Around the world in 80 Inventions

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Ice Cream

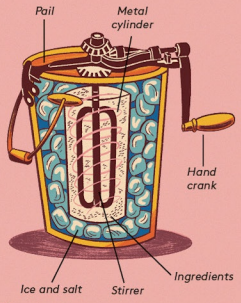
14

"Dreamy frozen dessert"

Our love of ice-based sweet treats goes back a long way. Around 200 BCE, the ancient Chinese packed a mixture of milk and rice into snow to make an ice-cream-like food. The Egyptians, Romans, Greeks and Indians all mixed ice and snow with fruit or flavourings to create refreshing desserts. Around the thirteenth century, possibly in the Middle East, it was discovered that cream could be frozen when surrounded (but not touched) by an ice-and-salt mixture. The ice melts, but the salt makes it melt at a lower temperature – the ice draws heat from what it's touching, keeping it colder for long. Suddenly, ice cream making got easier! This delicious idea spread through Europe and became especially popular in Italy and France. By the late 1600s, ice cream, which had been a luxury only enjoyed by the rich, become more affordable and the flavours more varied. Chocolate, pineapple and pistachio, and more unusual ones like chestnut and jasmine were enjoyed.

It's said that King Charles I of England (1600–1649) paid his chef £500 per year to keep his ice cream recipe secret, so only he could enjoy it!

Vanilla is the world's most popular ice cream flavour, and most of the vanilla pods used to make it come from Madagascar and Indonesia.



Easy Ice Cream

Stirring the cream, sugar and flavourings to make ice cream takes a long time. In 1843, American inventor Nancy Johnson came up with the first ice cream maker for home use to make the job easier. An outer container, or 'pail', contained the ice and salt. An inner metal cylinder contained the ingredients, which were mixed with a hand-cranked stirrer. A job that had once taken hours now only took about 45 minutes. Johnson's invention made ice cream easier to produce, and cheaper too, meaning anyone could afford it. Modern electric ice cream makers are even more convenient because they stir and freeze the ingredients automatically.

Bicycle

15

"Freedom on two wheels"

Did you know that the first bicycle was banned from the roads? People thought it looked too dangerous. After all, the *Laufmaschine* (which means 'running machine' in German) had no pedals or brakes. Invented by German Karl von Drais in the early 1800s as a quick method of travel for people who couldn't afford horses, his wooden contraption was the first human-powered, two-wheeled steerable vehicle. Other designs soon followed, but they were very expensive. The age of the bicycle truly began in the 1890s with the invention of the cheap, mass-produced Safety Bicycle, which gave everyone the ability to travel far and wide using only their legs.

A brake on the front wheel, operated by a lever on the handlebars, allows the rider to slow down safely.

Light and strong triangular frame – this is one of several features still used on modern bikes.

Same-size wheels allow the rider to touch the ground with their feet – a major safety advantage over the taller Penny-Farthing.

Chain – connects the pedals to the back wheel.

Perilous Penny-Farthing

If you like a bit of danger, mount up on the iconic Penny-Farthing. Invented before the Safety Bicycle in 1869 by Frenchman Eugène Meyer, the Penny-Farthing or 'high wheeler' was the first mass-produced bicycle. Perched high up on a leather saddle, a rider had to keep their balance while rotating the oversized front wheel using the pedals attached to it (this is a 'direct drive' system, which means without the use of cogs and a chain) and steering it with handlebars. Serious injury was common among riders as it was easy to lose control and tumble over the handlebars, also known as 'taking a header'!

Wheel

17

"The revolutionary design that makes the world go round"

Can you imagine a world without wheels? Apart from sledges and ships, there would be no vehicles – no carts, cars, bikes, buses, trucks, trains, trams or aeroplanes. The first wheeled vehicles were animal-drawn carts with solid wooden wheels. They were invented in Mesopotamia (modern-day Iraq) around 3200 BCE, 300 years after the horizontal potter's wheel. These carts carried **cargo** to market and heavy loads, such as stone and timber for building projects. The horse-drawn chariot came next. In about 2500 BCE, chariot wheels were spoked rather than solid like a cartwheel, so they were faster and lighter. The wheel may be one of the simplest inventions, but without it our world would be completely different.

Many early inventions were inspired by things in nature. However, apart from some animals that use rolling to move, there are no wheels found in the natural world.

The ancient Romans raced chariots as a sport.

