of letters, this allowed ink to be injected on to the pages below which allowed multiple copies of a document to be made quickly. As ever, Edison was confident that this would be bigger than telegraphy. It wasn't but someone else saw the potential of the rapidly punching pen and redeveloped it to inject ink under skin thus inventing the modern tattoo gun.

Interestingly the electric pen was first demonstrated at the Centennial Exhibition in Philadelphia in 1876 where it attracted way more interest than another invention – Alexander Graham Bell's telephone.

One of his successful inventions that most people know was the phonograph. Once he had patented this, he began to devise ways to use it.

One idea, first mentioned in a laboratory note in 1877, but not patented until 1890, was to miniaturize the phonograph and insert it into a doll or other toy, giving the formerly inarticulate plaything a voice of its own. The phonograph was enclosed in a tin casing that composed the doll's chest, then pre-made arms and legs were attached, along with a head made in Germany. The talking dollies sold for about \$10. Little girls sat in factory stalls and recorded the songs and nursery rhymes that were inscribed on the wax cylinders for the phonographs to play.

Unfortunately, the idea of a talking toy was far ahead of the technology needed to execute it. Sound recording was in its infancy, and the cracklings and hissing on early records were more disturbing when they were supposed to be the voices of sweet-faced dolls.

"The voices of the little monsters are exceeding unpleasant to hear," one customer complained. Most dolls did not play at all, or the voice was too faint to be heard. The doll's fragile form didn't protect the delicate mechanism from shaking and jolts, and its purpose as a child's toy almost guaranteed the phonograph for dolls would not get the delicate care it required.

Another wacky scheme was to take the idea of the telephone and the telegraph a bit further. Edison announced in October of 1920 that he was working on a machine to open the lines of communication with the spirit world. (In the aftermath of World War One spiritualism was undergoing a revival, and many people hoped science could provide a means to access the souls of the recently deceased.)

The inventor, himself an agnostic who admitted he had no idea if a spirit world even existed, spoke of his quest in several magazines and explained to The New York Times that his machine would measure what he described as the life units that scatter through the universe after death.

Edison corresponded with British inventor Sir William Crookes, who claimed to have captured images on "spirit photographs." These photos allegedly encouraged Edison, but he never introduced any machine that he said could communicate with the dead, and after his own death in 1931, no machine was found. Many people believe he was just playing a joke on the reporters he'd talked to about his "spirit phone."

Some people claimed that at a séance in 1941, Edison's spirit told the participants that three of his assistants possessed the plans. The machine was reportedly then built, but didn't work. Later, at another séance, Edison supposedly suggested some improvements. Inventor J. Gilbert Wright was present and worked on the machine until his own death in 1959, but, as far as we know, never used it to contact spirits.

Some random facts about Edison -

- He filed an estimated 500–600 unsuccessful or abandoned applications throughout his life.
- He made a device to kill cockroaches with electricity
- He was the first person in the world to project a motion picture. He did so successfully on April 23, 1896.

- Edison designed a battery for the self-starter for the Model T developed by Henry Ford who became a friend. So, he was ahead of his time here as battery powered cars are really just catching on now.
- Guglielmo Marconi, the inventor of the wireless telegraph, was also Edison's friend. He used some of the patents made available by Edison for his invention of the wireless telegraph.
- In 1881, Edison filed for a patent for a method to preserve fruits, vegetables or other organic substances in a glass vessel. The vessel was filled with the items to be preserved, and then all the air was sucked from it with an air pump. The vessel tube was sealed with another piece of glass.
- The storage batteries he invented became his most profitable invention and were used in miners' headlamps, railroad signals and marine buoys.
- Edison's first wife, Mary, died in 1884 and he remarried in 1886 after falling in love with Mina Miller.
- After his second marriage, Edison moved to West Orange. There, he built another laboratory for his experiments. This was a laboratory complex consisting of five research buildings. Later, some factories were developed around the complex for production purposes. The total area covered by the laboratory and the factories around it was more than 25 acres, and it employed no less than 10,000 people when it was functioning at its peak during World War I.
- Edison became the owner of his birthplace in Ohio in 1906. On his last visit, in 1923, he was reportedly shocked to find his old home still lit by lamps and candles
- Edison was an advocate for monetary reform in the United States. He was ardently opposed to the gold standard and debt-based money. Famously, he was quoted in the New York Times stating "Gold is a relic of Julius Caesar, and interest is an invention of Satan."
- He patented a design for a flying machine in 1910 which looks to me very like Leonardo Da Vinci's design for a helicopter **SHOW PICTURES**
- Writing of his hearing loss in 1855 Edison said "I haven't heard a bird sing since I was twelve years old."

- In 1914, on December 9, there was a massive fire that swept most of Edison's factories. However, Edison was determined to make another fresh start. With the aid of his team, he started working once again.
- Edison recorded the progress of thousands of his experiments in more than 2500 note books.
- Thomas Edison had a long-lasting rivalry with Nikola Tesla, another visionary and prolific inventor of his time. The duo conflicted over the use of direct current and alternating current. Nikola Tesla advocated the use of alternating current as opposed to direct current. Edison fired back by conducting demonstrations that showed the hazards of alternating current. In one such demonstration, he electrocuted a circus elephant in New York's Coney Island.
- Edison died of complications of diabetes on October 18, 1931, in his home, "Glenmont" in Llewellyn Park in West Jersey, which he had purchased in 1886 as a wedding gift for his wife. He is buried behind the home
- Edison's last breath is reportedly contained in a test tube at The Henry Ford Museum museum near Detroit.

Ford reportedly convinced Edison's son to seal a test tube of air in the inventor's room shortly after his death, as a memento. A plaster death mask and casts of Edison's hands were also made.

So, to sum up, the final count of Edison's patents was 2332 patents worldwide - 1,093 of them in the United States.

It wasn't until June 17, 2003 that he was passed by another inventor – a Japanese chap called Shunpei Yamazaki who works in computer science.

Who knows what Edison would be inventing if he was around today.