A chariot was drawn by a team of two horses.

Roman chariots had wooden wheels.

Potter's Wheel

The very first wheels were used to make pottery. The art of pottery began around 30,000 years ago. Originally, potters would shape clay into pots with their hands, but this took a long time. The Mesopotamians invented a better method in around 3500 BCE. The potter's wheel was a large stone disc balanced on a stick called an 'axle', which could be spun. By putting clay on the wheel and spinning it, the potter could shape the clay quickly into pots. We don't know for sure, but it seems likely that the potter's wheel led to the invention of the vehicle wheel.

Internet

18

"The world at your fingertips"

The invention of the Internet – a network of computers that 'speak' to each other – was a concentrated effort in the United States. The first computers were connected to each other in 1969, but scientists first began developing the Internet in the early 1960s during the **Cold War** (1947–1991), a time of heightened hostility between the **USSR** and the United States and when computers were the size of an entire room. The United States government wanted a communication system that couldn't be destroyed in a single attack, so they created ARPANET (Advanced Research Projects Agency Network): a series of linked computers across different locations, which allowed information to be relayed along telephone lines. The first message was sent in 1969. It was a single word: LOGIN, but only the 'L' and the 'O' got through before the network crashed. By the end of the same year four computers were connected on the ARPANET. It took years to create the 'network protocol' that allows computers to transfer data and 'speak' to each other. From the 1970s this network grew into the global Internet, which now links billions of devices. Today, whatever you want – books, food, holidays, cars – with the Internet you simply click a button and wait for it to arrive. Social media sites allow people all over the world to communicate instantly. We can consume films, television shows, music and video games, and even do our banking online.

World Wide Web

The World Wide Web (WWW) is a gateway to the Internet. It's made up of search engines like Google and Safari, the Internet addresses (also called URLs) we type in, and the websites that appear on our screens. It was invented by a British computer scientist called Tim Berners-Lee in 1989 while working at CERN, a science research laboratory in Switzerland. The WWW made the Internet accessible to everyone, not just scientists and academics.

Camera

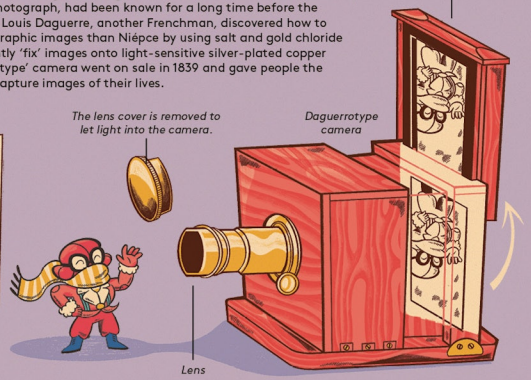
"Say cheese"

24

Although it only takes an instant to snap a photograph, it took decades for the camera to be perfected. Before the camera there was the 'camera obscura'. Invented in China around 400 BCE, camera obscuras were dark rooms with a small hole in one wall. Light coming through the hole projected an image of the outside world onto the opposite wall. In 1826, French inventor Joseph Nicéphore Niépce recorded the very first photograph using a handheld camera obscura with a light-sensitive metal plate inside. The image was a view of rooftops from his window. (The knowledge about light-reactive chemicals, which facilitated the first permanent photograph, had been known for a long time before the camera came about.) Louis Daguerre, another Frenchman, discovered how to create sharper photographic images than Niépce by using salt and gold chloride solutions to permanently 'fix' images onto light-sensitive silver-plated copper sheets. His 'daguerreotype' camera went on sale in 1839 and gave people the miraculous ability to capture images of their lives.

A light-sensitive metal plate is inserted into the camera. The image is developed using the vapours from heated mercury.

The first-known photograph of a person was taken in 1838 by Louis Daguerre. It shows a man having his shoes shined on a street in Paris.

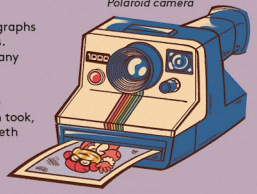


After the camera's invention many painters moved away from creating realistic works of art and instead used abstract and surrealist styles to express themselves.

Developed to Perfection

Many improvements to the camera followed. From around 1840 photographs could be transferred to paper instead of the less practical metal plates. Film negatives stored photographic images and could be developed many times over. Single Lens Reflex (SLR) cameras were invented in 1861 and produced high-quality photographs. The first cheap and easy-to-use cameras (the 'Kodak' in 1888 and the 'Brownie' in 1900) opened up the art of photography to everyone. Then came the Polaroid camera which took, developed and printed photos instantly. Towards the end of the twentieth century, the digital camera arrived. Without the need for film, instead it records photos and video clips onto a memory card.

Polaroid camera



High-Speed Train

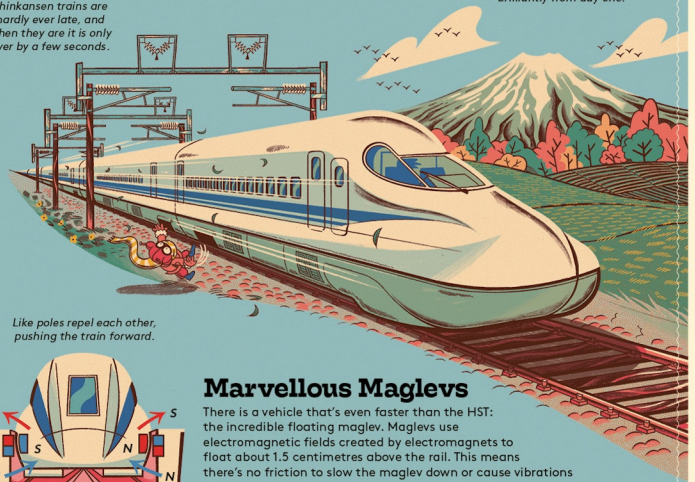
"Hi-speed worldwide"

25

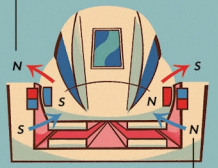
By the 1960s the golden age of the railway was long gone and people thought trains were slow and inconvenient, especially compared to the speedy automobile (see page 50) and commercial jet (see page 84). However, a new railway revolution began when the Japanese government decided to build the very first High Speed Train (HST). It was a massive task, 500 kilometres of track had to be laid between the cities of Tokyo and Osaka. On top of that, a ground-breaking, super-swift electric train had to be invented too. Flying over the rails at 220 kilometres per hour (twice as fast as any other train at that time) these trains were called Shinkansen, which means 'New Main Line', but they are commonly known as Bullet Trains. The first Shinkansen line opened in 1964 and was an immediate success. Since then, it's had a staggering 10 billion passengers. There are now High Speed Train networks all over the world, and they keep getting faster. The world speed record for a train was broken in 2007 when a French TGV service reached 575 kilometres per hour.

Incredibly, it only took five years for the Tokyo-Osaka high-speed railway line and the Shinkansen Bullet Trains to be developed and completed, and they worked brilliantly from day one.

Shinkansen trains are hardly ever late, and when they are it is only ever by a few seconds.



Like poles repel each other, pushing the train forward.



Opposite poles attract each other and pull the train forward.

Marvellous Maglevs

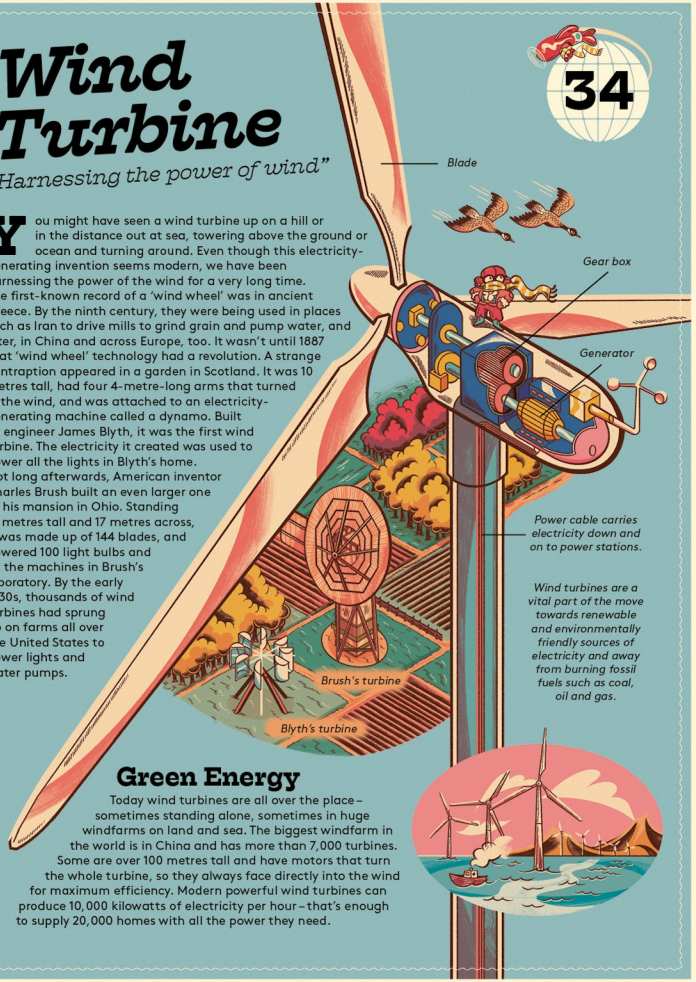
There is a vehicle that's even faster than the HST: the incredible floating maglev. Maglevs use electromagnetic fields created by electromagnets to float about 1.5 centimetres above the rail. This means there's no friction to slow the maglev down or cause vibrations (unlike a track-borne train). As the maglev reaches its top speed, passengers can enjoy a smooth journey, even though they're travelling faster than any other land vehicle in the world. In Japan, the experimental L0 Series maglev train set a land speed record of 603 kilometres per hour for rail vehicles.

Wind Turbine

34

"Harnessing the power of wind"

You might have seen a wind turbine up on a hill or in the distance out at sea, towering above the ground or ocean and turning around. Even though this electricity-generating invention seems modern, we have been harnessing the power of the wind for a very long time. The first-known record of a 'wind wheel' was in ancient Greece. By the ninth century, they were being used in places such as Iran to drive mills to grind grain and pump water, and later, in China and across Europe, too. It wasn't until 1887 that 'wind wheel' technology had a revolution. A strange contraption appeared in a garden in Scotland. It was 10 metres tall, had four 4-metre-long arms that turned in the wind, and was attached to an electricity-generating machine called a dynamo. Built by engineer James Blyth, it was the first wind turbine. The electricity it created was used to power all the lights in Blyth's home. Not long afterwards, American inventor Charles Brush built an even larger one at his mansion in Ohio. Standing 18 metres tall and 17 metres across, it was made up of 144 blades, and powered 100 light bulbs and all the machines in Brush's laboratory. By the early 1930s, thousands of wind turbines had sprung up on farms all over the United States to power lights and water pumps.



Green Energy

Today wind turbines are all over the place – sometimes standing alone, sometimes in huge windfarms on land and sea. The biggest windfarm in the world is in China and has more than 7,000 turbines. Some are over 100 metres tall and have motors that turn the whole turbine, so they always face directly into the wind for maximum efficiency. Modern powerful wind turbines can produce 10,000 kilowatts of electricity per hour – that's enough to supply 20,000 homes with all the power they need.

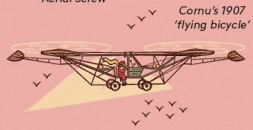
Helicopter

35

"A whirling way to fly"

Would you believe that the helicopter was conceived way back in the fifteenth century? Genius inventor Leonardo da Vinci's flying contraption idea, the Aerial Screw, had a 4.6-metre-wide rotor turned by a crew of four. Although it was never built (and wouldn't have flown even if it had been), da Vinci's idea was centuries ahead of its time. The first functioning helicopters didn't appear until the late 1930s. They were unstable and dangerous, and accidents were common. The first reliable helicopter to whirl into the air was the single-seater, twin-rotor FW-61, invented in 1936 by German engineer Henrich Focke. The first mass-produced helicopter was invented by Russian-born Igor Sikorsky. His R4 *Hoverfly* seated two and had a top speed of 120 kilometres per hour. Today there are many types of helicopters, from small twin-seaters to enormous **cargo**-carrying monsters with multiple engines.


Aerial Screw


Cornu's 1907 'flying bicycle'

Versatile VTOLs

The air is too thin at high **altitudes** for helicopters to be able to fly as high as aeroplanes. (The highest a helicopter has ever flown is 13,000 metres). However, they make up for that with their unique flying abilities: they can vertically take-off and land (VTOL), hover in one spot and move in any direction. They can also carry passengers and equipment such as winches, searchlights and fire-fighting kit, making the helicopter an ideal vehicle for emergencies. Rescuers have a perfect vantage point to search for people lost at sea or on land from a helicopter, and lower winches to hard-to-reach spots.